

# THE DIFFUSION OF IP-TELEPHONY AND THE VENDORS' COMMERCIALISATION STRATEGIES

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Suggestion-Running Title: THE DIFFUSION OF IP-TELEPHONY

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## Abstract

*IP-telephony has been presented as a technology which can replace existing fixed-line services and disrupt the telecommunications industry by offering new low priced services. This study investigates the diffusion of IP-telephony in Denmark by focusing on vendors' commercialisation strategies. The theory of disruptive innovation is introduced to investigate vendors' perceptions about IP telephony and explore their strategies which affect the diffusion process in the residential market. The analysis is based on interview data collected from the key market players. The study's findings suggest that IP-telephony is treated as a sustaining innovation which goes beyond the typical voice transmission and enables provision of advanced services such as video telephony.*

*Keywords: IP telephony, commercialisation strategies, diffusion process, disruptive innovation,*

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## INTRODUCTION

The Internet telephony (or IP telephony) came into the spotlight due to the massive increase in the number of users, worldwide, over the last two years. The successful case of Skype has been discussed by both the research community (Rao et al., 2006) and practitioners (Cook, 2003), while its acquisition from eBay can be partially explained by this increased market attention. Internet telephony, or IP telephony, has been available since the mid-nineties (Cawley, 1997). However, it took several years for most of the elements for successful deployment to be put in place. In terms of technological infrastructure the high bandwidth availability and consequently service reliability (Hovell et al., 2005; Varshney et al., 2002; Zubey et al., 2002) led to wide diffusion of broadband networks and the increased capacity of global backbones, which facilitated the supply of IP telephony services. For the purpose of this study IP telephony is defined as a communication service enabled by specific software which allows voice services transmission over IP networks. The communication may take place from any device (e.g. PC, Laptop, converted classical telephony devices) to any other accessible telecommunication device. In terms of market demand, the numbers of Internet and PC users have increased considerably, leading to a technologically mature community that could use more Internet-based telephony services (Corrocher, 2003). Finally, in supply terms, IP telephony providers have developed a variety of technological solutions and services such as video telephony and IP-mobile telephony (Varshney et al., 2002). These recent developments in the IP telephony market offer an interesting case for the exploration of the diffusion process and the vendors' commercialisation strategies.

Christensen introduced a systematic approach of analysing the diffusion process by classifying innovations as disruptive or sustaining (1997) and investigated their effects on the structural characteristics of an industry or a market. With respect to IP telephony, Christensen et al. characterised

it as a low-end disruption in the residential markets (2004). Other researchers, by taking either a technical (Ahuja and Ensor, 2004) or a regulatory (Garcia-Murillo and McKnight, 2005) view, clearly stated that IP-telephony was a disruptive innovation. Nevertheless, there were researchers such as Graham and Ure (2005) claiming that IP-telephony could be seen either as disruptive technology which had the potential to upset existing business models or as a stepping stone to the delivery of value-added services, such as multimedia through next generation networks.

This study explores the IP-telephony diffusion in the residential market as viewed through the vendors' commercialisation strategies using the theoretical perspective of disruptive innovation. In particular, this study investigates:

- *How do vendors' perceptions of the disruptive nature of IP telephony affect their commercialisation strategies?*

The empirical data was collected in Denmark, which maintained from 2005 to 2007 the top ranking of e-readiness, a measure developed by the Economist Intelligence Unit in an international study (2008). This measure includes among others connectivity, which measures the access of individuals and firms to fixed and mobile telephony, personal computers and the Internet, where Denmark has the highest score (Economist Intelligence Unit, 2008). This technologically advanced environment enabled the shaping of a dynamic IP telephony market. In 2007 there were 12 national providers, coming from Internet service provision, fixed-line telephony, cable TV, mobile telephony markets or new entrant (NITTA, 2007). Denmark is used in this study as an example of a technologically advanced market which may offer useful insights on strategy formulation of IP telephony vendors and indicate future market trajectories for other less technologically advanced countries in the Western world.

The paper is structured as follows. The next section introduces disruptive innovation in the diffusion research and presents the competition dimensions in the case of low-end disruptions along with some theoretical insights on the commercialisation strategies. Then, the study's research approach is described. The following section presents the research findings on vendors' views on the disruptive nature of IP telephony. The next section offers a discussion on the implications of the study's findings

for the IP telephony market. Finally, the paper concludes by revisiting the research question and identifying future research directions.

