

## Virtual Enterprises, Mobile Markets and Volatile Customers

### Entry and Innovation Strategies of Mobile Virtual Network Operators (MVNOs) into the Telecommunications Services Market

Ferdinand Jaspers, Willem Hulsink and Jules Theeuwes

ERIM REPORT SERIES <i>RESEARCH IN MANAGEMENT</i>	
ERIM Report Series reference number	ERS-2005-039-ORG
Publication	June 2005
Number of pages	28
Persistent paper URL	
Email address corresponding author	whulsink@rsm.nl
Address	Erasmus Research Institute of Management (ERIM) RSM Erasmus University / Erasmus School of Economics Erasmus Universiteit Rotterdam P.O.Box 1738 3000 DR Rotterdam, The Netherlands Phone: + 31 10 408 1182 Fax: + 31 10 408 9640 Email: <a href="mailto:info@erim.eur.nl">info@erim.eur.nl</a> Internet: <a href="http://www.erim.eur.nl">www.erim.eur.nl</a>

Bibliographic data and classifications of all the ERIM reports are also available on the ERIM website:  
[www.erim.eur.nl](http://www.erim.eur.nl)

REPORT SERIES  
*RESEARCH IN MANAGEMENT*

ABSTRACT AND KEYWORDS	
Abstract	<p>Recently, several new mobile virtual network operators (MVNOs) have entered the European mobile telecommunications markets. These service providers do not own a mobile network, but instead they buy capacity from other companies. Because these virtual operators do not possess an infrastructure of their own, they have signed contracts with incumbent mobile operators with a network. The growth of these MVNOs which use leased network capacity from existing carriers, presents the incumbent mobile operators with a strategic dilemma. Network-based mobile operators have almost full control over their infrastructure but they may not know their customers well enough to fill the demand for cheaper and/or innovative services. New service-based operators may create affinity with the customer and introduce quickly all kinds of innovations and/or price discounts, but they still have to negotiate access terms and conditions with one of the domestic network-based operators. It has become important, and in some countries even urgent, to introduce regulatory measures concerning non-discriminatory access to the mobile telecommunications sector. This paper looks furthermore deeper into the entry and innovation strategies by MVNOs on the mobile market in the Netherlands, and its impact on competition.</p>
Free Keywords	<p>MVNO (Mobile Virtual Network Operators), Entry &amp; Innovation Strategies, Virtual Enterprise, Unbundling Value Chain, David &amp; Goliath Competition</p>
Availability	<p>The ERIM Report Series is distributed through the following platforms:</p> <p>Academic Repository at Erasmus University (DEAR), <a href="#">DEAR ERIM Series Portal</a></p> <p>Social Science Research Network (SSRN), <a href="#">SSRN ERIM Series Webpage</a></p> <p>Research Papers in Economics (REPEC), <a href="#">REPEC ERIM Series Webpage</a></p>
Classifications	<p>The electronic versions of the papers in the ERIM report Series contain bibliographic metadata by the following classification systems:</p> <p>Library of Congress Classification, (LCC) <a href="#">LCC Webpage</a></p> <p>Journal of Economic Literature, (JEL), <a href="#">JEL Webpage</a></p> <p>ACM Computing Classification System <a href="#">CCS Webpage</a></p> <p>Inspec Classification scheme (ICS), <a href="#">ICS Webpage</a></p>

# **Virtual enterprises, mobile markets and volatile customers**

## **Entry and innovation strategies of Mobile Virtual Network Operators (MVNOs) into the telecommunications services market<sup>1</sup>**

Keywords: MVNO (Mobile Virtual Network Operators), entry & innovation strategies, virtual enterprise, unbundling value chain, David & Goliath competition

Ferdinand Jaspers  
RSM Erasmus University  
e-mail: [fjaspers@rsm.nl](mailto:fjaspers@rsm.nl)

Willem Hulsink  
RSM Erasmus University and Wageningen University & Research  
e-mail: [whulsink@rsm.nl](mailto:whulsink@rsm.nl)

Jules Theeuwes  
University of Amsterdam/Faculty of Economics and Scientific Council  
for Government Policy (WRR)  
[j.j.m.theeuwes@uva.nl](mailto:j.j.m.theeuwes@uva.nl)

Correspondence address: Willem Hulsink  
RSM Erasmus University, PO Box 1738, 3000 DR Rotterdam (The Netherlands)

May, 2005

---

<sup>1</sup> This article is based, among other things, on research conducted by SEO for the national regulator OPTA, to which both Jules Theeuwes and Ferdinand Jaspers contributed (SEO, 2001), Ferdinand Jaspers' more extended essay (Jaspers, 2002) and our joint publication (in Dutch): Jaspers, Hulsink & Theeuwes (2004).

# Virtual enterprises, mobile markets and volatile customers

Entry and innovation strategies of Mobile Virtual Network Operators (MVNOs) into the telecommunications services market

## **Abstract**

Recently, several new *mobile virtual network operators* (MVNOs) have entered the European mobile telecommunications markets. These service providers do not own a mobile network, but instead they buy capacity from other companies. Because these virtual operators do not possess an infrastructure of their own, they have signed contracts with incumbent mobile operators with a network. The growth of these MVNOs which use leased network capacity from existing carriers, presents the incumbent mobile operators with a strategic dilemma. Network-based mobile operators have almost full control over their infrastructure but they may not know their customers well enough to fill the demand for cheaper and/or innovative services. New service-based operators may create affinity with the customer and introduce quickly all kinds of innovations and/or price discounts, but they still have to negotiate access terms and conditions with one of the domestic network-based operators. It has become important, and in some countries even urgent, to introduce regulatory measures concerning non-discriminatory access to the mobile telecommunications sector. This paper looks furthermore deeper into the entry and innovation strategies by MVNOs on the mobile market in the Netherlands, and its impact on competition.

