

How to predict the future of an IT-innovation? – Examining Pre-adoption of the e-newspaper

Ihlström Eriksson, C. & Svensson, J.
Halmstad University
P.O Box 823
S-301 81 Halmstad, Sweden
{Carina.Ihlstrom_Eriksson, jesper.svensson}@hh.se

Abstract

In this study we investigate the perceptions of potential adopters in a pre-adoption phase of a new mobile innovation, i.e. the e-newspaper, a newspaper service published on e-paper technology, by applying Rogers' (1995) Innovation-Decision Process and perceived attributes of innovations. We have conducted a study in two stages, in 2005 and 2006, with user evaluations of e-newspaper prototypes and early version of an e-newspaper, including tests, questionnaires and interviews. The overall research question is: What attributes are central from a user adoption perspective to launch a successful e-newspaper innovation? The paper contributes to existing adoption and m-commerce research by a) exploring the applicability of Rogers' framework in a pre-adoption phase in two stages, comparing the results regarding perceived attributes and intention to adopt, and b) presenting detailed descriptions of factors that enhance or inhibit an e-newspaper introduction, compared to other publication channels. The identified factors influencing the intention to adopt besides price are; mobility, interactivity, readability, format and size, functionality, usability and navigation.

1. Introduction

The ongoing diffusion of personal computers, handheld devices, and mobile telephones (Lyytinen & Yoo, 2002) as well as the advent of new technologies such as the e-paper, creates new opportunities for the newspaper industry. Newspaper companies are facing a new mobile innovation, the e-newspaper, which has captured the interest of the industry [1;2]. An e-newspaper is a newspaper service published on e-paper technology, i.e. both the device and the

services. The main advantage with e-paper technology is that it is reflecting, giving the same reader experience as paper (such as high contrast with 160 dpi, and the possibility to read in sunlight) and is portable, thin, flexible and non-sensitive. The e-newspaper concept supports mobility in the sense of allowing updated news anytime and anywhere. E-paper technology is developing rapidly and many actors invest in “plastic electronics” [3;4], which is predicted to become a multi million industrial process [5].

Lately, the newspaper industry has faced declining subscription and advertising revenues, forcing them to seek new alternative ways to profit and to attract new audiences (WAN, 2006). The potential replacement of the printed edition with the e-newspaper in the future would dramatically reduce production and distribution costs, making it an interesting prospect. Moreover, there is a belief within the branch that the e-newspaper could reach new audiences, e.g. young people. However, it is essential to reach a critical mass of readers in order to attract advertisers into this new media form (Ihlström, 2005).

Most newspaper companies have evolved into media houses during the last decade, publishing in multiple channels. They started by publishing digitally on the web in the mid-nineties and online newspapers have since then found their own form and content to attract both audience and advertisers (Ihlström & Henfridsson, 2005). Next in line was the mobile services offered to mobile phones and PDAs, though they are still trying to find the form and content to attract a wider audience and advertisers. Now, the e-newspaper is arriving, merging the best from print and online, with the potential of becoming an alternative mobile channel (Ihlström *et al.*, 2004).

In Japan, the mobile channel has been the most common point of access to online services for years (Ratcliff, 2002), but the adoption of mobile services has not taken off as expected in Europe (Hammond, 2001; Carlsson *et al.*, 2006). This is strange as the penetration of mobile phones is very high, e.g. countries like Italy and Sweden reached a 110% penetration rate in 2006 [6]. This phenomenon has attracted researchers to study the adoption of mobile services (e.g. Constantiou *et al.*, 2004; Fife & Pereira, 2005; Mallat, 2006; Blechar *et al.*, 2006).

Despite the promises of the e-newspaper, there are a lot of challenges to meet for a successful adoption. One challenge is that the e-newspaper concerns both the adoption of new technology, i.e. the device, and the adoption of new services, thus making it an interesting case to study from an adoption point-of-view. However, as e-newspapers have not yet reached the European market (Yantai Media Group is the only company that has started to publish e-newspapers, they started in China during 2006), we have not been able to study the actual adoption.

This study focus on exploring the pre-adoption phase, inspired by Karahanna *et al.* (1999), who argue the benefits of exploring this phase. We investigate the perceptions of potential adopters by applying Rogers’ (1995) Innovation-Decision Process and perceived attributes of innovations. This study consists of user

evaluations of e-newspaper prototypes in 2005, and an early version of an e-newspaper in 2006, representing different stages in the pre-adoption phase. The use of mock-ups (pre-prototypes) in adoption research has earlier been used by e.g. Davis and Venkatesh (2004).