## DISRUPTIVE INNOVATIONS AND THE IP TELEPHONY DIFFUSION

### The diffusion process of a disruptive innovation

The study of IP-telephony as an innovation falls within the studies of information technologies diffusion where it is frequently reported that the providers' willingness to offer a new service is not always based on the usefulness of the technology. Alternatively, even though a new technology might be perceived as useful, advantageous and innovative, this does not always lead to adoption by the consumer mainstream market. In the case of IP-telephony for instance, a user may consider the value of using a fixed-telephony network (i.e. due to network effects) before choosing to adopt an IP-telephony solution, as well as the costs involved in such decision (i.e. switching costs), which may be higher than the expected benefits in case of incompatibility with existing networks.

One of the most widely used theories in the information systems domain which attempts to explain the reasons behind innovation adoption is diffusion of innovation theory (Rogers, 1995, 2003). The theory aims to trace and explain the path of an innovation's acceptance through a given social system over time. According to Rogers (2003), and other rational diffusion theorists (Agarwal and Prasad, 1997; Moore and Benbasat, 1991), there are certain characteristics of innovations which affect their rate of adoption. Diffusion of innovation theory has been criticised for not taking into account the particularities of complex information technologies (Lyytinen and Damsgaard, 2001). Other approaches in the study of information systems diffusion process (Baskerville and Pries-Heje, 2001; Cooper and Zmud, 1990; Edquist, 1997) seem to take a narrow perspective while emphasising particular areas of interest, with no single theory appearing to explain the particularities of certain technologies (Jones and Myers, 2001). Thus, the use of economic theories has been promoted as a possible way to get a better insight into IS diffusion (Wilkins and Swatman, 2006). In line with this suggestion the current study introduces insights from the theory of disruptive innovation developed by Christensen (1997) in order to get a better understanding of IP-telephony diffusion. The theory has

been used by few researchers in the information systems field. A systematic study of the phenomenon was offered by Lyytinen and Rose (2003) where they explore radical innovations within information systems with emphasis on Internet computing and offer a classification of different types of innovations and their disruptive impact in the organisational context. Nevertheless, they focus on the business segment, and the high-end market, while they did not explore the impact of low-end disruption in the market.

Christensen's theory (1997, 2006) offers an alternative approach to the diffusion of innovation research by focusing on both key players strategies and the consumer behaviour towards the services or the technologies (e.g. perceived substitutes by the consumer) in the existing market segments. In particular, Christensen explores the market players (established firms and new entrants) commercialisation strategies of the innovation in relation to the existing market segments. Christensen et al. (2004) depict three consumers' groups which the firms can target while shaping their strategy towards a specific innovation. Those groups are; *non consumers*, who are reached by new market, high-end, disruptive innovations; *undershot consumers*, who are targeted by the launch of up-market sustaining innovations and *overshot consumers*, who are reached by low-end disruptive innovations. In the case of telephony services the non consumers is virtually a nonexistent group as everybody uses fixed-line or mobile phones in the Western world. Undershot customers are a group of technology advanced consumers that adopt new technological solutions and are willing to pay for them. Those customers wish to overcome the limitations of existing fixed-line telephone services and may be willing, for example, to use picture and video apart from voice communication. Overshot customers are those willing to pay a low price in exchange for voice services offered at a lower quality than the current mainstream telecommunications services (e.g. prepaid cards for calling abroad at a low rate).

When a low-end disruptive innovation is introduced in the market the performance, or other dimensions of the service are lower than existing solutions which are available in the mainstream market (Christensen, 1997). The low-end disruption is offered at a lower price, yet it is unattractive to the mainstream market due to lower performance compared to existing solutions. As the product is diffused in the overshot segment vendors will have the incentive to improve the performance in order

to address consumer needs in the mainstream market. Besides, over time technological developments enable improving the performance and quality of the product at an acceptable level by the mainstream market (Govindarajan and Kopalle, 2006).

Christensen et al. (2004) claim that vendors treat IP telephony as a low-end disruption in the residential market. They use the example of Vonage (an IP telephony provider) as a case of successful low-end disruption due to the low price of the service. However, over the last three years Vonage has experienced high churn rates because of the low quality of services. During 2008, they built a strategic alliance with a major network service provider to improve the quality of service by introducing broadband services. They also offer service bundles with additional services to IP telephony such as broadband access designing “more attractive and valuable” offers to the customers than previously (Barthold, 2008; Vonage, 2008).