## **List of tables included in the paper**

Table 1: the innovation/capabilities mix

Table 2: MVNOs in some European countries

Table 3a: Overview providers of mobile services

Table 3b: Overview providers of mobile services

Table 4a. Market shares (number of network connections)

Table 4b Market shares (number of connections)

Table 5. Average quarterly turnover and Ebitda

## Introduction

After a number of years of strong growth the European mobile telecommunications sector is faced with many problems. The growth of the number of mobile phone users is stagnating and many mobile network operators (MNO) have acquired considerable debts and have cut back substantially on their efforts to upgrade their second generation (i.e. GSM) infrastructure gradually behind and migrating towards the third generation (i.e. UMTS) infrastructure.<sup>2</sup> Furthermore, they have cut back on their investments in new services development. These incumbent mobile network operators are now faced with simultaneously exploiting the redundant capacity on their current networks and churning out innovative services that will be commercially successful. Recently, several new *mobile virtual network operators* (MVNOs), such as Sense and Telmore in the Scandinavian markets, Virgin Mobile in the United Kingdom, and Albert Heijn/Ahold in the Netherlands, have entered the various mobile telecommunications markets throughout Europe. These service providers do not own a mobile network, but instead they buy capacity from other companies. Because the virtual operators do not possess a network of their own, they have signed commercial contracts with mobile operators such as TeliaSonera, TDC, Telenor, T-Mobile and Telfort. In the future also 3G or UMTS operators may have a lot of spare capacity which they may want to resell to existing and possibly new MVNOs.

The growth of mobile virtual network operators which use leased network capacity from an existing carrier, presents the incumbent mobile operators with a strategic dilemma. Network-based mobile operators have almost full control over their infrastructure and distribution systems (e.g. high-street shops, subsidy schemes for new handsets). However, they may not know their customers well enough to fill the (latent) demand for cheaper and/or additional innovative services, offering flexible pricing formulas, making package deals with other branded (i.e. non-telecommunications) products and services, target-group promotions, etc. Service-based operators may create affinity with the customer and introduce quickly all kinds

---

<sup>2</sup> GSM stands for Global System for Mobile communications and UMTS stands for Universal Mobile Telecommunications System.

of innovations and/or price discounts, but they still have to negotiate access terms and conditions with one of the domestic network-based operators.

The infrastructure-based mobile operators can be characterized by their highly integrated operations: they are very much focused on network coverage and control, capacity management and the provision of voice-based services. Their vertical integration strategy furthermore includes control over the distribution channels, sales and marketing (e.g. through direct sales forces, agents, retail shops), and operating their own billing systems and supporting technologies. The increasing modularisation of core technological components of the 2G/GSM industry, due to the further convergence of mobile telephony, the Internet and datacommunications, now allows for the unbundling of the value chain and with spare network capacity largely available, new entrants can now provide voice and data services without owning an infrastructure (Maitland et al., 2002; Anderson & Williams, 2004). The service-based MVNOs are virtual enterprises: on the basis of internal control over their own critical technologies and servicing platforms, they offer billing and additional support through the Internet and coordinate their activities through decentralised approaches involving commercial agreements with network operators (e.g. buying capacity) and infotainment firms (e.g. offering highly differentiated and innovative services).

There is another player that is relevant for analysing new entry and innovation strategies and the concomitant market dynamics, next to incumbent (mobile) network operators, (potential) new entrants without their own network, namely the national regulatory authorities, in charge of ensuring fair competition and equal infrastructural access. In case of inappropriate legislation or weak regulatory supervision and enforcement, facilities-based operators (as wholesalers and retailers) may have ways to disadvantage MVNOs, for instance, through vertical price squeezes. Also the regulatory framework to ensure or promote competition has to be up-to-date and appropriate, otherwise MVNO pioneers are killed by the incumbent Indians. One of the first MVNOs in Europe, the Scandinavia-based Sense painfully reached the conclusion that their intended international roaming service (‘one price

tariff for all countries') was not feasible across borders in the Nordic area.<sup>3</sup> Pure MVNOs are typically found in countries where there is a strong national regulation placing pressure on incumbents to overcome their reluctance to provide non-discriminatory access to their network infrastructure.

An interesting country to look into the regulatory obstacles and possible solutions in widening access and introducing (more) competition and innovation in the mobile services market is the Netherlands. In this small but densely populated country (approximately 16 million people), there are five companies that have their own mobile network. These network operators themselves provide telecommunications services to the end-user market. This means that the limited number of players at the network level also determines the number of players at the service level. Companies that want to enter the mobile market without having their own network have to be able to use at least one of the existing networks. In this market there are also a number of conflicts of interest between network operators (the companies supplying the networks) and the entrants without network (the companies constituting the demand of network services) (SEO, 2001; Jaspers, 2002). This paper looks into these problems and discusses the strategies and outcomes of the new entrants without a network, the responses and tactics of the incumbents with a network, and the various steps taken by the national telecommunications regulator. Whether the new entry, service innovation and outsourcing/partnering activities have eventually generated positive industry effects, will be the starting point of this paper. The closing section will contain the concluding remarks and a number of recommendations to make the (Dutch) mobile market an even better place.

### **Entry and innovation strategies in mobile telecommunications markets**

The emergence of MVNOs and the ambiguous response of the incumbent MNOs is an interesting case to look further into because there are a number of junctures that seem to shape the present and future direction of the mobile telecommunications

---

<sup>3</sup> Roaming is a particular facility supported by commercial agreements between operators and/or service providers which enables a subscriber to use his or her equipment on any other network.



market (see table 1): is the innovation autonomous or systemic, and do the capabilities needed to realize the innovation already exist or do they have to be created and where can they be found or need to be developed, either internal or external to the firm (Chesbrough & Teece, 1996; Christensen, 1997). In case of a stand-alone innovation, a virtual firm should be able to manage the development and commercialisation of it quite well; in case of a systemic innovation, however, the constituents in the virtual organisation are dependent on external stakeholders for complementary assets and additional capabilities over whom they have no control. When novel technologies depend on a series of interdependent innovations knit together, small and niche-oriented firms may not be able to organise the diffusion process properly, because the capabilities needed are located elsewhere. Furthermore, larger established companies may develop their own capabilities internally: the key development activities, needed for the systemic innovation, depend on each other and are central to the firm's portfolio and, hence, must be conducted in-house to capture the rewards from long-term investments in R&D, license fees, marketing and branding. When a common standard has been established in a later stage in the industry's life cycle, virtual firms do have a fair chance, either on their own in special niche markets or with others firms in a partnership agreement.

In light of the overall high level of market uncertainty, it is important for new entrants to ensure network access via an attractive commercial agreement. The likelihood that they will succeed in doing so depends on a number of factors. First of all, the position of network operators is important. Network operators with excess capacity and few customers are more interested in allowing entrants access to their network than operators with a powerful position. Powerful operators however may allow small scale entry to avoid disadvantageous legislation or to keep the entrant from using a competitor's network. Secondly, the characteristics of the entrants also play a major role. Entrants are especially attractive to network operators when they have access to the complementary resources needed to attract and retain customers. MVNOs that sell under a different brand can serve incremental customers and hence spur market segmentation between the MNO (e.g. serving professional and business

customers with post-paid services) and the MVNO (targeting households, youngsters with pre-paid services). The question whether the entrant wants to operate as a service provider (SP) or as an MVNO is also relevant. MVNOs are far more likely to compete with network operators than SPs, as they carry out more of the activities themselves. Thirdly, the situation on the end-user market also influences the entrant's chances of success.

