

MASTER

Potential effects of the Dutch net neutrality law on business models and innovation in the mobile telecommunication market

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Award date:
2012

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Potential effects of the Dutch net neutrality law on business models and innovation in the mobile telecommunication market

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In partial fulfilment of the requirements for the degree of

**Master of Science
in Innovation Management**

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Master Theses Innovation Management

Subject headings: Innovation, Business Models, Net Neutrality, Telecommunications, Telecom

DISCLAIMER:

This research has been performed for the Independent Post and Telecommunications Authority in The Netherlands (OPTA) as part of my internship at OPTA. Responsibility for the contents of the conclusions and recommendations of the report lies with me (the author: L. Hacking). The conclusions and recommendations do not necessarily represent the view of the Commission or the staff of OPTA.

Abstract

This report discusses the potential effects of the Dutch Net Neutrality law (DNNL) on innovation and business models in the mobile telecommunication market. Literature and in-depth interviews (28) were used to find these potential effects regarding innovation and business models. This report also provides recommendations to OPTA regarding the enforcement of this law. As preparation to find the potential effects of the DNNL, this report presents a discussion about innovation and business models of the last 15 years.

Acknowledgement

I would like to thank all the people who assisted and supported me in this project. First I would like to thank my university supervisors Dr. Jimme Keizer and Dr. Ir. Rudi Bekkers, for their input and constructive feedback during the project. Second I want to thank OPTA for giving me the opportunity to gain experience in their organization. Special thanks goes to my supervisor at OPTA Drs. Robert Stil, for his help, input and readiness to support.

At last I would like to thank my mother, girlfriend, brother and friends for their help and support.

Management Summary

This report describes the result of a graduation project of the study MSc Innovation Management at the Technical University of Eindhoven (TU/e). The project has been conducted at OPTA in The Hague, The Netherlands.

In 2013 (1st of January) net neutrality legislation will come into force in the Netherlands. This legislation has to be enforced by OPTA. OPTA is the Dutch telecommunication authority that focuses on the telephony, post, internet and television market. On these markets OPTA aims to promote competition, to encourage innovation and to protect consumers.

This research has two main goals. The first goal is to discover potential effects of the Dutch Net Neutrality Law (DNNL) on innovation and business models in the mobile telecom market. Therefore the following research question is defined: **What are the potential effects of the DNNL on innovations and business models in the mobile telecom market?**

The second goal of this research is to provide recommendations to OPTA regarding the enforcement of the DNNL, in such a way that OPTA's goals are to be fulfilled as much as possible.

To enable a better examination of the effect of the DNNL, this research started with an analysis of innovation processes and business models used in the last 15 years in mobile telecommunication. Also the way in which the DNNL is interpreted among experts is analysed.

Innovations

Innovations of the last 15 years in telecommunications were analysed by applying the framework of Henderson and Clark (1990), which distinguished between four types of innovations: incremental, modular, architectural and radical innovations.

Using this framework, we concluded that 2G and 3G meet the requirements to be categorized as radical innovations. (2G and 3G are the two leading generation of mobile telecommunications technology of the last 15 year.) This is because 2G and 3G consist of other techniques to transfer wireless data and is therefore based on a different set of engineering principles. In addition, both architecture and components are affected by 2G and 3G standards. Next to that, new markets were created and new applications were developed.

The innovation process in mobile telecommunications seems to have a fixed pattern of radical innovations which enables the creation of new markets and innovative applications.

Business models

The evolving of business models in mobile telecommunications of the last 15 years were described using the framework of Morris et al. (2005).

In general mobile telecom providers create value by implementing innovations, which is mainly achieved by improving service quality. The main services that mobile telecom providers have in their portfolio are: Voice, SMS and internet.

The possibility to provide internet on mobile devices gave MNOs (Mobile Network Operators) a lot of options to develop new business models. At the emergence of mobile internet (1999), mobile portals were very popular. Access to content was mainly controlled by MNOs. However, the public generally demanded an unrestricted and wide choice of content and applications, which resulted in more open models provided by MNOs. Nowadays, most Internet access providers (IAPs) offer an unrestricted Internet Access Service (IAS) or an IAS on which a few services are blocked or hindered.

The main used tariff plans regarding open internet access nowadays are flat-rate and usage based pricing. Voice, SMS and data services have been the main sources of revenue for MNOs of the last 15 years. However, MNOs are afraid to see their revenue of Voice and SMS services shrink at the expense of data services. In the Dutch telecom market there were signals that MNOs tried to prevent this cannibalisation by changing their business model. An option to do this is by raising prices of mobile internet and introducing data quantity caps to diminish the use of competitive services. A more straightforward way to prevent cannibalisation is by blocking, hindering or additionally charge competitive services.

Another reason Dutch providers gave to change their business model is the unexpected growth of mobile data traffic, which has as consequence that MNOs need to invest intensely in their mobile network.

Content of the DNNL

The goal of the DNNL is to maximize end-users' freedom of choice and expression on the internet. Next to that, this law is intended to secure that end-users can decide for themselves which content they want to send and receive, and which services, applications, hardware and software they want to use.

The DNNL prohibits IAPs to block or hinder services or applications on their IAS. In addition, the DNNL prohibits IAPs to make the level of tariffs for IASs dependent on the services and applications that are offered or used via the IAS. Consequently, a proposition in which VOIP traffic is more expensive than other traffic on an IAS is not possible.

The DNNL prohibits blocking of applications and services on the internet. However one exception is made using the separate service option. This way, a provider can offer a single service (e.g. VOIP) via the internet. Although this is a service provided via the internet, it is not intended to provide access to the internet. The provider is by using the separate service option allowed to block all other traffic.

Interpretation DNNL

To examine how the DNNL is interpreted, first exploratory interviews were held with external experts and experts of OPTA. These interviews indicated that there was no consensus about the interpretation of the law. Also the expert interviews about the potential effects of the DNNL on business models and innovation showed that the DNNL is interpreted in different ways.

Two plausible interpretation scenarios were created, in which most interpretations of experts can be categorized. The interpretation scenarios consist of a tolerant and a strict interpretation scenario. The tolerant interpretation scenario provides more possibilities regarding separate services, traffic management and tariff options. In contrast, the strict interpretation scenario provides fewer options regarding separate services, traffic management and tariff options.

Literature review and experts interviews

Literature and in-depth interviews were used to find the potential effects of the DNNL on innovation and business models in mobile telecommunications. The sample of the expert interviews consists of 32 participants who were consulted in 28 interviews. The consulted experts were categorized in five groups: Government; Content and Application providers (CAPs); Scientists and Market watchers; Telecom Operators; and Experts regarding network infrastructure and devices.

Findings

Findings are based on the literature review and experts interviews. We conclude that the consequences of DNNL are generally unclear. Only regarding one aspect consensus was found (which concerns the statement that there are less differentiation possibilities for IAPs by applying DNNL). Therefore this research only presents potential effects of the DNNL.

The offering of IAPs will potentially be less differentiated due the DNNL. For consumers this means they have potentially less choice regarding the offering of IAPs.

In addition, it can be expected that the profit of IAPs (value capturing) will potentially diminish due the DNNL.

The development of business models of IAPs will potentially be disturbed because there is a lot uncertainty whether certain business models are allowed or not. As consequence, innovation is potentially hindered. For consumers it could mean that some propositions, which are allowed, will not be available.

Both literature as well as expert interviews show that under DNNL, CAPs do not have to negotiate with IAPs to get access to their network. They also do not have to worry about getting blocked. This means for IAPs that the only option for them is to use the open internet access model. Regarding customers it means that they only have to subscribe for one internet connection to have access to the whole internet.

We do not expect that CAPs will charge IAPs or refuse to supply their content to IAPs, because CAPs typically search for a maximum reach. (Experts generally state that the DNNL does not prohibit CAPs charging IAPs for transmission of their content or CAPs refusing to supply their content to IAPs.)

The DNNL potentially limits options to acquire guaranteed quality for CAPs, which could harm value creation of CAPs providing time-critical applications. For customers it could mean that time-critical services of CAPs are received with lower quality. The limitation, regarding options to acquire guaranteed quality, also potentially harms innovation of time-critical applications. Regarding the innovation process, limiting options regarding guaranteed quality can be regarded as a limitation on architectural level.

The DNNL potentially stimulates innovation of CAPs, since this law protects the internet as an open platform, which guarantees that CAPs innovate with low entry costs. Regarding the innovation process, protection of the internet as an open platform influences innovation on an architectural level.

Particular innovations that will emerge outside the Netherlands are potentially not introduced in the Netherlands, or will be later introduced, because of the DNNL. Regarding the innovation process it means that potentially fewer options to innovate are applied on an architectural level in the Netherlands.

Concerning the effect of the DNNL on investment in infrastructure conflicting theories in literature were found. Based on the on the results of the expert interviews, the DNNL potentially limits investment in infrastructure, since fewer options to generate revenue are available for IAPs. Regarding the innovation process, less investment in infrastructure affects innovation negatively on an architectural level.

Recommendation OPTA

1. Communicate clear what is allowed and what is not allowed

Innovation is potentially hindered because there is a lot uncertainty whether certain business models are allowed or not. To take away this uncertainty OPTA should provide guidelines, which state clearly what is allowed and what is prohibited regarding the DNNL. The most questions are about separate services and priority.

2. Start with a tolerant interpretation of the DNNL

The main reason a tolerant interpretation is recommended is because it provides options regarding paid-priority, which provides the advantage for CAPs and consumers to retrieve guaranteed priority of services that need it. In addition the potential negative effect of the DNNL on innovation of time-critical services can be weakened by applying a tolerant interpretation.

Based on the results of this research a tolerant interpretation is recommended. However, the internet is a dynamic environment, in which circumstances can change rapidly. Therefore this advice is extended with a scenario analysis.

Scenario Analysis

This scenario analysis shows, depending on different circumstances, whether OPTA should apply a tolerant or a strict interpretation of the DNNL. Recommended is that OPTA should apply the tolerant interpretation as long as no intense degradation of IASs occurs. If IAPs start intensely degrading their IASs, to sell more priority services, it could harm customers and CAPs. As consequence innovation is hindered. It could therefore be advisable in this situation to move to a strict interpretation.

3. Monitor developments regarding potential degradation of Internet Access services

This scenario analysis shows that if IAPs will degrade their IASs intensely, it is better to apply a strict scenario. Therefore developments regarding potential degradation of IASs have to be monitored. This monitoring should happen regularly, since the internet is a dynamic environment, in which circumstances can change rapidly.

4. Examine possibilities regarding minimum quality requirements

The scenario analysis shows that if IAPs start degrading their IAS to sell more priority services, it could be considerable to move to a strict interpretation. However, also another approach is possible by applying related legislation of the DNNL. Using this approach a tolerant interpretation is applied in combination with setting minimum quality requirements¹. This makes it possible to get guaranteed quality, by allowing paid-priority, while there is no disadvantage regarding degradation of IASs (since IAPs can be obliged to provide a minimum quality of service). Possibilities to do this should be further analysed, since this is outside of the scope of this research.

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List of abbreviations

CAP – Content and Application Provider

DNNL – Dutch Net Neutrality Law

IAP – Internet Access Provider

IAS – Internet Access Service

MNO – Mobile Network Operator

NN – Net Neutrality

OPTA – Onafhankelijke Post en Telecommunicatie Autoriteit

VoD – Video on Demand

1. Introduction

In 2013 (1st of January) net neutrality legislation will come into force in the Netherlands. This paper discusses the potential consequences of this legislation for innovation and business models in the mobile telecommunication market. Furthermore, recommendations are given to OPTA, which is the Dutch telecommunication authority that has to supervise this law.

OPTA (The Hague, The Netherlands) is the organisation where the research was conducted. It is a government agency that focuses on the telephony, post, internet and television market. On these markets OPTA aims to promote competition, to encourage innovation and to protect consumers. OPTA is an independent administrative body (IAB) which means that it operates at a detached level from a ministry. The objective is to supervise whether market parties comply with Dutch regulations. This organisation is based in The Hague and has about 130 employees currently.

As Atkinson (2011) describes: “Net neutrality refers to the notion that broadband networks should not discriminate (either in quality or price) between the packets that are delivered on their networks.”

Net neutrality influences innovation and business models in the mobile telecommunication market. Innovation and the way these business models are designed have a direct influence on customer choice and wellbeing. Therefore it is very important to analyse these influences in the interest of society and in particular for OPTA.

Innovation can be defined as: “The generation, acceptance and implementation of new ideas, processes, products or services” (Thompson, 1965, p. 2). Innovations are key in the telecommunication industry, which is characterized by a rapid pace of technological development (Godoe, 2000). Some main innovations in mobile telecommunication include SMS, Internet access and touchscreen smartphones.

The term Business Model has a lot of different definitions. Doganova and Eyquem-Renault (2009), who compared different definitions, concluded that a business model generally describes how a company generates value, delivers value, and the way a company captures value.

This research has two main goals. The first goal is to discover potential effects of the Dutch Net Neutrality Law (DNNL) on innovation and business models in the mobile telecom market. Therefore the following research question is defined: **What are the potential effects of the DNNL on innovations and business models in the mobile telecom market?**

The second goal of this research is to provide recommendations to OPTA regarding the enforcement of the DNNL, in such a way that OPTA's goals are to be fulfilled as much as possible.

This report is structured as follows: First, Chapter 2 discusses the problem definition. Subsequently chapter 3 presents necessary background information regarding the DNNL. Next to this frameworks of Innovation and business models are introduced in this chapter. These frameworks will be used to analyse the effects of the DNNL. Chapter 4 discusses the design used to answer the research question. This design includes a literature review, in-depth interviews and a scenario analysis.

Thereafter chapter 5, 6, 7 and 8 present the results of this research. Chapter 5 focusses on the development of innovation and business models in mobile telecommunications of the last 15 years. Chapter 6 discusses the interpretation possibilities of the DNNL. Subsequently chapter 7 and 8 analyse the research question. Chapter 7 presents a literature review to analyse the research question and chapter 8 does analyse the research question on the basis of in-depth expert interviews.

Chapter 9 shows conclusions that are derived of the results in the preceding chapters. This chapter also presents requirements regarding recommendations to OPTA. This reports ends with recommendations to OPTA which are presented in chapter 10. One of these recommendations includes a scenario analysis.

2. Problem definition

OPTA is the government agency which has to enforce the DNNL. OPTA is interested in the potential effects of the DNNL on innovation and business models, since their goal is to promote competition, to encourage innovation and to protect consumers. However, the potential effects on innovation and business models are currently unclear.

OPTA obtains better insight regarding the effect of the DNNL on OPTA's goals, if the potential effects of the DNNL on innovations and business models are known. This also helps OPTA to determine how to enforce the law in such a way their goals are mostly fulfilled.

Not much room is given to OPTA by enforcing the DNNL, since they have to be subservient to the Dutch law. However, the DNNL provides possibly some space for interpretation. In that situation, OPTA can decide which interpretation of the DNNL will be used to enforce the law. In addition, OPTA can decide whether they provide guidelines about their enforcement of the law or not.

The end of this report (Chapter 10) presents recommendations to OPTA regarding the enforcement of the law.

The next chapter provides theoretical background regarding the DNNL, innovation and business models, which is needed in preparation to analyse the potential effect of the DNNL on innovation and business models.

3. Theoretical background

This chapter provides theoretical background regarding the DNNL, innovation and business models. This information will help to analyse the effect of the DNNL on business models and innovation.

3.1. DNNL

This section provides an analysis of the DNNL, starting with a description of the establishment of the DNNL. Subsequently the goal of the law, the content and the clarification of the law are presented.

3.1.1. Establishment of the DNNL

At the beginning of 2011 there were no signs that the Dutch government would apply regulations regarding net neutrality. The government of the Netherlands stated that there is so far no need to apply policies regarding net neutrality. The minister of Economic affairs, Innovation and Agriculture argued that if access to services on internet is blocked, users can switch to a provider that does not block access (February, 2012).^{a 2}

It is therefore remarkable that regulations regarding net neutrality were accepted by the House of Representatives in June 2011. We analyse shortly what happened meanwhile.

A key event which caused a lot of discussion is KPN's conference call (April 2012). In this conference call KPN stated that they were considering³ charging customers additionally for using chat, VoIP and video services. After this conference call a majority of the House of Representatives announced that they are against blocking of services on the internet if customers do not pay additionally.⁴ The extent to which the KPN's conference call can be linked to the establishment of the DNNL is hard to indicate. However, it may be assumed that this event started a discussion which influenced the establishment of the DNNL.

The DNNL is defined in Article 7.4a, section 1 and 3 of the amendment of Verhoeven (TK 2010-2011, 32 549, number 29). In May 2012 the senate accepted the DNNL. The relevant articles of the law will come into force on the 1st of January 2013.

The purpose of the DNNL is briefly stated in the clarification of the DNNL⁵. The goal of the Net neutrality law is to secure that end-users can decide for themselves which content they want to send and receive, and which services, applications, hardware and software they want to use. In addition, this law is intended to maximize end-users' freedom of choice and expression on the internet.

Related legislation of the DNNL concerns legislation regarding minimum quality requirements and transparency legislation. Legislation concerning minimum quality requirements is defined in Article 7.4a,

^a Endnotes can be found at the end of this report (format 1,2,3...). Format footnotes: A,B,C...

section 5. This law can be applied to prevent the degradation of service and the hindering or slowing down of traffic over public electronic communication networks, by imposing minimum requirements regarding the quality of service.

Legislation regarding transparency is defined in Article 7.3 of the amended telecommunication Act. This law gives (among others) options to oblige providers of public electronic communications networks to reveal information about their network management.

3.1.2. Content of the DNNL

This section describes the content of the DNNL, focussing on relevant parts regarding business models and innovation.

The DNNL prohibits Internet Access Providers (IAPs) to hinder or delay services or applications on the internet, unless it is necessary:

- a. to limit the consequences of congestion, whereby equal types of traffic are treated equally;
- b. for the purpose of integrity and security of the network and the service of the involved provider or the peripherals of the end-user;
- c. to limit the unsolicited communication to end-users;
- d. to implement a statutory provision or a court order.

The law also prohibits IAPs to set the level of tariffs for internet access services dependent on the services and applications that are offered or used via the internet access service, i.e. it is for example prohibited to charge VOIP traffic differently than other traffic on the Internet Access Service (IAS).

3.1.3. Clarification of the amendment

This section describes the clarification of the DNNL. Again the focus is on relevant parts regarding business models and innovation.

The clarification of the amendment⁶ states the following: “The term ‘internet’ in this context (of the DNNL) means: The worldwide, public network of endpoints with IP-addresses assigned by the Internet Assigned Numbers Authority. It is not intended to prohibit the reservation of bandwidth for IP-based services that are offered via own networks, like IP-based television that is not offered via the internet: This is no service or application on the internet.” The clarification further states that the term ‘internet access service’ has to be explained broadly, to prevent that this policy will be circumvented. A service can be definitely be regarded as an ‘internet access service’ if access to websites, multiple services or applications, like apps, is offered. In accordance to this article it is permitted to offer ‘separate services’ via internet.

The DNNL prohibits blocking of applications and services on the internet. However one exception is made using the separate service option. This way, a provider can offer a single service (e.g. VOIP) via the internet. The provider is by using the separate service option allowed to block all other traffic.

Not all services on the internet may be regarded as separate services; only services that are not intended to provide access to the Internet are eligible to be defined as separate services. A separate service is therefore not an Internet access service as defined in this section. For more information about separate services see Appendix J in which relevant extracts of the clarification are presented.

According to the clarification we can distinguish three types of services: 1. Internet Access Service, 2. Separate services, 3. Services on local network (Figure 1). These services can share the last-mile connection to customers.

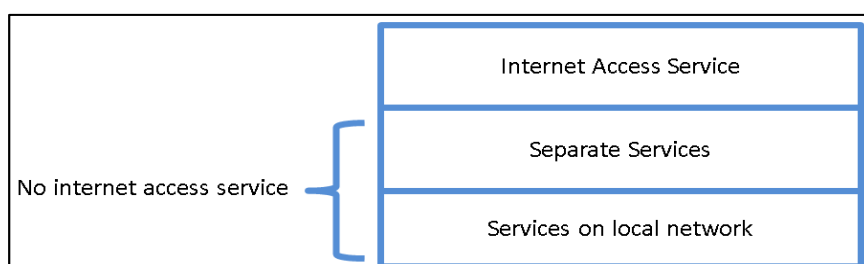


Figure 1: Overview types of services

The DNNL prohibits IAPs to block or hinder services and application on the internet. This means that an IAPs is not allowed to block or hinder a service or application of a particular party. It also means that the IAP may not hinder or slow down any specific service or application, such as Internet telephony. The clarification emphasises that providers are still allowed to differentiate their subscriptions for Internet access in other ways, for example by imposing bandwidth or data limits.

Exceptions made to the principle that IAPs may not hinder or slow down traffic from end-users must be interpreted narrowly. The exception made under (a) aims to ensure that, in time of congestion, time-critical traffic (e.g. VoIP) can be transmitted quickly, and that in such cases other traffic may be delayed. Under this exception, providers may only impose measures which are non-discriminatory, i.e. providers must treat equal types of traffic equally. In addition, in time of congestion the IAP is allowed to prioritise proportionally the traffic of internet users with a high bandwidth subscription over that of Internet subscribers with a lower bandwidth.

The third paragraph of the DNNL is intended to prevent IAPs from charging prices which result, in a restriction of services or applications on the internet. IAPs are for example prohibited from charging a higher price for VOIP-traffic by comparing it to other internet traffic.

The clarification emphasises that providers are still allowed to differentiate their subscriptions for Internet access in other ways, for example by imposing bandwidth or data limits.

3.2. Innovation

To analyse the effect of the DNNL on innovation it is important to know how innovation in telecommunication is developing. To obtain a clear view about this development we use the framework of Henderson and Clark (1990) to describe the innovation processes in mobile telecommunications. Using this framework we will also describe the effect of the DNNL on innovation. The framework of Henderson and Clark (1990) is chosen because this framework focusses (among others) on architectural changes, which are key in a telecommunication environment. Using this framework it can be analysed how architectural changes affect innovations. This framework can also be used to identify a (fixed) pattern in innovations in telecommunications. This way, the effect of the DNNL can be better analysed.

3.2.1. Framework Henderson and Clark

Henderson and Clark (1990) distinguish between four types of innovations, which have different effects on established capacities of firms. These are: incremental innovations, radical innovations, architectural innovations and modular innovation. In this section a definition is given of each of these types.

Incremental innovation

An incremental innovation introduces relatively minor modifications to an existing product; it exploits the potential of the established design, and often strengthens the dominance of established firms. In addition, an incremental innovation is component based and it refines and extends an existing design. An example of an incremental innovation is offering a new tariff plan in which it is cheaper to call after 20:00h or during weekends.

Radical innovation

A radical innovation, in contrast to an incremental innovation, is based on a different set of scientific or engineering principals (to the established paradigm) and it opens up new markets and potential applications. This type of innovation often creates great difficulties for established firms. Next to that, a radical innovation establishes a new dominant design, whereby components are linked together in a new architecture. In addition, new core design concepts are embodied in these components. An example of a radical innovation is the introduction of digital cameras, which changed both the architecture as well as components of the product considerably.

Architectural innovation

An architectural innovation generally does not change existing components and core design concepts, but it changes the way in which the components are interlinked. An architectural innovation thereby destroys the usefulness of a firm's architectural knowledge but preserves the usefulness of its knowledge about the product's components.

Creating a portable air fan by departing from a room air fan can be regarded as an architectural innovation. In this setting the main components (e.g., motor, blade). Though, the way in which these components are interlinked is considerably changed.

Modular innovation

In contrast to an architectural innovation, a modular innovation only changes a component, but does not change the way in which the components are interlinked. A component is defined as a physically separate part of the product that embodies a core design concept (Clark, 1985). An innovation in a bicycle seat (for example applying a new gel-filling material for better comfort) can be regarded as a modular innovation, since it does not involve any changes in the rest of the bicycle’s infrastructure.

Figure 2 classifies the defined types of innovations along two dimensions. The horizontal axis covers the impact on components, while the vertical axis covers the impact on linkage between core concepts and components. This figure is useful because it focusses on the impact of an innovation regarding the usefulness of the existing component and architectural knowledge of firms.

Henderson and Clark (1990) note that the differences between radical, incremental, and architectural innovations are matters of degree. Therefore an innovation can often not be classified as a purely radical or architectural innovation.

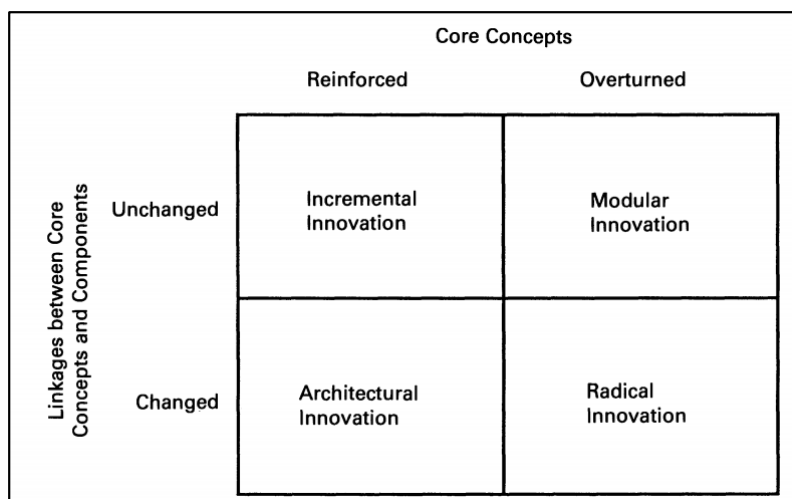


Figure 2: Framework for defining innovation (Henderson & Clark, 1990)

3.3. Business models

To analyse the effects of the DNNL on business models we first focus on the development of business models in telecommunications. To obtain a clear view about this development we use the model of Morris, Schindehutte, and Allen (2005). Using this framework we will also describe the effect of the DNNL on business models.

Morris et al. (2005) propose a six-component framework for characterizing a business model, regardless of venture type. This six-component framework is described at three levels, which are ‘foundation’, ‘proprietary’ and ‘rules’. Each level consists of six decision areas.

The three levels correspond to three different managerial purposes of the model. At the foundation level, there is a need to make generic decisions concerning what the business is and what is not. This level consists of basic decisions that all entrepreneurs have to make. This enables identification of universal models.