#### Key dimensions for competition in disruptive innovations

This study examines the possible disruptive nature of IP telephony by taking the vendors’ view on key dimensions of competition. The ease of use dimension, measured in terms of convenience, customisation and cost of use is related to the low-end disruption strategy (Christensen et al., 2004; Schmidt and Druehl, 2008). Firms compete on the ease of use dimension after having competed on functionalities and reliability of the product which enabled offering added value to consumers. In the case of the ease of use dimension, the strongest signal of low-end disruptive strategy is price competition. Improvements on convenience and customisation may create value for the users by covering specific needs and offer to vendors’ opportunities for setting premium prices. The three determinants of the ease of use dimension are identified in the case of IP telephony in relation to the value elements of the service.

*Convenience* relates to the flexibility of product use (Anthony, 2005; Christensen et al., 2004; Schmidt and Druehl, 2008). Flexibility of IP telephony use is related to compatibility with other communications services due to the underlining network effects (Katz and Shapiro, 1994). In particular, a fixed-line telephony user enjoys the benefits of network effects while communicating with other users of the network. In the case of IP telephony the consumer may wish to maintain the

benefits from network effects of the fixed-line telephony network. Thus, for IP telephony to take off, compatibility with fixed-line telephony is crucial. This in turn will reduce the importance of critical mass for IP telephony diffusion (Mahler and Rogers, 1999), as the consumer will not lose the benefits of network effects by switching to the new service. In addition, compatibility may reduce IP telephony vendor's investments in attracting new customers from the incumbent telecommunications operator's customer base (Shapiro and Varian, 1999). This study elaborates on the element of convenience in the case of IP telephony by exploring vendors' perceptions in terms of compatibility and network effects.

*Customisation* examines "how squarely a product lines up with the individual customers' idiosyncratic jobs" (Christensen et al., 2004 pp.12). Customisation also relates to the service simplicity (Anthony, 2005; Schmidt and Druehl, 2008). In the case of IP telephony, the direct comparison with fixed-line telephony makes consumers refer to the latter while evaluating the former. This situation underlines the importance of switching costs (Klemperer, 1987). For example, the value of customisation may decrease in case consumers cannot easily use the new application, but they need special training. The complexity involved in the use by consumers that are not familiar with computing technologies may be further accentuated by incompatibility between IP and fixed-line telephony services. In such case the consumers may have high switching costs which in turn may slow-down the diffusion process in the residential market (Corrocher, 2003; Varshney et al., 2002). In this study, customisation is explored in relation to the vendors' perceptions of the underlining switching costs.

Finally, ease of use is defined in terms of the cost of use or the *price* (Adner, 2002; Anthony, 2005; Christensen et al., 2004; Schmidt and Druehl, 2008). IP telephony's cost of use is explored in relation to prices on the contracts offered by the incumbent telecommunications operator. Cost is a recurring theme in IP telephony research with focus on the trade-off between quality of service and price (Foo and Cheung Hiu, 1998; Mason, 1998; McKnight and Leida, 1998; Ono and Aoki, 1998; Rowe and Richardson, 1998). The IP telephony's quality of service has been reported as lower than fixed-line telephony (Constantiou and Papazafeiropoulou, In Press). This study examines the cost of IP telephony use by exploring vendors' perceptions on the service price.



## Commercialisation strategies of disruptive innovations

The introduction of a disruptive or a sustaining technology in a market offers opportunities and raises challenges for both established firms and new entrants. For example, established firms may not be able to protect their market shares and maintain their customer base in the long run if they fail to recognise the difference between sustaining and disruptive technologies. However, a disruptive technology evolves through different stages and its widespread diffusion is not guaranteed, as it depends on market dynamics and specific strategies adopted by market players (Myers et al., 2002). Moreover, forecasting the diffusion of disruptive technologies is not straight forward as it is surrounded by uncertainty depending of specific characteristics and maturity levels of the served markets (Linton, 2002). A thorough review of the researchers' debate about the predictive power of the disruptive innovation theory is offered by Danneels (2004).

The firm's position, being a new entrant, or an established firm in the industry, is key factor affecting the strategy towards a disruptive innovation. A key difference between the two types of firms is the existence of a customer base. The established firm has a customer base using the existing products or services. The introduction of a disruptive innovation may not be perceived as beneficial because it can cannibalise the firm's revenues from existing products or services which are close substitutes. Walsh et al. (2002) investigate a high-tech industry and find that established firms prefer to commercialise sustaining innovations, while new entrants prefer to follow disruptive innovation strategies. The new entrants have more flexible marketing strategies and achieve shorter time to market than the established firms (Walsh et al., 2002). For example, Skype was a new entrant which successfully commercialised IP-telephony as a disruptive innovation (Rao et al., 2006).

