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# THE PROVIDERS' PERSPECTIVE IN IP-TELEPHONY DIFFUSION: INSIGHTS FROM THE DANISH MARKET

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## Abstract

*The IP telephony market has been subject to publicity due to the recent increase of users worldwide. Although not a new technology, given that IP telephony was developed in the mid-nineties, it lately became popular as a lower-priced alternative to fixed telephony through the availability of high bandwidth networks. While prior studies focused on technical aspects such as quality of service and regulatory issues, little attention has been paid to the vendors' perspective in the IP-telephony market. In this paper we argue that by using the innovation diffusion theory to examine the supply rather than the demand side of IP telephony, we can get a better understanding of existing market dynamics and future trends. We draw our conclusions based on a study of the IP-telephony market in Denmark where we interviewed the major providers. Our results indicate that the main concern for vendors is task complexity, which along with existing difficulties in task and technology compatibility seem to drive a shift of their interests from offering basic telephone call services to more advanced ones, such as video telephony. We believe that our research can be useful for the study of technology diffusion in general and IP-telephony in particular.*

*Keywords: IP-telephony, vendors' perspective, diffusion process, supply side analysis*

## 1 INTRODUCTION

The IP telephony market came into spotlight due to the massive increase of users world-wide in the last two years. The successful case of Skype has been discussed from both the research community (Rao & Angelov, 2005) and practitioners (Cook, 2003). The recent buy-out of Skype from eBay with the impressive amount of 2.6 billion US dollars in up-front cash and eBay stocks, plus potential performance-based consideration, awakes memories of the eBusiness "golden era". It appears that many people, initially Internet users and recently non-Internet users have adopted and appropriated IP telephony solutions. IP-telephony has been available since the mid nineties. However, most of the elements for the successful deployment of IP-telephony have been put in place the last three years. In technical terms, the main concerns of access network and low network service quality have been alleviated through the wide diffusion of broadband networks and the high bandwidth availability in most global backbones. In terms of market demand the numbers of Internet and PC users have increased considerably, leading to technologically "mature" users' that were readily available for more "technologically advanced" services compare to the basic fixed telephony. Finally, in business terms IP telephony providers, through collaborations with incumbent telecommunications operators and device manufactures have simplified the IP-telephony solutions offered and achieve compatibility with fixed telephony network.

In this article we investigate the market of Internet telephony using empirical data from a competitive and dynamic setting. In particular, we explore the current challenges and opportunities for vendors through data collected from semi-structured interviews from Denmark during January 2005. Our

objective is to explore vendors' perspective on the interplays between technology complexity and compatibility with adoption and diffusion process. We apply the framework proposed by Copper and Zmud (1990) to clarify the vendors' perspectives and contribute in IP telephony research by offering a supply side analysis. Moreover, we discuss this model by incorporating network economics' aspects that may affect adoption and diffusion of IP telephony. This discussion contributes to adoption and diffusion research by highlighting the importance of economic parameters that can complement the specific analysis.

Accordingly, our research questions are:

- What is the role of compatibility and complexity interplays in the adoption and diffusion of IP telephony as viewed by the vendors?

And in consequence;

- What are the projections for the future for IP telephony according to the supply side of one of the most advanced IP telephony markets (Denmark)?

Thus the paper is organised as follows. The next section offers an exhaustive review on the current research on Internet Telephony. Section 3 discusses the possible suitability of diffusion of innovation theories in the study of IP telephony adoption and presents the research framework. This is followed by our research methodology in section 4 and the presentation of the results in section 5. The article then concludes by underlining the main insights generated for the key players as well as proposing future research directions.

## **2 CURRENT RESEARCH ON INTERNET TELEPHONY**

The Internet growth and the technological evolution were the main drivers for the development of IP telephony solutions. From the early stage of a technologically feasible solution until today that IP telephony has evolved to a promising business opportunity, almost one decade has passed. Research on IP telephony, in the IS and telecommunications fields is not abundant. Surveying existing research efforts it appears that they were initially driven from the technological characteristics of the application. IP telephony's service quality and cost are the recurring themes of investigation (Babbage et al., 1997; Cawley, 1997; Foo & Cheung Hiu, 1998; Mason, 1998; McKnight & Leida, 1998; Ono & Aoki, 1998; Rowe & Richardson, 1998). The main research question of these studies is the trade-off between low price and service quality. The underlining conclusion suggests treating IP telephony as an application that will enable development of new value added services, i.e. combining voice and data (Cawley, 1997) and not as a substitute of fixed telephony or a real time application.