The aim of this paper is to explore the applicability of Rogers' framework in a pre-adoption phase in two stages, comparing the results regarding perceived attributes and intention to adopt. The overall research question is: What attributes are central from a user adoption perspective to launch a successful e-newspaper innovation?

The contribution of this paper to existing adoption and m-commerce research is twofold, i.e. by:

- exploring the applicability of Rogers' framework in a pre-adoption phase, using prototypes and early version of an e-newspaper, and
- empirically examine and compare different stages of the pre-adoption phase, presenting detailed descriptions of factors that enhance or inhibit an e-newspaper, compared to other publication channels.

The paper also contributes with practical implications for further development of the e-newspaper to device and service producers.

2. Theory

One of the most well cited diffusion theories is the Innovation Diffusion Theory (IDT) (Rogers, 1995), which explains the process of the Innovation-Decision Process, the determinants of the rate of adoption, and various categories of adopters. The Innovation-Decision Process consists of five stages, 1) knowledge, 2) persuasion, 3) decision, 4) implementation and 5) confirmation. In the second stage, the persuasion stage, the general perception of the innovation is developed which is explained by the perceived attributes (Rogers, 1995).

Rogers (1995) states that potential adopters judge an innovation based on their perceptions in regard to five attributes of the innovation, i.e. a) relative advantage, b) compatibility, c) complexity, d) trialability and e) observability. The relative advantage regards the added values compared to existing artifacts, compatibility is to what extent it fits in the users existing needs, values and experiences. Complexity concerns the perception of effort required to learn to use the new artifact. The extent to which the artifact can be tested and tried out is referred to as trialability and influences the acceptance of the new artifact. Finally, observability is an expression for that the more users you see using the new artifact, the more likely you are to try it out yourself.

Tornatzky and Klein (1982) have performed a review and a meta-analysis of 75 articles concerning innovation characteristics and their relationship to innovation

adoption. The authors assessed the generality and consistency of the empirical findings of the reviewed studies and concluded that compatibility, relative advantage and complexity, are the characteristics that had the most significant relationship to innovation adoption.

Rogers' (1995) diffusion theory has been used in several studies within the m-commerce field, for example regarding adoption of mobile payments (Mallat, 2006). The author has a qualitative approach using focus groups, investigating the users perceived attributes of mobile payment. The article identifies several barriers to adoption, including price, complexity and lack of merchant acceptance. Rogers' theory also serves as a base for the Global Adoption of Technology (GAT) model, proposed by Fife and Pereira (2005). This model incorporates culture in a higher degree as a mean to explain variances in mobile service adoption between national markets. Their study indicates that qualities affecting adoption of mobile services are foremost productivity and convenience.

In addition to Rogers's diffusion theory, there are other theoretical frameworks that explain technology diffusion and adoption, predicting potential user acceptance, e.g. the Technology Acceptance Model (TAM) (Davis, 1989), which primarily focus on the factors perceived usefulness and perceived ease of use to explain technology acceptance. This model has been used, modified or questioned within the m-commerce field by several authors, e.g. Pedersen and Nysveen (2003), who argues that TAM needs to extend its factors when applied in the field of mobile services. There is a difference in the user's motives when using traditional ICT compared to for example mobile services. In the latter, the authors argue that the motivational influence of self-expressiveness needs to be incorporated.

Another framework, the Unified Theory of Acceptance and Use of Technology (UTAUT), has been proposed as a unified model for explaining user acceptance by Venkatesh *et al.* (2003). This model was statistically proven to outperform eight traditional user acceptance models regarding the predictions of success for new technology introductions. This unified model has been applied in the m-commerce field by for example Carlsson *et al.* (2006) who tried to explain the acceptance of mobile devices/services. They conclude that UTAUT could be used as a starting point to find some explanations, if somewhat modified.

Karahanna *et al.* (1999) makes a distinction between the pre-adoption and post-adoption phase of an innovation and found differences in the attitudes towards the innovation in the two stages, e.g. they found that the pre-adopters had a much wider array of perceived characteristics influencing their intention to adopt the technology. They argue for the importance of further research concerning the distinction between these two phases. Davis and Venkatesh (2004) have also investigated user acceptance early in the development process by using TAM on product concepts with the help of mock-ups, suggesting that mock-ups can

successfully be used to assess the usefulness of an indented system in a pre-prototype phase.