----- table 1 about here -----

Unlike MNOs who are burdened by costs associated with license fees, infrastructural costs, and database management systems, MVNOs (with deep pockets) buy capacity from existing operators and may use the Internet as their sole distribution and sales channel, avoiding the need to build their own networks, buy licenses, hire large staffs, and set up shops in city centres. This allows MVNOs to deliver mobile services like voice calls and short messaging at lower rates and without any type of mobile subscription. And MVNOs such as Virgin Mobile and easyMobile can rely upon their brand and distribution channels and integrate it with other products and services (gaming, music, etc).

### **An overview of the structure of the mobile services market**

From the early 1990s on, when the European telecommunications markets were gradually opened to competition, the incumbent network operators have diversified into new product and geographical markets and have set up subsidiaries abroad or established strategic linkages with foreign partners. The sheer size and omnipotence of these companies, however, has caused concern about the lack of 'workable' competition' in newly liberalized markets. A characterization of *David and Goliath* competition seems to be more appropriate (Wubben & Hulsink, 2003). New entrants to the telecommunications market, such as Mercury/C&W, Tele2, Virgin and other MVNOs have complained about the anti-competitive practices and the abuse of market dominance by these incumbent operators, such as BT, KPN and Telia (similarly Virgin, Ryanair and Easyjet vis-à-vis BA and KLM in aviation). Therefore, next to the market place, the political arena is the second environment in which

regulated firms must compete by other means to advance their corporate interests. To be effective in the regulated environments, both old and new firms should adopt strategies, which secure a balance between improving market performance and obtaining institutional support from socio-political stakeholders.

Although current telecommunication legislation in some European countries Italy and Spain the entry to the mobile services market by MVNOs is discouraged by the national regulators (and until recently also in Belgium and France), in others (the Nordic countries and the United Kingdom) a first generation of MVNOs have established themselves on the market, it is important to look further into the regulatory issues involved (e.g. predatory pricing, tied-in sales, discriminatory access) . Although current telecommunication legislation seems to be appropriate to put incumbent operators under pressure to open up their networks to MVNOs and offers legal possibilities in this direction, in the fast developing mobile telecommunications sector it is yet unclear whether there are enough economic arguments to justify access of providers without a network of their own.

Since the late 1990s, the time and the conditions appear to be appropriate for the entry of a number of suppliers that do not have their own networks (Hamel, 2001), since it is highly doubtful that the network operators will be able to solve their problems by servicing the end-user market on their own. They may have to allow new service providers having access to their networks on commercial terms. In addition, it is possible that new entrants that do not have a network of their own will be given access to the mobile telecommunications market on the basis of regulation. An overview of the differences between the different mobile telecommunications providers is given in table 3.

----- table 2 about here -----

Mobile network operators (MNOs) are in charge of both network management (on the basis of proprietary (spectrum) rights (frequencies), infrastructure (e.g through base stations, switches), and routing capabilities) and service provision (i.e. the

development and operation of services and (potentially) arbitrage (resale of them). Since Service Providers (SPs) outsource a larger number of tasks to network operators than Mobile Virtual Network Operators (MVNOs), they operate on smaller margins. In addition, the only source of income SPs have comes from the calls their clients initiate, whereas MVNOs are also paid for terminating calls. Enhanced Service Providers (ESPs) also trade calling time, but compared to SPs they have more room to innovate and differentiate, for example by displaying the company logo on the telephone screen and offering a voicemail service. Unlike (E)SPs, MVNOs can be included in the definition of special access. Rather than selling calling time, MVNOs hire network capacity, and at least issue SIM-cards of their own (i.e. the smart cards inside mobile phones that identify and authenticate users) as well as having a *home location register* containing data on their customers (HLR) (OfTel, 1999).<sup>4</sup> All other network activities can be outsourced to the mobile network operator. If the MVNO does decide to carry out as many activities as it possibly can, it mainly uses the wireless connection between the end-user and the first point within the network where the MVNO can take over the traffic. This requires considerable investments in network elements, but it also means that the MVNO has a high level of freedom with regard to pricing, service development and routing.

When a vertically integrated network operator provides access to a new entrant, the network operator on the one hand is dealing with a customer (at the network level), but on the other hand with a competitor as well (at the service level). New entrants can improve the way the network is being used by providing services under a different brand name or by targeting specific segments. Network operators can lure the customers away from the competition, but they can also lose existing and potential customers to the providers that operate on their own network. In light of these characteristics the wholesale market (i.e. the market for network capacity) would appear to be interesting especially to network operators with excess capacity and a small customer base. It is hard for smaller entrants and start-up firms to

---

<sup>4</sup> The Subscriber Identification Module (SIM), a computer chip in the telephone with which a network can identify a customer. SIM-cards use an MNC (Mobile Network Code) that is unique to the (virtual) network. Control over the SIM-card offers the entrant a substantial competitive advantage and price flexibility. Operators do not allow small entrants to issue their own SIM-cards (Foros & Hansen, 2001). The HLR is a database with important customer data for carrying out network activities.

attract and retain end-users (i.e. the retail market), because they have insufficient access to the kind of complementary resources that are becoming increasingly relevant to mobile communications, such as the financial services and entertainment sectors. As a result it would be better for network operators not to provide access to these entrants (Foros & Hansen, 2001). Existing enterprises, however, such as banks, publishers, retailers, lifestyle and entertainment companies, to a certain extent have access to the relevant complementary assets and additional resources (such as a strong brand, cross-sectoral service offerings and loyalty programmes, etc.), which means that they are potential customers rather than competitors.

Concerning the future market for next generation mobile services the picture is not yet clear. On the one hand third generation operators may want to keep the key development activities in-house to capture the rewards from heavy investments in conducting R&D, obtaining licenses and marketing; on the other hand they may have a lot of spare capacity which they may want to resell to existing and possibly new MVNOs.