Moreover, a theoretical debate on regulatory implications was initiated due to the potential threat of IP telephony to incumbent telecommunications operators. The main research findings are fully in line with research in the IS and telecommunications fields. They suggest a new regulatory framework allowing IP telephony to become a communications infrastructure that would enable development of value-adding services and would complement fixed telephony (McKnight & Leida, 1998; Meisel & Needles, 2005; Rowe & Richardson, 1998). For example, Ono and Aoki (1998) in a comparative analysis of US, EU and Japan and Singapore's regulatory frameworks recommend treating IP telephony as both basic communications service and Internet application. Moreover, Graham and Ure (2005) offer the most recent analysis of the market by identifying key business challenges and trends and by proposing sensible regulation to safeguard end-users rights in terms of security law enforcement and monitoring as well as organisation of numbering.

The recent growth of IP telephony market led researchers to focus on end-user's requirements. Varshney et al (2002) identified a set of key attributes including service quality, reliability, price, security, value adding prospect of new services (e.g. service integration of voice and data) and cost of new equipment. Those attributes were also underlined by Zubey et al. (2002) who found that the most important requirement for end-users to be integration of new services such as unified messaging, call

waiting caller ID, followed by accessibility and price. Moreover, Tseng and Yu (2004) underlined the challenge of IP telephony's service quality based on data collected from Taiwan. Additionally, research has highlighted the importance of IP telephony in telemedicine due to significant cost savings and potential to develop new applications and functionalities (Zhao et al., 2002). Finally, researchers have proposed the use of IP telephony as a low cost solution for developing countries that could alleviate the high infrastructural investment costs of fixed telephony (Jaiwal & Raghav, 2004).

The above literature review on IP telephony clearly shows a demand driven approach to IP telephony with minimal attention to how the vendors view the current situation and future trends of the market. An exception is a recent paper by Corrocher (2003) who collected and analysed empirical data from IP telephony providers in Europe and the US and concluded that due to the service nature business users would drive the market evolution. In this paper we take a similar approach by examining the vendors rather than the users' perspective of IP telephony. Our theoretical argument is presented in the next section.

### **3 TAKING THE VENDOR'S PERSPECTIVE IN THE DIFFUSION OF IP-TELEPHONY**

New technologies often experience challenges when it comes to potential users' adoption. Although a new technology might be perceived as useful, advantageous and innovative, it does not always equal adoption in the consumers' mainstream market. For instance, the adoption of a new technology may involve high switching costs for the end-user in terms of searching for information buying new devices and obtaining new technical skills (Shapiro & Varian, 1998). Besides, end-user's choices may be influenced by network externalities (Katz & Shapiro, 1992) that are prominent in case of communication services. An end-user may consider the value of using a fixed-telephony network before choosing to adopt an IP telephony solution and this may become an impediment in case of incompatibility between the networks.

Rogers (1995, 2003) developed one of the most widely used theories for diffusion of innovation. The proposed models aim to trace and explain the path of an innovation's adoption through a given social system, over time. According to Rogers (2003), and other rational diffusion theorists such as (Agarwal & Prasad, 1997; Moore & Benbasat, 1991), there are certain characteristics of innovations which affect the rate of adoption. Although, it is acknowledged that social influences may impede or facilitate the process, the emphasis tends to play on the innovation itself. Rogers' theory has been criticised for not taking into account the particularities of complex information technologies (Lyytinen & Damsgaard, 2001). The theory has been judged as poorly equipped to facilitate the understanding of how different groups interact in the production and the provision of an innovation as well as lacking attention to acts of reinvention and the consequences of innovation adoption (Allen, 2000; Elliot & Loebbecke, 2000; Kautz & Pries-Heje, 1996). In contrast, interpretive approaches, such as those concerned with the social construction of technology (Bijker & Law, 1994), emphasise the way that technologies are 'configured' throughout the process of diffusion by various actors or relevant social groups.

