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

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## Abstract

*IP-telephony has been widely characterised as a disruptive innovation that has the potential to radically change the telecommunications industry. It has been presented as a technology that can replace existing fixed-line services by offering a new convenient and lower priced service. This paper explores diffusion of IP-telephony in Denmark, focusing on vendors' commercialization strategies. Insights from the theory of disruptive innovation are introduced to investigate vendors' perceptions and reveal their tendency to follow disruptive strategies, which in turn affects the diffusion process. The findings suggest that IP-telephony is promoted as a sustaining innovation which goes beyond the typical voice transmission and offers advanced features such as video telephony.*

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

# 1 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 recent buy-out 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. 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 “advanced services” in comparison to fixed-line telephony (Corrocher, 2003). Finally, in supply terms, IP telephony providers have developed a variety of technological solutions and services (Varshney et al., 2002).

IP telephony offers an interesting case to explore vendors’ commercialisation strategies and the diffusion process due to its postulated disruptive nature. Christensen during an executive seminar on the innovator’s dilemma presented IP-telephony as an example of a “huge disruptive technology” (1999). However, recently, in a later study he seemed less convinced of the disruptive nature of IP-telephony (Christensen et al., 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 paper explores the diffusion of IP telephony through 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 maintains since 2005 the top ranking of e-readiness, a measure developed by the Economist Intelligence Unit in an international study (2006). 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, 2006). This technologically advanced environment enabled the shaping of a dynamic IP telephony market. In 2006 there were 11 national providers, coming from Internet service provision, fixed-line telephony, cable TV, mobile telephony markets or being new entrants. During the first half of 2006, the highest market share belonged to an Internet Service Provider (ISP) (27%) and the second to an IP telephony vendor (15%) (NITTA, 2006). Denmark is treated as an example of a technologically advanced market that 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 focuses on the three dimensions of competition between firms in the case of a low-end disruptive innovation. Then, the research approach is described. The next section includes the research findings on vendors’ views on the disruptive nature of IP telephony, followed by a discussion on the implications for the IP telephony market. Finally, the paper concludes by revisiting the research question and identifying future research directions.

## 2 DISRUPTIVE INNOVATIONS AND THE IP TELEPHONY DIFFUSION

The study of IP-telephony as an innovation falls within the studies of information systems 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 that attempts to explain the reasons behind innovation adoption is diffusion of innovation theory (Rogers, 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 such as (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). This research introduces insights from the theory of disruptive innovation developed by Clayton Christensen in order to get a better understanding of IP-telephony diffusion.

The introduction of a disruptive or 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, since it relates to the market dynamics and the specific strategies adopted for its commercialisation (Myers et al., 2002). Moreover, it is complicated to forecast the diffusion of disruptive technologies since it is surrounded by uncertainty and the technology might serve different markets, which are in different points of the diffusion process (Linton, 2002).

The firm's type, being a new entrant, or an established player in the industry, affects 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 its 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 that are close substitutes of the former. Walsh et al. (2002) investigate a high-tech industry and find that established firms prefer to commercialise sustaining innovations, while new entrants prefer disruptive innovations. Besides, they suggest that new entrants have more flexible marketing strategies and achieve shorter time to market than the established firms. They become the pioneers in the exploitation of disruptive innovations (Walsh et al., 2002). For example, Skype is a new entrant which has successfully commercialised a disruptive innovation (Rao et al., 2006).

Christensen et al. (2004) depict three consumers' groups that firms should observe while shaping their strategy towards a specific innovation. Those groups are; *non consumers*, who are reached by new market 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 non existent group as everybody uses

fixed-line or mobile phones in the Western world. Overshot customers seemed to be the target of IP telephony vendors indicating a low-end disruption at the residential market. 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 apart from voice communication.

The performance, or other quality measures of a disruptive innovation may be lower than existing solutions which are available in the mainstream market in the short run (Christensen, 1997). As the product is diffused in the overshot segment vendors will have the incentive to improve the service quality in order to address the mass market needs. 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, the recent financial results of Vonage (in fall 2006) showed a high churn rate, that analysts attributed to the low quality of customer service<sup>1</sup>. It appears that the firm's strategy emphasizing low prices did not generate enough value to counterbalance the relatively low performance compared to fixed-line telephony. Thus, treating IP telephony as a low-end disruption in the residential market may not be a successful strategy as theoretically postulated.

