

Understanding the diffusion and adoption of telecommunication innovations: What we know and what we don't know

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Abstract. This paper provides a systematic account about what we know and what we don't know about the diffusion and adoption of telecommunication innovations. As our sample we obtained research papers from IFIP 8.6, ICIS and ECIS from the past ten years concerning telecommunication innovations diffusion and adoption to examine what aspects of the diffusion and adoption process are accentuated or overlooked using a general view of the process. As our theoretical vehicle we build a holistic framework that comprises the innovation, the unit of adoption and their interaction as captured by demand pull and supply push forces. The framework also takes into account the environment which embeds the diffusion and adoption. We find that there are certain shortcomings in the existing research within the field that needs to be addressed to provide a more comprehensive view of adoption and diffusion of telecommunication technologies.

1. Introduction

The success of the mobile phone has been unprecedented; from being almost unknown 15 years ago most people in the developed world now own one or more mobile phones. It has been embraced as the fourth technology carried by man – so in addition to the watch, the wallet and the keys we now also carry the mobile phone. Many people see the mobile phone as an extension of the self and in a sense we have become Cyborgs¹.

¹ The definition of a Cyborg is a cybernetic organism, a hybrid of machine and organism (Haraway, 1991)

The speed of which the mobile phone has spread has surprised most researchers. Today there are more than 3.3 billion mobile phone subscriptions in use in the world² growing at an astonishing number of 200 million phones per quarter. It is not something that is limited to the Western world as the mobile phone spreads pandemic. By 2011 it is estimated that nearly everyone on earth will own a mobile phone.

Even though the mobile phone has claimed global victory not all telecommunication innovations are adopted with the same pursuit. That may not in itself be surprising but it has proven quite difficult to predict which innovations will succeed and which ones will fail. To illustrate, some telecommunication innovations such as SMS have previously exceeded expectations in terms of speed of adoption while others, like for example MMS have not met expectations at all. The same holds true for GSM which has been tremendously successful in many parts of the world whereas UMTS has been much less so even though it has gained momentum more recently.

Scholars of diffusion and adoption have also focused on telecommunication innovations and many different theories have been put to the test of explaining the phenomenon with varying results (Blechar et al. 2008). There seems to be no synthesis or dominant theory that captures all relevant aspects of the telecommunication diffusion process adequately. Indeed, some may argue, there may not be one best theory that will fit all our needs for understanding different aspects of the diffusion process. We agree to that point of view and just observe that at the moment we do not have a systematic account of the experiences of using different theories. In a respond to this deficit this paper synthesizes what we know and by exclusion what we do not know about the diffusion and adoption of telecommunication innovations, as we believe that contributions to these three conferences the past ten years cover most important findings in this area. As an analytical tool we develop a framework based on an overall model of diffusion and adoption of innovation. All articles published in IFIP 8.6, ECIS and ICIS over the last ten years that portray the diffusion and adoption of telecommunication innovations are analysed using the framework to provide an overall picture of the accounts. We realise that not all papers on this topic has been published in these outlets but they provide a large and broad sample of available accounts. The aim is to condense knowledge that can help scholars better navigate between theories and their explanatory power vis-à-vis the research question they seek to remedy.

To achieve this objective this paper is composed as follows. It begins with an overview of the telecommunication innovations and especially the remarkable success of mobile phones is noted. The proceeding section presents our research method, and the next section presents and adapts a generic analytical tool for investigating diffusion and adoption literature. The investigative tool is then applied to all relevant papers from IFIP 8.6, ECIS and ICIS from the past ten years and an analysis is conducted. Finally our results are condensed and final conclusions are drawn.

² Reuters – 29 November 2007: <http://investing.reuters.co.uk/news/articleinvesting.aspx?type=media&storyID=nL29172095>

2. Telecommunication innovation

Since its discovery telecommunication has changed our lives in many ways both privately and professionally. From a diffusion and adoption point of view the first installations suffered from a lack of critical mass. If only few people had access to a telephone there were few people to call and hence the benefits of adopting a telephone were limited. However, as more people adopted the telephone the benefits of joining the adopters also increased. This phenomenon where one additional adopter increases the utility of the other adopters is labelled network externalities (Shapiro & Varian, 1999; Economides and Salop 1992) or network effects. Once the basic universal fixed line telecommunication infrastructure were in place many subsequent telecommunication innovations shared the accomplishments of this and have therefore not had to establish critical mass by themselves, i.e. subsequent telecommunications piggy-backed on the success of the fixed line network.

This is for example the case of the mobile phone that is always connected to the omnipresent fixed line telecommunication infrastructure. The mobile phone represents an interesting case in so that it is not only a device for voice communication but it has evolved into a data communication tool and also increasingly into a sophisticated computing device that can offer many different services. As an example many mobile phones bundle cameras, FM radio-receivers, Instant Messengers, music players and internet browsers. This means that the mobile device is not a fixed single purpose innovation but a multi-faceted and open-ended device. Its adoption is therefore not an atomic event but something that stretches over time and is quite learning intensive and the adopter will probably never use all the possibilities that the mobile device can offer.

From a diffusion and adoption perspective this complicates the matter. What is really the innovation being adopted? And also at what point in time should we denote the innovation as adopted? Finally it is worth noticing that the mobile phone has to compete with other devices or communication channels that the potential adopter already uses. So at any given time an adopter chooses between different available alternatives to satisfy her needs (Blechar et. al. 2006) so therefore any diffusion and adoption theory that seeks to understand and predict the faith of a telecommunication innovation has to consider not only the innovation at hand but also the alternatives and here it is imperative to consider established standards and habits as captured by switching costs and lock in effects (Shapiro & Varian, 1999).

Telecommunication innovations have always been subject to regulation (Petrazzeni, 1995; Melody, 1999). This holds true for the right to establish infrastructure and also the right to offer telecommunication services upon such infrastructure. Even though the period from the mid 1980s until now has been characterized as a period of de-regulation it is worth noticing that de-regulation has only been achieved through heavy use of regulation and legislation. For example to increase the competition in the mobile telephony market a number of licenses have been offered. The number and terms of the licenses is regulated by some telecommunication office. This means that a diffusion and adoption theory that seeks to offer broad and relevant explanations of the telecommunication innovation has to consider the context in which the process occurs.

3. Research method

To recapture, the objective of this paper is to examine what aspects on the diffusion process are accentuated or overlooked in the diffusion and adoption process as reported in scholarly work and thereby condense knowledge that can help in the navigation between theories and their explanatory power. The overall research method applied is a literature study. In order to explore the aim of the paper, we use the following elements in a holistic framework to probe and analyze the articles: type of technology, adopting unit, interaction between the innovation and adopting unit expressed as supply-push or demand-pull mechanisms as well as the context in which the diffusion and adoption occurs. Furthermore, we also explore the underlying theory and cause and effect structure of each paper.

3.1.Data collection

The search for articles was conducted at the AIS website to locate ECIS and ICIS papers from the past ten years, and the key words included: diffusion, adoption, innovation, mobile (service), UTAUT, technology acceptance, actor-network, network, institutional theory, critical mass, theory of reasoned action and theory of planned behaviour. The search for IFIP 8.6 was conducted browsing through the last 10 years of proceedings aiming to identify the same key words. Initially the combined search resulted in a total of 94 papers. However after scanning the papers and eliminating those that were not specifically related to either a telecommunication technology or information and communication technologies in general that could include a telecommunication technology we ended up with 36 papers. From the IFIP 8.6 6 papers (17%) were analysed, from ECIS, we analysed 23 papers (64%), from ICIS: 7 papers (19%). There were no IFIP 8.6 conferences in the years 1999 and 2000 hence those years are marked as “No Conf.” in the table (for an exhaustive IFIP 8.6 literature study see Kautz, Henriksen, Breer-Mortensen and Poulsen, 2005).