----- tables 3a and 3b about here -----

### **Experiences with MVNOs in the UK and the Nordic Countries**

We can argue that the market for new entries without a network consists of three groups of players: network operators, (potential) new entrants without their own network and the government watchdog. In light of the high level of uncertainty it is important for new entrants to ensure network access via an attractive commercial agreement. The likelihood that they will succeed in doing so depends on a number of factors. First of all, the position of network operators is important. Network operators with excess capacity and few customers are more interested in allowing entrants access to their network than operators with a powerful position. In addition, they may allow small scale entry to avoid disadvantageous legislation or to keep the entrant from using a competitor's network. Secondly, the characteristics of the

entrants also play a major role. Entrants are especially attractive to network operators when they have access to the complementary resources needed to attract and retain customers. The question whether the entrant wants to operate as an SP or as an MVNO is also relevant. MVNOs are far more likely to compete with network operators than SPs, as they carry out more of the activities themselves. Thirdly, the situation on the end-user market, and subsequent levels of competition and partnering, also influences the entrant's chances of success.

A good example of an entrant with valuable complementary resources is the retail and service provider Virgin Group, a company that is active in the mobile telecommunications market in various countries without having a network of its own. In the US, Virgin Mobile has a joint venture with Sprint, in the UK with T-Mobile (previously called One-to-One), and in Australia with Optus. Just to show that not everything Richard Branson touches turns into gold, the venture in Singapore to create a MVNO with Singtel collapsed). According to its website, Virgin Mobile's main selling points are: simple airtime pricing, no hidden fees, web-based administration (no monthly bills, no contracts to sign), access to Virgin extras (e.g. games, entertainment), and exclusive content (e.g. from MTV, and other Virgin partners).<sup>5</sup> Normally, Virgin's MVNO, initially founded in 1999, was 50% owned by Virgin and 50% by T-Mobile. Virgin Mobile did not have to carry the costs of building its own network, instead it bought airtime from One-2-one (T-Mobile's predecessor). Under this arrangement Virgin was able to issue its own subscriber identification (SIM) module cards (i.e. the smart cards in handsets which identify the customer and control his/her relation with the network). Virgin was responsible for setting its own tariffs, billing and customer service infrastructure, and for the full cost of acquiring customers. Not only did Virgin Mobile benefit from the company's overall strong brand name; activities in the areas of store chains, entertainment, financial services and Internet are also relevant factors. Unlike its competitors Virgin Mobile had not spend much on brand-building; the combination of simple but cheap tariffs and advanced services played a central role in Virgin's marketing message. Unlike the

---

<sup>5</sup> The official website of Virgin Mobile is <http://www.virgin.com/mobile/> (accessed on April, 10, 2005).

other four mobile network operators, Virgin Mobile does not subsidise the cost of handsets.

In 2001 Virgin Mobile UK had reached 1million customers and three years later, it has an estimated 4.25m customers in the UK. Apparently, the network supply agreement between Virgin Mobile and One-2-One/T-Mobile was very complicated and a long running legal dispute was the result. Later, in 2004, while preparing for Virgin Mobile's initial public offering (partly allowing T-Mobile to sell off its stock) the two companies drafted a new network supply agreement in which T-Mobile was locked in as the sole carrier of Virgin Mobile's voice calls for several years. The Virgin example shows that the relationship between entrant and network operator can move beyond the customer-supplier stage. Virgin has entered into joint ventures with network operators, which means that the providers are not only suppliers and competitors, but that they have a commercial interest in the entrant. It is important to maintain a good relationship with the network supplier, because the specific investments made by entrants, for instance in terms of their sales efforts and equipment, require contractual protection from the network supplier's market power (Ulset, 2002). Virgin Mobile in England is the most successful example of a new entrant without its own network in the world. Ironically enough that is exactly the reason that negotiations concerning a new contract with shareholder and network operator T-Mobile are proceeding slowly. T-Mobile now has sold its share in Virgin Mobile.

The emerging Nordic model is to put pressure on mobile network operators to sell chunks, at a price slightly above network operating costs. In the UK, virtual operators only get slight discounts to retail prices when they buy network capacity; together with the fact that many customers are locked into contracts, MVNOs were forced to compete on brand rather than price. Providing access to ESPs (to which special access does not apply) may please the regulators and prevent unfavourable regulation. The Norwegian network operator Telenor, for instance, has provided access to start-up company Sense, because Telenor was afraid that the watchdog would issue a license to a new network operator (Communicationsweek

International, 2000; Communications International, 2001). Reitan, a Scandinavian retail chain, which had already its own struggling MVNO brand Hello, bought in 2003 Sense Communications.

A pioneering MVNO in Denmark, is Telmore: this operator sold only Subscriber Identity Module (SIM) cards, which store users' account information. The SIM card can be slipped into a handset, and customers buy and pay for their mobile minutes and SMS messages online. Payments are made via credit card or bank account and customers can only use the available minutes on their account. In less than five years, Telmore had acquired nearly a small but non-negligible part of the Danish market (about 10%). The company's success seems to be based on cost efficiency (no shops, no network, no subscription fees or paper bills, balances are checked via text messages), and low and easy to understand pricing schemes. In 2003-2004, Telmore was bought by the incumbent mobile operator, TDC, and was positioned at the discount and low end of the Danish mobile market with its simple and cheap service offerings.

In 2004 the easyGroup announced that it wanted to launch, together with the aforementioned Telmore and TDC companies from Denmark (for billing and network operations), cut-price virtual mobile services in a number of European countries, starting in the United Kingdom with easyMobile. By just selling SIM cards via the Internet to consumers who already own a mobile phone, easyGroup intends to avoid expensive handset subsidy costs; also by targeting youngsters and offering prepaid services easyMobile seeks to emulate the web-based discount MVNO that is cool too, namely Virgin Mobile.

### **An outline of the Dutch market for mobile services**

The number of frequencies available for mobile telecommunication is limited. Because it is the government who distributes these frequencies, it has a large influence on the number of mobile telecommunication networks. In the 1980's, PTT Telecom (currently KPN Mobile) was the only provider of mobile telephony in the



Netherlands. In 1994, KPN Mobile introduced the GSM-technology. In 1995, Libertel (which was later taken over by Vodafone) ended KPN Mobile's monopoly. Like KPN Mobile, Vodafone ended up obtaining a license for free. At the start of 1999, KPN Mobile and Vodafone had over two million and one million customers respectively.

In 1998 and 1999, three new network operators entered the market: Telfort, Dutchtone (currently Orange) and Ben, currently T-Mobile (like KPN Mobile and Vodafone they too were able to purchase part of the remaining frequencies). Subsequently the number of mobile customers grew enormously, to a total of 12 million by the end of 2002 (see table 4). This growth was the result of, among other things, the possibility of prepaid calling, better mobile phones and the marketing efforts of the five vertically integrated network operators. To attract new customers and optimize the use being made of the network capacity, rates were reduced and the purchase of mobile telephones was heavily subsidized.