The proprietary level focusses on the creation of unique combinations among decision variables that result in marketplace advantage. This enables the entrepreneur to focus on how value can be created in each of the six decision areas. Finally, the rules level provides directorial principles governing execution of the decisions made at the foundation and proprietary level.

We focus at the foundation level in this paper, since this level enables identification of universal models.

At the foundation levels, six main questions, corresponding with the six-component framework, are addressed (see Appendix B: Figure 12). These questions focus at the value proposition; the customer; internal processes and competences; value capturing; competitive strategy element; and time, scope and size ambitions of the particular firm. Here follows an elaboration of each question. Ryanair is used as example to clarify:

3.3.1. How will the firm create value?

The first question is about the value offering of the firm. It addresses the product or service mix, the production or service delivery, and the way the offering is made available to the consumers.

The product or service mix of a business can among others be classified in term of standardisation or customization. Other ways to categorize the product or service mix is by focussing on the broadness and depthness of the product or service lines. A complete list to categorize the value offering is listed in Appendix B: Figure 12.

Here follow characteristics regarding Ryanair: Sell services only, standardized offering, narrow breadth, shallow lines, sell the service by itself, internal service delivery, direct distribution.

3.3.2. For whom will the firm create value?

This question addresses the scope and nature of the market in which the firm operates. Who are the customers and where in the value chain does the business operate?

Firms can be categorized regarding market factors, regarding type of organization (business-to-business, business-to-customer, both) and on a geographic level (local/ regional / national / international). It is also possible to categorise a firm a transactional based or relational based. Transactional based firms focus on single transactions, i.e. converting prospects to customers and completing sales transactions. In contrast, relationship marketing focusses on developing a long-term relationship with individual customers.

Here follow characteristics regarding Ryanair: Business-to-customer organisation, international oriented, focusses on niche market. In the value chain the customer of Ryanair is directly the final customer (no retailer),

3.3.3. What is the firm's internal source of advantage?

A firm's internal source of advantage or 'core competency' is an internal capability or skill in which the firm performs relatively better than others, which can for example be production, marketing, information management, technology or supply chain management.

Ryanair's internal source of competence is: Production/operating systems.

3.3.4. How will the firm position itself in the marketplace?

The core internal source of advantage provides the basis for external positioning. The goal is to recognize striking points of difference (preferably unique) which can be reserved. Examples of striking points of difference are: image of operational excellence, product or service quality, innovation leadership, efficiency and experience.

Competitive strategy factors Ryanair: Low cost/ efficiency and image of operational excellence.

3.3.5. How will the firm capture value?

The economic model is an essential element of the firm's business model, which enables the firm to earn profits. It can be addressed by four subcomponents. These are the cost structure, margins, revenue model (i.e. revenue sources and prices) and the way in which firms focus on higher or lower volumes in terms of both the market opportunity and capacity.

Here follow characteristics regarding Ryanair: Fixed revenue sources, high operating leverage, high volumes, low margins.

3.3.6. What are the entrepreneur's time, scope, and size ambitions?

Depending on entrepreneurs' ambition, different types of ventures are created. These differences have impact on other aspects of the organisation like competitive strategy and economic performance. Therefore entrepreneur's time, scope, and size ambitions have to be included in an integrated business model. Examples of models entrepreneurs can use are subsistence, income, growth, and speculative model.

Ryanair applies the growth model; a growth model needs a substantial initial investment, but also significant reinvestment to raise the value of the business in order to generate a substantial capital gain for investors.

4. Method

This chapter describes the research methods used during the project. The first section of this chapter describes the used approach of the research including its limitations. Subsequently, the way in which the literature review is executed is elaborated. Thereafter, the focus is on the applied interview protocol and scenario analysis. This chapter ends with an overview of the defined research questions.

4.1. Approach

This research consists of a literature review, in-depth interviews and a scenario analysis. This research mainly focusses on in-depth interviews. The literature review and in-depth interviews are used to find answers to the research question (see 4.4). The literature review is also applied to derive questions for in-depth interviews. The scenario analysis is applied to show the consequences of the DNNL under different circumstances.

This research is exploratory and uses a qualitative approach by taking in-depth interviews. We have chosen to use a qualitative approach, because there is a need to explore and describe the phenomenon of the DNNL. Next to that, a qualitative approach provides a more in-depth examination of complex questions. As a result, a qualitative approach provides issues that are often missed by other approaches.

Furthermore, this subject is not suited for quantitative research, since experts to consult are scarce. Besides, case studies are also no option for this research, because relevant information regarding business models and innovations is very confidential for telecom operators.

Limitations

A limitation of qualitative research is that it is hard to replicate. In addition, the sample used is small, since experts are scarce. Thereby it is not possible to generalise the found results. Next to that, the opinion of experts could be biased. Some experts could for example be inclined to give answers which are in line with the viewpoint of their organisation. To diminish this effect several stakeholder groups are consulted and the interviews are made anonymous. Another limitation is that the researcher's presence can affect participants, which can cause bias.

4.2. Literature review

Literature to answer the research questions is mainly found using search engines (Science Direct, ABI/INFORM, Google scholar). Key words used to search on consisted of: Net neutrality, network neutrality, business models, innovation, telecom, and telecommunication. By searching it became clear that Telecommunications Policy provides the most literature relevant for this research. The Telecommunications policy focusses on the role of information and communication technologies (ICT) in the society and economy. Also other scientific journals were consulted which are:

Journal of Economic Perspectives; Information Economics and Policy; Law & Economics Research Papers Series; The RAND Journal of Economics; Journal of Economic Perspectives; Journal of Business Research and Administrative Science Quarterly; Research Policy; Decision Sciences.

In addition, the paper of Marcus, Nooren, Cave, & Carter (2011) is consulted, which is commissioned by the European Parliament's Committee. Next to that, the paper of Williamson, B., Black, D., & Punton, T. (2011) is included which is commissioned by BBC, Blinkbox, Channel 4, Skype and Yahoo.

By executing the literature review, it is needed to link the results found in literature to the DNNL, because the DNNL is not defined the same as NN described in literature. To accomplish this, the interpretation of the DNNL of experts is taken in consideration.

4.3. Interview protocol

Using literature about DNNL a questionnaire was created which consists of 16 questions corresponding to the effect of DNNL on business models and innovations. Also the interpretation of the DNNL was taken into consideration. Nearly all questions are open questions. The main goal of the interview is to get insights of experts regarding the potential effect of the DNNL on business models and innovation. The interviews were typically conducted using a one-to-one setting. Only by 3 interviews more than one expert was consulted simultaneously (see "Appendix D: Overview participants").

The introduction of the interview includes a summary of the DNNL to inform the participants and to check whether enough knowledge about the DNNL is present.

The questionnaire is created in an English and a Dutch version (see Appendix B and C). The sample consists of 32 participants who were consulted in 28 interviews. The consulted experts can be categorised in five groups (“p” denotes the number of consulted participants, “i” the number of interviews held):

- Government (9p, 9i)
- CAPs (7p, 5i)
- Scientists and market watchers (6p, 6i):
- Telecom Operators (7p, 5i)
- Experts regarding network infrastructure and devices (5p, 3i)

These participants were found in different ways. To be selected experts need to have expertise regarding net neutrality, innovation and business models. Experts of government, telecom operators and experts about network infrastructure and devices, were mainly found by consulting my supervisor at OPTA, Drs. R. Stil. By selecting CAPs, the impact of the DNNL was taken in consideration. This led among others to the selection of three online video distribution organisations operating in the Netherlands. Finally, scientists were found consulting literature.

4.4. Research questions

This research has two main goals. The first goal is to discover potential effects of the DNNL on innovation and business models in the mobile telecom market. The second goal of this research is to provide recommendations to OPTA regarding the enforcement of the DNNL, in such a way that OPTA’s goals are to be fulfilled as much as possible. The second goal is elaborated in section 4.5.3.

In order to achieve the first goal of this research, i.e. discovering potential effects of the DNNL on innovation and business models in the mobile telecom market, the next main research question is defined:

What are the potential effects of the DNNL on innovations and business models in the mobile telecom market?

Hereby the focus is on innovation in general within the mobile telecom market. The mobile telecom market is defined broadly for this research, including mobile telecom providers, Content and Application Providers (CAPs) for mobile devices and mobile device developers. Regarding business models we are interested in business models of mobile telecom providers and CAPs.

We have chosen to research the effects of the DNNL on the mobile market instead of the fixed market, because effects of the DNNL are expected to have the biggest impact in the mobile market. An argument for this is that mobile networks need more data traffic management, because congestion is potentially more severe on these networks. The DNNL limits the possibilities to use traffic management.

Next to this, incumbent mobile telecom providers can have incentives to block or additionally charge competitive CAPs on their network. These CAPs typically compete with voice, SMS and video services of mobile telecom providers. This subject is very relevant since several mobile telecom providers recently reported a shift in usage of voice and SMS services to internet access services. Moreover, some mobile telecom providers make already use of blocking or additional charging of competitive CAPs. In contrast, on the fixed market these signs are less.

4.4.1. Preliminary research questions

To answer the main research question, it is important to know how business models and the innovation process have evolved in the last 15 years in the telecom market. Therefore research questions a & b are:

Research question (a): *How did the innovation process evolve in the last 15 years in the mobile telecom market?*

Research question (b): *How did business models evolve in the last 15 years in the mobile telecom market?*

These questions are answered by consulting literature and by using the theoretical frameworks of innovation and business models described in chapter 3. The results are presented in chapter 5.

As preparation to answer the main research question it is also key to know how the DNNL is interpreted. Since effects regarding business models and innovation could be dependent on this interpretation. Therefore the third research question is:

Research question (c): *How is the Dutch Network Neutrality law interpreted?*

To answer this question, experts were consulted. The results are presented in chapter 6.

4.4.2. Main research question

To answer the main research question five sub questions are defined. To answer these questions both literature and experts have been consulted. The results are presented in chapter 7 (literature) and 8 (expert interviews). The five sub questions are:

Research question (d): *What is the effect of the DNNL on Business Models of mobile telecom providers?*

We are interested in what will change regarding business models of mobile telecom providers when the DNNL law comes into force.

Research question (e): *What are the consequences for CAPs by implementing the DNNL?*

We would like to know whether all services are still accessible for the Dutch audience in the future. What are opportunities and threats for these CAPs? What are potential effects for business models of CAPs?

Research question (f): *What is the effect of the DNNL on innovation of products and services in the mobile telecom market?*

This may be related to innovation of mobile devices, CAPs and products and services of mobile telecom providers.

The innovation in products and services is dependent on the innovation and investment of the mobile telecom infrastructure. This results in the last two sub questions:

Research question (g): *What is the effect of the DNNL on the innovation of mobile infrastructure?*

Research question (h): *What is the effect of the DNNL on investment in mobile infrastructure?*

Investments and innovations in mobile infrastructure depend on the willingness of incumbent players to expand and innovate networks, as well as the willingness of newcomers to enter the market. A key characteristic of mobile telecommunication is the high barrier of entry due high investment cost and limited spectrum space, which as consequence can negatively affect competition. To stimulate competition in the Netherlands, reserved space will be created for new entrants on the mobile market by the next auctions of frequencies⁷ (autumn 2012). A sub question therefore is: What effect has Net Neutrality law on the willingness of newcomers to enter the market?

4.4.3. Recommendations OPTA

The second goal of this research is to provide recommendations to OPTA regarding the enforcement of the DNNL, in such a way that OPTA's goals are to be fulfilled as much as possible. OPTA's goals are promoting competition, encouraging innovation and to protect consumers. In order to provide recommendations to OPTA the next research question is defined:

Research question (i): *Which recommendations can be provided to OPTA regarding the enforcement of the DNNL, in such a way that OPTA's goals are to be fulfilled as much as possible?*

To answer this question, results of the previous research questions are consulted. In addition, by answering this question a scenario analysis will be made. This analysis examines which interpretation of the DNNL should be applied in different scenarios, taking in consideration possible degradation of basic internet services and the consequences for time-critical applications.

4.5. Scenario analysis

The scenario analysis is created using the checklist from "the art of the long view" by Schwartz (1991). This analysis shows what the consequences are by implementing DNNL for innovation of CAPs in diverse scenarios, taking in consideration possible degradation of basic internet services and the consequences for time-critical application.

5. Innovation and business models in mobile telecommunications

This chapter provides the first part of results of this research by answering the first and second research sub questions, which examine how the innovation process and business models evolved in the last 15 years. These questions are answered by consulting literature and by using the theoretical frameworks of innovation and business models described in chapter 3. This chapter starts with a discussion about innovations in mobile telecommunications. Thereafter business models are elaborated.

5.1. Innovations

This section discusses how innovation processes evolved the last 15 years in mobile telecommunications, starting with an overview of recent innovations. Thereafter the innovation process in telecommunications is described. Subsequently innovations are analysed using the framework of Henderson and Clark (1990). This chapter also provides an overview of governmental interventions to stimulate innovation in this sector. At the end of this chapter a summary is included.

5.1.1. Recent Innovations in mobile telecommunication

By the late 1990s Second Generation (2G) digital systems were widely used. In comparison with the first generation (1G) the second generation increased capacity to provide phone calls, which is enabled by the more efficient use of the radio spectrum. Next to this, the security is enhanced and the voice quality was improved upon. Besides, the transmission is now digital instead of analogue. The most used 2G standard worldwide is known as GSM (Global System for Mobile Communications). The second generation era was characterized by an explosive increase in mobile phone usage and the introduction of the prepaid mobile phone, also the use of SMS grew extensively (Chang, Lin, & Yang, 2001; Kano, 2000).

Main innovations in this era were the launch of the first mobile e-mail (1998) and internet service (1999). Examples of early internet services are I-mode, WAP and Vodafone Live, which typically gave access to a limited part of the internet. Another innovation presented in the market in 1999 was a mobile phone including a colour display. Later in 2000 a phone, including a camera, was introduced.

The need for data services (e.g. internet) and data speed was increasing. However, the technology of 2G could not meet these requirements. The successive generation named 3G (third generation), brought the solution (Tseng & Lo, 2011). The requirements for data transmission included 2048 kbps for an indoor office, 384 kbps for outdoor to indoor pedestrian environments and 144 kbps for vehicular connections (Akyildiz, Gutierrez-Estevez, & Reyes, 2010). The focus of 3G is more based on requirements rather than technology. As a result, a lot of competing standards showed up (Kano, 2000). In Europe the most used standard is UMTS (Universal Mobile Telecommunications System).

The increased data speed of 3G caused a radical change in the mobile phone industry. For the first time it was possible to use VoIP (Voice over Internet Protocol), stream radio or even stream video content to compatible mobile devices.

An evolution of 3G technology occurred in the mid 2000 by the implementation of High-Speed Downlink Packet Access (HSDPA) also known as 3.5G, which has higher data capacity and transfer speeds. Currently, a download speed of 28.8 Mbit/s can be reached. Also in the mid-2000s, devices showed up (named dongles) to access mobile internet on laptops (Akyildiz et al., 2010).

At the end of the first decennium of this century, it had become clear that the 3G could not handle all the bandwidth demand in the future. The fourth generation (4G) of cellular wireless standards have to overcome this. These standards are expected to provide a secure and comprehensive broadband solution for laptops, PCs, Smartphones and other mobile devices. Besides, transmission costs have to be reduced. The speed requirements for 4G are set at 100 Mbit/s for vehicular connections and 1 Gbit/s for low mobility communication by the International Telecommunications Union-Radio communications sector (ITU-R)⁸ (Akyildiz et al., 2010; Hui & Yeung, 2003). However, the ITU-R allows some beyond-3G technologies which do not fulfil the 4G requirements, to be branded as "4G"⁹. An example of such beyond-3G technology is 3GPP Long Term Evolution (LTE). Vodafone, T-mobile and KPN started enrolling LTE services in 2012 in the Netherlands.¹⁰

5.1.2. Innovation process telecommunication

As in other markets, firms in the telecom market are rewarded by extraordinary profits by introducing leading innovations, because a firm which introduces a leading innovation, has temporary monopoly power regarding that innovation (Kamien & Schwartz, 1975). This monopoly power diminishes as competitors imitate the innovation or if the innovation becomes obsolete. At that moment, a new cycle of innovation will come (Sundbo, 1998). This cycle has a regular pattern and consists of the introduction of the innovation, the imitation of the innovation, the devaluation of the innovation and the introduction of a new innovation.

The telecommunication environment is characterized by its network effects. In this environment the value of an innovation enlarges when more customers use the new product or service. This characteristic strengthens the position of a firm that introduced a leading innovation. Even if this innovation is imitated after some time the original innovation has still an advantageous position due to network effects. This advantage gives the innovator better assurance to recover the cost of innovation (Stylianou, 2011).

As a consequence of the strong network effects in this market, the pressure to adopt standards is high. Using standards, communication within and between networks is enabled, which maximizes the value of networks. In contrast, in a situation whereby for example every network provider uses another protocol, it would be hard or impossible to communicate to users of other networks (Abbott & Snidal, 2001).

Another characteristic of mobile telecommunication is the scarcity of radio spectrum. As consequence a limited number of mobile operators can receive a license. In addition, regulators typically use exclusive long-term spectrum licensing. These factors lead to a high barrier of entry, which as consequence can negatively affect competition and innovation (Ballon & Delaere, 2009).

The telecommunication environment is also characterised by the fact that innovations occur as result of creative input of end-users, suppliers and intermediates (Hippel, 2007). These actors create an integrated form of research and development (Gellatly & Peters, 1999). In consequence, the development in the telecom industry depends on related but distinct industries. For example, CAPs compete at the Internet services market, but the quality and variety of services they offer depends among others on other businesses that develop equipment to build infrastructure upon which telecommunications rely (e.g. routers, optic fiber) (Stylianou, 2011).

5.1.3. Analysing innovations using the framework of Henderson and Clark (1990)

This section discusses the types of innovations in mobile telecommunications of the last 15 years according to the model of Henderson and Clark (1990). 2G and 3G meet the requirements of Henderson and Clark (1990) to be categorized as radical innovations (see Figure 3) . Here follows an explanation:

2G and 3G consist of other techniques to transfer wireless data, by comparing it to previous generations. It is thereby based on a different set of engineering principles. In addition, the innovations in generations of mobile telecommunication open up new markets and potential applications. For example, 2G made it possible to offer internet services on smartphones and by implementing 3G it became even possible to stream online radio and video.

Next to that, the development of 2G and 3G digital systems both consists of changes in architecture, i.e. the way in which the components are interlinked, is altered by implementing new protocols for mobile communication. Also components (e.g. mobile phones) are affected since new hardware is needed to communicate using new protocols. In addition, the change in architecture also affects the possibilities to implement new functions regarding components (e.g. internet services and stream online video on smartphones).

Both 2G and 3G get the same place in the framework of Henderson and Clark (1990), since 2G and 3G are comparable regarding the degree of radicalness (See Figure 3). Figure 4 and Figure 5 present an overview of characteristics regarding radical innovations of 2G and 3G.

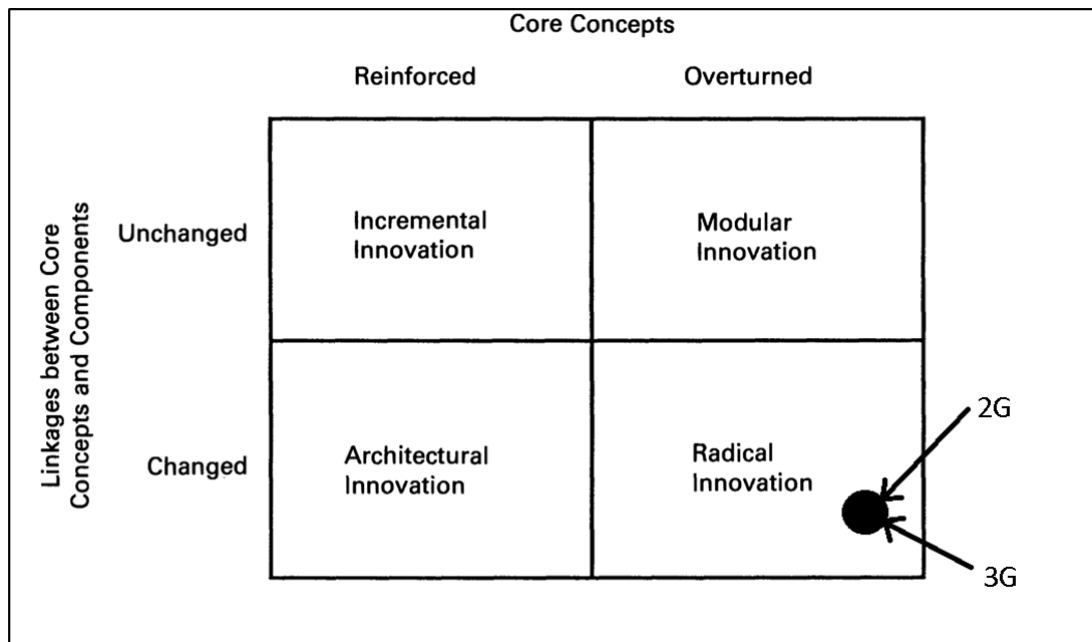


Figure 3: Position 3G and 4G in framework of Henderson and Clark (1990)

Radical innovation characteristics of 2G digital systems	
Different set of engineering principles	New technique introduced for mobile communication. Transmission is digital instead of Analogue (G1). Most used standard GSM.
New markets	Mobile e-mail market, Mobile internet market.
New applications	E-mail, mobile internet.
New dominant design	New technique introduced for mobile communication which changes the way components are interlinked. Most used standard GSM.
Components overturned	Components have to be compatible with the new used technique. New functions possible on components, like internet browsing and e-mail.

Figure 4: Radical innovation characteristics of 2G digital systems

Radical innovation characteristics of 3G digital systems	
Different set of engineering principles	New technique introduced for mobile communication. Most used standard in Europe is UMTS.
New markets	Mobile VoIP market, mobile radio and video streaming market, video-calling market.
New applications	Mobile VoIP, mobile radio and video streaming, video-calling.
New dominant design	New technique introduced for mobile communication which changes the way components are interlinked. Most used standard in Europe is UMTS.
Components overturned	Components have to be compatible with the new used technique. New functions possible on components: VOIP, mobile radio, video streaming, video-calling

Figure 5: Radical innovation characteristics of 3G digital systems

4G innovation

Since standards which comply with the 4G-requirements are not operational yet, no exact claims can be made regarding the innovations it will offer. However if 4G will be implemented it is certain that other techniques will be used that demand other hardware to send and receive the signal. Therefore both architecture and components will be affected. The extent in which 4G will open up new markets and potential applications is hard to predict. Though, by analysing the process of the previous generations we can observe that innovative standards enable the development of new markets and innovative applications.

Fixed pattern

The innovation process in mobile telecommunications seems to have a fixed pattern of radical innovations. It starts with improved standards for mobile telecommunication (step 1). Accordingly, new networks are created which are compatible with the defined standards (step 2). This changes both the architecture and components (hardware, services and applications) of the network. Subsequently, new functions are created regarding

components (step 3), which are enabled by the change in architecture. This process enables the creation of new markets and innovative applications. In chapter 5 and 6, we analyse whether this process of innovations is affected by the DNNL.

5.1.4. Stimulating innovation by governments

Governments try to stimulate innovation in the telecommunication market and do this mainly by increasing competition (Stylianou, 2011). An example is the policy of number portability, which allows retaining the same phone number by switching operators, thereby diminishing the lock-in effect.

Another way to stimulate competition is by sharing spectrum space to allow more telecom operators in the market. The obligation to open networks to other services providers is also a wide used instrument. In the Netherlands KPN is obliged to open their fixed network for competitors¹¹.

Governments also use auctions of spectrum space to enhance competition. In the Netherlands for example space is reserved for newcomers to stimulate competition.¹²

Next to that governments encourage standardisation in order to stimulate innovation. Standardisation can be regarded as developing technical specifications which are supported by all interested parties¹³.

5.1.5. Summary

This chapter presented an overview of innovations in mobile telecommunications of the last 15 years. Also innovation processes were discussed which are typical for this sector. In addition, innovations were analysed using the framework of Henderson and Clark (1990). In this way a clear view was created about the development of innovations in telecommunication. This enables a better analysis of the effect of the DNNL on innovations, which will be elaborated in chapter 5 and 6.

This chapter started with an overview of innovations in mobile telecommunications, which shows that there were a lot of innovations in this sector. An important observation is that the innovation in standards for mobile communications is a key driver for innovation in services on mobile communication networks. For example the increased data speed of 3G made it possible to use VoIP, stream radio or even stream video content to mobile devices.

In addition, this section presented some key characteristics of the innovation process in telecommunications, which are among others network effects. Network effects give the innovator better assurance to recover the cost of innovation. As a consequence of the strong network effects in this market, the pressure to adopt standards is high. Another key characteristic of mobile telecommunication is the scarcity of radio spectrum. Furthermore, regulators typically use exclusive long-term spectrum licensing. These factors lead to a high barrier of entry, which as a result can negatively affect competition and innovation.

To analyse the innovation process in mobile telecommunications the framework of Henderson and Clark (1990) was applied. Using this framework, we concluded that 2G and 3G meet the requirements to be categorized as radical innovations. This is because 2G and 3G consist of other techniques to transfer wireless data and is therefore based on a different set of engineering principles. In addition, both architecture and components are affected by 2G and 3G standards. Next to that new markets were created and new applications were developed.

The innovation process in mobile telecommunications seems to have a fixed pattern of radical innovations which enables the creation of new markets and innovative applications. In chapter 7 and 8, we analyse whether this process of innovations is affected by the DNNL.

This chapter also provided an overview of governmental interventions to stimulate innovation in this sector. Governments try to stimulate innovation in the telecommunication market and do this mainly by increasing competition (e.g. number portability and sharing spectrum space to allow more telecom operators in the market). Innovations do not only occur as a consequence of competition, but also as a result of creative input of end-users, suppliers and intermediates.

5.2. Business models

We want to get a clear view about the last 15 years regarding business models in mobile telecommunications. In this way we can examine how business models have evolved without the DNNL. Thereby we can better analyse what DNNL exactly changes regarding business models, which will be elaborated in chapter 5 and 6.

The evolving of business models in mobile telecommunications are described using the framework of Morris et al. (2005), which is outlined in section 3.3.