A point on which we agree with Rogers is that all innovations are not the same. We also recognise that IP telephony is part of a series of innovations (Baskerville and Pries-Heje, 2003) such as the web browser and broadband that came about after the Internet revolution. There are some elements of the innovation itself that the potential users perceive as important (or not) during their decision to adopt or reject it. Nevertheless, we believe that apart from the potential users the rest of relevant social groups have their own interpretation of the innovation's characteristics, which can be very different from what the users actually believe and value. Previous work on the diverse viewpoints in the innovation diffusion process demonstrates that the supply side might have a completely different view on the

maturity of the innovation under investigation from the demand side (Papazafeiropoulou, et.al. 2005). In the case of emerging technologies such as IP-telephony for example the providers' willingness to offer a new service is not always based on the usefulness of the technology for the consumers but also on their expected economic benefits. User's readiness (technical and financial) together with the ongoing support and maintenance requirements may signal a non-profitable contract and mitigate against initial supply (Brown and Lockett 2004). Different social groups are expected to cater for their individual needs and drive their own agendas. It is our intention to use this observation in order to see how these perspectives shape the diffusion process.

We adopt Cooper and Zmud (1990) research model. This model postulates that compatibility has positive effect on adoption while complexity has negative effects (see figure 1). Our research shows that this model may serve for exploring vendors rather than the users' perspective on the various elements that includes. More specifically, the nature of IP telephony service underlines the role of compatibility with existing communications networks in the diffusion process since it increases the IP telephony value for a user due to network externalities. Additionally, the importance of complexity in a market where potential users are mainly using fixed telephony services is high as high switching costs may incur.

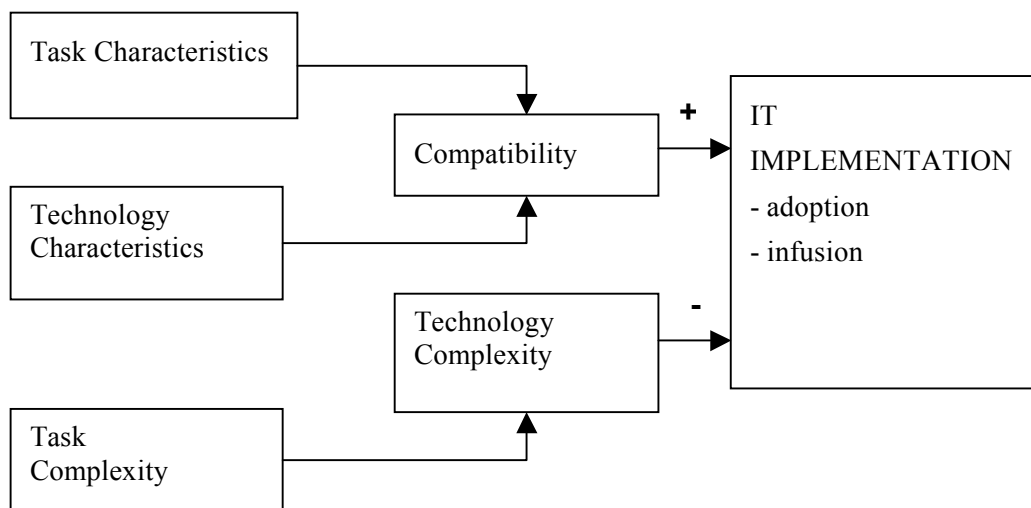


Figure 1. IT diffusion model by Cooper and Zmud (1990)

Copper and Zmud argue, using the example of material requirements planning systems (MRPs), that successful implementation is more likely to happen when the task characteristics are in accord with the technology assumptions. In this paper we seek to clearly define the assumptions on the technology (in our case IP telephony) by taking into account perceptions of the supply side. We use their framework as a starting point in order to argue that the innovation's characteristics can not be universally defined. Thus it is useful to take the providers viewpoint in order to draw some interesting conclusions on the effect of the supply side the IP-telephony diffusion process. We realize that the framework does not include every aspect of the market dynamics, as for example economic characteristics, but we use it as a way to get a basic understanding of the IP telephony market today. In the next sections we introduce more economic elements as a way to enhance the framework for future research. We support our argument by using data collected from the Danish IP-telephony market as presented in the next section.