Further, the established firms have developed competences to explore and analyse their customer base needs. In the case of a disruptive innovation it may be difficult for the established firm to evaluate its potential, because this requires major changes in the firm's market research approach. Thus, there might be a problem of organisational competence, or an organisational inertia (Henderson, 2006). Another reason of the established firm's inertia in reacting on the disruptive innovation might be the

lack of visionary leadership and the unwillingness to cannibalise assets to serve a new, perhaps niche market, which in turn relates to the organisational culture (Tellis, 2006).

Thus, the established firms, being able to offer sustaining innovations and satisfy the customers' needs can hold their leading market position, but because of this competence they may be challenged by new entrants offering a disruptive innovation (Slater and Mohr, 2006). However, for new entrants to succeed in the diffusion of the disruptive innovation in the mainstream market, there is a need to augment their skills with new capabilities and demonstrate that the new technology has a clear advantage over existing solutions (Slater and Mohr, 2006). Thus, they should be able to move from penetrating a niche market to the mainstream one and cross the "chasm" between early adapters and the early majority (Moore, 1999).

In a recent article, Christensen (2006) claims that disruption becomes a relative phenomenon when investigated in relation to its impact on different business models. The researcher point of view, a technological or a business model one, and the firm's perceptions of the financial attractiveness of the innovation may suggest a different classification of an innovation. For example, wireless telephony was a high-end disruption from a technological point of view and in relation to the wire line, but from a business model view of the incumbent operators it was treated as a sustaining innovation. Thus, the profit model was not a disruptive one and the telecommunications operators co-opted the technology through acquisition rather than being disrupted by it.

This section presented the main theoretical insights on the commercialisation strategies of a disruptive innovation. The next section presents the research approach adopted in this study.

## RESEARCH APPROACH

A qualitative approach was chosen for this exploratory study in order to understand emerging phenomena within their context. In line with Denzin and Lincoln (2000), the authors set out to collect information about IP telephony service delivery through direct contact with the key market players. Seven firms were chosen, representative of the key players of the Danish IP telephony market. Skype

was excluded since its international business activities were not representative of a national market player. Table 1 presents the profile of the participating firms.

INSERT TABLE 1 HERE

Different perspectives were sampled in order to triangulate and, thereby, strengthen the understanding of IP-telephony market. In particular, two IP telephony providers and two ISPs, in total representing 60% of IP telephony market in Denmark, were chosen. For the purpose of including additional viewpoints, three additional market players were interviewed; an incumbent telecommunications operator, a network reseller, and a specialized ISP serving communities defined by the physical proximity of their members. These three firms were chosen as they planned to expand their activities in the IP telephony market in the near future (i.e. the next 12 months). The participants were organised in two main groups of stakeholders, representing two distinctive viewpoints. Those were, *new entrants* (firms A and B) that were exclusive IP telephony providers, or *established firms* in the telecommunications industry either offering IP telephony as an additional service along their main business activity of Internet service provision (firms C and D), or firms with a clear intention to provide IP telephony services in the future (firms E, F and G).

The data collection was based on semi-structured qualitative interviews (Lacity and Janson, 1994). The interviews were conducted over a period of one month. The interviews lasted between 60–85 minutes, were tape recorded and subsequently transcribed. The interview guide included a total of 27 open-ended questions designed to explore the firm's history and profile (4 questions), the IP telephony market technological developments (8 questions) and the key players' strategies (4 questions), as well as the firm's strategy on targeting customers, positioning and offerings of the service (11 questions).

The data was analysed using thematic analysis (Boyatzis, 1998). Thematic analysis is rarely acknowledged but widely used in the analysis of qualitative data and has been presented as an accessible and flexible approach to search for meanings in informants' talk (Braun and Clarke, 2006). There are two primary ways where themes or patterns can be identified in thematic analysis: inductive (Patton, 1990) or deductive (Boyatzis, 1998; Hayes, 1997). An inductive approach means that the themes identified are strongly linked to the data themselves, making this form of thematic

analysis bearing similarities to grounded theory. The deductive or ‘theoretical’ thematic analysis is driven by the researcher’s theoretical approach. In this type of thematic analysis there is less rich description of the data and more detailed analysis of some aspects of the data.