----- tables 4a and 4b about here -----

After years of strong growth, the number of customers grew only slowly in recent years. By the end of 2004 KPN Mobile and Vodafone had about six million and four million customers respectively, and the three late entrants about two million each (see table 4). Due to their large market shares KPN Mobile and Vodafone have considerable cost benefits. In addition, they benefit from their strong position in the business market (together they have about 90 percent of the market). The asymmetry between the early and late entrants is revealed in the financial performance of the network operators (see table 5). KPN Mobile and Vodafone have a relatively high turnover and are making a profit, whereas the other network operators were not yet profitable as of 2002. Based on the market share, the national regulatory authority OPTA has designated KPN Mobile provider with considerable market power.

----- table 5 about here -----

In the mobile telecommunications sector many technological changes are taking place. The current GSM-networks are not only used for speech-related services, but for data applications like text messaging (short message service or sms) and mobile Internet (Wireless application protocol or WAP) as well. Now that the GSM-market is saturated, the network operators have modified their GSM-networks to facilitate General Packet Radio Service (GPRS) technology. This allows for a faster data transmission, making mobile Internet more user-friendly and allowing for new applications such as multimedia messaging services or MMS. The capacity for data transmission will further increase with the introduction of UMTS. Unlike GPRS, UMTS uses different frequencies from the ones used by GSM, which means that large investments will have to be made in the development of a new network.

The UMTS-licenses were auctioned in 2000. The five available licenses were bought by the existing five GSM network operators, which meant that no new network operators entered the market. Looking at the way the auction was organized it was to be expected that there would be no new entrants (Janssen et al., 2001). As a result of the investments in the licenses and new technologies, the financial resources the Dutch network operators have at their disposal is limited. In addition, there is great pressure to achieve good financial results, as most Dutch networks are part of companies that have spent large amounts of money to obtain networks and UMTS-licenses internationally.

Because of the relatively weak position of the three late entrants, the large investments in new technologies and the relatively large number of network operators (when compared to other European countries), there is continuous speculation that one or more of the network operators may withdraw from the market. However, the high level of sunk costs as a result of the investments in a network and the associated infrastructure present a considerable barrier to any operator contemplating such a move. As a consequence, network operators stay put as long as the expected cash flow is positive and the non-sunk costs can be retrieved. There has been one recent takeover. The British company mmO<sub>2</sub> has

pulled out of the Dutch market by selling its O<sub>2</sub> daughter company to an investment firm. O<sub>2</sub> is now once again called Telfort and the company is free of debt.

Although there is a relatively high number of networks in the Netherlands and competition among them is fierce, there are various examples indicating that customers may not be getting the best value for money. KPN Mobile, for instance, is able to maintain its prices above a competitive level (OPTA, 2002). This has to do, among other things, with the limited clout on the demand side as well as a lack of transparency with regard to the rates being charged by the providers. The lack of transparency means that consumers find it hard to choose the right subscription and that price-based competition is made harder (Consumentenbond, 2002). In addition, watchdogs (both at a national and at a European level) are suspicious about the rates for calling abroad as well as the compensation for transmitting calls from other networks (this makes calling a mobile number via a fixed line an expensive affair). In December 2003, OPTA for the first time approved KPN's fixed-mobile end-user prices. The network operator's margins on text messages are also high. Finally, the Dutch Competition Authority (NMa) has fined the network operators for anti-competitive arrangements and the exchange of sensitive information (NMa, 2002).

If it proves impossible to enter the market through commercial negotiations with network operators, potential new entrants can try to force their way onto the network via OPTA (Independent Post and Telecommunications Authority), the Dutch government watchdog established to realize a situation of steady competition for end-users in the mobile telecommunication market and other markets. On the basis of the former 1998 Telecommunications Act OPTA could designate network operators as providers with significant market power on the basis of their market share (OPTA, 2002). These providers are then obliged to favour all *reasonable* requests for *special access* to their mobile networks. OPTA (2002) states that no limitative indication can be given in advance as to what exactly constitutes special access, nor what reasonable conditions are. In addition, extended regulation could 'standardise' network access and thus prevent innovative commercial network access (OfTel, 2001). Although the interpretation of the term special access is not completely clear,

OPTA (2001) does formulate some points in its consultation document, making it possible to distinguish between *service providers* (SPs) and *mobile virtual network operators* (MVNOs) as different forms of access without network. SPs purchase calling time from a network operator and sell that time to end-users under their own brand name. They provide billing and customer support, without engaging in any network activities such as call routing. Because access to the network elements of a network operator are considered essential by law, SPs are not subject to this regulation.

Accept with regard to the interpretation of the term special access, OPTA can rule on the reasonability of a request for special access. This refers, for instance, to the price tag attached to a special access service. Here, OPTA is faced with the tricky task of finding a balance between the static and dynamic efficiency of the mobile market. In the short term (static efficiency) regulation may encourage access and price reductions, but in the long term (dynamic efficiency) encouraging network operators to invest in existing and new networks may diminish as a result. According to the parties involved, access is furthermore restricted as a result of the non-discrimination clause included in the regulation (EIM, 2001). This means that an operator with considerable market power has to enter into a commercial agreement involving special access with all applicants on equal terms. This makes MVNOs less attractive to operators with considerable market power.

Potential entrants have to start their own negotiations with a regulated network operator, with the option of appealing to OPTA in case those negotiations prove unsuccessful. However, the procedure is full of regulatory uncertainty and potentially a lengthy one, making entry via this route unappealing. In 2001 the relatively small mobile gaming company Yarosa for instance started negotiations with KPN Mobile (which at that time was designated as a network operator with significant market power) to get special network access to become an SMS-based MVNO. After years of legal procedures and disputes the regulator finally forced KPN Mobile to open up its network. Ironically, this wholesale service never got implemented, because KPN Mobile no longer has significant market power under the new Telecommunications

Act of 2004 as a result of the new EU guidelines. Despite the soft regulatory regime and KPN's hesitant attitude towards opening its network to service providers, the smaller operator Telfort has already made deals with MVNOs. Recently, two large cable operators in the country, namely UPC and Casema, have approached Telfort for further talks about providing mobile voice and data services through Telfort's network as part of an overall package for their customers. It remains to be seen whether this new regime will strengthen the position of new entrants and stimulate innovative business models and whether it will reduce the existing uncertainty and speed up the regulatory decision-making process.