Conference	Nb. 3	No Conf.	No Conf.	Nb. 4	Nb. 5	Nb. 6	Nb.7	Nb.8	Nb.9	Nb.10
IFIP 8.6	0			0	1	1	1	0	1	2
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ECIS	0	0	0	0	4	2	4	7	3	3
ICIS	0	1	0	1	1	1	1	1	1	0

Table I. Number of papers investigated from the IFIP 8.6, ECIS and ICIS conferences from 1998-2007.

3.2.Data analysis

One of the authors read each paper carefully making notes of sentences that relate to the categories in our study framework. The analysis was an iterative process, and after this first categorisation, the paper was re-read if any category was still left empty in search for clues to determine the right categorisation.

Initially, the analysis was conducted searching for the main categories identified; type of innovation, adopting unit, interaction and context as well as a category for interesting observations. As the analysis progressed it was clear that some of the categories were too broad and that it was necessary to perform a further division in some categories. It was for example of interest in the category 'cause and effect structure' to determine how many papers investigated cause-effect or applied a process view and also whether the approach to the research was interpretive or positivistic.

Furthermore, it became clear as the analysis of an 'interesting observations' category was analysed that more categories were of interest for this analysis. An example is the 'theory' categorisation that seemed obvious as the papers analyzed are all papers of diffusion and adoption, however, the papers utilised both traditional diffusion and adoption theories as well as other theories.

4. Model of diffusion and adoption

Technology diffusion and adoption has been a key area of research in the IS discipline since the influential work of (Tornatzky & Klein 1982; Davis 1989), and research has increased massively ever since.

Research has dealt with specific technologies such as the diffusion and adoption of e.g. EDI (Damsgaard & Lyytinen 1996; Lyytinen & Damsgaard 2001), internet services (Pedersen & Ling 2003) and adoption of telecommunication services (Mahler & Rogers 1999). Researchers have also investigated such different perspectives as the level of adoption (Yoo et al. 2002), gender differences in individual technology adoption (Venkatesh et al. 2000), grouping of users into distinct profiles (Constantiou et al. 2007) and adoption of technologies in different geographical regions; e.g. mobile services in German banks (Mahler & Rogers 1999), and South Korean broadband services (Yoo et al. 2002). Most papers apply one or more theoretical instruments developed for analysing and predicting diffusion and adoption as it is recognized that technological advances and service availability do not automatically lead to widespread adoption and use (Constantiou et al. 2007). Based on previous research, a generic framework for investigation of technology diffusion and adoption is assembled. The framework is based on previous research and experience of one of the authors.

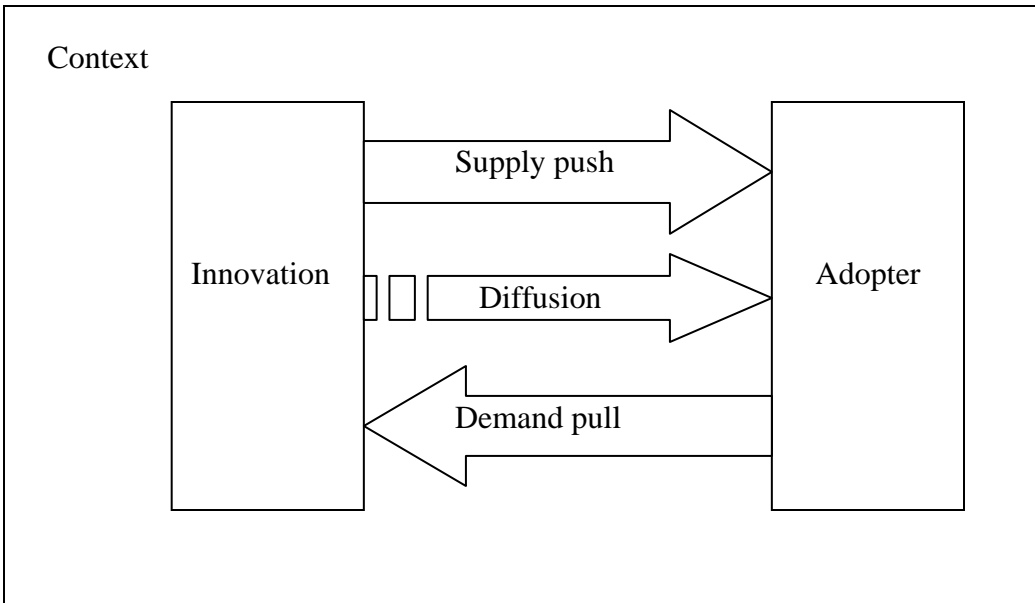


Figure 1. Holistic framework for investigating technology diffusion and adoption – static view.

Figure 1 shows a simple holistic framework for investigating technology diffusion and adoption of a snapshot in time. An innovation is diffused and adopted by one individual or a group of adopters as a consequence of a push from the producer or a pull from the adopters. This mechanism happens within a certain context; however the framework shows a static view of this process and the changes that occur over a certain time period is not captured.

Often when an innovation is diffused and adopted by an adopting unit, the use of the innovation is further expanded. As the adopting unit identifies additional ways of using the innovation, or recognises further needs in relation to the innovation, a demand pull mechanism takes place, and a transformation of the innovation transpires. This is depicted in figure 2 that shows the process view of the holistic framework, where the innovation and the adopting unit is considered at times T0 and T1 to explore these changes.

It is therefore of great interest to capture the distribution of articles that take a static view and a process view on the diffusion and adoption of telecommunication innovations.