The framework of Morris et al. consists of 6 components. This chapter focuses on component 1, 2 and 5, which cover value creation, market factors and value capturing. These components can be described in general terms for the whole Dutch mobile telecommunication market. Component 3, 4 and 6, cover internal capability factors, competitive strategy factors and investor factors. These components focus on specific or internal factors of business and are therefore excluded.

Regarding component 5 (value capturing) the focus is mainly about revenue sources, which be described in general for the whole market.

This section covers subsequently value creation (component 1) and market factors (component 2) generally. Then, main services of mobile telecom operators (Voice, SMS and internet) are discussed into detail regarding value creation (component 1) and value capturing (component 5). Thereafter this chapter focusses on recent changes regarding revenue sources.

The focus is mainly about business models of telecom providers since obligations that result from DNNL are imposed on them. Relevant business models of CAPs are discussed in the section 5.2.3.

5.2.1. Value creation

Mobile telecom providers are mainly focussed at offering services and create value generally by implementing innovations (Van Horne, Frayret, & Poulin, 2006). In this market, value is mainly created by improving service quality, which is particularly done by enhancing providers' sophisticated telecommunication network (Li & Whalley, 2002). The offering of mobile telecom operators varies from mainly standardised to some customization.

The main services that mobile telecom providers have in their portfolio are voice, SMS and internet. Voice and SMS services were already part of mobile providers' offering 15 years ago. Mobile internet was introduced in 1999¹⁴ in the Netherlands. Next to these services, also mobile phones and smartphones are offered by mobile telecom providers. Voice, SMS and internet consist of the own service delivery of telecom providers, while telecom operators are typically a reseller of mobile phones and smartphones.

Telecom operators generally use both direct and indirect distribution. Regarding product lines no general claims are made since this varies too much across different mobile telecom providers.

A style of offering which is widely used by telecom operators nowadays is bundling, whereby a number of products or services are combined in one offering. Such a bundle consists for example of a smartphone and services like voice transmission, internet and SMS (Dedrick, Kraemer, & Linden, 2011).

In combination with a bundled offering, often a handset subsidy is given. This is a subsidy on the device, given to a customer who signs up for a subscription. The bundled offering typically consists of an obligatory subscription period of 1 or 2 years. During this time the handset subsidy is recovered mainly by means of monthly service fees. The operator mostly combines this offering with a SIM-lock, which prevents the usage of the phone on competitive operators' networks. The handset subsidy in combination with SIM-lock often causes a strong lock-in effect. This is because the subscriber faces high switching costs by changing operators (Tallberg, Hammainen, Toyli, Kamppari, & Kivi, 2007).

5.2.2. Market factors

Market factors relate to the question: To whom do mobile telecom operators create value for?

MNOs deliver their services typically on a national or international scale. Next to that, most MNOs both offer services to businesses and private customers. Furthermore, services are offered in most instances on a relational base which is characterized by longevity of relationship with customers. Regarding target markets, MNOs use various tactics, which consist of a broad market, a multiple segment and a niche market approach.

5.2.3. Value creation and value capturing in detail

We saw that the offering of mobile telecom operators mainly consist of voice, SMS, and internet services. The next section focusses on each of these services in depth, focussing on both component 1 (value creation) and component 5 (value capturing) of the framework of Morris (2005) are addressed.

Voice and SMS

Mobile providers have through the years created a wide range of different tariff plans to offer voice services. These are both related to the value creation (component 1) and the value capturing (component 5) part of the business model. Corrocher and Zirulia (2010) gave an overview of different characteristics of these tariff plans.

Characteristics consist among others of the way of payment (Pre-paid or subscription) and the way in which voice services are charged (per second/minute etc.). For a complete overview see Appendix H: Overview tariff plans of voice services.

Except of fees charged directly to customers, MNOs charge termination fees to other MNOs and fixed network operator. Termination fees are charges that providers levy on other providers for completing calls on their network. These termination fees are regulated in every country in the EU. Cost models are used to determine which tariff may be charged regarding termination fees. (Harbord & Pagnozzi, 2010).

SMS is mostly offered using a flat fee or a usage-based pricing scheme (Basalisco, 2011).

Another source of income are international roaming services, which allow mobile consumers to use their domestic services (voice, SMS, data) abroad with the same number and convenience. Using international roaming services is expensive. According to the European Commission this can be attributed to competition problems in international roaming markets. To lower the charges for using mobile phones abroad, various tariff caps are applied in member states of the European Union (Ambjørnsen, Foros, & Wasenden, 2011; Infante & Vallejo, 2012).

Regulations regarding termination fees and roaming services limit options to capture value for MNO's (component 5 of the framework of Morris (2005)).

Internet

The possibility to provide internet on mobile devices gave Mobile Network Operators (MNOs) a lot of options to develop new propositions. MNOs invested a lot of money to purchase UMTS (3G) licenses. Li and Whalley (2002) state that "MNOs need a major share of the traffic and the value-added services that 3G makes possible in order to justify these investments". A way to do this is by offering mobile portals. Li and Whalley (2002) point out that this provides MNOs the opportunity to get in the profitable role of service provider.

In the following section mobile portals are discussed. Thereafter the focus is on open internet access including an explanation of two sided markets. This section ends with a discussing about quasi open internet access.

Mobile portal

Mobile portals provide access to content and applications. In this section the main used forms are discussed.

On a portal owned by the MNO, access can be offered to services provided by both the MNO and independent service vendors. In this setting the MNO maintains control of communication, customer data, purchase transactions and access to the customers. This model is known as the *walled garden*. MNOs can set requirements regarding branding and technology to admit CAPs on their portal. On this portal the MNO can also gain revenue by selling advertising space (Chakravarty & Werner, 2011; Jaokar & Fish, 2004; Reuver, 2011).

There are different forms of payment possible in the walled garden business model. The payment always consists of a fee for services and a fee for the usage of the network infrastructure. The first form is *fixed "wholesale" price*. In this form the service vendor has to pay a fee to the network operator based on the use of the network (use of megabytes data). Next to that, customers have to pay the service vendors for their chosen service. The second form is *revenue sharing* whereby the mobile network operators first receive all the money and subsequently shares the revenue with the service vendors (Chakravarty & Werner, 2011).

Another way to gain revenue is by outsourcing portals allowing independent portals to reach the customer base of a MNO. This model is known as the *open access* model. In both models, *walled garden* and *open access* it is not possible to reach portals or sites that are not admitted by the MNO (Li & Whalley, 2002). The open access model has not to be confused with open internet access in which the network operator has no gate-keeper role.

The walled garden model was very popular by MNOs. It gave them the possibility to capture a considerable part of revenue generated by content and application services (Feijóo, 2006), instead of being only a data

provider (Cuevas, Moreno, Vidales, & Einsiedler, 2006). A key advantage for customers using walled gardens is a consistent experience, because the presented content has the same look and feel (Methlie & Pedersen, 2007). In addition, complexity for the user is reduced by centralising billing, security and customer support at the MNO (Li & Whalley, 2002).

In contrast, the public generally demands an unrestricted and wide choice of content and applications. Walled gardens did not comply with this demand. This resulted in the collapsing of walled gardens all around Europe. MNOs replaced the walled garden with more open models, letting customers accessing content and applications not listed on their portals. This resulted in more content and applications accessible for end-users and less constrains for CAPs to reach mobile customers (Reuver, 2011).

Open internet access

The opposite of the walled garden model is the open internet access model. In this setting subscribers of MNOs can access the whole internet using their mobile phone. Subscribers are in this model not dependent on the provided content by MNOs.

This model implies for MNOs that they cannot control access to content. In practice this means that one stream of revenue is lost for MNOs by comparing it with the walled garden model. I.e. they cannot charge CAPs for access to MNOs' subscribers in this model. However they still have the possibility to offer own content and application services and pre-configure their own homepage on subscribers' phones.

The main used tariff plans regarding open internet access nowadays are flat-rate and usage based pricing (Altmann & Chu, 2001; Harno, 2010). By using flat-rate a single fixed fee is charged for unlimited data usage, or a set maximum of data usage. By applying usage-based pricing a customer can pay for a bundle of data (e.g. 200MB) or he can pay per used MB. In the Netherlands unlimited mobile internet access was available for a set price since 2005¹⁵. However, most providers stopped offering this service in 2010¹⁶. These unlimited mobile internet offerings were typically replaced by data bundles.

To reach other networks, Internet Access Providers (IAPs) generally negotiate transit and peering agreements. By using peering IAPs interconnect directly with each other. Using peering, IAPs can reach other networks including customers, without the obligation to carry traffic to other networks. In this settlement typically neither party has to pay.

In contrast, transit agreements demand payment. In this setting one provider (the transit provider) agrees to carry traffic to other networks on behalf of another provider. The transit provider carries this traffic typically to and from every destination that can be reached on the internet.

In the open internet access model users pay a fee to their Internet Access Provider (IAP) and have connection to all users who are connected to the internet. Also CAPs, who also can be users, can reach all users if they are connected, since the internet does not distinguish, by its own design, between CAPs and users. In this system no terminations fees have to be paid. Termination fees are in this context fees that an IAP can charge to CAPs for accessing their network. For CAPs this model has the advantage that they do not have to negotiate with MNOs to get access to their customer base, since no termination fees are present in this model, which is common today on the internet.

In contrast to the internet, on other networks such as cable television and telephone networks, termination fees are widely used. One reason for this is that the purpose of internet was that it enables reaching any user on any connected network. Next to this, no need existed to charge CAPs in the original design of the internet, since fees to connect to the network were paid by government, universities and research departments. Also government regulations, which designated the internet as a non-commercial network, discouraged termination fees. Regarding technology, the internet was designed to be used world-wide by diverse parties who would only need very little centralized knowledge, just that everyone could reach one another. Consequently, billing for accessing particular destinations was difficult (Lee & Wu, 2009).

Two sided market

The discussed networks can all be regarded as two sided markets (cable television, telephone network and internet). Two-sided markets can be “roughly”^b defined as “markets in which one or several platforms enable interactions between end-users, and try to get the two (or multiple) sides ‘on board’ by appropriately charging each side” (Rochet & Tirole, 2004). Payments are possible on both sides of the market. For more information about two-sided markets see Appendix I: Two-sided markets.

Quasi open internet access

Nowadays, most offered internet access services provide unrestricted internet or provide an intermediate form between the open internet access model and the walled garden model. A new term is introduced to categorize this type of internet access service is: the quasi open internet access model. In the quasi open internet access model, most independent CAPs are accessible, but some CAPs are blocked or hindered. This is mainly because of competitive or congestion management reasons. BEREC reported in 2012 that a part of the mobile telecom providers in Europe block VOIP and P2P traffic on their networks.¹⁷ In the Netherlands it was known in 2011 that KPN and Vodafone blocked VOIP in some of their mobile internet services¹⁸. However, no exact numbers are available about how many IAPs blocked services and in how many contracts this occurred.

5.2.4. Recent changes revenue sources

Voice, SMS and data services have been the main sources of revenue for MNOs of the last 15 years. Of them, voice services are the biggest source of revenue. Figure 9 (Appendix A) shows an overview of the revenue ratios of Dutch MNOs of the period 2008-2011 in the retail market. According to this data the revenue streams of SMS and Voice seem stable.

However, MNOs are afraid to see their revenue of Voice and SMS services shrink at the expense of data-services. This assumption is underlined in the Dutch Mobile Operators Q4 2011 report of Telecom Paper which expects that mobile data (SMS excluded) will be the major driver and has to compensate for drop in voice.¹⁹ In addition, they note that the use of data-services intensifies, leading to big growth of mobile data traffic. Nevertheless it does not cover the lost revenue they expect.

Due to these circumstances, Dutch mobile providers changed their tariff plans. These are mainly related to the fear of cannibalization and the growth of mobile data traffic.

In the Dutch telecom market there were signals that MNOs tried to prevent this cannibalisation by changing their business model. An option to do this is by raising prices of mobile internet and introducing data quantity or speed caps to diminish the use of competitive services. A more straightforward way to prevent cannibalisation is by blocking, hindering or additionally charge competitive services. Next to that expansion and innovation of data-networks could be stifled to prevent competition of traditional services. A remarkable business model that could be used to prevent cannibalisation is a special form of bundling. In this form it is only possible to purchase mobile internet combined with voice and SMS services. If you want more data, then you also have to purchase more voice minutes and SMS.

Another reason Dutch providers gave to change their business model is the unexpected growth of mobile data traffic, that has as consequence that MNOs need to invest intensely in their mobile network. The main business model changes that can be coupled to the growth of data are the raising of mobile internet prices, the reintroduction of data quantity caps and blocking or throttling of bandwidth-intensive services.

An extensive discussion about cannibalisation and data growth is presented in Appendix A: Cannibalisation and Data-growth.

Figure 6 presents an overview of main changes regarding business models of operators of the last 15 years, taking in consideration the framework of Morris et al. (2005).

^b The term “roughly” is used by Rochet and Tirole (2004) because there is no unambiguous definition of two-sided markets.

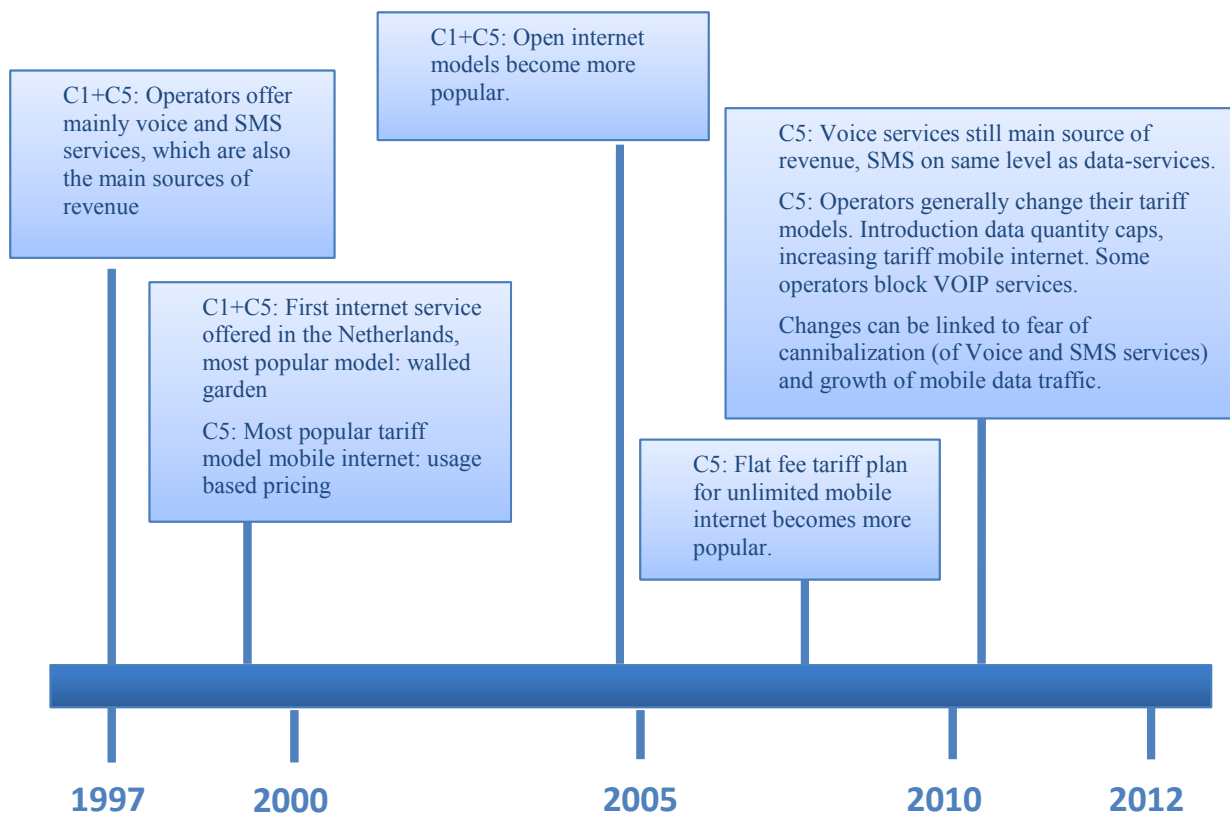


Figure 6: Overview of changes in business models of operators of the last 15 years (C refers to “component” of the framework of (Morris et al., 2005))

5.2.5. Summary

This chapter discussed business models in mobile telecommunications of the last 15 years. The goal was to get a clear view about how business models evolved without the DNNL, which results in a better analysis regarding the effect of the DNNL on business models. The evolving of business models in mobile telecommunications were described using the framework of Morris et al. (2005), which is outlined in section 3.3.

Mobile telecom providers are mainly focussed at offering services and create generally value by implementing innovations. In this market, value is mainly created by improving service quality. The offering of mobile telecom operators is mainly standardised.

The main services that mobile telecom providers have in their portfolio are: voice, SMS and internet. These services consist of the own service delivery of telecom providers. A style of offering which is widely used by telecom operators nowadays is bundling (e.g. a bundle including a smartphone, voice transmission, internet and SMS). In combination with a bundled offering, often a handset subsidy is given.

MNOs also capture value by offering international roaming services and by charging termination. However, regulations are imposed which limit this capturing of value.

MNOs deliver their services typically on a national or international scale. Next to that, most MNOs both offer services to businesses and private customers. Furthermore, services are offered in most instances on a relational base.

Mobile providers have through the years created a wide range of different tariff plans to capture value of voice services. Voice services are often bundled with SMS and internet services by MNOs. In combination with a bundled offering, frequently a handset subsidy is given.

The possibility to provide internet on mobile devices gave MNOs a lot of options to develop new business models. At the emergence of mobile internet, mobile portals were very popular. This business model gave

MNOs the opportunity to get in the profitable role of service provider. One form of a mobile portal, which was also the most popular form, was the *walled garden*. In this setting the portal was owned by the MNO, whereby the MNO maintained control of communication, customer data, purchase transactions and access to the customers. MNOs could set requirements regarding branding and technology to admit CAPs on their portal

However, the public generally demands an unrestricted and wide choice of content and applications, which resulted in the collapsing of walled gardens all around Europe. MNOs replaced the walled garden with more open models. The opposite of the walled garden model is the open internet access model, in which subscribers of MNOs can access the whole internet. The main used tariff plans regarding open internet access nowadays are flat-rate and usage based pricing. To reach other networks, IAPs generally negotiate transit and peering agreements. In this system no termination fees have to be paid. Termination fees are in this context fees that an IAP can charge to CAPs for accessing their network. In contrast to the internet, on other networks such as cable television and telephone networks, termination fees are widely used.

All these networks can be regarded as two sided markets and can be “roughly” defined as “markets in which one or several platforms enable interactions between end-users, and try to get the two (or multiple) sides ‘on board’ by appropriately charging each side” (Rochet & Tirole, 2004).

Nowadays, many offered internet access services lie somewhere between the open internet access model and the walled garden model. This is called the quasi open internet access model. In this model, most independent CAPs are accessible, but some CAPs are blocked or hindered. This is mainly because of congestion management or competitive reasons.

Voice, SMS and data services have been the main sources of revenue for MNOs of the last 15 years. However, MNOs are afraid to see their revenue of Voice and SMS services shrink at the expense of data-services like VOIP and text-message services. In the Dutch telecom market there were signals that MNOs tried to prevent this cannibalisation by changing their business model. An option to do this is by raising prices of mobile internet and introducing data quantity or speed caps to diminish the use of competitive services. A more straightforward way to prevent cannibalisation is by blocking, hindering or additionally charge competitive services.

Another reason Dutch providers gave to change their business model is the unexpected growth of mobile data traffic, that has as consequence that MNOs need to invest intensely in their mobile network. The main business model changes that can be coupled to the growth of data are the raising of mobile internet prices, the reintroduction of data quantity caps and blocking or throttling of bandwidth-intensive services.

We are interested in the question how the DNNL influences these developments regarding business models. Consequences for business models will be discussed in section 7.1 and 8.1, which focus on the effect of the DNNL on business models of mobile telecom providers. Next to that, section 7.2. and 8.2 discuss consequences for CAPs regarding business models.

6. Interpretation DNNL

This chapter provides the second part of results of the research by analysing how the DNNL is interpreted. This is important since the way in which this law is interpreted can affect the influence of the DNNL on business models and innovations.

To examine how the DNNL is interpreted, first exploratory interviews were held with external experts and experts of OPTA. Appendix C includes the questionnaire and list of consulted experts. These interviews indicated that there was no consensus about the interpretation of the law. Also the expert interviews about the potential effects of the DNNL on business models and innovation (Chapter 8) showed that the DNNL is not interpreted unambiguously.

Two plausible scenarios were created, in which most interpretations of experts can be categorized, considering innovation and business models. These interpretation scenarios will be used by discussing the effects of the DNNL on business models and innovation in chapter 7 and 8. The interpretation scenarios are also in chapter 10, which provides recommendations to OPTA

In addition, this chapter presents the interpretation of the DNNL regarding termination fees and possibilities of CAPs charging IAPs, or CAPs refusing to supply content to IAPs. This is important since effects of the DNNL on business models and innovation can depend on the interpretation of the DNNL regarding these issues. This chapter ends with a conclusion.

6.1. Interpretation scenarios

This section presents two interpretation scenarios. These are based on exploratory interviews regarding the interpretation of the DNNL and the interviews about the potential effects of the DNNL on business models and innovation.

The first defined scenario assumes a strict interpretation and the second scenario assumes a tolerant interpretation.

The DNNL is in both scenarios interpreted as a zero-price rule, i.e. no termination fees can be charged to CAPs to give them access to IAPs' networks. This is because most experts regard the DNNL as a zero-price rule (see 6.2). The scenarios provided have three foci:

- 1) IAS and 'separate service'
- 2) Traffic management
- 3) Tariff restrictions

Strict interpretation

By applying a strict definition of the net neutrality law, it is not allowed to offer separate services next to an IAS on the same connection, i.e. a proposition in which for example on the same connection an IAS is offered plus a VoIP-service as separate service is not allowed. The separate service can only be offered on a separate connection.

Regarding traffic management, IAPs are not allowed to prioritize traffic when there is no congestion in this scenario. Only in the event of congestion prioritizing is allowed, whereby same types of traffic have to be treated equally. The term congestion is in this scenario explained as a reduction of the quality of services and applications that is noticeable to the end-user and is caused by a temporary lack of capacity.

Regarding tariff restrictions, premium services or applications that are offered or used via the IAS cannot be bundled in an offering with an IAS, whereby the premium service or application is discounted. For example, an IAS combined with Spotify Premium for free (normally 10€) is not allowed. Moreover, it is not permitted to additionally price services and applications that are offered or used via the IAS.

Tolerant interpretation

The tolerant interpretation gives providers the possibility to offer separate service next to an IAS. (Not all services on the internet can be regarded as separate services: see section 3.1.3.) It is also possible to offer these separate services next to an IAS with (active) priority. It is for example allowed to provide IAS and a separate service like Netflix (video-streaming) with active priority on the same connection.

Next to that, payment of customers and CAPs for priority of services on an individual base is possible using the separate service option. In addition, there are no tariff restrictions regarding separate services, i.e. it is allowed to offer for example a separate service with a cheaper data-charge than the data-charge of an IAS.

Prioritizing of time-sensitive applications on the IAS (itself) is also always allowed by applying this interpretation, even if there is no congestion. This guarantees that when congestion occurs, the right measures are immediately operational. The Usage of active prioritization (bandwidth reservation) is also allowed, as long as it does not affect other traffic disproportional. If there is congestion the IAP still has to make sure that the same types of traffic have to be treated equally.

Regarding tariff restrictions it is allowed to bundle premium services on the internet with an IAS, whereby the service or applications is discounted. For example an IAS combined with Spotify Premium for free (normally 10€) is permitted. There is only an infringement if particular services or applications are additionally priced that are offered or used via the IAS.

Figure 7 shows an overview differences strict and tolerant interpretation.

	Strict interpretation	Tolerant interpretation
IAS and 'separate service'	<ul style="list-style-type: none"> Separate service next to an IAS on the same connection prohibited 	<ul style="list-style-type: none"> Separate service next to an IAS on the same connection allowed
Traffic management	<ul style="list-style-type: none"> Not allowed to provide (paid) priority to services on an individual base. 	<ul style="list-style-type: none"> Providing (paid-) priority to application or services on an individual base is possible using the separate service option.
Tariff restrictions	<ul style="list-style-type: none"> Premium services on the internet, like Spotify premium, may not be bundled with an IAS, in which the premium service is discounted (No option to offer separate services next to an IAS) 	<ul style="list-style-type: none"> Premium services on the internet, like Spotify premium, may be bundled with an IAS, in which the premium service is discounted No tariff restrictions regarding separate services, i.e. it is allowed to offer a separate service with a cheaper data-charge than the data-charge of an IAS

Figure 7: Overview differences strict and tolerant interpretation

6.2. Possibilities regarding termination fees

Experts generally point out that charging termination fees to CAPs by IAPs is not explicitly prohibited by this law. However, it is not allowed as an IAP to block or hinder traffic on the internet. As consequence, it makes no sense to charge CAPs, because IAPs cannot block or hinder traffic of CAPs, who do not pay. Therefore most experts regard the DNNL as a zero-price rule, i.e. no termination fees are charged to CAPs. Though, a few experts think that it is maybe allowed to charge a uniform tariff.

6.3. CAPs charging or refuse to supply their content to IAPs

Experts generally think it is allowed for CAPs to charge IAPs for transmission of their content or refuse to supply their content to IAPs. This is because the DNNL imposes restrictions to IAPs and not to other parties like CAPs.

6.4. Conclusion

The main conclusion that can be derived of this chapter is that the DNNL is interpreted in different ways. Two interpretation scenarios were made in which most interpretations of the consulted experts can be categorized. These are a tolerant and a strict interpretation scenario. The tolerant interpretation scenario provides more possibilities regarding separate services, traffic management and tariff options. In contrast, the strict interpretation scenario provides fewer options regarding separate services, traffic management and tariff options.

7. Literature

This chapter provides the third part of results of this research. In this part literature is consulted to find potential effects of the DNNL on business models and innovation. An overview of journals which are consulted for this literature review can be found in section 4.2.

This chapter is divided in four sections that each focus on one research sub question regarding potential effects of the DNNL on business models and innovation. In these sections first relevant extracts found in literature are presented. Thereafter the link to DNNL is discussed if needed.

The research questions regarding business models are answered using the framework of Morris et al. (2005). The research questions regarding innovation are answered using the framework of Henderson and Clark (1991) (see Chapter 2).

7.1. Research question (d): What is the effect of the Dutch net neutrality law on business models of mobile telecom providers?