### **Spongers or lifesavers?**

Do network operators view entrants without networks as wholesale customers or competitors? In the former case network operators may view entrants without networks as a means of reducing their own debts and generate additional income. In the latter case, network operators want to ward off new entrants, because new entrants benefit from the high-risk investments in mobile networks, and potential entrants have to focus on the long and uncertain regulatory path to gain access to the networks of the provider(s) with significant market power. In the Netherlands we see that, although no entry has yet taken place on the basis of regulation, several companies have taken the commercial road.

With the primary objective of stimulating demand in the introductory phase of GSM, KPN Mobile and Vodafone not only offered services to the end-user market themselves, but also used SPs to that end. At the end of the 1990's, nine of these wholesale customers were active: Sony2Connect, Phones4U, Debitel, Talkline, UniqueAir, IMC, ANWB Travelcom, Socratel and Cellway (OPTA, 2001). These SPs depended heavily on the network operators. They hardly had any possibilities to develop new services themselves, for example, or to distinguish themselves in other ways. In addition, the margin between purchase rates and end-user prices was very small. As a result, this market appears not to be all that profitable (EIM, 2001). Because of the importance of scale in purchasing calling time and because of the

entry of the three new networks there has been a period of consolidation. According to the parties involved these two factors have been decisive in the consolidation round (NMa, 2001). As a result of the consolidation Debitel is currently the only large SP with well over one million customers and a five percent market share in the business segment (see table 4).

During the growth years SPs were of little importance to the networks. It was easy for the network operators themselves to attract customers independently. During that time there were no new entries. In the current market situation the costs of attracting and retaining customers is considerable, which means there is a need for differentiation and segmentation. Under these circumstances the generic network operators seem to be welcoming new entrants with financial and complementary resources. Due to this relatively favourable negotiating position several new providers have recently entered the market.

In 2001, Tele2 entered the mobile market as MVNO via the Telfort network. Tele2 is a large international telecommunications firm that, as far as the Dutch market is concerned, is predominantly active in the fixed telecommunications market for consumers. In other countries the company operates as a mobile network operator, which means that entering the market as an MVNO was relatively simple and cheap. Since 2002, Debitel also uses Telfort's network, and in the same year it also signed a more attractive (ESP) contract with KPN Mobile.

The supermarket chain Albert Heijn also entered the market in 2002 via KPN Mobile. In its stores, AH Mobiel sells SIM-cards to new customers and upgrades to existing customers, of which there are currently 70,000. Since November 2003, AH Mobiel also uses Telfort's network. The fixed telecommunications company Versatel is also planning to sell its own mobile services via Telfort. Through a contract with ID&T (entertainment), Telfort is approaching youngsters in the dance scene with all kinds of music and party services. These examples show that the supply side of the wholesale market consists of only two networks. In light of its excess capacity and financial difficulties Telfort has decided to allow other companies access to its

network: Debitel, Tele2, and later Versatel, ID&T & retailer Albert Heijn. In 2004, fixed telecommunications operator Scarlet, in collaboration with Orange, announced its plan to become another MVNO. Like Telfort before, Orange's decision was driven by Orange's need to make better use of its network.

Despite these new entries, it would be incorrect to assume that the entry barriers are low. Although KPN Telecom has considerable debts, financial troubles do not seem to be the main reason for allowing Albert Heijn access to the network of its daughter company KPN Mobile. Perhaps the very profitable KPN Mobile is hoping that by providing Albert Heijn access to its network it can prevent OPTA from imposing a more formal kind of regulation. It would therefore appear that the only way to gain access to a network is through Telfort, but even there the entrants are for the most part existing companies. Despite a number of attempts, start-ups and small companies like Yarosa have not been given a chance to prove their innovative power and efficiency. Yarosa for example also failed to reach an agreement with T-Mobile. As far as the network operators are concerned these potential new entrants are competitors rather than customers. Thus, it would appear that the only road open to small companies is the unattractive one involving regulation. In many cases these entrepreneurs simply lack the financial means necessary to have any chance of success in taking this road.

The effects of the current entrants on market performance are limited. Debitel has a considerable customer base, but it has only recently managed to transform itself into an ESP. The remaining new entrants have only been active for a limited time and they to date have a limited but growing number of customers. About 650.000 of Telfort's subscribers are actually customers of its resellers. This accounts for about one third of its total customer base. Some providers use innovative pricing structures, but it could be argued that they succeed in further muddling the mobile market rather than offering greater transparency. Thus far there has been no positive effect on the high delivery rates for calls to mobile networks. In the negotiations the network operators probably do not allow entrants to compete on call rates. In addition, the entrants themselves have an interest in maintaining the level

of these rates. As far as the services that are based on new technologies are concerned, we can conclude that it is especially the network operators themselves that offer these services. This is the case, for instance, with KNP Mobile's i-mode and Vodafone's live!, based both on GPRS and MMS. Perhaps players that do not have their own network will become more valuable when the UMTS-network is introduced, which was also the case when GSM was introduced.

### **Concluding remarks and recommendations**

The emergence of non-infrastructure-based operators is an interesting phenomenon. At least three reasons seem to have contributed to the creation and increasing importance of MVNOs. One is the industry life cycle and particular stages in its evolution: the market conditions conducive to new entry in mobile telecommunications seem to include market inefficiency characterised by a lack of transparency with room for arbitrage, and some potential for market growth (some segments and customer groups are not yet served). A second is the competitive strategy by MVNOs: some are clearly pursuing a low-cost and web-based strategy (e.g. alternative billing and tariffing systems, all interactions via Internet, discount prices, etc.), some others follow a differentiation and focus strategy by targeting specific customer groups with made-to-measure services, and a last group seeks to capitalise on innovation in their offerings and stretching the brand of the parent organisation. The third is appropriate regulation, proactive regulators in Scandinavia, United Kingdom and the Netherlands to some extent, have had a positive effect on market development.

The number of network operators that are active in the Netherlands is relatively high. In addition, they fight each other tooth and nail in an attempt to attract and retain customers. The vertically integrated network operators control the entry of providers that do not have a network. In practice, regulations are forming a large entry barrier, the result being that the only feasible way of gaining access to a network is by commercial agreement. Recently a number of companies have managed to do just



that via the networks operated by KPN Mobile and Telfort. Recently, also Orange entered this wholesale market. It would appear that any companies wanting access to a network are likely to find that Telfort, an independent network operator, is their best bet. Apparently the other mobile network operators (all attached to large, international firms) tend to view new entrants as competitors rather than customers that can help solve the considerable problems with which the network operators are faced.