This paper examines the possible disruptive nature of IP telephony by taking the vendors' view on key dimensions of competition. Three dimensions namely, convenience, customisation and cost of use (Christensen et al., 2004) are related to the low end-disruption strategy. Firms compete on the ease of use dimension after having competed on functionalities and reliability. The companies turn to price competition after having competed on the other two dimensions signalling a low end disruption strategy. Improvements on convenience and customisation create value for the users and indicate business opportunities for vendors to generate revenue by serving the undershot segment.

*Convenience* relates to the flexibility of product use. 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), since 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 installed base (Shapiro and Varian, 1998). This paper elaborates on the element of convenience in the case of IP telephony by exploring vendors' perceptions 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). In the case of IP telephony, the direct comparison with fixed-line telephony leads consumers to 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 consumers' perceived high switching costs may slow-down the diffusion process and negatively affect residential market evolution (Corrocher, 2003; Varshney et al., 2002). This paper addresses customisation by exploring vendors' perceptions of the underlining switching costs.

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<sup>1</sup> "Don't blame VoIP for Vonage's belly-flop" Network World Sept. 25 2006 Vol. 23 Iss.37, p.30

Finally, ease of use is defined in terms of cost of use or *price* (Christensen et al., 2004). IP telephony's cost of use is explored in relation to prices on the contracts offered by the incumbent telecommunications operator. Besides, a recurring theme in IP telephony research is 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). IP telephony's quality of service is lower than fixed-line telephony (Constantiou and Papazafeiropoulou, In Press). This paper focuses on the element of cost of IP telephony use by exploring vendors' perceptions of the service price.

This section introduced disruptive innovation theory presented the three dimensions of competition in the case of IP telephony. The next section presents the research approach adopted in this study.

### 3 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 sought to study things in their natural settings, attempting to make sense of phenomena in terms of the meanings people bring to them. Thus, 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.

Organisation Type	Organisation coding	Current Service Offerings	Interviewee
IP Telephony Provider	Firm A Firm B	IP Telephony	CEO Co-founder & Sales Manager
Internet Service Provider	Firm C Firm D	Internet Access IP Telephony	Sales Manager for residential & ADSL market 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

Table 1. The profile of the selected firms

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 main technique for data collection was semi-structured qualitative interviews, where the researcher is presumed to have much in common with the subject, such as living in the same epoch, speaking the same language and living in the same culture (Lacity and Janson, 1994). The interviews were conducted over a period of one month (one interview per day). All interviews lasted between 60–

85 minutes, and were tape recorded and subsequently transcribed. The interview guide included a total of 27 open-ended questions in two parts. The first part included 17 questions that focused on the firm's history, profile and business activities (4 questions), the IP telephony market developments (4 questions), as well as the firm's strategy on targeting customers, positioning and offerings of the service (9 questions). The second part included 10 questions that explored vendors' views of the three dimensions of competition. Vendors' perceptions of *price* were explored through 2 questions asking the interviewees about the customers' reactions to pricing strategies and their main revenue sources. Perceptions of *customisation* were investigated through 3 questions asking them to compare IP telephony with fixed-line telephony and about the underlining switching costs. Perceived *convenience* (5 questions) was explored by asking interviewees about compatibility and network effects' impact on fixed-line subscribers' decision to switch to IP telephony.

The initial analysis of the empirical data focused on the identification of vendors' strategies for IP telephony and the analysis of the residential market developments. The initial analysis applied the IP telephony literature, as well as network economics theories, for the purpose of understanding market developments of IP telephony. 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 exhibit particular characteristics, which suggest an alternative explanation of IP telephony 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 that literature as the theoretical tool in the analysis. Hence, as the analysis evolved the authors began to apply 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).

During the "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 underlying adoption of IP telephony for vendors. The extraction of the relevant themes was made around the three dimensions of competition included in the theoretical basis. This process 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.

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.

## **4 RESEARCH FINDINGS**

This section presents vendors' perceptions of the three dimensions of competition on the IP telephony market in order to investigate the applicability of the low-end disruption argument (as proposed by Christensen) of the residential market of telecommunications services.

### **4.1 Convenience of IP telephony service**

Convenience of IP telephony is naturally related to fixed-line services that consumers are familiar with. This implies that the consumer is offered a seamless service. The main items about convenience in the vendors' agenda are backward compatibility with fixed-line telecommunications and managing of network effects.