We are interested in what will change regarding business models of mobile telecom providers when the DNNL comes into force. Therefore this section discusses the effect of the DNNL on business models of mobile telecom providers. Also consequences for consumers are addressed.

This section contains two sub sections. First, the focus is on value creation. Subsequently section two discusses value capturing.

7.1.1. Value creation

This sub section examines the effect of the DNNL regarding value creation (Component 1 of the framework of Morris et al. (2005)) of mobile telecom providers. Also consequences for consumers are addressed.

This sub section is split up in three parts, each focussing on an aspect regarding differentiation in business models of IAPs. First quality of access service is discussed. Thereafter, exclusive deals between IAPs and CAPs are examined. Subsequently the focus is on Limited internet offering. This section ends with a summary.

Quality of access service

Hermalin and Katz (2007) point out that net neutrality regulation would give internet providers no other option than to offer a single quality of access service. Thus, consumers, who were satisfied with only a low quality access service, have to purchase a service which is more expensive for them than needed, or would not purchase the single offer. Also consumers who want to have a high quality access service can only purchase the offering which is of less quality. Both would lose in this case from NN. The only consumers who may be better off are those who demand intermediate quality access.

By applying DNNL IAPs are allowed to differentiate on bandwidth and amount of data use. In the event of congestion IAPs are also allowed to prioritize traffic of subscribers who have a relatively high bandwidth subscription above subscribers who have a relatively low bandwidth subscription. However no combination, for example a proposition with relatively low bandwidth but high quality (priority during congestion), is allowed.

Next to that, it is not allowed to only offer a part of the internet for consumers who only need that. They have to pay for a whole internet connection, which is more expensive for them, or they would simply not buy the offer.

In conclusion, IAPs have fewer options to differentiate their offering, which can lead to a more standardized propositions and can thereby possibly affect the depth of IAPs' product line. Next to that, fewer options to differentiate could lead to consumers purchasing a service which is more expensive for them than needed, or they would not purchase the offer at all. This reduces customer welfare. However, it is still allowed to differentiate on bandwidth and data amount.

Crocioni (2011) further points out that the usefulness of services like VoIP, games and video-streaming could be damaged or made completely useless if there is no possibility to prioritize this kind of delay sensitive traffic. As a result certain, applications would not be developed, because developers know it cannot function.

As stated in section 6.1., using a strict interpretation of the DNNL prioritizing is only allowed in the event of congestion whereby same types of traffic have to be treated equally. However it is not allowed to prioritize

only one particular service. By applying a tolerant interpretation it is possible to prioritise one particular service using the separate services option. So there are still ways to enhance the quality of services by giving particular services priority in the DNNL. Though, options to prioritize are limited.

Crocioni (2011) further states that customers also want to assign preferences to some kind of traffic instead of other.

This is limited by applying DNNL which imposes rules regarding traffic management. An IAP is still allowed to choose what type of traffic is prioritized or delayed during congestion. However, only by applying a tolerant interpretation of the DNNL it is possible to prioritize traffic on an individual base, using the separate service option.

As a result, due to the DNNL, IAPs have fewer options to differentiate their propositions, which can lead to a more standardized product offering and can thereby possibly affect the depth of IAPs' product lines. Consequently, customer choice could be reduced.

Exclusive deals between IAPs and CAPs

Kocsis and De Bijl (2007) argue that the possibility for differentiation by IAPs can lead to exclusive deals between IAPs and CAPs. In result, particular content would only be accessible from one IAP, while other content is only accessible by another IAP. This would lead to horizontal differentiation between IAPs. As consequence, competition between IAPs is reduced, which could lead to higher prices and lower quality offered to customers.

One form of exclusive deals is clearly prohibited by the DNNL. In this form an IAP makes a deal with a CAP in which the IAPs blocks competitors of this CAPs on his network. It seems that exclusive deals in which an IAP exclusively offers access to one CAP is still allowed, because no competitive CAPs are blocked (see section "7.2.3" and section "8.2.3." which discuss this option for exclusive deals.)

Limited internet offerings

If an IAP blocks or hinders a competitive CAP this is called economic foreclosure in literature. This practice reduces customer choice and results in services not being consumed by comparing it with a competitive market (Marcus, Nooren, Cave, & Carter, 2011). By applying DNNL it is not possible anymore to block or hinder (competitive) CAPs by IAPs.

7.1.2. Value capturing

This section focuses on value capturing (component 5 of the framework of Morris et al. (2005)) of mobile telecom providers. We found in particular literature regarding revenue sources that are potentially affected by NN.

Guo, Cheng, and Bandyopadhyay (2012) analyse by using a game theoretic model why IAPs might want to charge lower subscription fees to consumers under a situation without NN. In their model it is possible to charge CAPs for preferential delivery under a situation without NN. Under NN no differentiation in access speed regarding services on internet is possible, which is defined in literature as a non-discrimination rule. In the used model termination fees are not taken in consideration.

It depends on the interpretation whether DNNL can be seen as a non-discrimination rule. By interpreting the DNNL tolerantly it is possible to let CAPs or customers pay for priority for specific services using the separate service option. However, by interpreting the DNNL strictly, prioritizing specific services is not possible. Therefore only by applying the DNNL strictly it can be seen as a non-discrimination rule.

Guo et al. (2012) conclude that abandoning NN would lead to lower subscription fees for customers. The rationale behind this is that IAPs lower subscription fees to attract more customers, thereby increasing the willingness-to-pay of content providers. This results, according to the model, in a bigger profit for IAPs in a situation without NN.

Economides and Tåg (2012) also show that in a situation without NN profit for IAPs is bigger. They use the same rationale as Guo et al. (2012) to explain this effect. However, in this model IAPs can charge CAPs to get access to IAPs' networks (termination fees) in a situation without NN. NN is applied as a zero-price rule. In chapter 6 we saw that most experts regard the DNNL as a zero-price rule, i.e. no fees are charged to CAPs to give them access to IAPs' networks.

Models described above use a monopoly setting or a duopoly setting. In the Netherlands the mobile market consist at the moment of 3 main players (having an own network) and a lot of Virtual Mobile Network Operators (VMNOs) who offer services nationwide. Kocsis and De Bijl (2007) point out that if competition is more intense between networks, IAPs have less power to charge CAPs. This is because CAPs have more choice for better quality. NN is hereby regarded as a non-discrimination rule. Thus, the described effects could be different for a market like the Netherlands.

Williamson, Black, and Punton (2011) point out that the open internet model has led to a wave of innovation. As a result customers have a higher demand for improved internet services. Customers are willing-to pay the IAP, because they get access to content and applications on the internet. Fees charged to CAPs negatively influence the growth in internet application and therefore also demand for internet access and willingness to pay by consumers. IAPs therefore benefit having an open internet.

Another advantage for IAPs, having an open internet, is that no transaction costs have to be made. These transaction cost include costs to negotiate with a big number of CAPs (Lee & Wu, 2009).

7.1.3. Summary

This section discussed the effect of the DNNL regarding business models of mobile telecom providers by consulting literature. The focus was on value creation and value capturing, considering the framework of Morris et al. (2005). Also consequences for consumers were addressed. This section provides a summary.

Value creation

According to several scholars, IAPs have fewer options to differentiate their offering by applying DNNL. IAPs' offering is limited regarding quality of access to customers. Also propositions in which a single service gets priority are limited. How severe the DNNL affects these propositions depends on the interpretation of the law. Still, by applying DNNL tolerantly, space to make propositions in which services are prioritized on a single base are limited. As a result, customer choice could be limited.

DNNL prohibits economic foreclosure (i.e. the practice of blocking or hindering competitive CAPs, by IAPs). According to Marcus et al. (2011) economic foreclosure reduces customer and results in services not being consumed by comparing it with a competitive market.

Value capturing

Several scholars conclude that, under a situation without NN, IAPs would make more profit. The rationale behind this is that IAPs lower subscription fees to attract more customers, thereby increasing the willingness-to-pay of content providers. In contrast, other researchers point out that charging CAPs (by IAPs) would decrease demand by customers, since less content will be available. IAPs therefore benefit having an open internet.

7.2. Research question (e): What are the consequences for CAPs by implementing the DNNL?

This section addresses the consequences for CAPs by implementing the DNNL. We would like to know whether all services will still be accessible for the Dutch audience in the future. In addition, we are interested in the opportunities and threats for CAPs resulting from the application of the DNNL. We would also like to know the potential effects of the DNNL for business models of CAPs, taking the framework of Morris et al. (2005) in consideration.

This chapter starts with a discussion about the effects of the DNNL on willingness to invest of CAPs. Subsequently, the focus is on the effects regarding quality differentiation for CAPs. This is followed by a discussion about CAPs charging IAPs and refusal to supply content to IAPs. This section ends with a summary.

7.2.1. Willingness to invest CAPs

Several scholars show that CAPs are more willing to pay to IAPs in a situation without NN. The rationale behind this is that IAPs lower subscription fees to attract more customers, thereby increasing the willingness-to-pay of content providers (see 7.1.2 Value Capturing). This influences the value capturing part of CAPs' business models. It typically means that CAPs' profit margins diminish. Proponents of NN point out that this could lead to problems for some CAPs. They believe that for many online start-ups, it would be hard or almost impossible to pay fees demanded by IAPs when revenue streams are low or even non-existent. As consequence,

entrepreneurs would be more reluctant to start an online business and customers' choice would be diminished (Guo et al., 2012; Wu, 2006).

Next to that, Pil Choi and Kim (2010) report that a discriminatory regime can weaken CAPs' investment incentives regarding cost reductions and quality enhancements, because of CAPs' concern that IAPs could capture some of the investment benefits. For consumers it means that quality of applications and services could potentially be less under a discriminatory regime. In the study they conducted, a queuing theory model is used whereby net neutrality is modelled as a non-discrimination rule.

As stated, DNNL can be regarded as a non-discrimination rule by applying it strictly. By applying the DNNL tolerantly, giving priority to services on an individual base is allowed (under certain circumstances).

Another concern for CAPs are transaction costs, which show up if CAPs have to pay fees to IAPs. These transaction cost include costs to negotiate with a big number of IAPs. This affects the value capturing part of CAPs' business models. It typically means that it diminishes CAPs' profit margins. Lee and Wu (2009) point out that this could endanger the existence of particular CAPs. They further state that these transaction costs often favour well-financed, established and commercially focussed CAPs at the expense of specialized, niche and non-established CAPs. As consequence diversity in consumers' choice could be reduced.

7.2.2. Quality differentiation

Hermalin and Katz (2007) point out that applying a non-discrimination rule implicitly results in IAPs only supplying one connection quality. Consequently, CAPs wanting a high quality connection cannot buy it. This can affect value creation for CAPs wanting high quality negatively. Also consumers could suffer who are interested in a high quality service.

In addition, Crocioni (2011) points out that the usefulness of services like VoIP, games and video-streaming could be damaged or made completely useless if there is no possibility to prioritize this kind of delay sensitive traffic. As a result certain applications would not be developed, because they know it cannot function. This can affect value creation of CAPs, who offer latency sensitive services, negatively.

Economides and Tåg (2007) point out other effects. In their view, the possibility of IAPs giving exclusive (priority) access to a particular CAP, for example by using auction, could lead to monopolization on the content and application market which is advantageous for big CAPs. This puts pressure on business models of small CAPs. Besides, it could also negatively affect innovation, because small firms have little chance to win such auction. As consequence, customer choice could be reduced. No examples from practise are known in which an IAP organises an auction among CAPs.

In addition, a model of Pil Choi and Kim (2010) shows that IAPs have an incentive to degrade low-priority service to increase the willingness of CAPs to pay for their priority service. Therefore CAPs could be worse off in a situation without NN. The practice of degrade low-priority service affects the value capturing part of CAPs' business models. It typically means that CAPs' profit margins diminish. For customers it could mean that the quality of applications and services, of CAPs who do not pay for priority, diminishes. It is also possible that that CAPs will charge customer heavier to pay for priority. As consequence, customer welfare could be reduced.

As stated, using a strict interpretation of the DNNL, prioritizing is only allowed during congestion and by treating same types of traffic equally. Though, it is not allowed to prioritize only one particular service. By applying a tolerant interpretation it is possible to prioritise one particular service using the separate services option. So there are still ways to enhance the quality of services by giving them priority in the DNNL. However flexibility to do this is taken away depending on the interpretation.

7.2.3. CAPs charging IAPs and refusal to supply content to IAPs

DNNL only applies to IAPs and not to CAPs. Therefore CAPs are allowed to charge IAPs or refuse to supply their content to IAPs.

Lee and Wu (2009) state that these arrangements are not desirable because they may lead to fees charged on others, such as end-users. In addition, even if this is the only stream of fees allowed, it would still enlarge transaction costs for IAPs and CAPs, which affect profit margins negatively. These transaction costs include negotiation costs between CAPs and IAPs. Besides, it would lead to fragmentation, because some IAPs could decide not to pay CAPs. As consequence, some services are only accessible by IAPs who pay for it. Also

exclusive deals are possible in which an IAP can agree with CAP to only provide their service to his network. As a result this fragmentation leads to customer foreclosure.

Lee and Wu (2009) also point out that regulations to prevent this behaviour are not necessary because CAPs who charge IAPs will automatically have less customers who can access their content. As consequence less revenue is expected regarding paid services of customers and advertisements. Also value creation of CAPs is affected negatively due network effects, i.e. a lot of services on the internet become more valuable for consumers if more people use these services.

Another reason why regulation to prevent CAPs charging is not necessary is because it is unlikely that customers of IAPs would collectively switch to another IAP when they cannot get access to a particular service. There are maybe a few CAPs who have the power to let customers switch. Consequently, the bargaining position to charge money to IAPs is little for CAPs (Lee & Wu, 2009).

7.2.4. Summary

This section addressed the consequences for CAPs by implementing the DNNL. Also consequences for consumers are taken into consideration. The framework of Morris et al. (2005) is used by analysing the effects of the DNNL on business models of CAPs.

This section provides a summary and is split up in three parts, starting with the willingness to invest of CAPs. Subsequently the focus is on the effects regarding quality differentiation for CAPs. This section ends with a discussion about CAPs charging IAPs and refusal to supply content to IAPs.

Willingness to invest CAPs

Several scholars show that CAPs are more willing to pay to IAPs in a situation without NN. Proponents of NN point out that for many online start-ups, it would be hard or almost impossible to pay fees demanded by IAPs when revenue streams are low or even non-existent. As consequence, entrepreneurs would be more reluctant to start an online business. If CAPs have to pay fees to IAPs, also transaction costs show up. Both fees as well as associated transaction cost influence the value capturing part of CAPs' business models negatively, i.e. profit margins will diminish.

Another scholar reports that a discriminatory regime can weaken CAPs' investment incentives regarding cost reductions and quality enhancements, because of CAPs' concern that IAPs could capture some of the investment benefits. Consumers' choice and quality of services and application could be negatively affected if CAPs' investment incentives diminish. As consequence, customer welfare could be reduced.

Quality differentiation

A scientist points out that applying a non-discrimination rule implicitly results in IAPs only supplying one connection quality. Another scientist points out that the usefulness of latency sensitive services could be damaged or made completely useless by applying a non-discrimination rule. This can affect value creation of CAPs negative. Also consumers could suffer who are interested in a high quality service.

Other scholars point out negative effects for small CAPs if giving exclusive (priority) access is allowed by IAPs. This could lead to monopolization on the content and application market which is advantageous for big CAPs. However business models of small CAPs are under pressure. Also customer's choice could be negatively affected. Next to that, a researcher shows that IAPs have an incentive to degrade low-priority service. This practice affects the value capturing part of CAPs' business models. It typically means that CAPs' profit margins diminish. Also customer's choice could be reduced.

CAPs charging IAPs and refusal to supply content to IAPs

DNNL only applies to IAPs and not to CAPs. Therefore CAPs are allowed to charge IAPs or refuse to supply their content to IAPs. Only one scientific paper addresses this issue. In this paper there is pointed out that this behaviour is undesirable (e.g. fees charged on others, transaction costs, fragmentation). However regulations to prevent this behaviour are not necessary because CAPs who charge IAPs will automatically have fewer customers who can access their content. As consequence less revenue is expected regarding paid services of customers and advertisements.

7.3. Research question (f): What is the effect of the DNNL on innovation of products and services in the mobile telecom market?

This section focuses on three found aspects regarding the effect of the DNNL on innovation of products and services in the mobile telecom market. These aspects are related to innovation of mobile devices, CAPs and products and services of mobile telecom providers. These aspects are discussed using the framework of Henderson and Clark (1990).

Innovation at the edge is the first aspect on which is focussed. This is followed by a discussion about collaborations between CAPs and IAPs. Thereafter, a discussion about the effects regarding quality differentiation for innovation is presented. This section ends with a summary.

7.3.1. Innovation at the edge

Lee and Wu (2009) show that a situation without NN can have negative effects for innovation. They argue that a zero-price rule contributes to creation and invention by CAPs on the internet. The policy can be regarded as a subsidy for content and inventions, i.e. when the net is neutral, CAPs do not have to negotiate with IAPs to reach end-users. Furthermore, fees that IAPs can charge in a situation without NN to CAPs, can have a strong negative effect on entry, because uncertainty is high for an internet start-up and their returns are skewed. Due to these circumstances even moderate fees may strongly hinder entry of internet start-ups. Moreover, many CAPs need a critical mass to create value for customers due to strong network effects on the internet. This critical mass is very hard to achieve if these CAPs first have to negotiate with IAPs to get access to their network (Wu, 2003).

Economides and Tåg (2007) have similar concerns. In their view, the possibility of IAPs giving exclusive access to a particular CAP, for example by using auction, could lead monopolization on the content and application market. In addition, it could also negatively affect innovation, because small firms have little chance to win such auction.

Guo et al. (2012) analyse NN using a game theoretic model and conclude also that a situation without NN negatively affects innovation. In their model NN is defined as a non-discrimination rule. They argue that in a situation without NN less effective CAPs can be driven out of the market. Especially internet start-ups could suffer from this policy because they often have low revenue rates. These low revenue rates combined with end-users, who demand low-latency and a competitive established player who pay the IAP for priority, could drive the internet start-up out of the market. A diminishing number of CAPs reduces competition and decreases innovation at the edge (i.e., innovations of content, services, and applications at the edge of the Internet).

As stated, DNNL can be regarded as a non-discrimination rule by applying it strictly. By applying the DNNL tolerantly, giving priority to services on an individual base is allowed (under certain circumstances).

Now we will analyse the above described effects by taking the framework of Henderson and Clark (1990) in consideration. By comparing a situation with NN and a situation without NN something changes considering architecture, i.e. the way in which components are interlinked. Applications and services can be regarded as components. The changes in architecture consist of changes in payment to interconnect. In a situation without NN, IAPs can charge terminations fees and fees for priority to CAPs. Under NN these charges are restricted.

In section 5.1.3, we described innovations process in mobile telecommunications according to the framework of Henderson and Clark (1990). In this process changes in architecture affect the possibilities to implement new functions regarding components. According to the above mentioned scholars (Economides & Tåg, 2007; Guo et al., 2012; Lee & Wu, 2009; Wu, 2003), this process is hindered on an architectural level (i.e. the way in which components are interlinked) by departing from NN. As consequence this affects the innovation of components negatively. The components consist of applications and services.

7.3.2. Collaborations between CAPs and IAPs

Allee and Taug (2006) point out that “collaborative relationships between operators and third parties will speed up mobile service innovation.” The question is: to what extent is collaboration between operators and CAPs less possible under DNNL? Again this depends on the interpretation of the DNNL. By applying a strict regime, there are fewer options to collaborate because fewer options are possible regarding separate services (section 6.1). Furthermore, by applying a strict tariff policy less collaborative business models can be made.

Unfortunately, there is too little information available to link the findings of Alee and Taug (2006) to the framework of Henderson and Clark (1990).

Regarding the framework of Henderson and Clark (1990) collaborations between IAPs and CAPs bring different aspects regarding architecture together. IAPs play a key role regarding architectural innovations while CAPs innovate at the component level.

7.3.3. Quality differentiation

Hermalin and Katz (2007) state that probably fewer applications would be developed if there would be no high quality access service available (e.g. for delay-critical games).

The DNNL allows for prioritising traffic in the event of congestion, whereby same types of traffic have to be treated equally. Next to that, by applying a tolerant interpretation, it is allowed to prioritise services and applications on an individual base (under certain circumstances). Under a strict interpretation it is prohibited to prioritize services and applications on an individual base.

It is not clear to what extend the DNNL will affect the availability of high quality access services. If high quality services are affected it can be regarded as a change in architecture (framework Henderson and Clark (1990)), which negatively influences the innovation of components (i.e. applications and services), according to Hermalin and Katz (2007).

7.3.4. Summary

This section focused on three found aspects regarding the effect of the DNNL on innovation of products and services in the mobile telecom market. These aspects are discussed using the framework of Henderson and Clark (1990). This summary starts with a discussion regarding innovation at the edge. Then, the focus is on collaborations between CAPs and IAPs. Finally, a discussion is presented about the effects regarding quality differentiation for innovation.

Innovation at the edge

Several scholars argue that a zero-price rule contributes to creation and invention by CAPs on the internet, since CAPs do not have to negotiate with IAPs to reach end-users. Others argue that, the possibility of IAPs giving exclusive access to a particular CAP (e.g. using an auction) could lead monopolization on the content and application market, excluding small CAPs.

Next to that, by applying NN as a non-discrimination rule, a scholar points out that in a situation without NN less effective CAPs can be driven out of the market. As consequence innovation at the edge suffers. DNNL can be regarded as a non-discrimination rule by applying it strictly. By applying the DNNL tolerantly, giving priority to services on an individual base is allowed (under certain circumstances).

In section 5.1.3, we described innovations process in mobile telecommunications according to the framework of Henderson and Clark (1990). In this process changes in architecture affect the possibilities to implement new functions regarding components. According to a number of scholars, this process is hindered on an architectural level (i.e. the way in which components are interlinked) by departing from NN. As consequence this affects the innovation of components negatively. The components consist of applications and services.

Collaborations between CAPs and IAPs

One scientific paper points out “collaborative relationships between operators and third parties will speed up mobile service innovation.” It depends on the interpretation of the DNNL to what extend collaboration is limited. By applying a strict regime, there are fewer options to collaborate.

Quality differentiation

Two scholars state that probably fewer applications would be developed if there would be no high quality access service available (e.g. for delay-critical games). It is not clear to what extend the DNNL will affect the availability of high quality access services. If high quality services are affected it can be regarded as a change in architecture, which negatively influences the innovation of components (i.e. applications and services).

7.4. Research question (g): What is the effect of the DNNL on innovation and investment of mobile infrastructure?

This section presents findings in literature regarding the effect of the DNNL on investment in networks. Unfortunately no literature was found regarding the effect of NN on innovation in infrastructure.

This section starts with a general discussion about the effect of investment on innovation telecommunication to show the relevance of investment in mobile infrastructure. Thereafter findings in literature are presented. This section ends with a summary.

7.4.1. Effect network investment on innovation

More investment in networks speeds up the process of radical innovations in mobile telecommunications which is described in section 5.1.3. This process is based on the framework of Henderson and Clark (1990). In this process first new standards are created. This is followed by the creation of new networks which are compatible with these new standards. The creation of new networks is speeded up if there is more investment in networks. As consequence, also the creation of new markets and innovative applications is accelerated.

7.4.2. Findings in literature

Conflicting theories are found in literature regarding effects of NN on innovation and investment of infrastructure.

Many IAPs have argued that popular CAPs enjoy a free ride on their network, since IAPs have invested their own capital to maintain and upgrade their network. Therefore they claim that IAPs should be allowed to charge fees to CAPs for priority services to compensate for the made costs of the network. Next to that, Hemphill (2008) writes that a prohibition to charge fees to CAPs will be necessary at the expense of the network investment.

Accordingly, Prüfer and Jahn (2007) argue that a discriminatory regime gives IAPs more incentives to invest. They refer to the capacity paradox that IAPs face. The internet consists of many data intensive services and applications. However, if IAPs provide more capacity, they also face more competition to their own provided services, like Video-on-Demand and voice services. Consequently, the IAP has less incentive to expand capacity when demand increases. To prevent this, IAPs should be allowed to use network management and prioritization.

In contrast, Lee and Wu (2009) point out IAPs do get compensation for their network. First, they charge customers for access, which is also allowed under a NN regime. Secondly, they are compensated through peering and transit agreements, i.e. when any other network (including CAPs) sends a packet through the IAP's network, the IAP gets compensated for it. In addition, they find that traffic associated costs are low by comparing it to actual mobile internet fees. Besides, it is expected that these costs will diminish with traffic growth, extra spectrum space and technology innovation (e.g. LTE). Therefore traffic increase seems to be profitable.

Lee and Wu (2009) also point out that termination fees do not raise the incentive to invest in network infrastructure. They consider that the incentive to invest gained revenue in network infrastructure is indeterminate: "Instead of investing in faster or more reliable service, firms could also pay out a (greater) dividend, undertake other projects, or even invest in increasing its returns on existing content by making it scarce and exclusive". They find that termination fees would only enlarge investment in network infrastructure in areas that do not yet have any broadband infrastructure.

Pil Choi and Kim (2010) even claim that, under a discriminatory regime, incentives to invest are smaller under a NN regime. Under the discriminatory regime CAPs can pay the IAP for priority. If capacity is higher, the advantage to prioritize becomes smaller and as consequence it is less profitable for an IAP to invest in the network.

Williamson et al. (2011) writes that as consequent of charging CAPs, CAPs' innovation and investment may reduce, which is a driver regarding demand for improved networks. Accordingly, IAPs investment in their network will reduce. This could be an argument to prohibit charging CAPs and thus introduce a NN regime.

7.4.3. Summary

This section presented findings in literature regarding the effect of the DNNL on investment in networks. Unfortunately no literature was found regarding the effect of NN on innovation in networks. This summary starts with a general discussion about the effect of investment on innovation in mobile telecommunications. Thereafter findings in literature are presented.

Effect network investment on innovation

More investment in networks speeds up the process of radical innovations in mobile telecommunications (section 4.1.3), since it stimulates the creation of new networks. As consequence, also the creation of new markets and innovative applications is accelerated.

Findings in literature

Conflicting theories are found in literature regarding effects of NN on innovation and investment of infrastructure.