Our study investigates the perceptions of potential adopters in a pre-adoption phase by applying Rogers' (1995) Innovation-Decision Process and perceived attributes of innovations. Our study of the pre-adoption phase was enabled by using prototypes and early versions of the e-newspaper. We focus on Rogers attributes concerning relative advantage, compatibility and complexity. Since the e-newspaper has not yet reached the European market, trialability and observability are not included. Relative advantage and compatibility have been identified as particularly important in past research (Rogers, 2003). According to Tornatzky and Klein (1982), these two constructs as well as the complexity construct, have provided the most consistent explanation on the technology adoption decision.

3. Research Method

This research is an example of a multi-method approach (Mingers & Gill, 1997; Mingers, 2001), and has been conducted within two projects, i.e. DigiNews (ITEA 03015) and UbiMedia (Designing Ubiquitous Media Services through Action Research). The research started within the DigiNews project, which was a two year project including partners from Belgium, Spain, Netherlands, France and Sweden and consisted of several major technology firms, media houses and universities. The overall goal was to explore research and development issues for the future e-newspaper, i.e. a newspaper published on e-paper technology. After the DigiNews project ended in mid-year 2006, the research continued within the UbiMedia project, which is a Swedish project with partners from 9 Swedish newspapers, the Swedish Newspaper Publishers' Association and Stampen (a parent company for several newspapers, printing houses and distribution companies). This two-year project targets the challenge of designing ubiquitous media services for a multitude of devices and contexts to be consumed anytime and anywhere.

The study presented in this paper concerns user preferences and intention to adopt e-newspapers, and reports from two stages of the pre-adoption phase, with user evaluations in 2005 and 2006. These user evaluations included multiple data collection activities (Table 1), which is also in line with the recommendations for m-commerce research by Lehner and Watson (2001).

Phase	Year	No. of respondents	Duration	Design			
1	2005	36	2 hours	test 75 minutes	structured interview 45 minutes	questionnaire	
2	2006	12	2 weeks	questionnaire	daily activities with online diary, specific questions and critical incidents	semi-structured interview 90 minutes	questionnaire

Table 1. User evaluations

In the first stage three e-newspaper prototypes were used, developed within the DigiNews project in collaboration with newspaper designers (see Svensson & Hakeröd, 2006). As the e-paper technology was not available at this time, we chose to test the prototypes on tablet PCs, which enabled the use of color and multimedia not possible in the second evaluation where actual e-paper devices were used. The three prototypes from Aftonbladet, a national evening press (Figure 1), Göteborgs-Posten, a major regional newspaper (Figure 2), and Sundsvalls Tidning, a local morning paper (Figure 3), were tested with 36 users in the autumn of 2005. Each respondent tested two different prototypes in the evaluation. The selection of respondents was made to secure a diversity of gender, age, and familiarity with the paper version of the corresponding newspaper. There was an even gender selection, six respondents were in the ages between 15-24, 12 between 25-44, 12 between 45-64 and six respondents were over 65 years.



Figure 1. The Aftonbladet Prototype in A4 format



Figure 2. The Göteborgs-Posten prototype in A5 format



Figure 3. The Sundsvalls Tidning prototype in A5

The first evaluation was designed to test different design solutions as well as to investigate user attitudes towards the e-newspaper concept and consisted of a 75 minutes test, a 45 minutes structured interview, and was ended with a questionnaire (Table 1).

The respondents were asked to think aloud (Dumas, 2003) during the tests, which were recorded on video and mp3. The test itself mainly focused on navigational and design related issues which have been reported in Svensson and Hakeröd (2006) and these results are not included in this paper. However, the test itself made the respondents familiar with the prototypes and the e-newspaper concept, which was essential for the following interview and the questionnaire.

A structured interview approach (Patton, 2002) with 47 questions divided into five themes was used. These themes were: a) user experience, b) e-newspaper versus other media, c) preferred e-newspaper services, d) willingness to pay/

business models, and e) advertisement preferences. At each interview two researchers were present, one leading the interview and one taking notes. The interviews were all recorded and stored in a database, question by question, and were thereafter transcribed by members of the research team. A coding technique (Miles & Huberman, 1994) was used when analyzing the answers of each question separately, where similar answers were clustered into categories.