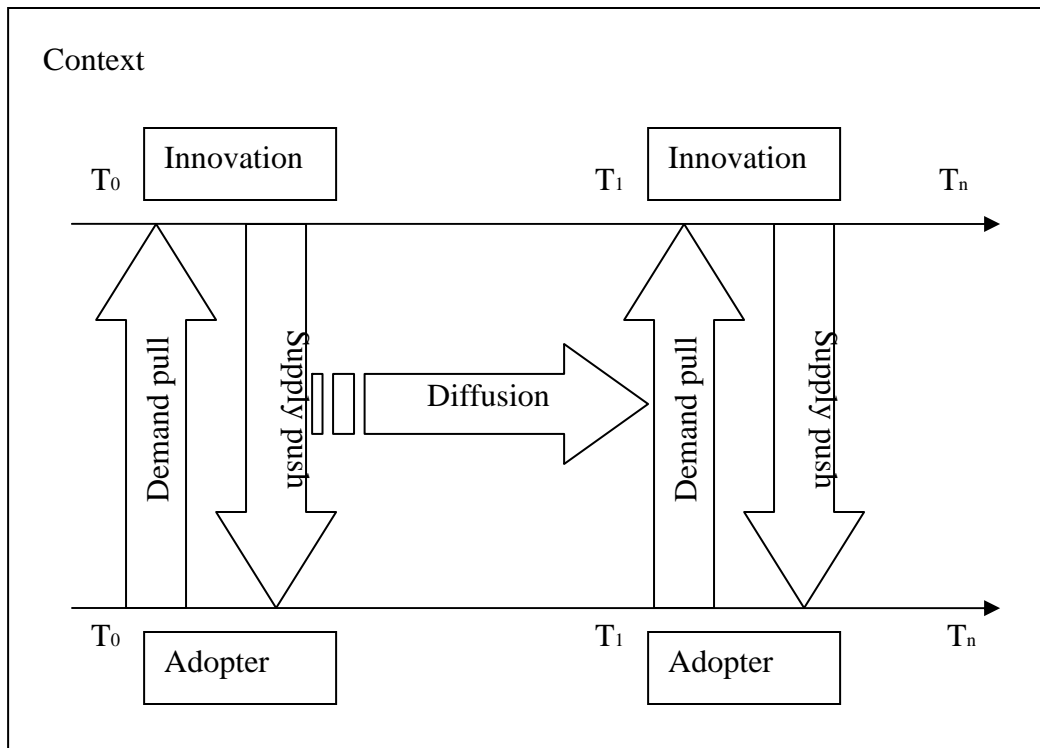


Figure 2. Holistic framework for investigating technology diffusion and adoption – process view.

Figure 1 and figure 2 provides an illustration of the diffusion process of innovations. They assist in understanding the elements and mechanisms of such a process. The elements of the framework are briefly introduced next.

4.1. Framework for analyzing diffusion and adoption telecommunication literature

4.1.1. Type of innovation

Telecommunication technologies have developed extensively the past decades and the massive increase of internet users has led to dramatic shifts in the way of conducting business.

The type of innovation investigated in this paper can be labelled a telecommunication innovation as the telecommunication industry is in focus. As part of the type of innovation, there are certain traits of the innovation that are interesting to investigate as they affect the diffusion and adoption process. Some technologies are integrated in the work environment and are therefore compulsory whereas other technologies are adopted voluntarily. According to (Moore & Benbasat 1991) this issue of compulsory versus voluntary adoption of a technology is of great significance. They define the voluntariness of use as ‘the degree to which use of the innovation is perceived as being voluntary or of free will’. One can assume that when a technology is compulsory the adoption rate is either higher as a consequence of the innovation being forced

upon the adopting unit or the opposite; the adoption rate is lower as a consequence of the adopting unit's resistance of adopting a compulsory technology. Therefore, consideration must be given to whether individuals are free to implement personal adoption or rejection decisions when examining the diffusion and adoption.

As stated above some technologies – especially networked technologies – enjoy network externalities. It is therefore moreover interesting to investigate whether the innovation only has an inherent value for the individual user (private utility) or it only has value if most people in a community of practice use it (collective utility).

4.1.2. Adopting unit

Researchers have for many years acknowledged that technologies affect organisations at different levels in different ways, and sought to understand associated behavioural phenomena (Banker & Kauffman 2004). We have adopted the classification of Lyytinen & Yoo (2002) who analysed the changes in demand in services and infrastructures at the individual, team, organisational and inter-organisational levels. Besides these four levels, when we found a paper studying the regional level so we included that in our categorisation.

The primary focus of IS research has been done with the individual (Venkatesh et al. 2000, Carlsson et al., 2006) and the organisation (e.g. Venkatesh & Davis, 2007; Mahler & Rogers, 1999) as the focal points, and only little research has centred at the group level. In addition group level analysis of diffusion and adoption of technologies have in general considered diffusion at an aggregate level of analysis of individuals instead of acknowledging that adoption of technologies at this level maintain synergy effects and therefore have different adoption curves.

In our analysis we distinguish between the following levels of analysis: individual, group/team, organisational, inter-organisational and regional levels.

4.1.3. Interaction between innovation and adopting unit

Technology diffusion can furthermore be understood by using two additional means of explanations: supply-push and demand-pull theories (Zmud 1984; Damsgaard & Lyytinen 1996) which display the interaction between technologies and the adopting unit.

Supply-push theories assume that the functionality of a technology enables the diffusion of it. The innovation is being determined before it is pushed to the users and the push forces enclose the adoption decision as a rational choice problem between a former and a new technology. The main source of information to make this decision is different communication channels (Rogers 1995), notably mass media and peer networks, however Lyytinen & Damsgaard reported that networked technologies can also be pushed “by powerful actors (gatekeepers) such as hubs, industry associations or government” (Lyytinen & Damsgaard 2001). Moreover, through sustained innovations within technologies, supply-side organizations try to make technologies more attractive for potential clients by encouraging users to acquire technologies as a technological problem-solver.

Demand-pull theories are conversely determined by the users' rational choice (Rogers 1995; Lyytinen & Damsgaard 2001). The demand-pull theories would explain the technology diffusion

by a growing demand for technological solutions created by potential clients and their needs. Users' perceived usefulness and image is improved by applying scientific or technical knowledge. This creates the demand for innovations and triggers their adoption. This could for example be realised in the form of new technologies. The pull perspective predicts that innovators will choose to work on topics which are perceived as problems on the demand side (Thirtle & Ruttan 1987) and accordingly increase the probability of a technology being adopted and diffused by improving its fit to the personal or business needs of the adopting unit.

Though the diffusion of a technology cannot be explained either by the supply-push or the demand-pull forces alone, it is of interest to identify the force that drives the interaction between the technology and the adopting unit when studying diffusion and adoption.

4.1.4. Context of research

In addition to the supply push and demand pull it is also necessary to consider the context in which the diffusion and adoption of a technology takes place. The analysis of the context is mainly a macro analysis in which the diffusion and adoption of an innovation takes place and consists of entities such as national governments, international agencies, consumers, products and services and other entities that might have an affect or the power to change the industries within the IS field (Damsgaard & Lyytinen, 2001; King et. al. 1994). Our analysis provides examples of the use of context in research but will not present data in tabular form as the context is characteristic for every single study.

4.1.5. Theory

The underlying theory of diffusion and adoption of an innovation revolves around different diffusion theories. The perception of diffusion and adoption was initially based on five classic characteristics of innovation derived by Rogers from Diffusion of Innovations (DOI) literature (Rogers 1995). The exploration of diffusion and adoption of technologies in the IS field furthermore include other theories such as the Technology Acceptance Model (TAM) (Davis 1989), the Theory of Reasoned Action (TRA) (Ajzen & Fishbein 1980), Theory of Planned Behaviour (Ajzen et al. 1985) as well as extensions to the above and the Unified Theory of Acceptance and Use of Technology UTAUT) (Venkatesh et al. 2000). These theories have been widely used within the IS field, however they are reported to show significant shortcomings in their ability to capture the diffusion and adoption of telecommunication services (Blechar et al. 2006).

Diffusion of innovations theory has had considerable impact on IS and has therefore been a widely used instrument to explain and predict rates of IT innovation diffusion (Moore & Benbasat 1991; Rogers 1995). It derives from rational theories of organisational existence and has its roots in economics, sociology and communication theory and has attempted to explain mainly individual adoption decisions (Lyytinen & Damsgaard 2001).

TAM is one of the most widely accepted theories to explain and predict IS acceptance and facilitate design changes before users have experience with a system (Venkatesh et al. 2000; Venkatesh et al. 2003). TAM predicts user acceptance based on two specific behavioural beliefs:

perceived ease of use (PEU) and perceived usefulness (PU), which determine an individual's behaviour intention (BI) to use IT and subsequently actual use (Davis 1989). Several researchers have extended its use to different settings and succeeded in demonstrating reliability and validity of the instrument (Adams et al. 1992).