Some researchers claim that a prohibition to charge fees to CAPs will be necessary at the expense of the network investment. Accordingly other scholars consider that discriminatory regime gives IAPs more incentives to invest by referring to the capacity paradox. I.e. if IAPs provide more capacity, they also face more competition to their own provided services. To prevent this, IAPs should be allowed to use network management and prioritization.

In contrast, other scientists point out that IAPs do get compensation for their networks (by subscription fees and peering and transit agreements). Next to that they claim that termination fees do not raise the incentive to invest in network infrastructure since this revenue could also be used to pay out (greater) dividend or to undertake other projects. Another researcher writes that as consequent of charging CAPs, CAPs' innovation and investment may reduce, which is a driver regarding demand for improved networks.

One scholar also points out that under a discriminatory regime, incentives to invest are smaller under a NN regime because when capacity is higher, the advantage to prioritize becomes smaller and as consequence it is less profitable for an IAP to invest in the network.

8. Expert interviews

This chapter provides the third part of results of this research. In this part experts are consulted to find potential effects of the DNNL on business models and innovation. To find these effects a questionnaire was created of 16 questions that correspond to the research questions. 28 interviews were conducted which are divided to 5 stakeholder groups:

- CAPs (5)
- Scientists and market watchers (6)
- Government (9)
- Experts about network infrastructure and devices (NI&D) (3)
- Telecom Operators (5)

A complete list can be found in Appendix D. For more information about the interview protocol see section 4.3. This chapter consists of four sections; each section addresses one research question.

8.1. Research question (d): What is the effect of the Dutch Net Neutrality law on Business Models of mobile telecom providers?

We are interested in what will change regarding business models of mobile telecom providers when the Net Neutrality law comes into force. Therefore this section discusses the effect of the DNNL on business models of mobile telecom providers. By analysing business models the framework of Morris et al. (2005) is taken in consideration.

This section is split up in three sections. The first section focuses on value creation. Subsequently section two discusses value capturing of IAPs. In section three of this section the focus is on the effect of the DNNL on the tariff of internet access.

8.1.1. Value creation

This section discusses the effect of the DNNL regarding value creation (Component 1 of the framework of Morris et al. (2005)) of mobile telecom providers. Also consequences for consumers are addressed.

All participants generally note that there are less differentiation possibilities by applying this law (Table 1). They point out that it is not possible anymore to make propositions in which particular services on the internet are blocked, delayed or charged differently. In addition, many experts state that possibilities to provide limited internet offerings (e.g. only offering web-browsing, YouTube or Facebook) are restricted. However several experts see some possibilities regarding separate services.

A majority (57%) considers that the limitation in differentiation possibilities leads to a more uniform product offering of IAPs. This statement is supported mostly by operators and experts regarding network infrastructure and devices. For consumers this means they have less choice regarding the offering of IAPs. Only one expert (group scientists) expects little or nothing will change regarding the propositions of IAPs due the DNNL. Other experts stated that it was too hard to predict what will change regarding the product offering.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
There are less differentiation possibilities for IAPs due DNNL	5/5	6/6	9/9	3/3	5/5	28/28	100,0%
DNNL leads to a more uniform offering of IAPs	2/5	3/6	4/9	3/3	4/5	16/28	57,1%
Nothing changes due DNNL regarding the offering of IAPs	0/5	1/6	0/9	0/3	0/5	1/28	3,6%
No answer/ Do not know/Too hard to predict	3/5	2/6	5/9	0/3	1/5	11/28	39,3%

Table 1: Opinions of consulted experts regarding differentiation possibilities

The remainder of this section focusses on differentiation possibilities regarding priority. This is followed by a section about signalling costs and uncertainty regarding business models. The section ends with a summary.

Priority

A majority (61%) points out that the DNNL limits options to sell guaranteed quality to CAPs (Table 2). For

consumers it could mean that time-critical services of CAPs are received with lower quality. Remarkable is that all of the operators agree on this statement, while only 2 of 5 CAPs indicated that they agree on this statement regarding guaranteed quality. The other CAPs did not address this issue.

About 40% of the experts think the separate service option can provide options to prioritise services individually. In addition about 60 % of the experts point out some applications need priority to enhance the quality for consumers. There were no remarkable differences spotted between groups. Examples given by experts of services that need priority consists of game, VOIP and online payment services. Also emergency channels and Telehealth services are mentioned, whereby a doctor can remotely monitor a patient (or even in the future operate). An overview of opinions among consulted groups is presented in Table 2.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
Options to sell quality guarantee to CAPs limited	2/5	3/6	5/9	2/3	5/5	17/28	60,7%
No answer/ Do not know	3/5	3/6	4/9	1/3	0/5	11/28	39,3%
Separate service can provide options for priority	2/5	2/6	3/9	2/3	2/5	11/28	39,3%
Separate service cannot provide options for priority	0/5	0/6	0/9	0/3	1/5	1/28	3,6%
No answer/ Do not know	3/5	4/6	6/9	1/3	2/5	16/28	57,1%
Some services need priority to enhance quality for consumers	3/5	3/6	4/9	3/3	4/5	17/28	60,7%
No answer/ Do not know	2/5	3/6	5/9	0/3	1/5	11/28	39,3%

Table 2: Opinions of consulted experts regarding guaranteed quality

Signalling costs

Three of five operators point out that it is harder to differentiate to network load. They refer to the high cost of signalling traffic on mobile networks. Services like Whatsapp and Facebook use a lot of signalling traffic by checking whether new messages are present or checking whether a user is still online. Other services like YouTube use relatively little signalling traffic. They point out that every internet user has to pay collectively for these signalling costs, i.e. consumers who only use a little signalling traffic pay relatively more.

Some of the operators point out that even if there was no law it would be difficult to pass the cost of signalling traffic directly to consumers, because consumers are generally not aware which services cause a lot of signalling traffic. However, by introducing the DNNL there are no options left to do this, such as charging less for services that relatively use little signalling traffic like video streams.

It is remarkable that the subject of signalling costs is only pointed out by mobile operators and not by participants of other stakeholder groups. It seems that this issue is not generally known at the moment.

Uncertainty

About 40% of the consulted experts point out that in general the development of business models will be disturbed because there is a lot uncertainty whether certain business models are allowed or not (see Table 3). Most questions relate to possibilities and impossibilities regarding separate services and pricing. For consumers this could mean that some propositions, which are allowed, will not be available.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
Development of business models will be disturbed due uncertainty regarding DNNL	0/5	2/6	2/9	3/3	4/5	11/28	39,3%
Subject not addressed	5/5	4/6	7/9	0/3	1/5	17/28	60,7%

Table 3: Opinions consulted expert regarding uncertainty

Nearly all operators and experts regarding network infrastructure and devices mention the statement regarding uncertainty. An explanation why IAPs addressed this issue broadly is that they faced this uncertainty already regarding the possibilities and impossibilities regarding separate services and pricing. (This was

inferred from the interviews). In contrast, the consulted CAPs did not address this uncertainty. An explanation for this is that they did not face this uncertainty already, or they think this uncertainty is only a minor issue.

8.1.2. Value capturing IAPs

About one half of the experts indicate that revenue for IAPs will diminish by introducing this law, because it offers fewer options to create value and capture value (Component 1 and 5 of the framework of Morris et al. (2005)). In particular, fewer options regarding prioritization and limited internet offerings are mentioned. About 20 % of the experts think that the DNNL does not affect the revenue of IAPs (see Table 4). Two experts point out that IAPs can profit from traffic increase due the DNNL (capturing more value). According to these experts the DNNL stimulates innovation on the internet, which creates more demand for data transmission. Consequently IAPs can profit from this demand for bandwidth by charging customers for their data use. However these experts are not sure whether the total effect on revenue of the DNNL will be positive.

Many experts are not sure how the DNNL influences IAPs' revenue, because the rule applies to all IAPs and there are a lot of other factors influencing revenue, which makes it hard to isolate the DNNL-factor.

Remarkable is that regarding consulted CAPs only one experts (out of five) expects less revenue due DNNL for IAPs, while a majority of officials; experts of network infrastructure and devices; and operators expect less revenue. It is also notable that none of the experts addressed termination fees as a loss regarding revenue, while in literature models were presented in which IAPs profit from these fees (see section 7.1.2). In section 8.4.1 experts provide several arguments why IAPs would also refrain from termination fees without the DNNL.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
IAPs generate more revenue due DNNL	0/5	0/6	0/9	0/3	0/5	0/28	0,0%
IAPs generate the same amount of revenue due DNNL	2/5	2/6	2/9	0/3	0/5	6/28	21,4%
IAPs generate less revenue due DNNL	1/5	2/6	5/9	3/3	3/5	14/28	50,0%
No answer/ Do not know/ Too hard to predict	2/5	2/6	2/9	0/3	2/5	8/28	28,6%

Table 4: Opinions consulted experts regarding revenue IAPs

8.1.3. Tariff mobile internet access

The price costumers have to pay for mobile internet connection is part of IAPs' revenue model (Component 5 of the framework of Morris et al. (2005)).

There is no consensus among interviewed experts how this law affects the price customers pay for mobile internet access. About 35 % of the consulted experts consider that the average price of internet access will rise because of the DNNL. Only in the operator group, a majority was found who think the average price of internet access will rise because of the DNNL (see Table 5).

About 60 % of the experts do not know whether the price of internet access will rise because of the DNNL, or did not answer. Only one consulted official thinks the DNNL does not affect the price of internet access (see Table 5).

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
Average tariff of mobile internet access will rise due DNNL	0/5	3/6	3/9	1/3	3/5	10/28	35,7%
DNNL does not influence the average tariff of mobile internet access	0/5	1/6	1/9	0/3	0/5	1/28	3,6%
No answer/ Do not know/Too hard to predict	5/5	2/6	5/9	2/3	2/5	17/28	60,7%

Table 5: Opinions consulted experts regarding tariff mobile internet

Here follows a list of arguments given by experts who think the average tariff of internet access will rise because of the DNNL:

- Limited internet offerings are not possible anymore, for example only for web-browsing.

- Without DNNL there is more space to offer cheaper propositions with less quality.
- It is not anymore allowed to block VOIP. When VOIP becomes widely used on mobile, IAPs will charge a high fee for internet access to recover for that.
- There are fewer tools to counter congestion. As a result, more investment is needed in the network. Consequently the price for an internet connection rises.
- The law prohibits business models in which a CAP pays a part of the cost for data access, which would result in a lower internet access price for the customer.

Experts, who think that it is too hard to predict whether the DNNL raises the access tariff for internet connections, point out that it is difficult to isolate the effect of the DNNL because other factors, like competition that influence the price of mobile internet. In addition some argue the past prices for internet access are not comparable because these prices are probable subsidised by SMS and voice revenue. Only one official thinks that the price for an internet connection will be relatively low due the DNNL, because there will be more competition on price (since there are fewer options to differentiate).

8.1.4. Summary

This section discussed the effect of the DNNL on business models of mobile telecom providers, focussing on value creation, value capturing and tariff of mobile internet access. The framework of Morris et al. (2005) is taken in consideration to analyse business models.

Value creation

All participants generally noted that there are less differentiation possibilities by applying the DNNL. A majority considers that the limitation in differentiation possibilities leads to a more uniform product offering of IAPs. For consumers this means they have less to choose regarding the offering of IAPs. A majority also points out that the DNNL limits options to sell guaranteed quality to CAPs. For consumers it could mean that time-critical services of CAPs are received with lower quality. There is no consensus whether limited internet offerings are not allowed anymore.

Three out of five operators point out that it is harder to differentiate on network load. They refer to the high cost of signalling traffic on mobile networks. This issue was only pointed out by mobile operators and not by participants of other stakeholder groups.

About 40% of the experts point out that in general the development of business models will be disturbed because there is a lot uncertainty whether specific business models are allowed or not.

Value capturing IAPs

About one half of the experts indicate that revenue for IAPs will diminish by introducing this law because it offers fewer options to create value and capture value. In particular, fewer options regarding prioritization and limited internet offerings are mentioned. About 20% think that the DNNL does not affect the revenue of IAPs. Two experts point out that IAPs can profit from traffic increase due the DNNL (capturing more value).

Tariff mobile internet access

There is no consensus among interviewed experts how this law affects the tariff a mobile IAS. About 35 % of the experts consider that the average price of internet access will rise because of the DNNL. About 60 % of the experts do not know whether the price of internet access will rise because of the DNNL, or did not answer. Only one consulted official thinks the DNNL does not affect the price of internet access.

8.2. Research question (e): What are consequences for CAPs by implementing the Dutch Net Neutrality law?

This section discusses the consequences for CAPs by implementing the DNNL and is split up in five sections. Section one focusses on the consequences of forbidding blocking and differently charging services and applications on an IAS. In section 2 consequences for CAPs regarding quality differentiation are discussed. Subsequently section 3 analyses the possibility of CAPs charging IAPs. Section 4 discusses consequences for CAPs regarding creating awareness. Subsequently section 5 focusses on the relation of DNNL to the global market. This section ends with a summary. By analysing business models the framework of Morris et al. (2005) is taken in consideration.

8.2.1. Consequences forbidding blocking and differently charging services and applications

Regarding consequences for CAPs the next question was asked: "What are the expected consequences of the DNNL for CAPs?" By answering this question about 70 % of the experts pointed out that the law guarantees

access to IAPs' networks, i.e. CAPs do not have to negotiate with IAPs or have to worry about getting blocked (see Table 6). No big differences were spotted among groups. In addition, two experts stated that nothing will change, because according to them the net was already neutral.

Guaranteed access to IAPs' network affects the value capturing part (Component 5) regarding the framework of Morris et al. (2005) since it assures that CAPs do not have to negotiate to get access to IAPs' networks. It also affects the value creation part (Component 1), because it assures that IAPs cannot limit CAPs' reach.

	CAPS	Scientists	Government	NI&D	Operators	Total	Percentage
DNNL guarantees access to IAPs' networks	4/5	5/6	7/9	2/3	2/5	20/28	71,4%
Nothing or little changes	1/5	0/6	0/9	1/3	0/5	2/28	7,1%
No answers given/ do not know	0/5	1/6	2/9	0/3	3/5	6/28	21,4%

Table 6: Opinions of consulted experts regarding guaranteed access CAPs on IAPs' networks

One scientist further says that this law prevents fragmentation, whereby particular content is only accessible by particular IAPs. For consumers it means that they only have to subscribe for one internet connection to have access to the whole internet.

Seven experts (25%) point out that some propositions which are advantageous for CAPs are not allowed anymore by applying the DNNL. For example propositions in which only access to Facebook, Skype or Spotify is offered. Consumers who are only interested in access to a part of the internet (e.g. only Facebook or Gmail) have to purchase a whole internet connection (see Table 7).

Another example given by experts are propositions in which data transmission for particular services (e.g. video-services) is charged cheaper as other data on an IAS (see Table 7). For consumers it means that all internet services are charged equally regarding data traffic if the DNNL is applied strictly. Consequently, data intensive services offered via the internet (e.g. video services) will be more expensive regarding data traffic than services that only need little data transmission (e.g. text-messaging).

	CAPS	Scientists	Government	NI&D	Operators	Total	Percentage
Limited internet offerings restricted	1/5	1/6	1/9	1/3	1/5	5/28	17,9%
Propositions, in which particular data is charged differently, are restricted	0/5	0/6	1/9	0/3	1/5	2/28	7,1%
Subject not discussed	4/5	5/6	7/9	2/3	3/5	21/28	75,0%

Table 7: Opinions of consulted experts regarding restricted Business models for CAPs

Restrictions regarding limited internet propositions or restriction of propositions in which particular data is charged differently on an IAS, affect the value creation (Component 1 of the framework of Morris et al. (2005)) of CAPs, since options to distribute their content is blocked. Also market factors are affected (Component 2, Morris et al. (2005)), since it is harder for CAPs to create value for niche markets. Also component 5, value capturing is affected since cost structures and revenue options are limited.

One scientist points out that this law does not guarantee that CAPs also get peering. Peering is important for CAPs that need a lot of volume like video-services. If they do not get peering they have to pay a lot transit costs he states.

8.2.2. Quality differentiation

A majority (60%) points out that the DNNL limits options to acquire guaranteed quality for CAPs. This affects the value creation part (Component 1 regarding the framework of Morris et al. (2005)). For customers it could mean that time-critical services of CAPs are received with lower quality. About 40% of the experts think the separate service option can provide options to prioritise services individually (see Table 2, page 44).

In addition, about 60% of the experts point out some applications need priority to enhance the quality for consumers (see Table 2, page 43). Examples given are e-health, games, VOIP and emergency services. If CAPs do not get priority it could mean that their services lose in quality. Also their product lines can become shallower.

One of the interviewed CAPs was interested in the possibility to make agreements about quality guarantees with IAPs for his video services.

29 % of the experts do not expect that IAPs would degrade the quality of their basis-internet services to make their priority services more attractive (see Table 8). Only in the group government a majority was found who support this statement. In contrast, four of the consulted experts (14%) think IAPs would actually degrade the quality of their basis-internet services to make their priority services more attractive. These experts point out that consumers as well as CAPs are harmed, since basic quality is degraded. In other interviews, this issue was not discussed.

	CAPS	Scientists	Government	NI&D	Operators	Total	Percentage
IAPs would degrade basic internet to sell priority services better	1/5	1/6	2/9	0/3	0/5	4/28	14,3%
IAPs would not degrade basic internet to sell priority services better	0/5	2/6	5/9	0/3	1/5	8/28	28,6%
No answer/ Don't know/Too hard to predict	4/5	3/6	2/9	3/3	4/5	16/28	57,1%

Table 8: Opinions of consulted experts regarding the possibility of degradation

In addition, three other experts (11 %) point out that if paid priority is permitted, this would always be advantageous for big CAPs. Newcomers and small CAPs could be worse off, since they have less money available to pay for priority. Two experts state that if paid priority is permitted, there could be a situation in which small players have to bid against big CAPs as Apple and Google to get priority. As consequence a few big players would get the priority at the expense of small players who have to rely on best-effort internet. This relates to the value creation and capturing part (Component 1 and 5 regarding the framework of Morris et al. (2005)). Regarding value creation it affects the distribution of IAPs' services and regarding value capturing margins are affected. For consumers it could mean that only services of big CAPs are accessible in high quality.

According to one expert, permitting paid priority could lead to a fragmented market, in which particular services are prioritised by one IAP, while it is not prioritised by another IAP. In this situation, consumers, who want to receive different internet services in high quality, typically have to purchase more than one internet connection.

Another expert states that, if CAPs cannot pay for priority via the IAS, this means that an IAP has a monopoly to provide QoS. This is because an IAPs can also offer services on his own network, which is not regarded as the internet. (The IAP is then in the role of service provider). In this situation, CAPs can only get priority by creating something outside the internet by cooperating with the IAP, since it is impossible for them to get guaranteed priority via the IAS.

8.2.3. CAPs charging or refuse to supply their content to IAPs

CAPs are still allowed to charge IAPs or refuse to supply their content to IAPs (see section 6.3). Four experts point out that this means that exclusive deals between CAPs and IAPs are still possible.

A majority of the consulted experts (57 %) generally does not expect that CAPs will charge IAPs or refuse to supply their content to IAPs, because CAPs typically search for a maximum reach. (This majority includes also experts who think CAPs would only refuse to supply their content to IAPs, if they do not have the right to distribute content in particular areas (See Table 9)). They also miss out network effects by limiting their reach, which negatively affects CAPs' value creation. No big differences were noted among groups. The expectation, that CAPs would not charge IAPs or refuse to supply their content to IAPs, matches with findings in literature (see section 7.2.3).

One valid exception to refuse to supply their content to IAPs, pointed out by 6 experts, is if CAPs do not have the rights to distribute content in a particular area (Table 9). Besides, one IAP points out that a CAP will not exclusively deliver his content to one IAP, as long as an IAP has less than 35 per cent of the market. This will not happen because a big part of the market is then excluded.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
Do not expect that CAPs will charge IAPs or refuse to supply their content to IAPs	1/5	2/6	4/9	2/3	1/5	10/28	35,7%
Do not expect that CAPs will charge IAPs or refuse to supply their content to IAPs. One exception: CAPs will refuse to supply their content, if they do not have the right to distribute content	1/5	1/6	2/6	1/3	1/5	6/28	21,4%
No answer/ Do not know/Too hard to predict	3/5	3/6	3/9	0/3	3/5	12/28	42,9%

Table 9: Opinions of experts regarding the possibility of CAPs charging IAPs or refuse to supply content

About 30% of the experts consider that it is a CAP’s own choice to make a contract with whoever they want. In their view CAPs are also end-users and have the right to communicate with who they want. Only in the group government a majority was found who support this statement.

In addition, a scientist points out that obliging CAPs to supply their content to all IAPs would reduce flexibility and possibilities of CAPs, because a lot of innovations can be realized, since CAPs have the possibility to decide where they want to offer their services. Next to that, one expert points out that he has no problems with CAPs choosing which public to serve because it would be an element for competition between IAPs.

In contrast, another expert states that CAPs charging or refuse to supply their content to IAPs, could lead to horizontal differentiation between IAPs. According to him this reduces competition between IAPs. In addition, three experts state that if a NN rule is applied it has to work out both ways, i.e. if IAPs are not allowed to charge or block CAPs on their networks, than CAPs should also not be allowed to charge IAPs for their content or refuse to supply content.

Furthermore, one expert considers it is undesirable if CAPs will charge IAPs, because it could lead to fragmentation. Next to that, an IAP points out it could be bad for little IAPs who do not have the power to bid against big IAPs by making exclusive deals.

A CAP points out that refusing to supply content is not desirable. However sometimes it is needed to put IAPs under pressure to counter unreasonable requirements he states (for example high fees for peering). In contrast, an expert of network infrastructure warns that CAPs who have a dominant position could misuse this possibility by putting an IAPs under pressure.

8.2.4. Creating awareness

One expert (operator) considers that CAPs will miss options to create awareness since options to cooperate are limited due the DNNL. CAPs profit from collaborations since IAPs can do part of the marketing. Especially little CAPs suffer by fewer options to cooperate, since they have the most to gain regarding awareness.

8.2.5. Relation DNNL to global market

Four experts state that the CAP market is generally a global market whereby a few services purely are focused at the Dutch market. Therefore they consider that only a few CAPs have advantage by implementing this law.

8.2.6. Summary

This section discussed the consequences for CAPs by implementing the DNNL, focusing on forbidding blocking and differently charging services; quality differentiation; possibility of CAPs charging IAPs and creating awareness and the relation of DNNL to the global market.

Consequences forbidding blocking and differently charging services and applications

About 70% of the experts pointed out that the law guarantees access to IAPs’ networks, i.e. CAPs do not have to negotiate with IAPs or have to worry about getting blocked. Next to that, five experts (18%) point out that some propositions which are advantageous for CAPs are not allowed anymore by applying the DNNL strictly.

Quality differentiation

Regarding quality differentiation, a majority (60%) of the consulted experts point out that the DNNL limits options to acquire guaranteed quality for CAPs. In addition, about 60% of the experts point out that some applications need priority to enhance the quality for consumers. About 30 % of the experts do not think IAPs would degrade the quality of their basis-internet services to make their priority services more attractive. Four (14%) of the consulted experts think IAPs would actually degrade the quality of their basis-internet services to make their priority services more attractive.

Caps charging or refuse to supply their content to IAPs

CAPs are still allowed to charge IAPs or refuse to supply their content to IAPs. Four experts point out that this means that exclusive deals between CAPs and IAPs are still possible. A majority of the consulted experts (about 60 %) generally does not expect that CAPs will charge IAPs or refuse to supply their content to IAPs, because CAPs typically search for a maximum reach. They also miss out network effects by limiting their reach.

Creating awareness and relation DNNL to global market

One expert considers that CAPs will miss an opportunity by applying DNNL to create awareness by cooperating with an IAP. Besides, four experts point out that the CAP market is generally a global market whereby a few services purely are focused at the Dutch market. Therefore they consider that only a few CAPs have advantage by implementing this law.

8.3. Research question (f): What is the effect of the Dutch net neutrality law on innovation of products and services in the mobile telecom market?

This section discusses the effect of the Dutch net neutrality law on innovation of products and services in the mobile telecom market. If applicable the framework of Henderson and Clark (1990) is used.

This section is split up in eight sections. Section one focusses on the effects of DNNL for innovations at the edge of the internet. In section 2 consequences for services that need priority are discussed. Subsequently, section 3 focusses on limited internet and price differentiations. Section 4 discusses the effect of innovation in relation to the global market and the effect of uncertainty. In addition, section 5 focusses on the consequences of more legislation on innovation. Next section six is about the effects of this law on devices. Section 7 discusses the effects on collaborations in relation to innovations. This section ends with a summary.

8.3.1. Internet as an open platform

16 of 28 experts (57%) point out that the law protects the internet as an open platform (see Table 10). 10 experts (36%) state that due this protection innovation on the edge of the internet is stimulated because the DNNL guarantees that people can innovate with low entry cost (see Table 10). This is especially advantageous for start-ups.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
DNNL protects the internet as an open platform	4/5	3/6	7/9	1/3	1/5	16/28	57,1%
Subject not discussed/ No answer	1/5	3/6	2/9	2/3	4/5	12/28	42,9%
DNNL stimulates innovation on the edge of the internet due protection open internet	3/5	2/5	5/9	0/3	0/5	10/28	35,7%
Subject not discussed/ No answer/ Too hard to predict	2/5	3/5	4/9	3/3	5/5	18/28	64,3%

Table 10: Opinions experts regarding internet as an open platform and innovation

Protection of the open internet can be regarded as protection of the architecture (framework Henderson and Clark (1990)) as it is nowadays. This positively influences the innovation of components (i.e. applications and services) according to the above mentioned experts. Other experts are not sure whether this guarantee was needed, since according to them the net was already neutral.

Remarkable is that none of the operators and experts of NI&D (Network Infrastructure and Devices) points out that innovation on the edge is stimulated by the DNNL due the protection of the open platform. In contrast, in the groups of CAPs and government a majority was found who support this statement.

8.3.2. Quality differentiation

50% of the consulted experts consider that time-critical services or applications could be negatively affected by this law. As consequence, innovation of these services and applications could be limited. Only two experts stated that priority services are not affected by this law (see Table 11).

If high quality services are affected it can be regarded as a change in architecture (framework Henderson and Clark (1990)), which negatively influences the innovation of components (i.e. applications and services). Notable is that a majority was found in the groups of operators and NI&D, who support this statement, while in the groups of CAPs, government and scientists only a minority pointed out that time-critical services or applications could be negatively affected by this law.