The entrants are predominantly large companies with valuable complementary resources at their disposal. With regard to small players and start-ups the entry barriers are virtually unassailable, and as a result little is being done by way of innovation and entry offers no solution to problem areas such as the complexity of the rates and the high prices being charged for certain services. To solve these problems regulation may well be needed. This means that the network operators as well as OPTA are faced with considerable challenges in the near future. Hopefully, OPTA will be supported in its quest by a hopefully more effective new Telecommunications Act that allows for a fast decision-making process and specific measures.

With the looming large-scale introduction of 3G/UMTS mobile networks in Europe, some MNOs may be eager to recoup their investments by selling large chunks of airtime to MVNOs while others want to keep the 3G-business under their control and keeping the MVNOs out. The strategic position of regulators in this infant UMTS industry, intervention or not, is not clear yet.

## References

- Anderson, J. & B. Williams (2004), 'Unbundling the mobile value chain', *Business Strategy Review*, Autumn: pp.51-57.
- Chesbrough, H.W. & D. Teece (1996), 'When is Virtual Virtuous? Organizing for Innovation', *Harvard Business Review*, Jan-Feb: 65-74.
- Christensen, C.M. (1997), *The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail*. Harvard Business School Press.
- Communications International (2001), *Case study: Making sense*, May 1, 2001.
- Communicationsweek International (2000), *Scandinavia: Virtual operators – New business opportunities for MVNOs*, October 9 2000.
- Consumentenbond (2002), *Aanbieders mobiele telefonie belemmeren concurrentie (translation: Providers mobile telephony block competition)*, press release June 19, 2002.
- EIM (2001), *Marktonderzoek AMM 2001: de markt van mobiele telefonie; openbare versie (translation: Market Research AMM 2001: the mobile telephony market; public version)*, October 8, 2001.
- Foros, Ø. & Hansen B. (2001), Connecting customers and disconnecting competitors: The facility-based firms' strategy towards virtual operators. *Journal of Network Industries*, 2, (2), 207-230.
- Hamel, A. (2001), 'Mobile Virtual Network Operators', *I&I Nieuwe media in perspectief*, 19 (1): 7-11.
- Hulsink W. & E. Wubben (2003), 'Making markets and controlling competition: Regulatory reform in public utilities', In: E. Wubben & W. Hulsink (eds), *On creating competition and strategic restructuring: Regulatory reform in public utilities*. Cheltenham UK: Edward Elgar. pp. 1-26.
- Janssen, M.C.W., Ros, A.P. & Windt, N. van der (2001), *De draad kwijt? Onderzoek naar de gang van zaken rond de Nederlandse UMTS-veiling (translation: Disconnected? Research into the process surrounding the Dutch UMTS auction)*.
- Jaspers, F.P.H. (2002), *Mobile Virtual Network Operator: Klaploper of Redder in Nood? Toetreding en Innovatie in een Gereguleerde Netwerkindustrie (translation: Mobile Virtual Network Operator: Sponger of Lifesaver? Entry and Innovation in a Regulated Network Industry)*, Msc.Thesis RSM Erasmus University Rotterdam.
- Jaspers, F., W. Hulsink & J. Theeuwes (2004), 'Reguleren? Reguleren! Nieuwkomers zonder netwerk in de mobiele telecomsector' (in Dutch: Regulate? Regulate! New entrants without a network in mobile communications)', *I&I Nieuwe media in perspectief*, No.6: 34-41.
- Maitland, C.F., J.M. Bauer & R. Westerveld (2002), 'The European market for mobile data: evolving value chains and industry structures', *Telecommunications Policy* 26: 485-504.
- NMa (2001), *Besluit van de directeur-generaal van de Nederlandse mededingingsautoriteit tot afwijzing van een aanvraag tot het nemen van een besluit op grond van artikel 56, eerste lid, van de Mededingingswet. Zaaknummer 1657 Talkline vs KPN (translation: Decision by the director-general of the Dutch competition authority to reject a request to rule on the*

- basis of article 56, subsection 1, of the Dutch Competition Act. Case number 1657 Talkline vs KPN).*
- NMa (2002), *NMa beboet operators mobiele telefonie voor EUR 88 miljoen (translation: NMa fines operators mobile telephony € 88 m.),* press release December 30, 2002.
- Oftel (1999), *Mobile virtual network operators: Oftel inquiry into what MVNOs could offer consumers.*
- Oftel (2001), *Effective competition review: mobile,* September 26, 2001.
- OPTA (2001), *Vormen van bijzondere toegang tot mobiele netwerken en redelijkheid van verzoeken hiertoe (translation: Forms or special access to mobile networks and reasonability of requests thereto),* November 30, 2001.
- OPTA (2002), *AMM evaluatie mobiele telefonie 2002 (translation: AMM evaluation mobile telephony 2002),* December 16, 2002.
- Planet Multimedia (2004), *'Debitel wint in zakelijk mobiel',* February 5, 2004, [www.planet.nl/multimedia](http://www.planet.nl/multimedia).
- Planet Multimedia (2005), *Marktaandeel Orange en Telfort groeien het hardst,* March 25, 2005, [www.planet.nl/multimedia](http://www.planet.nl/multimedia).
- Public Network Europe (2002), *'MVNOs: virtually established?'*, January, pp. 32-36.
- SEO (2001), *Toegang tot mobiele netwerken; onderzoek in opdracht van OPTA (translation: Access to mobile networks; research commissioned by OPTA),* September 12, 2001
- Ulset, S. (2002), *Mobile virtual network operators: a strategic transaction cost analysis of preliminary experiences,* In: *Telecommunications Policy*, 26, pp. 537-549.