The Theory of Reasoned Action (Ajzen & Fishbein 1974; 1980) is a model for the prediction of behavioural intentions and/or behaviour. The theory has been useful for identifying where and how to target strategies for changing behaviour. Later Ajzen (1985) extended the boundary condition of pure volitional control in the model to incorporate perceived behavioural control as an antecedent to behavioural intentions in the Theory of Planned Behaviour by extending the Theory of Reasoned Action (Ajzen et al. 1985).

UTAUT is an attempt by (Venkatesh et al. 2003) at unifying eight renowned models of technology acceptance, diffusion and adoption: TRA, TAM, Motivational Model, TPB, Combined TAM-TPB, Model of PC Utilization, Diffusion of Innovations theory and Social Cognitive Theory. The model is validated with six longitudinal field studies in usage intention and UTAUT is regarded as a superior model than the above models individually. However, only few studies apply this theory (Anderson & Schwager 2004).

The above theories within the field of diffusion and adoption of technologies are considered during the analysis; however some papers include other theories in their analysis or do not include theories at all. This is taken into account in the analysis where we examine the theories employed.

4.1.6. Cause and effect structure

Causality or causation captures the directional relationship between a cause and an effect. The effect is the outcome (result) of the cause. Often in diffusion and adoption models there is an aim to identify a set of predictor variables with a certain desirable outcome (adoption). There is often a distinction between necessary and sufficient causes of adoption. For example TAMs constructs of *perceived ease of use* and *perceived usefulness* are both necessary and sufficient conditions for the intention to adopt. This type of theory that explains why adoption occurs is labelled variance theory (Markus and Robey 1988). Process theory on the other hand identifies a number of necessary conditions that through a process explains *how* the diffusion occurs.

5. Analysis and discussion

The initial data material consisted of 94 conference contributions, however after an initial evaluation the material was reduced to 36 conference contributions pertaining to diffusion and adoption of a telecommunication technology.

The analysis is conducted by analysing the conference contributions according to the six elements described above. The analysis is structured in the following way: each element is discussed in relation to the framework described above. For an overview the discussion paragraph also contains a table showing the number of contributions within each element. The papers are referenced through a unique ID (from 1 to 36) associated with each contribution. The appendix shows a table linking each ID with a paper contribution and the elements of the

framework. The analysis draws upon findings that show both findings that are representative to the articles and findings that are peculiar. The results are represented in percentages and are discussed though the sample is relatively small as percentages act as a visualisation of the results.

5.1. Type of innovation

All papers investigated studied a specific telecommunication technology or the more general concept of ICT. The ICT papers selected for this literature study all analysed ICT that could irrefutably include a telecommunication technology. 94% of the papers deal directly with telecommunication technologies and innovations and only 6% of the papers concern ICT. Although several researchers have formerly classified types of technologies, no classification has been provided within ICT or telecommunication technologies. It is however apparent that the majority of the papers (72%) analyse the diffusion and adoption of mobile devices and services such as mobile TV services (Lin & Chiasson, 2007), mobile devices and services (Constantiou et al. 2005) and video streaming (Stanoevska-Slabeva & Hoegg, 2005) whereas only 22% analyse the diffusion and adoption of broadband technologies (e.g. Choudrie & Dwivedi 2005, Damsgaard & Gao 2004). A few papers include a study of both; e.g. a solution containing a combination of GPRS phone, PC and WLAN (Breu et al. 2005) and broadband and mobile services (Middleton 2002).

Looking at the division of papers investigating the diffusion and adoption of compulsory and voluntary use of technologies, it is worth noticing that the papers contain an overweight of voluntary use (81% of the papers) of technologies. This is expected as these technologies are widely used in personal settings where users adopt a technology voluntarily. There is a clear correlation between voluntary use of a technology and the level of adoption analysed i.e. 67% of the papers investigating technologies adopted voluntarily where adopted at the individual level. However, at the organisational, group and regional levels 19%³ of the papers were related to compulsory and 14%⁴ were related to voluntary diffusion and adoption of technologies.

There is a slight overweight of papers investigating compulsory use of technologies in organisations. Muzzi & Kautz (2003) investigated adoption of ICT through two studies and found that firms that involve high investments and a clear projection, such as ERP, videoconferences, EDI and groupware have not been widely adopted. Most of these are technologies enforced upon employees in an organisation and further research could therefore benefit from the investigation of compulsory use of ICT to explain this lack of adoption. As noted before, the adoption rate of a compulsory can be higher or lower as a consequence the adopting unit's resistance to adopting the enforced technology.

17% of the papers analysed are directly concerned with technologies that enjoy network externalities and 83% are not. However, it cannot be deduced that the technologies do not benefit from these; it is just not apparent in the papers.

³ Compulsory use: organisational level: 14%, group level: 2,5% and regional level: 2,5%

⁴ Organisational level: 14%

	# papers	IFIP 8.6	# papers	ECIS	# papers	ICIS
Compulsory	2	4, 5	3	10, 22, 23	2	32, 36
Voluntary	4	1, 2, 3, 6	20	7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 24, 25, 26, 27, 28, 29	5	30, 31, 33, 34, 35
With network effects	2	2,4,	1	11	3	30, 34, 36
Without network effects	4	1, 3, 5, 6	22	7,8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29	4	31, 32, 33, 35

Table II. Papers distributed on the compulsory and voluntary use of technologies

5.2. Adopting unit

Approximately 69% of the research conducted the past ten years represents the individual level. This is not surprising as mobile services and technologies are often targeted to individuals and their needs. The units of adoption investigated are distributed in the papers as follows: individuals: 25 (69%); groups/teams 1 (3%), organisations 9 (25%), inter-organization 0 (0%) and regions 1 (3%). It is interesting to notice that research at the inter-organisational level is not represented at all.

The distribution of papers from the three investigated conferences is representative for research of the different adopting units within the IS field as such.

Diffusion and adoption of technologies in social networks have been discussed lately; however, only one paper out of 36 discusses adoption at the group level of analysis (Harrington & Ruppel, 1999). They discuss practical and value compatibility and its relationship to telecommuting's adoption, diffusion and success among IS personnel. The study is therefore conducted in an organisational setting but the authors study group values, and therefore the paper has been classified as research at the group level. It should be mentioned that Sarker (2006) examined the levels of analysis issue in understanding technology adoption by groups. Sarker points out that groups should be investigated and "treated in their own right," and not as an aggregation of the individuals (Sarker, 2006, pp.1276) we concur with this point of view.

	# papers	IFIP 8.6	# papers	ECIS	# papers	ICIS
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Individual	3	1, 2, 6	17	7, 8, 9, 11, 12, 15, 16, 17, 18, 19, 20, 21, 25, 26, 27, 28, 29	5	30, 31, 33, 34, 35
Group / team	0	-	0	-	1	36
Organizational	2	3, 4	6	10, 13, 14, 22, 23, 24	1	32
Inter-organizational	0	-	0	-	0	-
Regional	1	5	0	-	0	-

Table III. Papers distributed on adopting unit of technologies

It can be argued that in the future researchers should conduct studies at the group level and within organisations. When investigating organisations, researchers should bear in mind that the internal structure of many organisations consists of working groups and teams with their own and not just a large number of individuals.