In the initial analysis of the data we applied strategy making at the firm level (Shapiro and Varian, 1999) as our theoretical lens. As the analysis evolved we realised that the value of this theoretical approach was quite limited, and therefore, we decided to “re-read the data.” While re-reading the data we identified a different pattern, which could be analysed by the theory of disruptive innovation. Thus, using first deductive and thereafter inductive techniques we followed the steps of thematic analysis suggested by Braun and Clarke (2006):

1. *Familiarising with the data.* During this phase the empirical data was read with the view to identify vendors’ commercialisation strategies for IP telephony and the current status of the residential market’s developments.
2. *Generating initial codes.* The data were organised into common themes which emerged from the interviews. To facilitate the analysis a table was created and the common themes were presented on the rows while the interviewees’ responses were presented on the columns (i.e. one column for each interviewee).
3. *Searching for themes.* As the authors performed the initial analysis, they became increasingly puzzled by the observation that the vendors repeatedly referred to the challenge of the commercialisation of IP telephony as a lower performance alternative to fixed-line telephony, and thereby, the vendors underlined a main characteristic of a low-end disruptive innovation. The empirical data exhibited characteristics, which suggested an alternative explanation of IP telephony’s market dynamics. Based on this alternative reading of the empirical data the authors developed an interest in using the disruptive innovation theory, foremost applying the ease-of-use dimension from the literature as the theoretical tool in the analysis.
4. *Reviewing themes.* As the analysis evolved the authors applied a “second read” approach to the data analysis (see other examples of this approach in Walsham (2002), Barrett and Walsham

(1999), Christiansen and Vendelø (2003)) while reviewing the developed themes. During this “second read”, the empirical data were analysed by careful reading and reflection on the field notes and the transcribed interviews and through frequent discussions between the two authors in order to extract the key perceptions of the disruptive nature of IP telephony for vendors.

5. *Defining and naming themes.* The extraction of the relevant themes was made around the three determinants of competition included in the disruptive innovation theory. In particular, the *price* dimension was explored by focusing on 2 themes on pricing strategies. The *customisation* was investigated by focusing on 3 themes on vendors’ reactions to switching costs from fixed-line to IP telephony. The *convenience* was explored by focusing on 5 themes on vendors’ reactions to compatibility and network effects for fixed-line subscribers switching to IP telephony. The process of organising data involved the first author identifying patterns and quotations in the raw text, excerpting them and bringing them to the other author for joint discussion and refinement over a period of 2 months and more than 25 hours of discussion.
6. *Producing the report.* This was the writing exercise leading to this paper, as the themes identified in the analysis were related back to the research question and literature producing an academic paper.

Having described the research approach of this study, the next section presents the analysis of vendors’ views on disruptive nature of IP telephony for the residential market.

## RESEARCH FINDINGS

The research findings offer insights into the vendors’ perceptions of the competition in the residential market of IP telephony by analysing its determinants.

### Convenience of IP telephony service

Convenience of IP telephony is naturally related to fixed-line services which consumers are familiar with. It is perceived as having access to a seamless service. The main items on convenience in the vendors’ agenda were backward compatibility with fixed-line telecommunications and network

effects. As an interviewee from firm C said compatibility was more important than the service quality: *“It does not matter if it is VoIP or VoATM as long as the telephony service is working ... We advertise that you can drop your fixed line subscription. We don’t want to start a debate on whether this is as good.”* Vendors were aware of the reduced service quality in the case of IP telephony but emphasised the need to offer a compatible service and allow the consumer to maintain the benefits of network effects.

Compatibility between the different networks also shifts competition in the value adding components or services (Matutes and Regibeau, 1988). New entrants wished to eliminate the direct comparison with existing fixed-line telephony services which intensified competition by developing new value-added services, such as video telephony. As one of the interviewees in firm B said: *“We have standard IP services such as caller ID. Other services? Absolutely, video telephony. This is something we definitely are going to make money on.”*

The interviewee from the incumbent telecommunications operator believed that customers were quite satisfied with what they already had, and that the challenges for IP telephony diffusion were strong, *“because those customers that adopt IP telephony are those that use fixed line today and perhaps mobile users. The customers today are very satisfied with the solutions they have”* (interviewee in firm G). This showed the incumbent’s reluctance to view IP telephony as a technology which could replace existing telecommunication services. Although their approach of not seeing IP telephony as a disruptive innovation was justifiable it also indicated that they might not seize the opportunities for the development of advanced services beyond the typical voice transmission.

Moreover, new entrants did not have a clear position in relation to the interconnection between the IP telephony networks. For example, peering agreements did not seem to be in the current agenda of vendors because of the costs involved. A peering agreement includes reciprocal exchange of traffic between two networks with no monetary compensation involved, which would allow users of different vendors to communicate for free while increasing benefits from network effects. As the interviewee of firm B highlighted *“Today the business is very young. No matter how you look at it, we have costs when we facilitate a call between A and B, even if it is on our network. It is traffic and why to make it*

*free? It is a cost that someone will have to pay and it is not going to be us, otherwise we won't survive."* However, IP telephony vendors acknowledged the importance of seamless service provision and full network coverage. *"We had a policy that if we were going to do this [launch IP telephony application], it had to be compatible with anything called IP telephony. It had to be compatible with all the hardware and software standards that exist within IP telephony."* (interviewee in firm A).