As an interviewee in firm C said compatibility is 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 are aware of the reduced service quality in the case of IP telephony but emphasize on 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 service (Matutes and Regibeau, 1988). For example, IP vendors wish to eliminate the direct comparison with existing fixed-line telephony services that intensifies competition by developing new value-added services, such as video telephony. As one of the interviewees in firm B clearly described: *"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."*

In the incumbent telecommunications operator they believe that customers are very satisfied with what they already have, and that the challenges for IP telephony diffusion are 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 shows the incumbent's reluctance to view IP telephony as a technology that can replace existing telecommunication services. Although their approach of not seeing IP telephony as a disruptive innovation is justifiable it also indicates that may not seize the opportunities for the development of advanced services beyond the typical voice transmission.

Moreover, IP telephony vendors do not have a clear position in relation to the interconnection between the IP telephony networks. For example, peering agreements do 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 involve, which would allow users of different vendors to communication 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 acknowledge 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 reveals that vendors are aware of the importance of compatibility in the diffusion process. Maintaining network effects, which consumers already benefit from fixed-line telephony networks, is crucial for the adoption decision. However, vendors do not seem ready to interconnect their networks and increase the benefits of network effects for their users. This may create challenges to the wide diffusion of the service. Furthermore, vendors are aware of the direct comparison of IP telephony with fixed-line one and the need to offer value-added services that will increase consumer's benefits.

#### 4.2 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 their access to computer services. The switch from common fixed-line services to IP telephony depends on whether consumers are trained in the new technology and they can get support to develop the technical skills required.

Customisation issues become more important in the case of people with limited technical skills that may 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). Some providers move into stimulating the demand but are 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 grand parents as such without PCs”* (interviewee in firm A).

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

The consumer’s investments in new devices and other technical infrastructure are also main concerns for vendors. *“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).

Besides, vendors acknowledge 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. People are not stupid.”* (Interviewee in firm C).

The analysis of customisation shows that there is a great concern from the vendors’ point of view about the consumers’ ability to use IP telephony services. This is due to the difficulties involved in learning how to use the new equipment, and the change of practice from traditional telephony services. The vendors do not seem prepared to invest in consumers’ training or to offer simpler devices, which will accelerate diffusion in the mass market. They believe that the market potential of IP telephony for consumers who are not familiar with computer technologies is rather limited. They depict the mass consumer market as not ready for the new technological solutions, while seeing a market potential for technology advanced consumers and businesses.

#### 4.3 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 are called to meet this expectation and keep the prices of IP telephony low. The vendors believe that right pricing will be a deal breaker for them and they claim that offering low prices is of fundamental importance to the market. They explain that their target group is anyone who wants a good and cheap telephony solution. They also aim 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 are clearly aware of consumers’ need for low prices when it comes to IP telephony adoption. They introduced flat rates that seem to be more beneficial to heavy users of telephony service. Interestingly enough a vendor (firm B) has 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 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”*.

Vendors express their concern about consumers being price sensitive. This is 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 expect the market to expand further as they believe that communication costs become 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, it seems that vendors are concerned about consumers' need for low prices and make systematic efforts to offer economic packages as they believe that is the one way to attract and keep customers. Nevertheless, vendors do not expect to generate revenue from foreign calls specifically those made by consumers at home, while they believe that their main income comes from businesses. A vendor (firm A) actually estimated that their 80-85% of their revenue comes from the business segment. These indications further support the observed shift of IP telephony vendors' interest from offering basic telephony services to providing advanced services in order to increase their revenues.

## **5 DISCUSSION ON THE OPPORTUNITIES FOR THE IP TELEPHONY MARKET**

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 show an interesting deviation from this path. In particular, the analysis of an advanced telecommunications market highlights 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 worse than the fixed-line service for the mainstream customers who are used to high quality of voice services. This is a short term characteristic of low-end disruptive innovations (Christensen et al., 2004). However, during the interviews vendors address service quality as a challenge which will not be resolved in the near future. For example, ISPs already experienced in dealing with service quality in the Internet market highlight the challenge in the case of IP telephony. One representative of the ISPs (from firm D) said: *"IP telephony will never offer better quality than the PSTN [public switched telephone network]. It is naive to think that."*

The IP telephony vendors acknowledge the importance of convenience enabled through compatibility of IP telephony to fixed-line network, which in turn allows the consumers to maintain existing benefits from network effects. In the residential market, network effects become of major importance as consumers are mostly interested in calling friends and family, who are mainly using fixed-line telephony at the current take-off stage of IP telephony market (Constantiou and Kautz, 2008). Thus, lack of IP telephony's service compatibility with the fixed-line service may be a major obstacle for consumers' adoption decision. This argument offers an explanation on why the ease of use dimension did not counterbalance the performance weaknesses (in terms of service quality) when IP telephony vendors did not offer compatible solutions.