5.3.Context of research

The context in which the research in the investigated studies takes place is of great importance to research question posed. Most of the papers performing empirical data collection describe the context in which the study is performed with a fair amount of detail. When conducting research in the telecommunication industry it is necessary to capture local regulations and policies for the markets investigated as these may have considerable impact in explaining the adoption and diffusion of a telecommunication innovation. Constantiou & Papazafeiropoulou (2006) explains the Danish market in detail, when they investigate the provider's perspective in IP-telephony diffusion. Oh & Lee (2005) explain how alliances between mobile carriers, banks, and other related parties are formed, and analyse how technology affects competition and collaboration among them when a new convergence service is created by two, previously unrelated industries banks and mobile carriers as mobile carriers had a hidden agenda to enter the financial market. These information provide a deeper understanding of the market and thereby the adoption and diffusion

5.4.Theory

It is common for researchers to use an analytical framework in the analysis of diffusion and adoption studies. Rogers' (1995) Diffusion of Innovations is one of the often applied theories in numerous fields of study; still researchers have come to understand that other frameworks and theories might explain the diffusion and adoption of telecommunication technologies even better. There are still some gaps in the application of certain theoretical frameworks, and it is apparent from the table below that both the TRA and TPB or even more interesting the UTAUT are totally absent in the research conducted in this field of research the past ten years in contributions submitted to the three investigated conferences.

TAM is still the most applied theory in the field even though the application of the theory in this study seems moderate. 19% of the papers analyse technology acceptance using this theory. TAM has been widely criticised for not being falsifiable, questionable heuristic value, and limited explanatory and predictive power (e.g. Szajna, 1994). This could be the reason for the relatively diminished application. Researchers have attempted to explain (the lack of) diffusion and adoption of technologies using a variety of other theories relevant to the context they are investigating; for example, Walden et al. (2007) apply the Braudel rule as a theoretical framework to find out why and how mobile services can make sense as a basis for viable business. They paraphrased the Braudel rule by stating that “mobile services become mobile value services when they offer the possibility to expand the limits of the possible in the structure of everyday routines”. They found that the mobile services investigated did not satisfy the Braudel rule.

Haghirian & Madlberger (2005) use advertising theory to analyse the consumer attitude toward advertising via mobile devices in Austria, and Cheng & Arthur (2002) propose using the Trans-theoretical Model of Behaviour Change to explain the construction of a mobile internet healthcare solution for problem drinkers. Several papers choose not to apply a theoretical framework to their studies but instead conduct empirical data collection and analyse the results statistically (e.g. Abu-Samaha & Mansi, 2007).

Dahlberg & Mallat (2002) use consumer perceived value (Grönroos, 1997), technology acceptance model (Davis et. al., 1989), and network externalities theory (Shapiro & Varian, 1999) to explain managerial implications of consumer value perceptions in relation to mobile payment service development. The usage of the three theories is an attempt to impede the shortcomings of each theory individually. This implies a need for testing and evaluating more theories within the field of diffusion and adoption of telecommunication innovations to explain the observable facts.

	# papers	IFIP 8.6	# papers	ECIS	# papers	ICIS
DOI	2	1, 3	1	20	1	36
TAM / TRA	0	-	7	10, 13, 15, 19, 23, 25, 27	0	-
TPB	0	-	0	-	0	-
UTAUT	0	-	0	-	0	-
Other	3	4, 6, 7	10	7, 9, 12, 17, 18, 21, 22, 24, 26, 29	5	30, 31, 32, 33, 34, 35
None	2	2, 5	5	8, 11, 14, 16, 28	0	-

Table IV. *Papers employing the most applied theories of diffusion and adoption*

5.5. Cause and effect structure

Of the papers investigated 83% depict the relationship between a cause and an effect and only 17% of the papers take a process view and seek to explain how diffusion and adoption occurs over time. Most research within telecommunication theory takes a static view when investigating diffusion and adoption of technologies and thereby does not take into account that when an innovation is adopted and diffused by an adopting unit, the use of the innovation is further expanded and a transformation of the technology takes place. Wareham et al. (2002) is an example of a paper that tries to accommodate this shortcoming in research as they gather data in two stages to investigate the implications for the digital divide in wireless diffusion and mobile computing. The first sample of survey data is obtained in 1994 and contains information from 8,700 households, and the second sample is gathered in 1998 and contains over 16,000 households. Their results should be used to predict how mobile telecom diffusion may affect the digital divide as internet access is incorporated by smartphones and wireless.

Studies taking a process view provide a dynamic and thereby more realistic view on the diffusion process, and therefore more studies should be conducted to offer further insight.

A slight majority of the studies within the field take a positivistic approach – 56% - but the distribution of interpretive versus positivistic papers are fairly even.

	# papers	IFIP 8.6	# papers	ECIS	# papers	ICIS
Cause-effect	5	1, 2, 3, 4, 6	19	7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24, 25, 26, 27, 28	6	31, 32, 33, 34, 35, 36
Process	1	5	4	9, 18, 22, 29	1	30
Interpretive approach	5	1, 3, 4, 5, 6	9	10, 11, 13, 20, 21, 22, 24, 27, 28	4	30, 31, 32, 34
Positivistic approach	1	2	14	7, 8, 9, 12, 14, 15, 16, 17, 18, 19, 23, 25, 26, 29	3	33, 35, 36

Table IV. *Papers distributed on cause and effect structure*

6. Conclusion

This paper has provided a framework for analysing what we know and what we don't know about the diffusion and adoption of telecommunication innovations and provided insight into what aspects of the diffusion and adoption process are accentuated or overlooked using a general view of the process. Three conferences have been chosen in this analysis, as the coverage at these conferences spans IS research to a wide extent. Many important contributions have been accepted in a variety of journals and we do not claim that this literature study is comprehensive; however we believe that the elements within the diffusion and adoption framework are covered at these conferences.

Through our holistic framework, we found that most research has been conducted on the voluntary use of technologies targeting the individual. There is nearly a total absence of papers investigating the group and the inter-organisational level of adoption. As social networks have gained attention the past ten years, this is surprising and it is therefore recommended that further research into this level of adoption is performed.

Many different theories and frameworks are used to explain the adoption and diffusion of innovations, and TAM is used frequently. It seems that researchers apply theories not only linked to adoption and diffusion to investigate further explanations to the research problem in question but also theories from other fields of study and this trend is encouraging as there are no dominant theory that captures all relevant aspects of the telecommunication diffusion process adequately. Theories that look into the network externalities that the telecommunication technologies benefit from are especially interesting when seeking explanations for the diffusion and adoption.

Most studies take a cause-effect view in a snapshot in time and not a process view that could provide a dynamic and thereby more realistic view on the diffusion process and therefore more studies should be conducted to offer further insight. The distribution of interpretive versus positivistic approaches to the studies is equal and this trend should continue.

Finally, it is worth mentioning the emerging field of neuroeconomics that might complement diffusion and adoption research within information systems. Neuroeconomics seeks to develop our understanding of human behaviour and in particular the role of emotions and emotional response (Damasio 1994; Hansen and Christensen 2007; Seo and Baret 2007). As TAM has recently been criticized for redirecting researchers' attention away from the antecedents of beliefs, not taking the IT artifact or its design into account, neglecting important outcomes of information technology (Benbasat and Barki 2007), as well as reaching maturity (Venkatesh et al. 2007), Dimoka et al. (2007) have proposed the application of neuro-science theories, methods and tools to the field and labelled it Neuro-IS. The field might benefit from the exploration and exploitation of cognitive neuroscience to improve and advance information systems.