The analysis of convenience revealed that vendors, both established firms and new entrants, were aware of the importance of compatibility in the diffusion process. Compatibility with fixed-line telephony would decrease the importance of critical mass (Mahler and Rogers, 1999) for the IP telephony, since the user could maintain the benefits of network effects. Maintaining network effects was crucial for the adoption decision. However, for IP telephony networks, interconnection agreements were not in the current agenda of vendors because of the costs involved in the termination of the calls.

#### Customisation of IP telephony service

Customisation of IP telephony services is mostly related to the application's potential to meet consumers' needs in terms of their maturity in using the technology (i.e. technical skills) and the infrastructure needed to access the services. The switch from "common" fixed-line services to IP telephony depends on whether consumers are trained in the new technology, or can get support to develop the technical skills required as well as to the simplicity of the new service.

Customisation issues became very important in the case of people with limited technical skills that might not own a PC, as pointed out during the interviews. *"You can always put something out on the Internet, like Skype and if it works it is fine, but to our parents' generation, this is not a feasible way. It will never gain a foothold among the broad public"* (interviewee in firm C). New entrants moved into stimulating the demand but were quite uncertain about the anticipated results: *"We just signed a deal with a housing association of 200 apartments. They just got fibre optic cables by a supplier that is our partner and they wanted IP telephony. They consist of grandparents as such without PCs"* (interviewee in firm A).

Concerning IP telephony access devices, most of the interviewees had experienced challenges when dealing with consumers' requirements on lower complexity and seemed aware of the negative impact in the adoption of IP telephony. For example one of the interviewees in firm C said: *"Take the Skype phone that is being offered. It is not being sold. It is complicated and not competitive. People don't understand it"*.

Besides, established firms acknowledged the need to offer value-added services in order to make fixed-line telephony subscribers switch *"There is a long way to go before people are offered what they already have and even if VoIP is a little hype, it needs added value."* (Interviewee in firm C).

The consumer's investments in new devices and other technical infrastructure were main concerns for new entrants. *"In order for people to switch from PSTN, we have to do like the mobile telephony. In order to reach the broad market there can't be a 600 kr. [80 Euro] investment. It has to be something that the customer pays 1 kr [0.14 Euro]"* (interviewee in firm B).

The analysis of customisation showed that new entrants emphasised the challenges raised from users' difficulty to adjust their practices when they used a new device for IP telephony and to make the required physical investment. Switching costs, which related mainly to the physical investments and the uncertainty on the quality of the new brand, seemed to create unease within the new entrants. Besides, there was a concern about the non technologically experienced consumers' ability to use IP telephony services. The vendors did not seem prepared to invest in consumers' training or to offer simpler devices, which would accelerate diffusion in the mass market. The established firms targeted different market segments, namely the technology advanced consumers, which had advanced requirements in communications services (e.g. video telephony, conferencing) and planned to offer them premium services at higher prices than voice services.

### Price of IP telephony service

Price is an obvious concern for consumers and IP telephony in particular has been advertised as a service offering cheaper calls than fixed-line ones especially when it comes to international rates (Constantiou and Kautz, 2008). Vendors were called to meet this expectation and keep the prices of IP



telephony low. New entrants believed that right pricing would be a deal breaker for them and they claimed that offering low prices was of fundamental importance to the market. They explained that their target group was anyone who wanted a good and cheap telephony solution. Established firms aimed to offer economic solutions to existing dial-up users. According to a vendor (in firm C) an ADSL line and an IP telephony solution cost less than a dial up service and a fixed-line solution.

IP telephony vendors were clearly aware of consumers' need for low prices when it comes to IP telephony adoption. They introduced flat rates that seemed to be beneficial to heavy users of telephony service. Interestingly enough a new entrant (firm B) used price as a way to keep customers away when they launched the IP telephony services because they were not sure about their capabilities to handle a large number of customers. As the interviewee from this firm said: *"We made it [the price] semi-flat at the beginning ... in order not to attract too many customers, because when you start something new ... you need to clarify all your processes in a sensible way"*.