## 4 RESEARCH APPROACH

This paper explores the Internet telephony market through data collected from interviews conducted in Denmark during 2005. Denmark is among the most advanced European countries in the Information and Communications Technologies sector (i.e. Information Society Index Denmark is in the first place) and has a high Internet penetration rate, almost 70%, including 48% of users with broadband connections<sup>1</sup>. Broadband access enables deployment of IP telephony by offering the required bandwidth capacity. This environment has enabled shaping a dynamic Internet telephony market with seven service providers (excluding Skype and MSN), four ISPs and three IP telephony providers. This market is expected to expand and reach 12% of Danish population in the next three months (NITTA, 2004). This market may offer useful insights and indicate trends to be observed in other markets of the Western world.

We first collected information on existing models of IP telephony service delivery through direct contact with the key market players. Figure 2 presents these players, while the business relationships between them can be divided in two different instances that correspond to the main available types of end-user's access devices (Mason 1998).

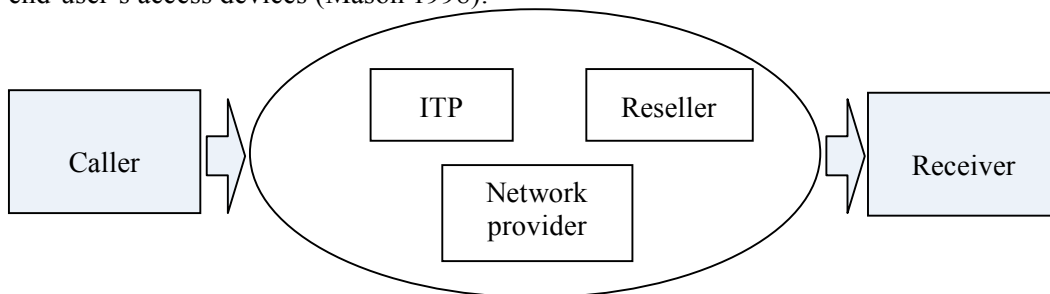


Figure 2. *Players in the Internet Telephony market*

These instances involve offering PC-to-PC or PC-to-phone calls. In the case of PC-to-PC communication, the service flow between Caller and Receiver includes only the Internet Telephony Provider (ITP). In the case of PC-to-phone calls the Reseller intermediates between ITP and Network Provider. However, Internet telephony might be offered by an ISP. In such cases the ISP has direct access to the Network Provider and the role of Reseller is eliminated.

Having identified the key players in service provision we then chose seven representative companies to collect empirical data. In particular, those included companies currently active in the market; two Internet telephony providers and two ISPs that have different service flow models and together they represent a substantial market share. We also interviewed three additional market players that have a key role in service delivery chain, namely, the incumbent telecommunications operator, a network reseller and a different type of ISP that serves specific communities defined by physical proximity of the members. These three companies have plans to expand their activities in the IP-Telephony market in the near future (i.e. next 12 months). The rationale behind the selection of the specific interviewee roles was according to our research questions the systematic observation of the different providers' perspectives on the current situation and the future projection of the IP telephony market. Table 1 offers information on the profile of those companies.

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<sup>1</sup> IDC's market analysis for 2004 including four infrastructures; compute, telecom, Internet and social. It is available at <http://www.idc.com/groups/isi/main.html>

Table 1. The business profile of selected companies

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

The seven interviews were conducted in January 2005 (one interview per day), and lasted between 60-85 minutes. Data was collected in Danish, then transcribed and finally translated into English. In each meeting we used an interview guide and a figure including the existing models of IP telephony service delivery identified in the Danish market. The objective of this figure was to ignite additional discussions following the interview guide, on the company's positioning in the market.

The interview guide included 27 questions divided in two sections. First, a generic section included 6 questions on the company's history, profile and business activities. The second part included 21 questions covering a range of themes including strategic aspects, such as market penetration and diffusion, as well as themes related to network effects, switching costs and market dynamics. The questions in the interview guide were designed to be as neutral as possible in order to get the interviewees own views and perceptions about the different themes addressed. The questions were open-ended allowing for follow up, when new and unanticipated information appeared.