Five experts point out that innovative service that need priority may not be introduced in the Netherlands, because they will not be allowed here (see Table 11). How severe these problems will be depends on the quality of best-effort internet and scarcity they state.

Next to that, two experts consider it is positive if this law prohibits possible fast lanes and CAPs who want to pay for these fast lanes (see Table 11). This is always advantageous for big players they claim, while innovation comes especially from small players.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
Time-critical services or applications could be negatively affected by the DNNL. As consequence, innovation of these services and applications is potentially limited.	2/5	2/6	3/9	3/3	4/5	14/28	50,0%
Time-critical services or applications are not affected by the DNNL	1/5	0/6	0/9	0/3	1/5	2/28	7,1%
Subject not discussed/ No answer/ Too hard to predict	2/5	4/6	6/9	0/3	0/5	12/28	42,9%
Particular priority services will not be introduced in the Netherlands	0/5	1/6	1/9	2/3	1/5	5/28	17,9%
Subject not discussed	5/5	5/6	8/9	1/3	4/5	23/28	82,1%
If the DNNL forbids fast lanes, it secures innovation	1/5	1/6	0/9	0/3	0/5	2/28	7,1%
Subject not discussed	4/5	5/6	9/9	3/3	5/5	26/28	92,9%

Table 11: Opinions experts regarding quality differentiation and innovation

8.3.3. Limited internet and price differentiation

4 experts (14%) point out that restrictions regarding limited internet and restrictions regarding price differentiation can affect innovation negatively (see Table 12). These are for example offerings in which only a part of the internet is offered (e.g. only web-browsing) or offerings in which data use of some types of services is cheaper.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
Restrictions of the DNNL regarding limited internet and restrictions regarding price differentiation can affect innovation negatively	0/5	3/6	0/9	0/3	1/5	4/24	14,3%
Subject not discussed	5/5	3/6	9/9	3/3	4/5	24/28	85,7%

Table 12: Opinions experts regarding limited internet, price differentiation and innovation

Restrictions of limited internet and restrictions of price differentiation can be regarded as restriction concerning architecture (framework Henderson and Clark (1990)). This negatively influences innovation of components (i.e. applications and services) according to these experts.

8.3.4. Global market and uncertainty

8 experts (28%) point out that the effect on innovation is small because the internet is a global market. For global players the Netherlands is just a small country. Next to that, 12 experts (43%) state that innovations, which will emerge outside the Netherlands, are possibly not introduced in the Netherlands, or will be later introduced, because of the DNNL. This statement was mostly supported by operators (see Table 13).

There is also pointed out by 4 experts that it would be complicated for global CAPs if there are a lot of different legislations among countries (see Table 13). This means that a global player like Google cannot enrol a new service at once, but have to adjust these offerings to local legislation, which hinders innovation. Different national NN legislations will aggravate this kind of fragmentation. Therefore these experts argue for a uniform law on a European level.

Two experts point out that DNNL provides the possibility to see how this law functions over time and learn from it. Next to that, three experts state that the DNNL can stimulate other countries to also introduce NN legislation (see Table 13).

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
Effect DNNL limited due global market	0/5	3/6	4/9	0/3	1/5	8/28	28,6%
Subject not discussed	5/5	3/6	5/9	3/3	4/5	20/28	71,4%
Particular innovations not offered in the Netherlands due DNNL, or later available	2/5	3/6	2/9	2/3	3/5	12/28	42,9%
Subject not discussed	3/5	3/6	7/9	1/3	2/5	16/28	57,1%
National NN law, like the DNNL, contribute to fragmentation among countries regarding legislation, which hinders innovation	1/5	3/6	0/9	0/3	0/5	4/28	14,3%
Subject not discussed	4/5	3/6	9/9	3/3	5/5	24/28	85,7%
DNNL provides the possibility to see how this law functions over time and learn from it	1/5	0/6	1/9	0/3	0/5	2/28	7,1%
Subject not discussed	4/5	6/6	8/9	3/3	5/5	26/28	92,9%
DNNL can stimulate other countries to introduce also NN legislation	0/5	1/6	2/9	0/3	0/5	3/28	10,7%
Subject not discussed	5/5	5/6	7/9	3/3	5/5	25/28	89,3%

Table 13: Opinions experts regarding global market and innovation

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
Uncertainty about what is possible and what is not regarding business models hinders innovation	0/5	2/6	2/9	3/3	4/5	11/28	39,3%
Subject not discussed/ No answer	5/5	4/6	7/9	0/3	1/5	17/28	60,7%

Table 14: Opinions experts regarding uncertainty and innovation

11 experts (39%) further point out that uncertainty about what is possible and what is not regarding business models hinders innovation. Since it was not explicitly asked whether uncertainty could hinder innovation (see Table 14). 39% can be seen as a considerable part of the experts who support this statement. One IAP denotes: It takes 4 years when you want to let check your investment decision by a judge. That is bizarre in the fast developing world he states. (See also section 7.1.1).

Regarding the framework of Henderson and Clark (1990) the effects of the DNNL on innovation in this chapter can affect both architecture as well as components.

8.3.5. General implication more legislation

One scientist points out that more laws generally cause a barrier to innovate for entrepreneurs, because more attention has to be paid to law issues, which lessens the focus on innovation and technique. Regarding the framework of Henderson and Clark (1990) this can both affect both architecture as well as components.

Another expert states that we forbid something in the Netherlands before we know the problem by applying the DNNL. Experience learns that consequently things are forbidden that are advantageous.

8.3.6. Effects on devices

50% of the consulted experts do not see consequences for devices by applying the DNNL (see Table 15). They pointed out that the law is not applicable to devices. Moreover, devices are made on a worldwide level. Some experts mention that these device makers are not even aware of the Dutch law.

Only two experts (7%) denote that there is possible an indirect effect. One scientist argues that this law guarantees an open internet on which CAPs can innovate. Innovative services and applications demand hardware that is suitable for these innovations. As consequence better hardware needs to be developed. Guarantee of an open internet influences architecture (framework Henderson and Clark (1990)). This positively influences the innovation of services and application (components). Accordingly innovation of hardware (also components) is positively affected according to this scientist.

Another expert states that there are fewer options to generate income for IAPs. This will possibly affect handset-subsidy negatively, which negatively affects innovation regarding smartphones (component) (see Table 15).

Next to that, one CAP points out there is reported that operators have put pressure on some manufacturers to remove some functionality (e.g. VoIP). The big telecom operators have a lot of power because they sell a lot of their devices. He thinks device makers would have more freedom to innovate, if they did not have to worry about which content or applications would be supported by the operator. It could be that operators only subsidize smartphones that do not allow for VoIP. He states that it is than very difficult to know which operator had pressured to forbid functionality. The CAP thinks it is a good idea to investigate as supervisor what harm this can bring.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
There are no consequences for devices due the DNNL	2/5	3/6	6/9	1/3	2/5	14/28	50,0%
DNNL stimulates innovation of devices	0/5	1/6	0/9	0/3	0/5	1/28	3,6%
DNNL hinders innovation of devices	0/5	0/6	0/9	0/3	1/5	1/28	3,6%
No answer/ Do not know	3/5	2/6	3/9	2/3	2/5	12/28	42,9%

Table 15: Opinions experts regarding effect DNNL on devices

Gatekeeper role

10 experts (35%) do not think this law has as consequence that the gatekeeper role of IAPs will move to other parties like developers of operating systems, or manufacturers of (mobile) devices. They mostly point out that their gatekeeper role is already present and is not a consequence of the law. Two experts further point out competition will prevent that more market power goes to OSs and mobile devices. In contrast, only 2 experts think the gatekeeper role will possibly move to other parties like developers of operating systems, or manufacturers of (mobile) devices (see Table 16).

Several experts point out that the gatekeeper role of operating systems or manufacturers of (mobile) devices is already present. NPO (Dutch public broadcaster) reported that their application to watch broadcasts (Uitzending gemist) was dismissed by Apple's Appstore, because in a documentary a naked body was observed. "This is totally accepted in the Netherlands" pointed Egon Verharen of NPO out. Eventually the application was accepted after negotiation by T-mobile.

In addition, some experts state that the law is asymmetric and only about one aspect (IAPs). Another expert notes that device makers or platform owners are allowed to block particular services and an IAP not.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
DNNL does affect the gatekeeper role of device manufacturers and platform owners (e.g. android)	0/5	2/6	0/9	0/3	0/5	2/28	7,1%
DNNL does not affect the gatekeeper role of device manufacturers and platform owners (e.g. android)	1/5	3/6	4/9	0/3	2/5	10/28	35,7%
No answer/ Do not know	4/5	1/6	5/9	3/3	3/5	16/28	57,1%

Table 16: Opinions experts regarding gatekeeper role

8.3.7. Collaborations and effect on innovation

About 30% of the consulted experts think this law limits collaboration (see Table 17). They generally point out that collaborations are often about exclusivity, price for particular content and improved quality (priority). The law makes rules about this. The most concerns are regarding collaborations that demand priority. Only one expert thinks this law stimulates cooperation whereby CAPs and IAPs work together to stimulate demand.

Four experts point out that it depends on the interpretation of separate services whether many collaborations are allowed or prohibited. If there is a lot room for separate services many collaborations are still allowed. Next to that, three experts state that less collaboration does not necessary mean that less innovation takes place (see Table 17). Unfortunately it is not clear whether the othe experts actually think the degree cooperation affects innovation.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
Less cooperation due DNNL	0/5	0/6	6/9	1/3	2/5	9/28	32,1%
More cooperation due DNNL	1/5	0/6	0/9	0/3	0/5	1/28	3,6%
No answer/ Do not know	4/5	5/6	3/9	2/3	3/5	18/28	64,3%
The degree in which cooperation is limited depends on possibilities regarding separate services	0/5	3/6	1/9	0/3	0/5	4/28	14,3%
Subject not discussed/ No answer	5/5	3/6	8/9	3/3	5/5	24/28	85,7%
Less collaboration does not necessary mean that less innovation takes place	0/5	2/6	1/9	0/3	0/5	3/28	10,7%
Subject not discussed/ No answer	5/5	4/6	8/9	3/3	5/5	25/28	89,3%

Table 17: Opinions experts regarding cooperation

Regarding the framework of Henderson and Clark (1990) collaborations between IAPs and CAPs bring different aspects regarding architecture together. IAPs play a key role regarding architectural innovations while CAPs innovate at the component level.

8.3.8. Summary

This section discussed the effect of the Dutch net neutrality law on innovation of products and services in the mobile telecom market using the framework of Henderson and Clark (1990). The next subjects were discussed: Innovation on the edge of the internet; Quality differentiation; Global market and uncertainty; Effects on devices and collaborations.

Innovation on the edge of the internet

A majority of the experts point out that the law protects the internet as an open platform. About 36% state that due this protection, innovation on the edge of the internet is stimulated because the DNNL guarantees that people can innovate with low entry cost.

Quality differentiation

50% of the consulted experts consider that time-critical services or applications could be negatively affected by this law. As consequence innovation of these services and applications could be limited. Next to that, four

experts (14%) point out that restrictions regarding limited internet and restrictions regarding price differentiation can affect innovation negatively.

Global market and uncertainty

8 experts (28%) point out that the effect on innovation is small because the internet is a global market. For global players the Netherlands is just a small country. Next to that, 12 experts (43%) state that innovations that will emerge outside the Netherlands are possibly not introduced in the Netherlands, or will be introduced later, because of the DNNL. In addition 11 experts (39%) further point out that uncertainty about what is possible and what is not regarding business models hinders innovation.

Effects on devices

50% of the consulted experts do not see consequences for devices by applying the DNNL. They pointed out that the law is not applicable to devices. Moreover, devices are made on a worldwide level they state.

Only two experts (7%) denote that there possible is an indirect positive effect for innovation.

10 experts (35%) do not think this law has as consequence that the gatekeeper role of IAPs will move to other parties like developers of operating systems, or manufacturers of (mobile) devices.

Collaborations and effect on innovation

About 30% of the consulted experts think this law limits collaboration. They generally point out that collaborations are often about exclusivity, price for particular content and improved quality (priority). The law makes rules about this. The most concerns are regarding collaborations that demand priority.

8.4. Research question (g): What is the effect of the Dutch Net Neutrality law on innovation and investment of mobile infrastructure?

In this section three aspects regarding the effect of DNNL on innovation and investment in mobile infrastructure are discussed. These are termination fees, quality differentiation and restrictions regarding business models. The relation between investment and innovation in infrastructure based on the framework of Henderson and Clark (1990) is described in section 7.4.1.

8.4.1. Termination fees

Eleven of the consulted experts (39%) consider that, even without a law, IAPs would not charge terminations fees to CAPs (see Table 18). An argument for this, is that IAPs cannot simply afford to block or hinder CAPs (which is needed to put CAPs under pressure to pay), because probably customers would leave. Others point out that IAPs have not enough power to get money of big CAPs. One CAP points out charging CAPs is a bad idea, because it would not generate enough money for telecom operators. "If you put Google, Amazon and Ebay together, they make still less money together than T-Mobile on its own". In addition, a scientist points out that Dutch CAPs generate very little revenue compared to big international players. Therefore charging CAPs would not be lucrative for IAPs. Moreover, transaction costs would diminish these revenues is pointed out by some experts. These transaction cost include costs to negotiate with a big number of CAPs (Lee & Wu, 2009).

Since these experts consider that IAPs would not charge terminations fees to CAPs even without a law, no potential source of revenue is lost by forbidding termination fees. Therefore forbidding termination fees has no effect on investment in infrastructure.

In contrast, five experts (18%) think that forbidding termination fees would affect investment in infrastructure by IAPs negatively, since one possible source of revenue is forbidden. According to most expert termination fees are implicitly forbidden applying DNNL (see section 6.2).

8.4.2. Quality differentiation

Eight experts (29%) consider that paid-priority can positively affect investment in infrastructure (see Table 18). Most of these experts state that the reason for this is that IAPs will lose an option to gain revenue, which could be used to invest. One expert points out that paid-priority positively affects investment because it is an incentive for IAPs to invest to deliver the required quality. Also innovation in the intelligent layer is stimulated that way he states.

In contrast, seven experts (25%) consider that forbidding paid-priority has no effect on investment (see Table 18). An argument given for this is that IAPs are still stimulated by competition and bandwidth demand, which

are far more important for investment according to these experts than paid-priority. Another reason why paid-priority has no effect on investment is that IAPs will charge customers more if they cannot sell paid-priority services. In result, the budget for investment is unaltered.

8.4.3. Restrictions business models

11 experts (39%) point out that the restrictions regarding business models of IAPs have a negative effect on investment in infrastructure, since fewer options to generate revenue are available. These experts refer to the restrictions regarding priority services, limited internet and price-differentiation restrictions. In contrast, six experts (21%) consider that limitations regarding business models, have no effect on investment. Two consulted experts even think the DNNL affects investment in infrastructure positively (see Table 18). One of them points out that as consequence of DNNL there is more innovation on the internet, which creates more demand for data, which stimulates investment in infrastructure. The other expert states that because IAPs have fewer options to apply network management they are forced to invest in the network.

	CAPs	Scientists	Government	NI&D	Operators	Total	Percentage
Forbidding termination fees has a little negative effect on investment in infrastructure	1/5	0/6	3/9	1/3	0/5	5/28	17,9%
Forbidding termination fees has no effect on investment in infrastructure	3/5	2/6	3/9	2/3	1/5	11/28	39,3%
Subject not discussed/ No answer	1/5	4/6	3/9	0/3	4/5	12/28	42,9%
Allowing paid priority can stimulate investment in infrastructure	0/5	1/6	4/9	1/3	2/5	8/28	28,6%
Allowing of forbidding paid priority has no effect regarding investment in infrastructure	2/5	2/6	2/9	1/3	0/5	7/28	25,0%
Subject not discussed/ No answer	3/5	3/6	3/9	1/3	3/5	13/28	46,4%
Restrictions regarding business models hinders investment in infrastructure	0/5	1/6	4/9	3/3	3/5	11/28	39,3%
Restrictions regarding business models have no effect on investment in infrastructure	2/5	2/6	2/9	0/3	0/5	6/28	21,4%
Subject not discussed/ No answer	3/5	3/6	3/9	0/3	2/5	11/28	39,3%

Table 18: Opinions experts regarding effect DNNL on investment

8.4.4. Summary

This section discussed three aspects regarding the effect of DNNL on innovation and investment in mobile infrastructure. These are termination fees, quality differentiation and restrictions regarding business models.

Termination fees

39% of the consulted experts consider that even without a law IAPs would not charge terminations fees to CAPs. As consequence forbidding termination fees would also not affect investment. Arguments pointed out by these experts are that it would not be lucrative, IAPs have not enough power to charge big CAPs and IAPs cannot simply afford to block or hinder CAPs to put these CAPs under pressure to pay. In contrast, five experts (18%) think that forbidding termination fees would affect investment in infrastructure by IAPs negatively, since one possible source of revenue is forbidden.

Quality differentiation

About 30% of the consulted experts consider that paid-priority can positively affect investment in infrastructure. Most of these experts state that the reason for this is that IAPs will lose an option to gain revenue, which could be used to invest. In contrast, 25% of the experts consider that forbidding paid-priority has no effect on investment, because IAPs are still stimulated to invest by competition and bandwidth demand.

Restrictions business models

About 40% of the experts point out that the restrictions regarding business models of IAPs have a negative effect on investment in infrastructure, since fewer options to generate revenue are available. In contrast, about 21% consider that limitations regarding business models, like forbidding paid-priority, have no effect on investment.

9. Conclusions, Future Research

This chapter presents subsequently the main conclusions of chapter 5, which analyses the development of innovation and business models in mobile telecommunications. Thereafter conclusions are presented about the interpretation of the DNNL (chapter 6). After this, conclusions of the literature review and expert interviews are discussed (chapter 7 & 8). This chapter ends with a section about future research options.

Conclusions

To analyse the innovation process in mobile telecommunications the framework of Henderson and Clark (1990) was applied. Using this framework, we concluded that 2G and 3G meet the requirements to be categorized as radical innovations. This is because 2G and 3G consist of other techniques to transfer wireless data and is therefore based on a different set of engineering principles. In addition, both architecture and components are affected by 2G and 3G standards. Next to that, new markets were created and new applications were developed.

We also concluded that the innovation process in mobile telecommunications seems to have a fixed pattern of radical innovations. It starts with improved standards for mobile telecommunication (step 1). Accordingly, new networks are created which are compatible with the defined standards (step 2). This changes both the architecture and components of the network. Subsequently, new functions are created regarding components (step 3), which are enabled by the change in architecture. This process enables the creation of new markets and innovative applications.

The DNNL affects this process on an architectural level in the first place. Consequently the DNNL also affects this process also on the component level.

Business models were analysed using the framework of Morris et al. (2005). We concluded that mobile telecom providers are mainly focussed at offering services and create generally value by implementing innovations. The main services that mobile telecom providers have in their portfolio are: voice, SMS and internet. Regarding internet, many current offered internet access services lie somewhere between the open internet access model and the walled garden model nowadays. This is called the quasi open internet access model. In this model, most independent CAPs are accessible, but some CAPs are blocked or hindered.

Next to this, we observed that MNOs are afraid to see their revenue of Voice and SMS services shrink at the expense of data-services like VOIP and text-message services. In the Dutch telecom market there were signals that MNOs tried to prevent this cannibalisation by changing their business model.

The main conclusion that can be derived of chapter 6, which is about the interpretation of the DNNL, is that the DNNL is interpreted in different ways. Two interpretation scenarios were made in which most interpretations of the consulted experts can be categorized. These are a tolerant and a strict interpretation scenario. The tolerant interpretation scenario provides more possibilities regarding separate services, traffic management and tariff options. In contrast, the strict interpretation scenario provides fewer options regarding separate services, traffic management and tariff options.

Regarding the literature review and experts interviews (chapter 7 and 8), we conclude that the consequences of DNNL are generally unclear. Only regarding one aspect consensus was found (which concerns the statement that there are less differentiation possibilities for IAPs by applying DNNL). Therefore this research only presents potential effects of the DNNL:

The results of the literature as well as the results of the expert interviews show that the DNNL provides fewer options to differentiate. According to a majority of the experts (60%) this limitation leads to a more uniform product offering of IAPs (no literature was found regarding this issue). Based on these results, the offering of IAPs will potentially be less differentiated due the DNNL. For consumers this means they have potentially less choice regarding the offering of IAPs.

The development of business models of IAPs will potentially be disturbed because there is a lot uncertainty whether certain business models are allowed or not, which limits value creation (40% of the consulted experts pointed this effect out; no literature was found regarding this issue). As consequence, innovation is potentially hindered. For consumers it could mean that some propositions, which are allowed, will not be available.

Based on the results of the experts interviews it can be expected that the profit of IAPs (value capturing) will potentially diminish due the DNNL. Interviewed experts point out that this is due fewer options to create and capture value. (50% of the consulted experts support this effect, literature showed conflicting effects.)

Both literature as well as expert interviews show that under DNNL, CAPs do not have to negotiate with IAPs to get access to their network. They also do not have to worry about getting blocked. This means for IAPs that the only option for them is to use the open internet access model. Regarding customers it means that they only have to subscribe for one internet connection to have access to the whole internet.

We do not expect that CAPs will charge IAPs or refuse to supply their content to IAPs, because CAPs typically search for a maximum reach. (Literature and 60% of the consulted experts support this statement.)

The DNNL potentially limits options to acquire guaranteed quality for CAPs, which could harm value creation of CAPs providing time-critical applications. (60% of the consulted experts pointed this effect out.) For customers it could mean that time-critical services of CAPs are received with lower quality. The limitation, regarding options to acquire guaranteed quality, also potentially harms innovation of time-critical applications. (50% of the consulted experts pointed this effect out and this statement is supported by literature.) Regarding the innovation process, limiting options regarding guaranteed quality can be regarded as a limitation on architectural level.

The DNNL potentially stimulates innovation of CAPs, since this law protects the internet as an open platform, which guarantees that CAPs innovate with low entry costs. (36% of the consulted experts pointed this statement out. It is also supported by literature). Regarding the innovation process, protection of the internet as an open platform influences innovation on an architectural level (and as consequence also on a component level).

Particular innovations that will emerge outside the Netherlands are potentially not introduced in the Netherlands, or will be later introduced, because of the DNNL. (43% of the consulted experts pointed this statement out. No literature was found considering this issue). Regarding the innovation process it means that fewer options to innovate are applied on an architectural level in the Netherlands.

Concerning the effect of the DNNL on investment in infrastructure conflicting theories in literature were found. Based on the on the results of the expert interviews, the DNNL potentially limits investment in infrastructure, since fewer options to generate revenue are available for IAPs. (This statement was supported by 40% of the consulted experts). Regarding the innovation process, less investment in infrastructure affects innovation negatively on an architectural level.

Future research

This research provides a lot of clues for future research. Economic models about investment in networks and revenue could be extended to markets which have three or more competing players. Models found in economic literature typically assume a monopoly or duopoly setting and are thereby not good applicable to the Dutch market.

A lot of arguments were given by experts, show that the price for mobile internet access raises, by applying DNNL. However no literature was found which discusses these price effects. Future research should address this. Also nothing was found regarding signalling costs of wireless traffic. It could be interesting to research how much these costs actually are and what the impact of NN legislation is in relation to these costs.

Next to this some experts point out that by applying DNNL the discussion probably moves to transit and peering agreements for services that need a lot of traffic. Consequences of these transit and peering agreements should therefore be elaborated.

10. Recommendations

This chapter provides four recommendations to OPTA, which are based on the conclusions of this report (Chapter 9). These recommendations meet the requirements which are outlined at the beginning of this chapter.

Requirements

OPTA is the government agency that has to enforce the DNNL. OPTA's goal is to promote competition, to encourage innovation and to protect consumers. Therefore the recommendations have to be in line with these goals.

Next to this, OPTA has to be in the capacity to execute the recommendations. OPTA can determine how to enforce the law and can choose the way in which they want to communicate the enforcement of the law. There is also some space for interpretation. However they are not allowed to amend the DNNL.

The recommendations to OPTA are:

1. Communicate clear what is allowed and what is not allowed

A lot of experts point out that particular innovations will not be introduced because there can be uncertainty whether certain business models are allowed or not. According to these experts this can potentially hinder innovation. To take away this uncertainty OPTA should provide guidelines, which state clearly what is allowed and what is forbidden regarding the DNNL. In order to do this OPTA should first determine how the DNNL will be interpreted. It can be concluded from the expert interviews that the most questions are about separate services and priority.

2. Start with a tolerant interpretation of the DNNL

A tolerant interpretation of the DNNL (see section 6.1 Interpretation scenarios) provides more space to IAPs to differentiate their service offering in comparison with the strict interpretation. In this interpretation it is possible to offer priority for one particular service, whereby payment for this priority is possible. Also business models are possible in which some traffic is charged differently. For consumers it means that they have potentially more choice regarding the offering of IAPs in comparison with a strict interpretation of the DNNL.

According to the results of the expert interview a tolerant interpretation is better regarding investment in networks than a strict interpretation, because a tolerant interpretation offers more options for IAPs to gain revenue, which can be used for investment in networks and consequently stimulates innovation.

In addition, a regime in which paid-priority is possible is recommended, because it provides, according the analysis, the advantage for CAPs and consumers to retrieve guaranteed priority of services that need it.

A considerably part of the experts stated that time-critical services or applications could be negatively affected by the DNNL. As consequence, innovation of these services and applications is potentially limited. A tolerant interpretation provides relatively more options regarding prioritizing, which can weaken the potential negative effect regarding innovation of time-critical services. Moreover, experts mostly stated it is not to be expected that IASs will be degraded by IAPs to sell more priority services.

Based on the results of this research a tolerant interpretation is recommended. However, the internet is a dynamic environment, in which circumstances can change rapidly. Therefore this advice is extended with a scenario analysis.

Scenario Analysis

This scenario analysis shows, depending on different circumstances, whether OPTA should apply a tolerant or a strict interpretation of the DNNL. The circumstances focus on the development of time-critical application and on the possibility of IAPs degrading basic internet services.

The scenarios analysis is created using the checklist from "the art of the long view" of Schwartz (1991). This checklist consists of eight steps:

Step 1: Identify focal decision

OPTA can decide between a strict and a tolerant interpretation, which is outlined in Chapter 6. A tolerant interpretation provides options for paid priority regarding internet services. In contrast, applying a strict interpretation gives IAPs only the possibility to prioritize whole categories of traffic.