The questionnaire consisted of 19 questions. These questions mostly concerned adoption, preferences and media habits. In this paper, we only use descriptive statistics for this data when comparing the results from the two evaluations.

In the second stage, the evaluation was conducted with 10 families who tested an early version of an e-newspaper published on an actual e-paper device (i.e. the iRex iLiad) in real-life settings over a two week period in the autumn of 2006. The iRex iLiad has an 8.1-inch display with a resolution of 768x1024 pixels (160 dpi) with 16 levels of grayscale and supports WLAN and LAN connections.

The e-newspaper of Sundsvalls Tidning (Figure 4) was published twice daily, at 6 pm and 1 am, and was downloadable via Internet. The respondents were foremost selected to represent different types of households such as singles, couples, families with children, and senior citizens, to secure different use patterns, but we also tried to get differences in gender, ages, occupation and education. In two of the families both adults participated in the evaluation, resulting in a total of 12 respondents, consisting of three females and nine males in the ages between 21 and 69.



Figure 4. E-newspaper prototype in iRex iLiad



Figure 5. Home setting

The second evaluation was designed to more specifically explore pros and cons with an early version of an e-newspaper, as well as the users' preferences and intentions to adopt (Table 1). This evaluation consisted of a two week test, two questionnaires (one before and one after the test), daily online activities (diary, questions and critical incidents), and a 90 minutes semi-structured interview.

The two-week evaluation started with a meeting in Sundsvall, where the respondents were introduced to the device, and got a questionnaire about their media and reading habits. The test design was explained and they signed an agreement, assuring their active participation through daily online activities, e.g.

writing a diary, answering three specific questions and reporting critical incidents daily on the test web site. The answers to the questionnaire and the daily activities were all stored in a database.

After two weeks of e-newspaper use, the respondents were visited in their homes (Figure 5) for an interview about their experiences and preferences of the e-newspaper. A semi-structured interview approach (Patton, 2002), with an interview guide consisting of 5 themes were used. The themes corresponded to the themes in the first evaluation. Our set-up for the interview, i.e. one researcher asking the questions and the others listening and taking notes, allowed for a detailed discussion within the research team after each interview. The interviews were recorded and transcribed by a professional audio typist. The transcriptions (~310 pages) were corrected by the authors. In order to analyze the data collected, patterns were identified in the transcribed material by using a coding system (Miles & Huberman, 1994).

Finally, the respondents received a questionnaire consisting of 14 questions which matched the questionnaire of the first evaluation. This data was handled in the same way as in the first evaluation.

4. Empirical Findings

In this section our findings are presented according to Rogers' (1995) constructs regarding relative advantage, compability and complexity. In addition, we present issues regarding intention to adopt the e-newspaper.

4.1 Relative advantage

In the prototype test, the 36 users were asked what opportunities they envisioned with the e-newspaper and what problems the e-newspaper solves. In Table 2 the answers are clustered into four categories, some answers are mapped into more than one category.

Opportunities with an e-newspaper			
Availability of news 10	Updated news 10	Easier and more agile reading compared to paper 9	Multimedia, interactivity, more functionality 9
Problems that an e-newspaper solves			
Easier and more agile compared to paper 13	Do not have to handle and throw away paper 10	Updated news 8	Availability of news 4

Table 2. Opportunities and problem solved by the e-newspaper

In the interviews after the final test with the iRex iLiad, the most commonly mentioned problem solved regarding the consumption of news, was the ability to bring the newspaper with you on travel and still get local news every day. Many

were also positive towards not having to get the newspaper from the mailbox, and having less paper to recycle. Finally, some users were positive to gather all reading to one device.

Data from the prototype test concerning the relative advantage compared to the traditional newspaper and the online newspaper is presented in Table 3.

Added value or benefits compared to the traditional newspaper					
Updated news 14	Availability 12	Easier to get an overview and to navigate 9	Do not have to throw away and handle paper 8	Multimedia and interactivity, 6	A smaller format 6
Added value or benefits compared to the online newspaper					
Laid back reading 22	Able to finish the newspaper, better newspaper feeling 9	Easier to navigate, better overview, easier to use 6			

Table 3. Added value or benefits compared to the traditional and online newspaper

The interviews after the final test with the iRex iLiad also concerned comparison of different media. The opinions were quite scattered, but some thought the experience was as good as with the traditional newspaper. The most frequently mentioned positive aspect was the updated news, i.e. new editions during the day. Compared to the online edition the users thought that the e-newspaper had a much higher readability and gave a more laid back reading experience.