Established firms expressed their concern about consumers being price sensitive. This was very vividly illustrated by the statement of an interviewee in firm D: *"If there is no financial savings to be made. Why adopt it?"* Nevertheless, the vendors expected the market to expand further as they believed that communication costs became a very big part of a family's annual expenditure. *"A household today with broadband, two teenage daughters and parents with mobiles perhaps pays a bill for communications above 20.000 DKK [3000 Euro] yearly... There will be a time when this is a huge item on the family budget"* (interviewee in firm D)

Overall, vendors, both established firms and new entrants, were concerned about consumers' need for low prices and made systematic efforts to offer economic packages as they believed that this was the best way to attract and keep customers and increase the market shares. The vendors' strategies to offer IP telephony at lower prices was an indication of pursue of a low-end disruption strategy. Nevertheless vendors did not expect to generate revenue from voice calls specifically made by individuals in the residential market. A new entrant's representative estimated that 80-85% of the revenue came from the business segment.

## DISCUSSION

The analysis shed light to the diffusion process of IP telephony and the commercialisation strategies of the key players by introducing the disruptive innovation theory's perspective. The main findings are discussed in this section.

*The diffusion process of IP-telephony as a disruptive innovation:* Although IP telephony started as an innovation which had the potential to be disruptive and could replace the widely diffused fixed-line telephony, the data showed an interesting deviation from this path. In particular, the market analysis in Denmark highlighted the vendors' tendency to treat IP telephony as a sustaining innovation, enabling the provision of new value added services. When IP telephony came into being the service offered was cheaper and worse than the fixed-line service for the mainstream customers who were used to high quality of voice services. This was a short term characteristic of low-end disruptive innovations (Christensen et al., 2004). However, during the interviews vendors addressed service quality as a challenge which would not be resolved in the near future. Especially the ISPs, already experienced in dealing with quality of service in the Internet market highlighted the challenge faced in the case of IP telephony. Moreover, the new entrants' dependence on network service providers for network resources implied that the level of quality of service for IP telephony was not chosen by the vendors. Rather it was imposed by network service providers who had the full control of the network resources. Thus, the lower quality of IP telephony compared to fixed-line was a necessity and not a characteristic of a low-end disruption. Further, the vendors' reluctance to invest on improving quality of service was not in line with the theoretical prediction postulating that firms launching a low-end disruption would improve the quality in the long run to reach the mass market.

*Key dimensions for competition in the IP-telephony market:* The IP telephony vendors acknowledged the importance of convenience enabled through compatibility of IP telephony with fixed-line networks. In the residential market consumers were mostly interested in calling friends and family, who were mainly using fixed-line telephony (Constantiou and Kautz, 2008). Thus, lack of IP telephony's service compatibility with the fixed-line service might be a major obstacle for the

consumer's adoption decision. Besides, the vendors were not ready to offer compatibility between the IP telephony networks, which might become a problem for the communications of users in different networks as well as for the diffusion of the value added services (e.g. video telephony). Further, the main challenge underlined by all vendors in terms of customisation was switching costs in the form of physical investments, learning costs and the uncertainty surrounding a new firm. New entrants acknowledged the challenges involved in relation to customisation but they seemed overwhelmed and willing to diversify their service offerings to avoid this competition and target customers with unsatisfied needs. Overall, IP telephony vendors seemed reluctant to invest on the service offered to the market in terms of convenience, customisation or quality of service and moved their attention to customers who were willing to pay for new "advanced" services. They planned to offer new services to undershot customers of fixed-line communications. Those customers might be willing to pay for the new service enabled by IP telephony. This strategy indicated that vendors treat IP telephony as a sustaining innovation that offered the infrastructure to launched value added services such as video telephony.

*Commercialisation strategies for IP-telephony.* The sustaining innovation approach seems natural for the established firms (Walsh et al., 2002) in the telecommunications industry which can add IP telephony on premium services offered to their customer base. Some IP telephony vendors came from the Internet service provision market. They realised that offering a low priced substitute to fixed-line telephony would not be a profit generating activity. ISPs turned their focused on exploiting their core competence (Henderson, 2006), namely Internet services provision and management of network resources. They treated IP telephony as a sustaining innovation which enabled them to introduce valued added services such video telephony and video conferencing in service bundles along with Internet access. Those services were drawing heavily upon their competence of IP technologies and networks management. Video telephony was highlighted as a future revenue source, which could satisfy the undershot customers by addressing their needs for more advanced services in telecommunications markets. Video telephony has been available for some time, but consumers have appreciated its value recently (Constantiou and Kautz, 2008).