The decision between a strict and a tolerant interpretation, in this scenario analysis, is focused on consequences regarding innovations of CAPs. Consequences regarding innovations of CAPs are chosen because a lot of experts have concerns regarding innovation of time-critical services, if no paid-priority is possible. In contrast, some experts think that IAPs could degrade the quality of basic internet to sell more priority services, which would negatively affect innovation of CAPs and harm consumers.

This scenario analysis shows what the consequences are for innovation of CAPs in diverse scenarios.

Step 2: Key forces in the environment

The identified key factors which influence the success or failure of the decision mentioned in step 1 are:

- Quality of best effort internet
- Development of time-critical services
- Demand of time-critical services

Step 3 & 4: Driving forces a ranking importance and uncertainty

In this section driving forces are listed that influence the key forces identified earlier. In addition importance and uncertainty of the factors are identified on a scale from 1 to 10 (Im: Importance, Un: Uncertainty).

The quality of best effort internet (Im8 Un4) depends on:

- Competition between IAPs (Im 8 Un5)
- Innovation in network infrastructure (Im 7 Un 2)
- Demand for quality on best effort internet (Im 7 Un4)
- The degree to which best-effort internet is degraded by IAPs to sell more priority services (Im 10 Un 3)

The development of time-critical services depends on (Im 8 Un 4):

- Quality of best-effort internet (Im 8 Un 4)
- Demand of time-critical services (Im 8 Un 4)^c

The demand of time-critical services depends on (Im 8 Un 4):

- Development of time-critical services (Im8 Un 4)^d
- Consumers' need for time-critical services (Im7 Un 3)

Step 5: Selecting the scenario logics

In this step the axes on which the eventual scenarios differ from each other are chosen.

Some scholars as well as participants point out that if paid-priority is allowed IAPs could degrade best-effort internet to make their priority proposition more attractive. This is the only mentioned concern by participants regarding time-critical services. Therefore "The degree to which best-effort internet is degraded by IAPs to sell more priority services" is selected as a first axis.

"The development of time-critical services" is chosen as second axe because paid priority is more important if more services need it.

Leads to four scenarios (see Figure 8):

1. Intense degradation of IAS & little time-critical services developed
2. Intense degradation of IAS & A lot of time-critical services developed
3. Little or no degradation of IAS & Little time-critical services developed
4. Little or no degradation of IAS & A lot of time-critical services developed

^c The demand of time-critical services and the development of time-critical services are mutually dependent

^d Ad d

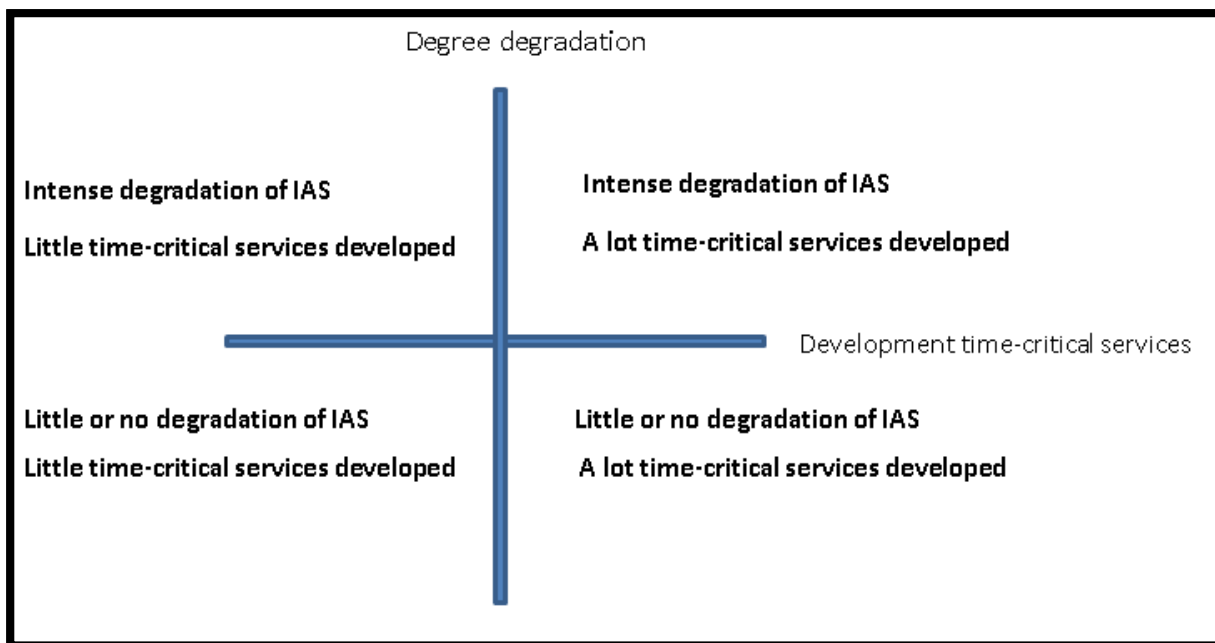


Figure 8: Scenarios innovation time-critical services

Step 6: Implications

In this step the decision which has to be made is analysed using the different scenarios.

Scenario 1:

In scenario 1 (Intense degradation of IAS & little time-critical services developed) applying a tolerant interpretation means that IAPs exploit the possibility to sell more priority services by degrading the IAS. However, little time-critical services are developed which could suffer from this degradation. Nevertheless, IAPs could degrade the best effort IAS that also non time-critical services would suffer. This would mean that CAPs could be harmed by charges of IAPs.

As only a few time-critical services could suffer by applying a strict interpretation and because a lot of services can be hindered by applying a tolerant interpretation, it would be advisable to decide to apply a strict interpretation in this scenario.

Scenario 2:

In scenario 2 (Intense degradation of IAS & A lot of time-critical services developed) it would also mean that by applying a tolerant interpretation IAPs exploit the possibility to sell more priority services by degrading the IAS. The difference with scenario 1 is that a lot of time-critical services are developed that need priority. By applying a tolerant interpretation CAPs and users who want guaranteed quality for these services have the opportunity to get this. However, because the IAS is degraded a lot of CAPs, who provide non time-critical services, suffer by applying a tolerant interpretation.

Therefore this seems to be the most difficult scenario since each decision will be disadvantageous for one of the involved parties. I would say that a strict interpretation should be applied, since by applying this interpretation only time-critical services suffer. By applying a tolerant interpretation a lot more (non time-critical) services suffer, which can negative affect innovation and harm consumers.

Scenario 3:

In scenario 3 (Little or no degradation of IAS & Little time-critical services developed) the impact of choosing one of the two options is less than in scenario 1 and 2, because IAPs would not degrade the IAS intense, to exploit CAPs. By applying a tolerant interpretation it is possible for the few developed time-critical services to get guaranteed priority while no intense degradation of IAS occurs. By applying a strict interpretation also no intense degradations of IAS occurs. However, also the few services that need guaranteed priority cannot get it.

Therefore applying a tolerant interpretation seems the best decision in this scenario.

Scenario 4:

In scenario 4 (Little or no degradation of IAS & A lot of time-critical services developed) applying a tolerant interpretation means that no or little degradation of the IAS occurs while it is possible for time-critical services to get guaranteed priority. Therefore the best option is to apply a tolerant interpretation in this scenario.

Concluding remarks step 6

In the expert interviews most participants pointed out that degrading of the IAS is not to be expected. Regarding development of time-critical services most participants point out that they expect that more time-critical services will be developed in the future. However they are not sure to what extent this will happen. Therefore the most relevant scenarios are scenario 3 and 4. In these scenarios little or no degradation of the IAS is expected and development of time-critical services is small in scenario 3 and intense in scenario 4.

In both scenarios 3 and 4 a tolerant interpretation was chosen as best decision. Therefore it is recommended that OPTA should start with a tolerant interpretation.

Step 7: Selection of leading indicators

One leading indicator that has to be monitored is whether IAPs will degrade their IAS to sell more priority services. As long as this does not happen a tolerant interpretation is the best decision according to the analysis.

If IAPs start degrading their IAS to sell more priority services, it is disadvantageous for CAPs who do not need priority (which is a much larger group as CAPs who need priority), consequently customers are harmed and innovation is hindered. It is therefore advisable move to a strict interpretation.

3. Monitor developments regarding potential degradation of Internet Access services

This scenario analysis shows that if IASs will degrade their IASs intensely, it is better to apply a strict scenario. Therefore developments regarding potential degradation of IASs have to be monitored. This monitoring should happen regularly, since the internet is a dynamic environment, in which circumstances can change rapidly.

4. Examine possibilities regarding minimum quality requirements

The scenario analysis shows that if IAPs start degrading their IAS to sell more priority services, it could be considerable to move to a strict interpretation. However, also another approach is possible by applying related legislation of the DNNL.

Using this approach a tolerant interpretation is applied in combination with setting minimum quality requirements²⁰. This makes it possible to get guaranteed quality, by allowing paid-priority, while there is no disadvantage of degradation of IASs (since IAPs can be obliged to provide a minimum quality of service). Possibilities to do this should be further analysed, since this is outside of the scope of this research.

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Appendix A: Cannibalisation and Data-growth

This section discusses cannibalisation and data growth and describes observed changes in business models that can be linked to these subjects.

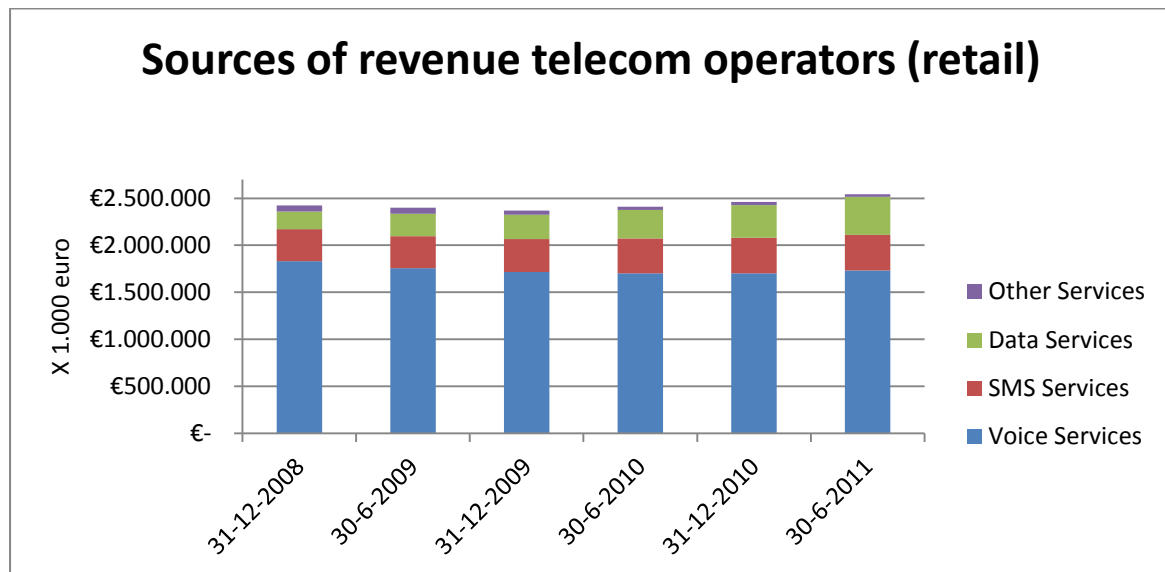


Figure 9: Sources revenue retail market Dutch MNOs per half year (OPTA, 2011)

Cannibalisation

MNOs are afraid of cannibalisation of revenue regarding voice and SMS services by competitive services on their mobile internet services²¹. The main competitive services are VoIP services (e.g. Skype and Google Talk) and text-message services (e.g. Whatsapp, Ping and E-mail). These services are (if not blocked) accessible via the mobile internet service of the MNOs. MNOs also compete with services on the internet regarding video-content. The mobile video market is growing and is expected to be a big source of revenue in the near future.²² In the Dutch telecom market there were signals that MNOs tried to prevent cannibalisation by changing their business model²³. Some options to do this are discussed:

Raising prices mobile internet

Raising prices of mobile internet could lead to a slower speed of adoption of mobile internet services, and thereby also slowing down the adoption of competitive services. Also users that already have adopted mobile internet services could be stimulated to use more traditional services (voice and SMS) by raising mobile internet prices. In the Netherlands short after each other the three biggest MNOs raised their prices for mobile internet in 2011, which could be done to prevent cannibalisation.

Data quantity caps

In the Netherlands unlimited mobile internet access was available for a flat fee since 2005²⁴. However, most providers stopped offering this service in 2010²⁵. The most heard argument of the providers to do this was to prevent congestion on the network. However, it could also be that the MNOs tried to hinder VoIP usage by reintroducing data caps. If a provider sets a data cap at 100MB²⁶, it could limit the use of VoIP services like Skype, which needs minimal 25 MB per hour.²⁷ In theory 4 hours of VoIP use is possible. Though, in practice this will be less, because consumers of course use the mobile internet for more purposes than VoIP only.

This strategy would be even more effective to hinder competitive video services because these services need a lot of bandwidth. In contrast data caps are not effective to hinder competitive chat

services, since these services only need a fraction of data amount compared to VoIP and video services.

Data speed caps

Another way to hinder competitive services is by using data speed caps. Competitive services like VoIP and video services need a minimum speed to function. For example Hi (brand of KPN) offers a mobile internet subscription with a speed of 32 kbps²⁸ which is enough to send and receive messages. However, it is practically not enough to provide a stable VoIP connection²⁹ or a video-stream.

Block or hinder competitive services

A more direct way of preventing cannibalisation is blocking or hindering of competitive services. BEREC (Body of European Regulators for Electronic Communications) reported in 2012 that a part of European mobile providers blocks VoIP-services to reduce competitive pressure on their retail services.³⁰

Additionally charge competitive services

In 2011, KPN considered³¹ to charge chat, VoIP and video services additionally to consumers. KPN tried to recap their declined revenue on voice and SMS services by using this strategy. Afterwards they decided to only additionally charge for VoIP services.³²

How these tariffs would be presented exactly is not clear. However a few options are possible regarding additional charging. One of the options is to charge for the amount of data use of the services. This can be done by setting a price per MB or KB use of the particular service. Another option is to charge more subscription fee for an offer that allows for VOIP, video and/or chat services. A specific option for VoIP could be to charge per minute of VoIP calls.

Bundling

A remarkable business model that can be used to prevent cannibalisation is a special form of bundling. In this form it is only possible to purchase mobile internet combined with voice and SMS services. If you want more data, then you also have to purchase more voice minutes and SMS. In Table 19 an example of this kind of offering is presented.

Subscription fee	Minutes or SMS	MB
€ 27.50	90	100
€ 30.00	120	200
€ 35.00	175	250
€ 40.00	250	350
€ 45.00	325	500
€ 52.50	400	600
€ 67.50	550	700
€ 82.50	700	800

Table 19: Hi (Brand of KPN) offering 2011³³

Stifle expansion and innovation of data-networks

As mobile internet services improve, more bandwidth will be available and the reliability will be enhanced. This can be a rationale for consumers to shift to a more intensive use of mobile internet instead of voice and SMS services. As consequence MNOs see their revenue of SMS and voice services decline. In line with this Prüfer and Jahn (2007) point out that if IAPs provide more capacity, they also face more competition in light to their own provided services, which is named the capacity paradox.

MNOs could therefore slow down the expansion and innovation of data-networks. This strategy is supported by the rationale that “operators may stop investing in innovative network and middleware technologies if they are uncertain whether or not they can still recoup a sufficient portion of the revenues” (Reuver, 2011).

Growth in data-use

Another reason Dutch providers gave to change their business model is the unexpected growth of mobile data traffic, that has as consequence that MNOs need to invest intensely in their mobile network. However the providers do not want to give exact information about these investments due to competitive reasons, which makes it hard to verify this statement³⁴.

An interesting trend which can be observed in Figure 10 is that the data traffic has grown 6 times as big in a timeframe of 2,5 years (2008-2011). In contrast, the average revenue of data-services only doubled in the same timeframe (Figure 11).

The main business model changes that can be coupled to the growth of data are the raising of mobile internet prices, the reintroduction of data quantity caps and the blocking or throttling of bandwidth-intensive services. According to BEREC’s research (2012)³⁵ on traffic management the most frequent reported traffic management practise is the blocking or throttling of P2P-traffic, both on mobile and fixed networks. It is likely that P2P is mainly blocked to reduce data traffic.

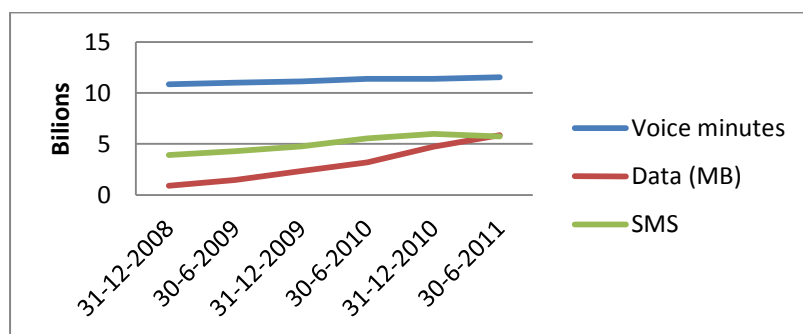


Figure 10: Volume retail voice, data and SMS of Dutch MNOs and MVNO’s³⁶

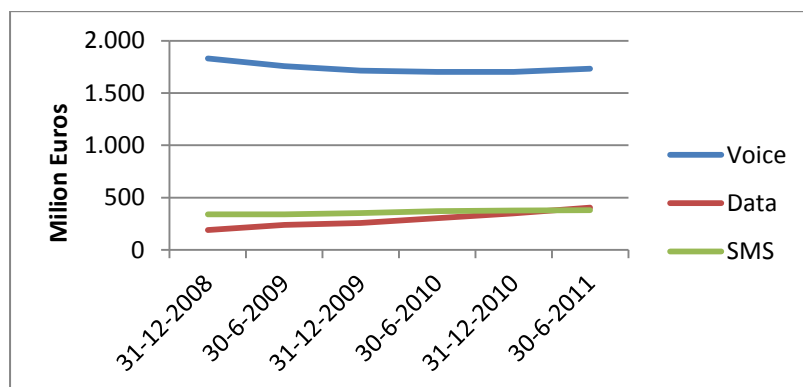


Figure 11: Revenue retail voice, data and SMS of Dutch MNOs and MVNO’s³⁷

Appendix B: Business model, (Morris et al., 2005)

<p><i>Component 1 (factors related to the offering): How do we create value? (select from each set)</i></p> <ul style="list-style-type: none">• offering: primarily products/primarily services/heavy mix• offering: standardized/some customization/high customization• offering: broad line/medium breadth/narrow line• offering: deep lines/medium depth/shallow lines• offering: access to product/ product itself/ product bundled with other firm's product• offering: internal manufacturing or service delivery/ outsourcing/ licensing/ reselling/ value added reselling• offering: direct distribution/indirect distribution (if indirect: single or multichannel) <p><i>Component 2 (market factors): Who do we create value for? (select from each set)</i></p> <ul style="list-style-type: none">• type of organization: b-to-b/b-to-c/ both• local/regional/national/international• where customer is in value chain: upstream supplier/ downstream supplier/ government/ institutional/ wholesaler/ retailer/ service provider/ final consumer• broad or general market/multiple segment/niche market• transactional/relational <p><i>Component 3 (internal capability factors): What is our source of competence? (select one or more)</i></p> <ul style="list-style-type: none">• production/operating systems• selling/marketing• information management/mining/packaging• technology/R&D/creative or innovative capability/intellectual• financial transactions/arbitrage• supply chain management• networking/resource leveraging <p><i>Component 4 (competitive strategy factors): How do we competitively position ourselves? (select one or more)</i></p> <ul style="list-style-type: none">• image of operational excellence/consistency/dependability/speed• product or service quality/selection/features/availability• innovation leadership• low cost/efficiency• intimate customer relationship/experience <p><i>Component 5 (economic factors): How we make money? (select from each set)</i></p> <ul style="list-style-type: none">• pricing and revenue sources: fixed/mixed/flexible• operating leverage: high/medium/low• volumes: high/medium/low• margins: high/medium/low <p><i>Component 6 (personal/investor factors): What are our time, scope, and size ambitions? (select one)</i></p> <ul style="list-style-type: none">• subsistence model• income model• growth model• speculative model

Figure 12: Six questions that underlie a business model (Morris et al., 2005)

Appendix C: Questionnaire interpretation DNNL

Consulted experts for exploratory interviews regarding the interpretation of DNNL:

Nico van Eijk - Professor of Information Law, Amsterdam university

Pieter Nooren - Consultant at TNO ICT

Robert Stil - OPTA

Huib de Kleijn - OPTA

Stef de Vries - OPTA

Marc Peeters – OPTA

Ilse van der Haar - OPTA

Interview:

Interpretatie Nederlandse Netneutraliteit

In het kader van het onderzoek naar de potentiële effecten van de Nederlandse wet Netneutraliteit op innovatie en business modellen in de mobiele telecommunicatie markt

Datum: 9-3-2012

Auteur/ Interviewer: Ing. L.M.M. (Laurent) Hacking

Onderzoek in opdracht van: Technische Universiteit Eindhoven en OPTA

Begeleider bij OPTA: Drs. R. (Robert) Stil

Mentor (TUE): Dr. J.A. (Jimme) Keizer

Inleiding

Dit interview maakt deel uit van het onderzoek naar de potentiële effecten van de Nederlandse wet netneutraliteit op innovatie en verdienmodellen in de mobiele telecommunicatiesector. Om deze potentiële effecten te kunnen onderzoeken is het van belang om een goed beeld te krijgen van hoe deze nieuwe wet geïnterpreteerd zou kunnen worden: Wat mag wel en wat mag niet volgens deze wet? Met de Nederlandse wet Netneutraliteit wordt de wet bedoeld zoals beschreven in het amendement³⁸ van het lid Verhoeven. Deze wet wordt mogelijk op korte termijn ingevoerd³⁹.

Dit interview wordt gehouden om een beter beeld te krijgen van hoe de wet kan worden geïnterpreteerd. De focus daarbij is op delen van de wet die relevant zijn voor het onderzoek en waarbij het niet duidelijk is hoe de wet geïnterpreteerd kan worden.




Het eerste deel van het interview richt zich op de wijze hoe ISP's hun producten en diensten mogen aanbieden volgens deze wet. Het 2^e deel richt zich op de technische consequenties van deze wet.

Deel 1: Hoe mogen ISP's hun producten aanbieden volgens deze wet?

1. In het eerste lid van artikel 7.4a wordt gesproken over een internettoegangsdienst. Wat zijn plausibele interpretaties van dit begrip?
2. Kan gratis internet in een winkelcentra of gratis internet in de trein worden aangemerkt als een internettoegangsdienst, zoals in het artikel bedoeld wordt?
3. Kan internet op een bedrijf worden gezien als een internettoegangsdienst, zoals in het artikel bedoeld wordt?
4. Kan internet in een studentenflat worden gezien als een internettoegangsdienst, als de bewoners gebruik maken van het universiteitsnetwerk?
 - a. Maakt het hierbij uit of de internettoegangsdienst gratis wordt geleverd of tegen betaling?
5. Welke van de volgende diensten mogen worden aangeboden door ISP's als een losse dienst (gelet op de verschillende interpretaties)?
6. Mag een fabrikant van een mobiel apparaat met 3G/4G toegang bepaald verkeer beperken?
 - a. Case Kindle: een voorbeeld hiervan is een geavanceerde Kindle, waarbij het instap abonnement enkel gratis toegang biedt om boeken te downloaden, terwijl op het zelfde apparaat het ook mogelijk is om het internet op te kunnen.
 - b. Case Facebook: Een ander voorbeeld is een Facebook telefoon, waarbij de fabrikant alleen verkeer van facebook.com toestaat.

Spotify case KPN vast (m.b.t. vraag 2)

KPN-klienten krijgen bij bepaalde alles-in-één-pakketten een gratis Spotify Premium-abonnement. Normaal kost dat 10 euro per maand. KPN zegt de 'exclusieve partner' van Spotify in Nederland te zijn: deals met andere isp's zijn dus uitgesloten. ⁴⁰

	Instap	Standaard	Premium
	Info & opties	Info & opties	Info & opties
		Meest gekozen	
 Interactieve TV op 2 tv's met: Live tv pauzeren Programma Gemist Ruim 55 tv- en 90 radiozenders Videotheek Thuis Standaard 10 HD zenders	✓	✓	✓
 Internet	8 Mb/s download, 1 Mb/s upload	40 Mb/s download, 4 Mb/s upload	50 Mb/s download, 5 Mb/s upload
 Voordelig bellen	✓	✓	✓
+			
KPN HotSpots	✓	✓	✓
Draadloos modem	✓	✓	✓
Interactieve TV Online Thuis live tv op tablet of laptop	✓	✓	✓
Spotify Premium (t.w.v. € 10,- /mnd)	optie	✓	✓
Opnemen Pakket (t.w.v. € 5,- /mnd)	optie	✓	✓
HD Extra Pakket (t.w.v. € 7,50 /mnd)	optie	optie	✓
Pluspakket (t.w.v. € 10,- /mnd)	1e 3 mnd gratis	1e 3 mnd gratis	1e 3 mnd gratis
Prijs per maand*:	€ 45,-	€ 55,-	€ 65,-
Goeie Deal: Eerste 3 maanden (/mnd):	€ 30,-	€ 40,-	€ 50,-
Webdeal: Geen verzend- en activatiekosten (t.w.v. € 35,-)	€ 0,-	€ 0,-	€ 0,-
	Bestel	Bestel	Bestel
	Info & opties	Info & opties	Info & opties

Figuur 1: Aanbod Spotify KPN in combinatie met een alles-in-één-pakket⁴¹

Spotify case Hi mobiel

Voor €10 per kalendermaand krijg je Spotify Premium én 500MB mobiel internet-tegoed bij een Hi Abonnement. Deze 500MB komt bovenop je reguliere internet-tegoed. De bundel is maandelijks opzegbaar.