The data analysis was undertaken using an issue categorisation method, which was used to provide a 'common sense' breakdown of issues, root causes and potential action strategies of the themes related to our research questions and our theoretical framework. Each theme was further broken down to specific sub-areas as they were emerged during the interview process. In the next section we present the analysis of the interview data based on the framework described in section 3 on our effort to answer our research questions by acquiring the vendors' perspective on compatibility and complexity interplays in the adoption and diffusion of IP Telephony.

## 5 THE VENDORS' PERSPECTIVE OF THE DANISH IP-TELEPHONY MARKET

The elements involved in the framework are analysed based on the responses we received from the interviewees.

### 5.1 Compatibility task characteristics

Task compatibility in the case of IP telephony relates to the use of the service and the related devices without the users having to change a lot the way they are used to make phone calls. In service terms this relates to quality of service (Mason, 1998) and fixed telephony provides a direct reference point to users for comparisons. When it comes to compatibility with existing services vendors expressed their

worries about users' difficulty to adjust their habits when it comes to IP telephony use. An interviewee in company B said: *"Some people don't buy the adapter but use headsets just as with Skype, but they can't receive calls. I don't think that is smart"*. Additionally, during the interviews, service quality was a recurring theme. For example, ISPs, already experienced in dealing with service quality in the Internet service provision highlighted the challenge in the case of IP telephony. One of the ISPs (from company D) said: *"IP-telephony will never have better quality than the PSTN [public switched telephone network]. It is naïve to think that. PSTN in Denmark offers very high quality and it always delivers voice better."* Similarly another interviewee from company E admitted the problems of poor quality of service: *"We had some problems explaining noise on the Internet. I don't think the quality of our IP-telephony will be as good as PSTN. We are dependent on the network we use"*.

Similarly, provision of IP telephony services to business users sets big challenges to providers as the task compatibility and the quality of transmitted voice is of paramount importance for these users. For example, providers highlighted that in case of business users IP telephony solution has to be compatible with existing processes and devices used for communication services in order to deliver for the tasks required. In the case of more advanced services such as video telephony that might be valued in specific tasks such as video conferencing the main challenge is availability of hardware and user friendly interfaces as pointed out during the interviews. *"Video-on-demand could be very practical, but is it a screen interface for e-mail you want to use when you are used to a PC or a laptop?"* (Interviewee in company G).

Overall, in terms of task compatibility there are strong influences from users' experiences with substitute technologies. Besides the constraints on willingness to use new hardware from users' experiences, different user types (such as domestic or business) have varied practices that need to be taken under consideration when new IP telephony services are developed.

## 5.2 Compatibility technology characteristics

IP telephony like any communication service is influenced by strong network externalities (Katz & Shapiro, 1992). Moreover, there are significant switching costs for end-users underlining the need for full technical compatibility. During the interviews vendors seem to be aware of compatibility's importance on the diffusion process, in the light of strong network externalities in case of fixed telephony services that users already use. As an interviewee in company C said: *"It does not matter if it is VoIP or VoATM as long as the telephony is working. We advertise that you can drop your fixed line subscription."* Yet, in the incumbent telecommunications operator they believe that customers are very satisfied with what they already have and thus the challenges for IP-telephony diffusion are stronger. *"...because those customers that adopt IP-telephony are those that are on fixed line today and perhaps mobile users. The customers today are very satisfied with the solutions they have."* (Interviewee in company G)

However, the availability of complementary hardware and network infrastructure that enables provision of more advanced services was also raised as a concern. *"Being first mover is not a treasure trove, on the contrary. You can't do all these fancy things before the equipment is there. We are not going to invest 10-20 million DKK in all kinds of advanced video platforms before we see customer's equipment that can support it."* (Interviewee in company C). IP telephony providers are also aware of the switching costs involved for end-user and emphasize on the need to offer full coverage to a new customer. *"We had a policy that if we were going to do this, it had to be compatible with anything called IP-telephony (not Skype). ... most important thing to a new IP-customer is that it works first time he lifts the handset and calls and that it works tomorrow and the day after that"* (Interviewee in company A).

Overall, the technological compatibility in the light of network externalities and switching costs involved, makes IP telephony diffusion more challenging as the users willingness to switch to a new service is rather limited if they can not get the system to work by using existing technology.