<b>Table 1: the innovation/capabilities mix (Chesbrough &amp; Teece, 1996)</b>		
<b>Innovation</b>		
<b>Capabilities</b>	Autonomous innovation	Systemic innovation
Exist outside the company	Go virtual	Ally with caution
Must be created	Ally or bring in-house	Bring in-house

<b>Table 2: MVNOs in some European countries</b>			
<b>Country</b>	<b>MVNO</b>	<b>Host Network</b>	<b>Launch</b>
Belgium	United/JimTV/Versatel	Base	2005
	Scarlet	Base	2005
	Happy Many/Transatel	Base	2004
Denmark	Toledo	Proximus	2005
	Tele2	Sonofon	2001
	Telmore (now part of TDC)	TDC	2001
Finland	Song Networks	Sonofon	2003
	Tele2	Radiolinja	2004
	Song Networks	Radiolinja	2003
France	My Sport	Telenor	2000
	Debitel	SFR	2004
	Tele2	Orange	2005
Netherlands	Omer/Carphone Warehouse	Orange	2005
	Tele2	Telfort/O2	2001
	Albert Heijn	Telfort/O2	2002
	Hema	KPN	2004
	Versatel	O2/Telfort	2003
	Scarlet	Orange	2004
	ID&T	O2/Telfort	2004
Norway	Sense	Telenor	1999
	Tele2	Telenor	2000
	Zalto (part of Telenor)	Telenor	1999
Sweden	Sense	TeliaSonera	2000
	Mint	TeliaSonera	2000
	Spray/Lycos	TeliaSonera	2002
	Dial n' Smile	Tele2	2000
	Lunar Storm	Vodafone	2001
	RSL Comms	TeliaSonera	2002
	MTV Europe	TeliaSonera	2003
United Kingdom	Virgin Mobile	One-2-One/T-Mobile	1999
	Sainsbury's Mobile	O2	2001
	Tesco Mobile	O2	2003
	EasyMobile	T-Mobile	2004
	Timico	T-Mobile	2004

**Table 3a: Overview providers of mobile services**

		<b>Types of Providers</b>			
		Mobile Network Operator	Mobile Virtual Network Operators	Enhanced Service Providers	Service Providers
<b>Network management</b>	Infrastructure/frequency availability	X			
	Routing	X	X		
<b>Service provision</b>	Service development	X	X	X	
	Resale	X	X	X	X

**Table 3b: Overview providers of mobile services (original source: Public Network Europe, 2002; some minor adjustments)**

	Classic MVNO	Enhanced service provider	Enhanced reseller	Reseller
Has own switching centre	Yes	No	No	No
Issues own SIM cards	Yes	Sometimes	No	No
Has own network codes	Sometimes	Sometimes	No	No
Customers aware of underlying network operator	No	No	Yes	Yes
Issues own branded phones/packages	Yes	Yes	Yes	No
Offers own independent mobile subscriptions	Yes	Yes	Partially	No
Sets own tariff and tariff plans	Yes	Yes	Partially	No
Free to offer any mobile service or service bundle	Yes	Yes	No	No
Sends own bill to customers	Yes	Yes	Yes	Sometimes
Example	Tele2 (DK)	Sense (NO), Tele2 (NL)	Debitel, Virgin Mobile (UK)	Carphone Warehouse (UK)

	<b>Post-paid</b>	<b>%</b>	<b>Prepaid</b>	<b>%</b>	<b>Total</b>	<b>%</b>
<b>KPN Mobile</b>	1.877.000	42	3.157.000	42	5.034.000	42
<b>Vodafone</b>	1.294.000	29	1.990.000	26	3.284.000	27
<b>Telfort</b>	309.000	7	937.000	12	1.246.000	10
<b>Orange</b>	307.000	7	717.000	9	1.024.000	9
<b>T-Mobile</b>	643.000	15	793.000	10	1.436.000	12
<b>Total</b>	4.430.000	100	7.594.000	100	12.024.000	100

Table 4a. Market shares (number of network connections at the end of 2002)  
Source: based on data provided by the operators. As far as Orange is concerned the division between post-paid and prepaid is based on Planet Multimedia (2002)

	<b>Overall (in percentage)</b>	<b>Overall (in percentage)</b>	<b>Overall (in millions)</b>	<b>Business Segment</b>
	<b>2003</b>	<b>2004</b>	<b>2004</b>	<b>2003*</b>
<b>KPN Mobile</b>	38.6%	38.0%	6.1	58%
<b>Vodafone</b>	25.3%	22.9%	3.7	30%
<b>Telfort</b>	11.5%	14.4%	2.3	2%
<b>T-Mobile</b>	14.7%	14.1%	2.3	2%
<b>Orange</b>	9.8%	10.6%	1.7	2%
<b>Debitel</b>	-	-	-	5%

Table 4b Market shares (number of connections (2004)  
Source: Planet Multimedia (2005) based on a Report by Telecompaper.  
\*Planet Multimedia (2004) based on a research by Heliview

	<b>Average quarterly turnover (in millions of Euros)</b>		<b>Average quarterly Ebitda (in millions of Euros)</b>	
	<b>2001</b>	<b>2002</b>	<b>2001</b>	<b>2002</b>
<b>KPN Mobile</b>	516	558	220	244
<b>Vodafone</b>	334	361	113	136
<b>Telfort</b>	75	89	-19	-11
<b>Orange</b>	91	100	-69	-7
<b>T-Mobile</b>	unknown	136	unknown	-16

Table 5. Average quarterly turnover and Ebitda\*  
Source: based on financial publications by the mother companies.  
\* Ebitda refers to the result before deducting taxes, interests, write-offs and repayments.

## Publications in the ERIM Report Series Research\* in Management

### ERIM Research Program: “Organizing for Performance”

2005

*Continuous versus Step-Level Public Good Games*

Susanne Abele and Garold Stasser

ERS-2005-015-ORG

<http://hdl.handle.net/1765/1937>

*Collective Consuming: Consumers as Subcontractors on Electronic Markets*

Wilfred Dolfsma

ERS-2005-020-ORG

<http://hdl.handle.net/1765/1932>

*Appropriability in Services*

Wilfred Dolfsma

ERS-2005-021-ORG

<http://hdl.handle.net/1765/1926>

*Is China a Leviathan?*

Ze Zhu

ERS-2005-031-ORG

<http://hdl.handle.net/1765/6551>

*Information Sharing and Cognitive Centrality*

Susanne Abele, Garold Stasser and Sandra I. Vaughan-Parsons

ERS-2005-037-ORG

*Virtual Enterprises, Mobile Markets and Volatile Customers*

Ferdinand Jaspers, Willem Hulsink and Jules Theeuwes

ERS-2005-039-ORG

*No Black Box and No Black Hole: from Social Capital to Gift Exchange*

Rene van der Eijk, Wilfred Dolfsma and Albert Jolink

ERS-2005-040-ORG

---

\* A complete overview of the ERIM Report Series Research in Management:  
<https://ep.eur.nl/handle/1765/1>

ERIM Research Programs:

LIS Business Processes, Logistics and Information Systems

ORG Organizing for Performance

MKT Marketing

F&A Finance and Accounting

STR Strategy and Entrepreneurship