De Hi Spotify 500MB is een exclusief aanbod voor klanten met een Hi Abonnement in combinatie met één van de volgende Internet op je Mobiel abonnementen of voordeelbundels; Eindeloos

Deel 2: Technische consequenties interpretatie wet

1. In het eerste lid van artikel 7.4a wordt gesproken over congestie. Wat zijn plausibele interpretaties van dit begrip?
2. Welk verkeer zou een provider in het geval van congestie mogen beperken of belemmeren?
 - a. In hoeverre mogen soorten verkeer onderscheiden worden? Mag bijvoorbeeld het Bittorrent verkeer als een apart soort verkeer worden gezien? Of valt dit onder P2P verkeer?
3. Als er bepaald netwerkverkeer geprioriteerd wordt, betekent dat dan per definitie dat ander verkeer vertraagd wordt?
 - a. Technisch gezien?
 - b. Juridisch gezien?
4. Mogen volgens deze wet prioriteringstechnieken worden gebruikt als er geen congestie is? Mag bijvoorbeeld Active prioritisation worden toegepast, waarbij voor bepaald verkeer ruimte wordt gereserveerd?
5. Is het te garanderen dat gelijke soorten dataverkeer gelijk worden behandeld als een provider bepaald soort verkeer wil prioriteren boven ander verkeer in geval van congestie?
6. Stel, losse diensten en internet toegangsdiensten gebruiken dezelfde mobiele bandbreedte. Mogen volgens deze wet losse diensten dan voorrang krijgen op de internettoegangsdienst?
7. In de toelichting op het amendement staat dat het mogelijk is dat abonnees met meer bandbreedte voorrang mogen krijgen bij congestie boven abonnees met minder bandbreedte. Op mobiele netwerken is vaak sprake van congestie. Zou dit kunnen betekenen dat een abonnee met een lage bandbreedte regelmatig/altijd een hogere vertraging hebben waardoor bepaalde diensten onbruikbaar worden? Denk hierbij aan VoIP, games, videochat, InternetTV.
8. Op mobiele netwerken (3G/4G) kunnen verschillende providers gebruik maken van het zelfde netwerk. Denk hierbij aan virtuele providers (zoals BEN, Tele2) die gebruik maken van het netwerk van de licentiehouders (KPN, T-mobile, Vodafone).

Kunnen er problemen optreden als de licentiehouders netwerkmanagement?

Appendix D: Overview participants

28 interviews 32 participants:

Government (9):

Marloes van Caspel – Ministry of Economic Affairs, Agriculture and Innovation, The Netherlands

Paul de Bijl – Bureau for Economic Policy Analysis (Centraal Planbureau)

Mark de Jong - OPTA

Robert Stil - OPTA

Huib de Kleijn - OPTA

Stef de Vries - OPTA

Marc Peeters - OPTA

Frode Sørensen - Norwegian Post and Telecommunication authority (NPT)

Ivan Brincat - Policy Developer at European Commission

CAPs (5):

John de Jong – RTL (Commercial Dutch broadcaster)

Egon Verharen- NPO (Public Dutch broadcaster)

Thomas van de Weerd - Pathé (VoD)

Jean-Jacques-Sahel - Skype

Michiel Buitelaar – Sanoma (Providing diverse media services)

Scientists and market watchers (6):

Rudi Bekkers - TU/e

Mark de Reuver - TU Delft

Pierre Larouche - Tilburg University

Reg Brennenraedts - Dialogic innovation & interaction

Pietro Crocioni

Tim Poulus - Telecom paper

Telecom Operators (5)

Paul knol - KPN

Joepke vd Linden & Michiel Huisken - T-Mobile

Jorn van Steenis - Vodafone

Arie Landsmeer & Stein Smeets - Ziggo

Roel Polmans - Tele2

Experts regarding network infrastructure and devices (3)

Stef van der Ziel - Jet-Stream

Marcel van Haren - NETELCOM , Jos Grond and Cristian Alexandru - Nokia Siemens Networks

Pastora Valero - Cisco

Appendix E: Dutch questionnaire effect DNNL on business models and innovation

Interview Netneutraliteit, Verdienmodellen en Innovatie

In het kader van het afstudeeronderzoek naar de potentiële effecten van de Nederlandse wet Netneutraliteit op innovatie en business modellen in de mobiele telecommunicatie markt.

Datum: 21-5-2012

Afstudeerder: Ing. L.M.M. (Laurent) Hacking

Begeleider OPTA: Drs. R. (Robert) Stil

Begeleider TU/e: Dr. J.A. (Jimme) Keizer

2e beoordelaar TU/e: Dr. ir. R.N.A. (Rudi) Bekkers

Inleiding

Dit interview is onderdeel van het onderzoek naar de effecten van de Nederlandse wet Netneutraliteit op verdienmodellen en innovatie in de mobiele telecommunicatiemarkt. Dit onderzoek voer ik uit in het kader van mijn afstudeertraject aan de TU/e. Hiervoor loop ik stage bij OPTA.

Het betreft een onafhankelijk onderzoek. De resultaten zullen als het onderzoek is afgerond openbaar worden gemaakt. U ontvangt dan uiteraard een exemplaar.

De uitkomsten van dit interview worden geanonimiseerd. Er zal enkel op stakeholderniveau worden gerapporteerd. Van dit interview worden notulen gemaakt. Zou u deze willen inzien?

In dit document wordt allereerst een samenvatting gegeven van de Nederlandse wet Netneutraliteit. Vervolgens wordt de vragenlijst gepresenteerd.

Samenvatting wet

De Nederlandse wet netneutraliteit (NWN) wordt beschreven in artikel 7.4a ⁴³ (<https://zoek.officiëlebevestigingen.nl/kst-32549-29.pdf>) van de gewijzigde telecommunicatiewet. Deze wet is onlangs aangenomen in de eerste kamer en zal naar verwachting op 1 januari 2013 in werking treden.

De wet verbiedt aanbieders van internettoegangsdiensten om diensten en toepassingen op het internet te belemmeren of te vertragen, tenzij het noodzakelijk is:

- a. om de gevolgen van congestie te beperken, waarbij gelijke soorten verkeer gelijk moeten worden behandeld;
- b. ten behoeve van integriteit en veiligheid van het netwerk;
- c. om ongevroegde communicatie te beperken;
- d. ter uitvoering van een wettelijk voorschrift of rechterlijk bevel.

Ook verbiedt deze wet aanbieders van internettoegangsdiensten om de hoogte van tarieven voor internettoegangsdiensten afhankelijk te stellen van de diensten en toepassingen die via deze diensten worden aangeboden of gebruikt.

De wet geeft daarnaast nog mogelijkheden voor het stellen van nadere minimum kwaliteitsvoorschriften.

In de toelichting staat dat aanbieders “losse diensten” via het internet, maar geen pakketten voor toegang tot een deel van het internet kunnen aanbieden. Als voorbeeld van een “losse dienst” wordt een los VOIP abonnement genoemd. Verder kan worden opgemaakt uit de toelichting van het amendement dat “losse diensten” weliswaar via het internet kunnen worden geleverd, maar dat deze dienst niet bedoeld is om toegang tot internet te verlenen. Bij het aanbieden van een “losse dienst” mag overig verkeer worden geblokkeerd.

Afkortingen

CAP: Content and Application Provider

IAP: Internet Access Provider

NWN: Nederlandse wet Netneutraliteit

Vragenlijst

1. In hoeverre verwacht u dat de wijze waarop mobiele IAP's hun geld verdienen zal veranderen door de invoering van de NWN?
2. Verbiedt deze wet impliciet termination fees aan CAP's door IAP's? (termination fees zijn tarieven die IAP's kunnen vragen om CAP's toegang te verlenen tot hun netwerk)
3. Wat zijn waarschijnlijke gevolgen van de NWN voor CAP's?
4. Wat is gevolg van het verbieden van een betaalde prioriteitsdienst voor CAP's?
5. Is het wenselijk als CAP's direct kosten in rekening brengen bij IAP's? (Niet verboden in de NWN)
6. Is het te verwachten dat CAP's dit gaan doen?
7. Wat zijn mogelijke gevolgen van de NWN op innovatie van producten en diensten bij CAP's?
8. Wat zijn mogelijke gevolgen van de NWN op innovatie van mobiele apparaten en besturingssystemen?
9. Welk effect heeft het al dan niet breed toestaan van "losse diensten" op innovatie van applicaties en diensten op het internet?
10. Wat zijn de mogelijke effecten van de NWN op samenwerkingsverbanden tussen IAP's en CAP's? Hoe beïnvloedt dit innovatie?
11. Wat zijn mogelijke gevolgen van het verbieden van termination fees aan CAP's door IAP's voor innovatie en investeringen in het netwerk? (termination fees zijn tarieven die IAP's kunnen vragen om CAP's toegang te verlenen tot hun netwerk)
12. Wat zijn mogelijke gevolgen van het verbieden van een betaalde prioriteitsdienst voor innovatie en investeringen in netwerken? (nog andere effecten van NWN op investeringen netwerk?)
13. Hoe staat het effect van de NWN in verhouding tot andere factoren (bijv. concurrentie, vraag naar bandbreedte) die invloed hebben op innovatie en investeringen in het netwerk?
14. Wat zijn mogelijke neveneffecten van deze wet?
15. De wet richt zich op IAP's, maar laat andere partijen ongemoeid (ontwikkelaars van besturingssystemen, fabrikanten van (mobiele) apparaten). Zal dit nog consequenties hebben? zo ja, welke?
16. Wat voor effect heeft de wet op innovatie als deze enkel in een beperkt aantal landen van kracht wordt?

Appendix F: English questionnaire effect DNNL on business models and innovation

Interview net neutrality, business models and innovation

In the context of research about potential effects of the DNNL on innovation and business models in the mobile telecommunication market.

Date: 19/05/2012

Student: BSc. L.M.M. (Laurent) Hacking

Supervisor at OPTA: Drs. R. (Robert) Stil

1st supervisor at TU/e: Dr. J.A. (Jimme) Keizer

2nd supervisor at TU/e: Dr. ir. R.N.A. (Rudi) Bekkers

Introduction

This interview is part of my graduation research about potential effects of the DNNL on business models and innovation in the mobile telecommunication market. This research is commissioned by the Technical University of Eindhoven and OPTA.

The results of this research will be made public when the project is finished. You of course receive a copy then.

Besides, the results of this interview will be made anonymous. There will only be reported at stakeholder level.

Minutes will be made of this interview. Would you want to verify it?

This document starts with a summary of the DNNL. Thereafter the questionnaire will be presented.

Summary DNNL

The DNNL is described in article 7.4a⁴⁴ (<https://zoek.officielebekendmakingen.nl/kst-32549-29.pdf>) of the changed telecommunication law. This law is recently approved by the senate and will be operational in 2013.

This law forbids IAPs (Internet Access Providers) to hinder or delay services or applications on the internet, unless it is necessary:

- e. to limit the consequences of congestion, whereby equal types of traffic are treated equally;
- f. for the purpose of integrity and security of the network and the service of the involved provider or the peripherals of the end-user;
- g. to limit the unsolicited communication to end-users;
- h. to implement a statutory provision or a court order.

The law also forbids IAPs to set the level of tariffs for internet access services dependent on the services and applications that are offered or used via the internet access service.

Besides, the law gives options to set minimum requirements regarding quality of public electronic communication services.

In the clarification is stated that IAPs are allowed to offer “separate services” via the internet, but are forbidden to offer packets for access to a part of the internet. As example of a “separate service” a VOIP offering is given. It can be concluded that “separate services” can be provided via the internet. However these services are not intended to give access to a part of the internet. When a “separate service” is offered it is allowed to block all other traffic.

Abbreviations

- CAP: Content and Application Provider
- IAP: Internet Access Provider
- DNNL: DNNL

Questionnaire

1. To what extend do you expect that the way mobile IAPs earn money will change caused by the DNNL.

This can for example be in relation with differentiation possibilities, extend of using “separate services”, tariff internet access service, sources of revenue, customer choice.

2. Does this law implicitly forbid termination fees to CAPs by IAPs? (termination fees are tariffs that IAPs can charge to CAPs for accessing the IAP's network)
3. What are the expected consequences of the DNNL for CAPs?
This can for example be in relation to business models of CAPs and quality of transmission content
4. What is the consequence of forbidding a paid priority service for CAPs?
This can for example be in relation to competitive position of CAPs and quality guaranty. (Do some services need always priority?)
5. Is it desirable if CAPs directly charge IAPs? (not forbidden by the DNNL)
6. Can it be expected that CAPs will use this possibility?
7. What are the possible consequences of the DNNL on innovation of products and services of CAPs?
Innovation can be regarded as new or renewed products and services.
8. What are possible consequences of the DNNL on innovation of mobile devices and operating systems?
9. What effect has a broad permission of "separate services" on innovation of applications and services on the internet?
Think of possible new services by using "separate services", possibility of use of separate service as priority service.
10. What are possible effects of DNNL on collaborations between IAPs and CAPs? How does this affect innovation?
11. What are possible consequences of forbidding termination fees to CAPs by IAPs for innovations and investments in the network? (termination fees are tariffs that IAPs can charge to CAPs for accessing the IAP's network)
12. What are possible consequences of forbidding paid priority for innovation and investment in networks?
13. What is the effect of NWN in relation to other factors (e.g. competition, demand for bandwidth) that affect innovation and investment in the network?
14. What are possible unintended effects of this law?
15. The focus of the law is on IAPs and leaved other parties untouched (developers of operating systems, manufacturers of (mobile) devices). Will this have consequences? If so, what?

What effect has this law on innovation if it is only operational in a limited number of countries?

Appendix G: Dutch Net Neutrality Law

Section 7.4a

1. Providers of public electronic communication networks which deliver Internet access services and providers of Internet access services must not hinder or slow down applications and services on the Internet, unless and to the extent that the measure in question with which applications or services are being hindered or slowed down is necessary:
 - a. to minimise the effects of congestion, whereby equal types of traffic must be treated equally;
 - b. to preserve the integrity and security of the network and service of the provider in question or the terminal of the end-user;
 - c. to restrict the transmission to an end-user of unsolicited communication within the meaning of Section 11.7(1), provided that the end-user has given its prior consent;
 - d. to give effect to a legislative provision or court order.
2. If an infraction of the integrity or security of the network or the service or a terminal of an end-user, as referred to in (b) of the first paragraph, is being caused by traffic coming from the terminal of an end-user, the provider, prior to the taking of the measure which hinders or slows down the traffic, must notify the end-user in question, in order to allow the end-user to terminate the infraction. Where the required urgency means that this is not possible prior to the measure being taken, the provider must give notice of the measure as soon as possible. The first sentence does not apply where this concerns an end-user of a different provider.
3. Providers of Internet access services must not make their charges for Internet access services dependent on the services and applications which are offered or used via these services.
4. Further regulations with regard to the provisions in the first to the third paragraph may be provided by way of a general administrative order [*algemene maatregel van bestuur*]. A proposal for a general administrative order as provided for under this paragraph will not be made earlier than four (4) weeks after the draft has been submitted to both chambers of the States General.
5. In order to prevent the degradation of service and the hindering or slowing down of traffic over public electronic communication networks, minimum requirements regarding the quality of service of public electronic communication services may be imposed by or pursuant to a general administrative order on undertakings providing public communications networks.

Appendix H: Overview tariff plans of voice services

Mobile providers have through the years created a wide range of different tariff plans to offer voice services. These are both related to the value creation (component 1) and the value capturing (component 5) part of the business model. Corrocher and Zirulia (2010) gave an overview of different characteristics of these tariff plans.

One of the characteristics is whether the offer consists of a Pre-paid card or a subscription. Using a Pre-paid card customers first have to put money on their Pre-paid card before they can make a call. Pre-paid users do not have to pay a subscription fee.

Another characteristic of tariff plans is whether there exists a subscription fee or not. Besides this, a provider can charge a price per unit or a price on the basis of the actual seconds/minutes. By charging a price per unit, with for example a unit of 30 seconds, the customer has to pay for the whole unit by only making use of a part of it, e.g. 10 seconds.

Other differences can be made by including or excluding a call connection fee. Time or day-based charges are also used to differentiate. Using this, the provider can charge differently according to time, day and geographical location of the caller/receiver. For example they can make it cheaper to call after 20:00h or during weekends. Furthermore differentiation between on-net vs. off-net is possible. On-net means services between 2 devices on the same network and off-net means services between two different networks.

Besides this, a rebate mechanism can be included or not. Another possibility is to give minutes for free related to the total expenditure. For instance 20% rebate on all calls when spending more than 40 euro per month. A last character described is making variable prices, which indicates whether the tariff plan provides variable prices during the call (for example 20 cents/min for the first minute and 15 cents/min afterwards).

Appendix I: Two-sided markets

The discussed networks in section 5.2.3 can all be regarded as two sided markets (cable television, telephone network and internet). Two-sided markets can be “roughly”⁵ defined as “markets in which one or several platforms enable interactions between end-users, and try to get the two (or multiple) sides ‘on board’ by appropriately charging each side” (Rochet & Tirole, 2004). Payments are possible on both sides of the

Another example of a two-sided market is broadcast television (e.g. DVB-T). Typically broadcasters/programmers (and ultimately advertisers) are paying. Customers usually pay little or nothing in this setting. It is remarkable that customers pay less than the cost of the service, which would be exceptional in a common market. However it is often seen in a two-sided market (Marcus et al., 2011)

Regarding internet the two sides of the market consist of CAPs on the one side and end-users on the other side. The platform that enables interaction between these parties consists of IAPs who are interlinked with one another.

In this setting IAPs typically charge their connected end-users as well as CAPs that are directly connected. However IAPs do not charge CAPs that are not directly attached to the IAPs’ network for access to his network (Musacchio, Schwartz, & Walrand, 2009). These CAPs can reach the IAP’s network via interlinked networks. Such ecosystem, in which IAPs do not charge external CAPs is defined in the literature as a zero-price rule (Musacchio et al., 2009).

Some IAPs argue that charging external CAPs for accessing IAP’s network should be allowed to cover the costs for raising bandwidth demand (Whitacre, 2005). This could be done on the basis of non-discrimination in which every CAP has to pay the same tariff to get access to the IAP’s network (Guo et al., 2012). Without such a rule an IAP can negotiate different tariffs for CAPs.

⁵ The term “roughly” is used by Rochet and Tirole (2004) because there is no unambiguous definition of two-sided markets.

Appendix J: Relevant extracts clarification DNNL regarding separate services

This appendix presents relevant extracts of the clarification of the DNNL regarding separate services:

...."It will be obvious that the term "Internet access service" should be interpreted broadly so as to prevent circumvention of this provision. If access to websites, multiple services or applications, including apps, is offered, this should at any rate be considered an Internet access service. Under this section, it is not at any rate permissible, therefore, to offer a service consisting of access to (certain) web pages, services or applications, with the use of certain applications or services being blocked or priced differently. This means that providers are allowed to offer separate services over the Internet, but may not offer packages to access a part of the Internet. Providers may of course differentiate their subscriptions for Internet access in other ways, for example by imposing bandwidth or data limits."...

...."To prevent any misunderstanding, the Members introducing the motion wish to emphasise that providers are permitted under this section to provide separate services over the Internet. This means, for example, that a provider may offer a separate subscription for mobile VoIP calls instead of the regular mobile phone service (for example a VoIP mobile phone subscription). Although this service is provided over the Internet, it is not a service intended to provide access to the Internet. Such a service is therefore not an Internet access service as defined in this section; rather, it is a telephone service. In such cases, it is permissible to block the remaining Internet traffic (in the case of a VoIP-only subscription: all traffic that is not used for VoIP)."....

Source: Parliamentary paper: year 2010–2011, 32 549, number 29

- ¹ Article 7.4a, section 5 of the amendment of Verhoeven (TK 2010-2011, 32 549, number 29)
- ² <http://tweakers.net/nieuws/72849/regering-toegang-tot-internet-is-geen-primaire-levensbehoefte.html> (accessed 15-04-2012)
- ³ <http://tweakers.net/nieuws/70747/kroes-geen-nieuwe-eu-wetten-nodig-voor-netneutraliteit.html> (accessed 15-04-2012)
- ³ KPN announced to charge chat, VoIP and streaming video services additionally: <http://tweakers.net/nieuws/74017/kpn-chatheffing-voor-mobiel-internet-komt-deze-zomer.html> (accessed 18-04-2012)
- ⁴ <http://tweakers.net/nieuws/74096/meerderheid-tweede-kamer-is-tegen-kpns-chatheffing.html> (accessed 18-04-2012)
- ⁵ Parliamentary paper: year 2010–2011, 32 549, number 29
- ⁶ Ad 4
- ⁷ <http://www.agentschaptelecom.nl/actueel/Abonneren/Ontwikkelingen+in+de+markt+-+september+2012/Veiling+mikt+op+meer+concurrentie+en+mobiel+breedbandgemak> (accessed 18-10-2012)
- ⁸ http://wirelessman.org/liaison/docs/L80216-08_008.pdf "Invitation for submission of proposals for candidate radio interface technologies for the terrestrial components of the radio interface(s) for IMT-Advanced and invitation to participate in their subsequent evaluation" Radiocommunication Bureau, ITU, 7 March 2008, (accessed 18-5-2012)
- ⁹ http://www.itu.int/net/pressoffice/press_releases/2010/48.aspx "ITU World Radiocommunication Seminar highlights future communication technologies" Geneva, 6 December 2010 (accessed 18-5-2012)
- ¹⁰ <http://tweakers.net/nieuws/81775/vodafone-en-t-mobile-kondigen-volgende-week-4g-abonnementen-aan.html> (accessed 16-6-2012)
- ¹¹ <http://www.computable.nl/artikel/nieuws/146592/250449/kpn-opent-wijkcentrales-voor-concurrentie.html> (accessed 4-6-2012)
- ¹² <http://www.nu.nl/internet/2779654/nieuwe-telecomaanbieders-begin-2013-slag.html> (accessed 14-8-2012)
- ¹³ http://ec.europa.eu/enterprise/policies/european-standards/index_en.htm European standards (accessed 12-11-2012)
- ¹⁴ <http://www.bellen.com/content/historie-mobiel-internetten.aspx> (accessed 14-6-2012)
- ¹⁵ T-Mobile provides unlimited internet (2005): <http://www.telecomwereld.nl/n000513.htm> (accessed 6-6-2012)
- ¹⁶ http://www.rtl.nl/actueel/rtnieuws/binnenland/components/actueel/rtnieuws/2010/08_augustus/14/binnenland/einde-aan-onbeperkt-mobiel-internet.xml (accessed 6-6-2012)
- ¹⁷ "BEREC: A view of traffic management and other practices resulting in restrictions to the open Internet in Europe": BoR (12) 30, 29-5-2012, http://berec.europa.eu/files/document_register/2012/7/BoR12_30_tm_snapshot.pdf (accessed 6-8-2012)
- ¹⁸ http://www.rtl.nl/components/actueel/rtnieuws/2011/04_april/21/binnenland/KPN-gaat-voip-blokkeren.xml (accessed 6-6-2012)
- ¹⁹ Telecom paper: Dutch Mobile Operators Q4 2011/ DMO2114, <http://www.telecompaper.com/research/dutch-mobile-operators-q4-2011> (accessed 6-6-2012)
- ²⁰ Article 7.4a, section 5 of the amendment of Verhoeven (TK 2010-2011, 32 549, number 29)
- ²¹ <http://tweakers.net/nieuws/74017/kpn-chatheffing-voor-mobiel-internet-komt-deze-zomer.html>, KPN wants to regain lost revenue voice and SMS services, (accessed 6-6-2012)
- ²² http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.html, "Cisco Visual Networking Index: Global mobile data traffic forecast update, 2011-2016" (accessed 8-6-2012)
- ²³ Ad 16
- ²⁴ Ad 14
- ²⁵ http://www.rtl.nl/actueel/rtnieuws/binnenland/components/actueel/rtnieuws/2010/08_augustus/14/binnenland/einde-aan-onbeperkt-mobiel-internet.xml (accessed 6-6-2012)
- ²⁶ http://www.vodafone.nl/internet/internet_op_ie_telefoon/kosten/, Vodafone for example offers mobile internet with 100MB data limit (accessed 6-6-2012)
- ²⁷ In this example the minimal requirements to make Skype calls are used for the calculations. These are 30kbps upload and download <https://support.skype.com/en-us/faq/FA1417/How-much-bandwidth-does-Skype-need>
- ²⁸ <http://tweakers.net/nieuws/80152/hi-wijzig-databeleid-en-komt-met-lease-construc-tie-smartphones.html>
- ²⁹ Skype states that their calling services require between 24 and 128 kbps. With a maximum speed of 32 kbps this will result in an unstable connection: <https://support.skype.com/en-us/faq/FA1417/How-much-bandwidth-does-Skype-need>. Google Talk requires a 56kbps connection to function: <http://support.google.com/talk/bin/answer.py?hl=en&answer=23906> (accessed 18-5-2012)
- ³⁰ Ad 17
- ³¹ <http://tweakers.net/nieuws/74017/kpn-chatheffing-voor-mobiel-internet-komt-deze-zomer.html>, KPN announced to charge chat, VoIP and streaming video services additionally (accessed 18-5-2012)
- ³² <http://tweakers.net/nieuws/74360/kpn-maakt-mobiel-internet-duurder-en-ziet-af-van-chatheffing.html>, KPN waives their proposal to additionally charge for chat services (accessed 18-5-2012)
- ³³ <http://tweakers.net/nieuws/75699/kpn-introduceert-nieuwe-abonnementen-en-verlaagt-smartphonekorting.html>, KPN introduces new tariff plans (accessed 18-5-2012)
- ³⁴ <http://www.nu.nl/internet/2601522/minister-grijpt-niet-in-prijsstijging-mobiel-internet.html>, (accessed 18-5-2012)
- ³⁵ Ad 17
- ³⁶ <http://www.opta.nl/nl/actueel/alle-publicaties/publicatie/?id=3552>, OPTA Public report mobile Q3 2011, (accessed 18-5-2012)
- ³⁷ Ad 36
- ³⁸ Ad 4
- ³⁹ De vernieuwde telecommunicatiewet, waarvan het amendement Verhoeven onderdeel is, ligt voor ter goedkeuring aan de Eerste Kamer. Het is op dit moment niet bekend wanneer de wet operationeel wordt. (1-5-2012)
- ⁴⁰ <http://tweakers.net/nieuws/77589/alles-in-een-klanten-kpn-krijgen-spotify-premium.html> (accessed 20-4-2012)
- ⁴¹ <http://www.kpn.com/privé/pakketten.htm> (accessed 20-4-2012)
- ⁴² <http://www.hi.nl/Spotify/Wat-is-Spotify.htm> (accessed 20-4-2012)
- ⁴³ Ad 4
- ⁴⁴ Ad 4