This paper contributes with an overview of the existing research within diffusion and adoption of telecommunications research and provides a suggestion for areas in which further research is needed: research is needed at the group level, continual research applying different theoretical views than the widely used DOI and technology acceptance theories (e.g. theories from the field of neuroeconomics) may capture new aspects of the telecommunication diffusion process and finally research taking a process view.

References

- Abu-Samaha, A. M. & I. Mansi (2007). "Information Technology Diffusion in the Jordanian Telecom Industry". Proceedings of the IFIP TC8 / WG 8.6. Tenth Working Conference on Organizational Dynamics of Technology-Based Innovation: Diversifying the Research Agenda. Pages 431-442.
- Adams, D. A., Nelson, R. R., & P. A. Todd (1992). "Perceived usefulness, ease of use, and usage of information technology: A replication". *MIS Quarterly* 16. Pages 227-247.
- Ajzen, I. and M. Fishbein (1974). "Factors Influencing Intentions and Intention-Behavior Relation." *Human Relations* 27(1). Pages 1-15.
- Ajzen, I. and M. Fishbein (1980). *Understanding Attitudes and Predicting Social Behaviour*, Prentice-Hall.
- Ajzen, I., Kuhl, J. And J. Beckman (1985). *From Intentions to Actions: A Theory of Planned Behaviour. Action Control: From Cognition to Behavior*, Springer.
- Anderson, J. E. and P. H. Schwager (2004). "SME Adoption of the Wireless LAN Technology: Applying the UTAUT Model". 7th Annual Conference of the Southern Association for Information Systems. Savannah.
- Banderker, N. & J.-P. Van Belle (2006). *Mobile Technology Adoption by Doctors in Public Healthcare in South Africa*. Proceedings of the 14th European Conference on Information Systems.
- Banker, R. D. and R. J. Kauffman (2004). "The Evolution of Research on Information Systems: A Fiftieth-year Survey of the Literature in Management Science." *Management Science* 50(3). Pages 281-298.
- Blechar, J., I. D. Constantiou, and J. Damsgaard (2006). "Exploring the Influence of Reference Situations and Reference Pricing on Mobile Service User Behaviour." *European Journal of Information Systems* 15(3). Pages 285-291.
- Breu, K. & C. Hemingway (2005). "The Impact of Mobile and Wireless Technology on Knowledge Workers: An Exploratory Study. Proceedings of the 13th European Conference on Information Systems.
- Carlsson, C., Carlsson, J, Hyvönen, K., Puhakainen, J and P. Walden (2006). "Adoption of Mobile Devices/Services – Searching for Answers with the UTAUT". Proceedings of the 39th Hawaii International Conference on System Sciences, Hawaii.
- Carlsson, C., Carlsson, J. & P. Walden (2005). "Mobile Services for the Hospitality Industry". Proceedings of the 13th European Conference on Information Systems.
- Cheng, E. & D. Arthur (2002). "Constructing a Virtual behaviour Change Support System: A Mobile Internet healthcare Solution for Problem Drinkers". Proceedings of the 10th European Conference on Information Systems.
- Choudrie, J. & Y. Dwivedi (2005). "Investigating Broadband Diffusion in the Household: Towards Content Validity and Pre-Test of the Survey Instrument. Proceedings of the 13th European Conference on Information Systems.
- Choudrie, J., Papazafeiropoulou & H. Lee (2003). "Applying Stakeholder Theory to Analyse the Diffusion of Broadband in South Korea: the Importance of the Government's Role". Proceedings of the 11th European Conference on Information Systems.
- Constantiou, I. D., J. Damsgaard and L. Knutsen (2007). "The Four Incremental Steps toward Advanced Mobile Service Adoption." *Communications of the ACM* 50(6). Pages 51-55.
- Constantiou, I. D., J. Damsgaard and L. Knutsen (2005). "Beware of Dane-geld: Even if Paid, M-Service Adoption Can be Slow". Proceedings of the 13th European Conference on Information Systems.
- Constantiou, I. & A. Papazafeiropoulou (2006). "The Providers' Perspective in IP-Telephony Diffusion: Insights from the Danish Market". Proceedings of the 14th European Conference on Information Systems.

- Coursaris, C., Hassanein, K., Head, M. & Bontis, N. (2007). "The impact of distractions on the usability and the adoption of mobile devices for wireless data services". Proceedings of the 15th European Conference on Information Systems.
- Dahlberg, T. & N. Mallat (2002). "Mobile Payment Service Development – Managerial Implications of Consumer Value Perceptions. Proceedings of the 10th European Conference on Information Systems.
- Damsgaard, J. & P. Gao (2004). "Mobile Telecommunications Market Innovation: the Transformation from 2G to 3G. Proceedings of the 12th European Conference on Information Systems.
- Damsgaard, J. and C. Kelleher (2007). „What drives Innovation Usage and Adoption”. Proceedings of the Sixth Annual Global Mobility Roundtable. Los Angeles, CA
- Damsgaard, Jan and K. Lyytinen (2001). "The Role of Intermediating Institutions in Diffusion of Electronic Data Interchange (EDI): How Industry Associations in the Grocery Sector Intervened in Hong Kong, Finland, and Denmark". The Information Society, 17(3). Pages 195 - 210.
- Damsgaard, J. and K. Lyytinen (1996). "Government Strategies to Promote the Diffusion of Electronic Data Interchange (EDI): What we Know and What we don't Know." Information Infrastructure and Policy 5(3).
- Davis, F. D. (1989). "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology." MIS Quarterly 13(3): Pages 319-340.
- Dutta, A. & R. Roy (2001). "The Mechanics of Internet Diffusion in India: Lessons for Developing Countries". Proceedings of the 22nd International Conference on Information Systems.
- Dwivedi, Y. K., Choudrie, J. & V. Weerakkody (2006). "Broadband Adoption in the UK Household: Towards Reliability and Construct Validity of a Survey Instrument". Proceedings of the 14th European Conference on Information Systems.
- Economides, N. and S. C. Salop (1992). "Competition and Integration among Complements, and Network Market-Structure." Journal of Industrial Economics 40(1). Pages 105-123.
- Goh, K.-Y., Lee, C & C. Lee (2003). „Information Technology Product Bundling in the Presence of Complementarities, Quality Uncertainty and Network Effects: An Agent-Based Approach“. Proceedings of the 24th International Conference on Information Systems.
- Grönroos, C. (1997). Value-driven Relational Marketing: from Products to Resources and Competences. Journal of Marketing Management, 13(5). Pages 407-439.
- Haghirian, P. & M. Madlberger (2005). "Consumer Attitude Toward Advertising via Mobile Devices – An Empirical Investigation Among Austrian Users. Proceedings of the 13th European Conference on Information Systems.
- Hampe, F. & G. Schwabe (2002). "Enhancing Mobile Commerce: Instant Music Purchasing over the Air". Proceeding of the IFIP TG8 / WG 8.6. Fifth Working Conference on Seeking Success in E-business – A Multidisciplinary Approach. Pages 107-131.
- Harrington, S. & C. Ruppel (1998). "Practical and Value Compatibility: Their Roles in the Adoption, Diffusion and Success of Telecommuting". Proceedings of the 19th International Conference on Information Systems.
- Katz, M. L. and C. Shapiro (1986). "Technology Adoption in the Presence of Network Externalities." Journal of Political Economy 94(4). Pages 822-841.
- King, J. L., Gurbaxani, V., Kraemer, K. L., McFarlan, F. W., Raman, K. S., and Yap, C. S. (1994). "Institutional Factors in Information Technology Innovation". Information Systems Research, 5(2). Pages 139-169.
- Knebel U., Leimeister, J. M. & H. Krcmar (2007). „Personal Mobile Sports Companion: Design and Evaluation of IT-Supported Product-Service Bundles in the Sports Industry. Proceedings of the 15th European Conference on Information Systems.
- Leimeister, J.-M., Daum, M. & H. Krcmar (2002). „Mobile Virtual Healthcare Communities: an Approach to Community Engineering for Cancer Patients“. Proceedings of the 10th European Conference on Information Systems.
- Lin, S. & M. W. Chiasson (2007). "A Dynamic Approach to Context Diffusion Research: An Actor-Network Theory Study of Mobile TV Service". Proceedings of the IFIP TC8 / WG 8.6. Tenth