Christensen et al (2004) suggested that the separation of network services and data services might change the competitive market equilibrium and enable new entrants, or “specialists”, to penetrate the market and follow diversification strategies. New entrants offered exclusively IP telephony services. Those firms were supposed to exploit the decoupling of voice and data transmission and invest on customization and convenience of their service offerings in order to reach the mass market. Nevertheless, this study indicated that new entrants did not treat IP telephony as Christensen suggested. The study’s findings about new entrants were in accordance to Walsh et al. (2002) and might relate to the specific characteristics of telecommunications industry, where voice calls were perceived as commodities and there was no room for disruptive innovations.

The market of IP telephony is a dynamic environment shaped by the influences of different technological advancements and the different strategic approaches. While in the late nineties there were strong indicators of the disruptive nature of IP telephony almost a decade later the data showed a shift in the vendors’ strategies treating the innovation as a sustaining one. It remains to be seen how the market will reach equilibrium and whether video telephony will be the new revenue source, boosting the financial results of key players in the telecommunications market.

## CONCLUSIONS

The study explored the diffusion of IP telephony through vendors’ commercialisation strategies. Primary data from a technologically advanced residential market, where IP telephony evolved the last five years, were used. The main market players were interviewed and their strategies were investigated focusing on low-end disruption and the determinants of market competition. The findings suggested that the vendors rather than looking to compete in overshot consumer markets seemed more interested in offering advanced services to undershot consumers. The undershot segment of the IP telephony market includes individuals who find fixed-line telephony as too limited for their needs, while they may welcome video telephony and video conference facilities.

This study's contributions are both practical and theoretical. It offers useful insights for vendors interested to IP telephony's market opportunities, while applying the theory of disruptive innovation in the context of IP telephony's diffusion.

From a *practical perspective*, the paper offers suggestive evidence that IP telephony may not succeed as a low-end disruption in the residential market and this may affect the diffusion process. The vendors' strategy of targeting the undershot customers may alter the diffusion process of IP telephony. For example, the adoption rate may relate to the purchase and use of other complementary services offered in the same bundle. The market data validate this observation, as IP telephony is currently sold in service bundles (e.g. voice and internet access or "triple play"). The service did not reach the mass market alone (NITTA, 2007) and the lower performance compare to the mainstream market's product was a significant obstacle on its diffusion.

The authors investigated the current position (autumn 2008) of the firms in the Danish market. Five of the seven firms are still active in the IP telephony market (apart firm A and firm F). Firm F never entered the market while firm A became a technology supplier, offering technical solutions (e.g. adapters) to IP telephony vendors. According to the official data for the second half of 2007, firm C had the highest market share in terms of subscribers (27.1%), followed by firm G (18.3%) and the new entrant, firm B (3.1%) and then by firm D (0.2%). Firm E had a small market share and was mainly active in domestic traffic market (NITTA, 2007).

From a *theoretical perspective*, the study addressed the diffusion of an innovation such as IP telephony using the economic theories and elaborating on the low-end disruption argument of Christensen. The authors believe that the use of economic concepts such as switching costs and network effects has enriched the analysis of the commercialisation strategies. Thus, this study presents an attempt to develop a more comprehensive interpretation of the competition dimensions proposed by Christensen et al. (2004) in the case of low-end disruption, by using the key economic concepts of networked technologies. In particular, convenience was analysed in relation to network effects, compatibility and performance while customisation in relation to switching costs. Further research is warranted on the

proposed concepts and additional concepts may be identified through the examination different innovations in other empirical settings.

The limitations of this study relate to the study of one market and the analysis of the supply-side in a specific time frame. These limitations can be addressed in future studies by investigating different market settings, taking supply and demand sides into consideration and collecting data over a larger period of time.

Future research efforts should take a longitudinal approach to investigate the developments in the IP telephony market. The present study of IP telephony market highlighted the need to add a time dimension into the analysis. While in the late nineties there were strong indicators of the disruptive nature of IP telephony almost a decade later the data showed a shift in the vendors' strategies treating the innovation as a sustaining one. Thus, taking a longitudinal approach to investigate the progress of a technology would offer a more comprehensive view of the current position and the future developments.

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*Table 1. The profile of the selected firms*

Organisation Type	Organisation coding	Current Service Offerings	Interviewee
IP Telephony Provider	Firm A	IP Telephony	CEO
	Firm B		Co-founder & Sales Manager
Internet Service Provider	Firm C	Internet Access	Sales Manager for residential & ADSL market
	Firm D	IP Telephony	Project Manager on IP telephony
Community Internet Service Provider	Firm E	Internet Access	Technical Manager
Network Service Reseller	Firm F	Resale network services	Sales Manager
Telecommunications Operator	Firm G	Fixed telephony, wholesale network services, Internet access	Manager of Broadband telephony Unit