In sum, we identified three factors related to relative advantage that influence the intention to adopt the e-newspaper, i.e. *mobility, interactivity and readability*.

4.2 Compability

In the prototype test we asked about disadvantages with the e-newspaper (Table 4).

Problems created by the e-newspaper					
Unstable technology 7	Can not share the newspaper in the morning 6	An object of value 5	Could be more expensive 4	Must charge it, both the batteries and the news 3	
Disadvantages compared to the traditional newspaper					
More difficult to use, harder to navigate 7	Can not share the newspaper in the morning 5	An object of value 5	Risk that you will not be surprised by the news 3	Technical errors 3	Must be recharged 3
Disadvantages compared to the online newspaper					
An object of value 5	Internet contains a lot more than just a newspaper 3	The www is free 3	Always connected on the web 2	No scrollbar 2	

Table 4. Problems and disadvantages with the e-newspaper

The interviews following the final test with the iRex iLiad also concerned problems and disadvantages compared to other media. The most frequently mentioned problem was the lack of a save and print function. Other concerns were about the need to be more careful with the device, and that it needed Internet connection as well as batteries. Furthermore, others mentioned problems regarded

getting an overview of the content and of sharing the device. Almost half of the users mentioned negative aspects such as it sometimes malfunctioned, and had a slow refresh rate, as one of the users remarked: *“The visual part is just fine, the rest is like being in a hurry and get behind a tractor on the highway”*.

Overall the users thought the size of the e-reader was acceptable, with opinions ranging from being too small, to the possibility of being even smaller. Still, more than half of the users favored the actual size which enabled mobility, as illustrated by one of the users: *“I liked this format, even if it initially seemed a little small, it was quite good... I had it with me on the airplane and on the bus, and then this size was perfect”*.

In sum, we identified the influencing factors *format and size*, and *functionality* regarding compability.

4.3 Complexity

The empirical data presented in this sub-section is derived only from the interviews from the final test with the iRex iLiad, due to the lack of e-paper technology in the first evaluation.

Many of the users felt that they had to adjust their reading to the functionality of the device and its navigational system. Some of the users gained control and understood the device after a couple of days, while others felt that they did not achieve control of their reading. It was generally problems with the navigation that negatively affected the feeling of control, as illustrated with the following quotation: *“... but this is the part that is stressful. I did not feel one hundred percent in control. It was not intuitive, it do not do what I feel is right... when you read you do not want to feel like the distribution of presents on Christmas when you never really know what you will get”*.

More than half of the users thought it was hard to learn how to find information in the e-newspaper. One of the respondents said: *“it is a little bit like a psychology test, you do not know what will happen, this eventually leads to that you do not really dare to press on something cause you do not know what will happen”*. The most commonly mentioned problem was the fact that you could not move between the different levels of information, there were no shortcuts to the sections or the first page. Some also mentioned the lack of a working pagination as a reason. However, some of the users thought that it was quite easy to find what they sought after and stated that it only took three to four days to learn how they should act to find what they wanted.

In sum, the most influencing factors regarding complexity are *usability* and *navigation*.

4.4 Intention to adopt

Under this section, data from both tests are used including answers from the questioners. In Table 5, the answer to the question if the users in the future would consider exchanging the traditional newspaper with an e-newspaper, is presented. Even though the iRex iLiad and the e-newspaper services were plagued with technical restraints and difficulties, 100% of the users in the final test were interested to migrate to an e-newspaper.

Test	Opinions	
	Yes	No
Prototype	83%	17%
Final	100%	0%

Table 5. Overview regarding future adoption.

In the interviews following both tests, the most common demand that needed to be fulfilled before the users would consider exchanging their traditional newspaper, was that the price was acceptable and the technology stable. In Table 6, an overview of the requirements from the interviews after the prototype test is presented.

The price	Stabile technology	A good format and a good design	Easy to use	Able to test it first	Nothing	Will not ever replace
21	9	6	5	2	2	2

Table 6. Demands that need to be fulfilled before adopting the e-newspaper

In the interviews following the final test, very few demanded a lower price, but most said that the price could not be higher than the price of the paper edition. There were also technical aspects that needed to be addressed in the e-newspaper before it could replace the traditional newspaper, e.g. faster update and better stability of the device. Some users also wanted more content and some mentioned that a better navigational system needed to be implemented.