- Working Conference on Organizational Dynamics of Technology-Based Innovation: Diversifying the Research Agenda. Pages 315-330.
- Lyytinen, K. and J. Damsgaard (2001). "What's Wrong with Diffusion of Innovations Theory?" Proceedings of the IFIP TC8 / WG 8.1. Fourth Working Conference on Diffusing Software Products and Process Innovations. Pages: 173 – 190.
- Mahler, A. and E. M. Rogers (1999). "The Diffusion of Interactive Communication Innovations and the Critical Mass - the Adoption of Telecommunications Services by German Banks." *Telecommunications Policy* 23. Pages 719-740.
- Markus, M. L. and Robey, D. (1988). "Information Technology and Organizational Change: Causal Structure in Theory and Research". *Management Science*, 34 (5). Pages 583-598
- McManus, P. & C. Standing (2004). "The Value of Life Histories in Researching the Adoption and Use of M-Services". Proceedings of the 12th European Conference on Information Systems.
- Melody, W. H. (1999). "Telecom Reform: Progress and Prospects". *Telecommunications Policy* 23 (1). Pages 7-34.
- Middleton, C. (2002). "Exploring Consumer demand for Networked Services: The Importance of Content, Connectivity and Killer Apps in the Diffusion of Broadband and Mobile Services". Proceedings of the 23rd International Conference on Information Systems.
- Moore, G. C. and I. Benbasat (1991). "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation." *Information Systems Research* 2(3). Pages 192-222.
- Muzzi, C. & K. Kautz (2003). "Information and Communication Technologies Diffusion in Industrial Districts". Proceedings of the IFIP TC8 / WG 8.6. Sixth Working Conference on Networked Information Technologies Diffusion and Adoption. Pages 19-39.
- Ney, M., Schätz, B., Höck, J. & C. Salzmann, (2004). "Introducing Mobility: The mPolice Project". Proceedings of the IFIP TC8 / WG 8.6 Seventh Working Conference on IT Innovation and Competitiveness. Pages 383-405.
- Oh, S. & H. Lee (2005). "How Technology Shapes the Actor-Network of Convergence Services: a Case of Mobile Banking". Proceedings of the 26th International Conference on Information Systems.
- Pedersen and Ling (2003). "Modifying Adoption Research for Mobile Internet Service Adoption Crossdisciplinary". Hawaii International Conference on System Sciences. Hawaii.
- Petrazzeni, B. A. (1995). "The Political Economy of Telecommunications Reform in Developing Countries: Privatization and Liberalization in Comparative Perspective". Praeger Publishers.
- Rogers, E. M. (1995). *Diffusion of Innovations*, Free Press.
- Sarker, S. (2006). "Examining the 'Level of Analysis' Issue in Understanding Technology Adoption by Groups - Social, Behavioral, and Organizational Aspects of Information Systems". Proceedings of the 27th International Conference on Information Systems.
- Scheepers, H. & J. McKay (2004). "An Empirical Assessment of the Business Value Derived from Implementing Mobile Technology. A Case Study of Two Organisations". Proceedings of the 12th European Conference on Information Systems.
- Scheepers, H. & R. Scheepers (2004). "The Implementation of Mobile Technology in organizations: Expanding Individual Use Contexts". of the 25th International Conference on Information Systems.
- Sell, A., Patokorpi, E., Walden, P. & B. Anckar (2004). „Adoption of Mobile Technology: An Empirical Study on Females Working in Elderly Care“. Proceedings of the 12th European Conference on Information Systems.
- Shapiro, C. and H.R. Varian (1999). "Information Rules: A strategic Guide to the Network Economy". Harvard Business School Press, Boston, Mass., 1999.
- Stanoevska-Slabeva, K. & R. Hoegg (2005). "Towards Guidelines for Design of Mobile Services". Proceedings of the 13th European Conference on Information Systems.
- Szajna, B. (1994). Software Evaluation and Choice: Predictive Evaluation of the Technology Acceptance Instrument. *MIS Quarterly*, 18(3). Pages 319-324
- Thirtle, C. G. and V. W. Ruttan (1987). "The Role of Demand and Supply in the Generation and Diffusion of Technical Change". Harwood Academic Publishers. Routledge. Switzerland.

- Tornatzky, L. G. and Klein, K. J. (1982). Innovation Characteristics and Adoption-Implementation. IEEE Transactions on Engineering Management, EM-29(1). Pages 28-45.
- Van der Heijden (2003). "Measuring Attitudes Towards Mobile Information Services: an Empirical Validation of the HED/UT Scale". Proceedings of the 11th European Conference on Information Systems.
- Van der Heijden, H., Ogertschig, M. & L. Van der Gaast (2005). „Effects of Context Relevance and Perceived Risk on User Acceptance of Mobile Information Services“. Proceedings of the 13th European Conference on Information Systems.
- Venkatesh, V., M. G. Morris, P. L. Ackerman (2000). "A Longitudinal Field Investigation of Gender Differences in Individual Technology Adoption Decision-Making Processes." Organizational Behavior and Human Decision Processes 83(1). Pages 33-60.
- Venkatesh, V., Morris, M. G., Davis, G. B. and F. D. Davis (2003). "User Acceptance of Information Technology: Toward a Unified View." MIS Quarterly 27(3). Pages 425-478.
- Wainwright, D. W. & T. S. Waring, (2006). "The Politics of ICT Diffusion: A Case Study in a UK Primary Health Care Trust". Proceedings of the IFIP TC8 / WG 8.6. Ninth Working Conference on Transfer and Diffusion of Information Technology for Organizational Resilience. Pages 71-90.
- Walden, P., Han, S., Carlsson, C & P. Majlender (2007). "The Sleeping Giant – A Longitudinal Study Surveying the Mobile Service Market in Finland". Proceedings of the 15th European Conference on Information Systems.
- Wang, Y. & Y. Yuan (2006). "The Role of SMS in Mobile Data Service Diffusion in China: A Longitudinal Case Study Based on Actor-Network Theory". Proceedings of the 27th International Conference on Information Systems.
- Wareham, J., Levy, A. & K. Cousins (2002). "Wireless Diffusion and Mobile Computing: Implications for the Digital Divide". Proceedings of the 10th European Conference on Information Systems.
- Yoo, Y., Lyytinen, K. and H. D. Yang (2002). "The Role of Standards in Innovation and Diffusion of Broadband Mobile Services: The Case of South Korea." Journal of Strategic Information Systems 14(3). Pages 323-353.
- Zmud, R. W. (1984). "An Examination of Push-Pull Theory Applied to Process Innovation in Knowledge Work." Management Science 30(6). Pages 727-738.