In the presence of network effects, compatibility shifts the locus of competition from the overall services package, which includes benefits to consumers due to the network size, to specific components' costs and performance characteristics (Economides, 1989; Katz and Shapiro, 1994; Matutes and Regibeau, 1988). For IP telephony these involve the cost of specific equipment necessary, the convenience, the customisation and the quality of service offered through different solutions, that consumers evaluate by comparing the services to fixed-line telephony. Vendors acknowledge this situation but seem overwhelmed from the comparison and willing to diversify their service offerings to avoid this competition and target customers with unsatisfied needs.

IP telephony vendors seem to be reluctant to invest on the service offered to the market in terms of convenience, customisation or quality of service and move their attention to customers who are ready to pay for new "advanced" services. They want to offer much better products to customers with unsatisfied needs, transforming IP telephony to a sustaining technology. These are undershot customers of fixed-line communications that may be willing to pay for the new service enabled by IP telephony, hence generate revenues for the vendors. Video telephony is identified as a value added service, which may become a future revenue source. Video telephony may satisfy the undershot customers by addressing their needs for more advanced services in telecommunications markets. Video telephony has been available for some time. However, market analysis shows that consumers have started appreciating video telephony's value recently (Constantiou and Kautz, 2008).

The sustaining innovation approach seems natural for the established firms (Walsh et al., 2002) in the telecommunications industry that can add IP telephony on an improved services offering to their existing customer base. Some IP telephony vendors come from the Internet service provision market. They have realised that offering a low priced substitute to fixed-line telephony would not be a profit generating activity. ISPs have turned their focus on their core competence, namely Internet services provision and management of network resources. They treat IP telephony as a sustaining innovation that enables them to introduce valued added services such video telephony and video conferencing. Those services are developed drawing heavily upon their competence of IP technologies and networks management.

Christensen et al (2004) suggest that the separation of network services and data services may change the competitive market equilibrium and enable new entrants, or “specialists”, to penetrate the market and follow diversification strategies. New entrants offer exclusively IP telephony services. Those firms are 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, our findings indicate that new entrants do not treat IP telephony as a disruptive innovation, which is not in line with the theory of Christensen. This observation about new entrants was also made by Walsh et al. (2002). In the case of IP telephony it may relate to the specific characteristics of the telecommunications industry where voice calls are perceived as commodities and there is no clear space for a disruptive innovation.

## **6 CONCLUSIONS**

The paper explored 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 the three key dimensions of market competition. The findings suggest that the vendors rather than looking to compete in overshot consumer markets seem 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 potentially welcome video telephony and video conference facilities.

This paper’s contributions are both practical and theoretical as it offers some useful insights for vendors interested to the opportunities of the IP telephony market, while applying the theory of disruptive innovation in the context of IP telephony’s diffusion. In particular, 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 other complementary services such as video telephony.

As the three dimensions are briefly described by the theory, the authors believe that the use of economic concepts such as switching costs and network effects would enrich this description. This paper presents an attempt to develop a more comprehensive interpretation of the three key dimensions of competition proposed by Christensen et al. (2004) in the case of low-end disruption, by using the key economic concepts of networked technologies. Thus, convenience was analysed in relation to network effects and compatibility while customisation in relation to switching costs. While further research is warranted on the proposed concepts, additional concepts may be identified through the examination different innovations in other empirical settings.

The application of the theory came with some difficulties as the strategies for undershot customers are not developed enough to enable getting a better understanding of the dynamics in the market under considerations. Besides, there seems to be a need to add the time dimension into the theory as the example of IP telephony clearly has shown. While in the late nineties there were strong indicators of the disruptive nature of IP telephony almost a decade later the data show a shift in the vendors’

strategies treating the innovation as a sustaining one. Thus, taking a longitudinal approach to the progress of a technology would offer a more realistic view of its current position and future developments.

The limitations of this research relate to the study of one market and the analysis of 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.

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