### 5.3 Task complexity

Technological complexity may have detrimental effects bearing in mind the comparison made by the end user between IP and fixed line telephony. Most of the interviewees have experienced challenges when dealing with end-users' requirements on lower complexity and seem aware of the negative impact in diffusion of IP telephony. One of the interviewees in company 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"*. Task complexity becomes more important in cases of people with limited technical knowledge that may not possess a PC, as pointed out during the interviews. *"...to our parents' generation, this [IP telephony use] is not a feasible way. It will never gain a foothold among the broad public."* (Interviewee in company C). Some providers took a step further by stimulating the demand but are quite uncertain about the anticipated results: *"We just signed a deal with a housing association with 200 apartments. They just got fibre optic cables put down by a supplier that is a partner of ours and they wanted IP-telephony. They consist of grand parents as such without PC's"* (Interviewee in company A).

Similarly to concerns related to compatibility, task complexity seems to create unease within the vendors who despite the fact that are operating in a market where computer literacy is quite advanced it indicates user resistance. The dominance of the fixed telephony seems to be very difficult to overcome. Peoples' habit to "pick up the phone" will be rather challenging to break. This specific element of task complexity seems to be troublesome for vendors as we analyse in the next section and it appears to affect their strategies on targeting specific market segments of the population with more advanced technical skills such as business users.

## 6 DISCUSSION-CONCLUSIONS

Task complexity seems to be a main concern for vendors and existing difficulties described in terms of task and technology compatibility develop an interesting interplay for the diffusion of IP telephony. This interplay influences vendors who shift their strategies towards advanced communications services such as video telephony. After collecting and analyzing the data we realised that by taking the vendors approach we could draw conclusions about IP telephony adoption though not as we know it at the moment (plain phone calls) but as a future technology that is mostly addressed to advanced and business users exploiting needs such as video calls. Thus, in line with existing literature in IP telephony research (see Section 2), the competition with fixed telephony services seems to be a disadvantage that IP telephony vendors want to eliminate by developing value added services (such as video telephony) and differentiate their offerings. As one of the interviewees in company B clearly described: *"We have standard IP-services such as caller ID, knocking on. Other services? Absolutely, video calling. This is something we definitely are going to make money on. However new services are mainly seen as being directed towards the business side"*. The supply side of the market highlights the importance of value added services in case of IP telephony, targeting potential profit generating market segments such as business users.

In our effort to answer our research questions we came to two main conclusions.

- The existing situation with issues involved in technical and task complexities of IP telephony make the less technically capable users less of a target as the cost to train them or giving them access to necessary software and hardware is not part of the vendors' agenda.
- The projection for the future show that IP telephony vendors are shifting their attention to business users and giving priority to the provision of advanced services such as video calling.

In this paper we used a framework of IT diffusion which is mainly focused on the examination of task, technical complexities and compatibility involved in the use of the technology. Those factors are important for IP telephony diffusion in the light of network externalities and switching costs. Our study points to the gap in the exiting literature in IP telephony as it is presented in section 2. We observe that focusing on the users' side of the story where quality of service and price are very important the interests of the demand side are disregarded. Our study shows that the vendors rather than looking to address existing needs have shifted their attention to the offering of new advanced services while focusing on a different market segment (business users).

In terms of our theoretical contribution we have extended this framework in order to capture the vendors rather than the users view on the complexities involved in the provision of IP telephony services we believe that it can be further enhanced. More specifically, we believe that the economic characteristics such as network externalities and switching costs are useful elements in a framework trying to analyse IT adoption. For example, alleviating or decreasing user's switching costs to IP telephony because of technological complexity may be vital for mass adoption which in turn will increase network externalities. Although, in this study we have referred to these elements in our analysis we believe that a comprehensive framework should clearly and separately include them as important factors of IT adoption. In terms of future research we intent to develop a framework where both demand and supply sides will be analysed in order to identify potential gaps in the perceptions on IP telephony use. These gaps or their absence may provide reasons behind IT adoption or non-adoption. Additionally, we consider extending our analysis to different national or cultural settings that will offer useful insights to markets dynamics in different contexts. We believe that our research is useful to both practitioners such as vendors or policy makers as well as researchers in the adoption of IT in general and IP telephony in particular.

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