Appendix

This table provides an overview of the papers analysed from the IFIP 8.6, ECIS and ICIS conference from 1998 – 2007. The table shows all elements of the framework for each conference contribution. For further information on the papers, see the References.

ID	Author	Title	Conference	Year	Compulsory /Voluntary	With/without Network effects	Adopting unit	Interaction	Theory	Cause effect/ Process	Methodology
1	Lin & Chiasson	A dynamic approach to context diffusion research: An actor-network theory study of mobile TV service	IFIP 8.6	2007	V	WO	I	Pull	DOI, other	C-E	I
2	Abu-Samaha & Mansi	Information technology diffusion in the Jordanian telecom industry	IFIP 8.6	2007	V	W	I	Pull	None	C-E	P
3	Wainwright & Waring	The politics of ICT diffusion: A case study in a UK primary health care trust	IFIP 8.6	1998	V	WO	O	Pull	DOI	C-E	I
4	Ney, Schätz, Höck, Salzmann	Introducing mobility: The mPolice project	IFIP 8.6	2004	C	W	O	Pull	Other	C-E	I
5	Muzzi & Kautz	Information and communication technologies diffusion in Industrial districts	IFIP 8.6	2003	C	WO	R	Push	None	Process	I
6	Hampe & Schwabe	Enhancing mobile commerce: Instant music purchasing over the air	IFIP 8.6	2002	V	WO	I	Pull	Other	C-E	I
7	Coursaris & Hassanein & Head & Bontis	The impact of distractions on the usability and the adoption of mobile devices for wireless data services	ECIS	2007	V	WO	I	Pull	Other	C-E	P
8	Knebel & Leimeister & Krcmar	Personal mobile sports companion - Design and evaluation of IT-supported product-service bundles in the sports industry	ECIS	2007	V	WO	I	Pull	None	C-E	P
9	Walden & Han & Carlsson &	The sleeping giant - a longitudinal study surveying the mobile service market in	ECIS	2007	V	WO	I	Pull	Other	Process	P

	Majlender	Finland									
10	Banderker & VanBell	Mobile technology adoption by doctors in public healthcare in South Africa	ECIS	2006	C	WO	O	Pull	TAM	C-E	I
11	Constantiou & Papazafeiropoulou	The providers perspective in IP-telephony diffusion - Insight from the Danish market	ECIS	2006	V	W	I	Pull	None	C-E	I
12	Dwivedi & Choudrie & Weerakkody	Broadband adoption in the UK household - Towards reliability and construct validity of a survey instrument	ECIS	2006	V	WO	I	Push	Other	C-E	P
13	Breu & Hemingway & Ashurst	The impact of mobile and wireless technology on knowledge workers - an exploratory study	ECIS	2005	V	WO	O	Pull	TAM	C-E	I
14	Carlsson & Carlsson & Walden	Mobile services for the hospitality industry	ECIS	2005	V	WO	O	Pull	None	C-E	P
15	Choudrie & Dwivedi	Investigating broadband diffusion in the household	ECIS	2005	V	WO	I	Push	TAM, DOI	C-E	P
16	Constantiou & Damsgaard & Knutsen	Beware of Dane-geld - Even if paid-m-service adoption can be slow	ECIS	2005	V	WO	I	Push	None	C-E	P
17	Haghirian & Madlberger	Consumer attitude toward advertising via mobile devices - an empirical investigation among Austrian users	ECIS	2005	V	WO	I	Push	Other	C-E	P
18	Stanoevska-Slabeva & Hoegg	Towards guidelines for design of mobile services	ECIS	2005	V	WO	I	Pull	Other	Process	P
19	Van der Heijden & Ogertschnig & Van der Gaast	Effects of context relevance and perceived risk on user acceptance of mobile information services	ECIS	2005	V	WO	I	Pull	TAM	C-E	P
20	Damsgaard & Gao	Mobile telecommunications market innovation - the transformation from 2G to 3G	ECIS	2004	V	WO	I	Pull	DOI, other	C-E	I

21	McManus & Standing	The value of life histories in researching the adoption and use of m-services	ECIS	2004	V	WO	I	Pull	Other	C-E	I
22	Scheepers & McKay	An empirical assessment of business value derived from implementing mobile technology - a case study of two organisations	ECIS	2004	C	WO	O	Pull	Other	Process	I
23	Sell & Patokorpi & Walden & Anckar	Adoption of mobile communication technology - an empirical study on females working in elderly care	ECIS	2004	C	WO	O	Pull	TAM	C-E	P
24	Choudrie & Papazafeiropoulou	Applying stakeholder theory to analyse the diffusion of broadband in South Korea	ECIS	2003	V	WO	O	Pull	Other	C-E	I
25	Van der Heijden	Measuring attitudes towards Mobile Information Services - An empirical validation of the HED-UT scale	ECIS	2002	V	WO	I	Pull	TAM	C-E	P
26	Cheng & Arthur	Constructing a virtual behaviour change support system - A mobile internet healthcare solution for problem drinkers	ECIS	2002	V	WO	I	Pull	Other	C-E	P
27	Dahlberg & Mallat	Mobile payment service development - managerial implications of consumer value perceptions	ECIS	2002	V	WO	I	Pull	TAM, other	C-E	I
28	Leimeister & Daum & Krcmar	Mobile virtual healthcare communities - an approach to community engineering for cancer patients	ECIS	2002	V	WO	I	Pull	None	C-E	I
29	Wareham & Levy & Cousins	Wireless diffusion and mobile computing - Implications for the digital divide	ECIS	2002	V	WO	I	Pull	Other	Process	P
30	Wang & Yan	The role of SMS in mobile data service-Diffusion in China-Longitudinal case study based on ANT	ICIS	2006	V	W	I	Push	Other	Process	I
31	Oh & Lee	How technology shapes the Actor-Network of convergence	ICIS	2005	V	WO	I	Push	Other	C-E	I

		services-Case of mobile banking									
32	Scheepers & Scheepers	The implementation of mobile technology in organizations-expanding individual use contexts	ICIS	2004	C	WO	O	Push	Other	C-E	I
33	Goh & Lee & Lee	IT product bundling in presence of complementarities, quality-uncertainty and network effects-an agent-based approach	ICIS	2003	V	WO	I	Push	Other	C-E	P
34	Middleton	Exploring consumer demand for networked services-the importance of content, connectivity and killer apps in the diffusion of broadband and mobile services	ICIS	2002	V	W	I	Pull	Other	C-E	I
35	Dutta & Roy	The mechanics of Internet diffusion in India: Lessons for developing countries	ICIS	2001	V	WO	I	Push	Other	C-E	P
36	Harrington & Ruppel	Practical and value compatibility - their roles in the adoption, diffusion and success of telecommuting	ICIS	1999	C	W	G	Push	DOI	C-E	P