In the last part of this section, results from the questioners that followed both tests are presented. In Table 7 the main reasons for a future replacement of the traditional newspaper is presented. The respondents rated the factors on a 7-point Likert scale where 1 represented *do not agree* and 7 *totally agree*. In the table the means per item is presented.

Test	Opinions					
	Environmental reasons	Financial savings	Save time	Availability	Interested in new technology	Added value
Prototype	5,2	5,3	4,2	6,6	5,9	5,9
Final	4,8	5,6	3,9	6,3	6,1	6

Table 7. Reasons for future replacement of the traditional newspaper

Finally, in Table 8 the answer to when the users think they will be ready to read the newspaper on e-paper is presented.

Test \ Opinions	Today	Within 2-5 years	Within 10 years	Within 20 years
Prototype	58%	28%	11%	3%
Final	55%	45%	0%	0%

Table 8. Intention to adopt

5. Discussion and Conclusion

In this paper we have addressed the research question: *What attributes are central from a user adoption perspective to launch a successful e-newspaper innovation?* In order to answer that question we have identified seven factors influencing the e-newspaper introduction: i.e. *mobility, interactivity, readability, format and size, functionality, usability, and navigation*. As the e-newspaper concerns both adoption of new technology and new services, we separate our findings according to device and service, and summarize our findings related to factors influencing enhancement or inhibition of the e-newspaper sorted by Rogers' (1995) perceived attributes; relative advantage, compability and complexity as well as compared to print and web, in Table 9. Some attributes only relates to one specific test and is marked with (1) or (2) accordingly.

Influencing factors	Device				Service				
	Enhancement		Inhibition		Enhancement		Inhibition		
	Print	Web	Print	Web	Print	Web	Print	Web	
Relative advantage	Mobility	Availability Environmental benefits Smaller format	Laid back reading			Updated news			
	Interactivity	Added functionality				Multimedia (1) Added functionality			
	Readability	iPod for reading	High resolution display			Easier and more agile reading (1)	In-depth reading Better newspaper feeling Easier to use (1) Able to finish reading the news Easier to get an overview and to navigate (1)		
Compability	Format and size	Smaller format		Object of value Not able to share newspaper parts				Limited content (2) Harder to navigate Smaller format	
	Functionality			Unstable technology Slow update frequency	Missing functions, i.e. save and print Slow update frequency			More difficult to use Technical errors	More expensive than online news Less information than on the web Not always connected
Complexity	Usability			Hard to learn Slower refresh rate	Long time to update Slower refresh rate			User not in control of reading Hard to learn	
	Navigation			Smaller screen Built-in navigational restrains (2)				Harder to get an overview Hard to navigate between levels	

Table 9. Summary of findings

The enhancement that an e-newspaper brings compared to traditional news channels, including the device and the services, are foremost the availability of news. Availability includes both updated news in the device, as well as the mobility to bring the news. Other identified enhancements compared to print and online, were the readability, mobility, laidback reading, and environmental

benefits. Some enhancements were only perceived in the first evaluation, e.g. multimedia, interactivity, navigational benefits, and agile reading. This was due to the fact that some enhancements identified in the first evaluation could not be implemented in the e-paper device due to technical issues and restraints.

One of the biggest concerns of the users, also an influencing factor regarding the intention to adopt, was the price. Other concerns regarded the e-paper device as an object of value, and that the content is not free as it is online. Furthermore, technology issues such as instability, errors in the services, slow update rate as well as issues about usability and learnability was identified.

In our study, we compared the e-newspaper with the traditional newspaper and the online newspaper. As very few of the respondents in the two studies had any experience of mobile services, we could not ask questions for comparison. However, in Table 10, we discuss the influencing factors, divided into device and service, in comparison to other mobile channels, such as mobile phones and PDAs.

Influencing factors		Comparison of the e-newspaper to mobile phones and PDAs			
		Device		Service	
		Positive	Negative	Positive	Negative
Relative advantage	Mobility		Lacks support for GSM and 3G, Bigger screens result in less mobility	Use of editions allow more reading "on the fly"	
	Interactivity		Lacks the ability to present multimedia content		Lacks the ability to browse the web
	Readability	Much higher readability Display technology allows for more in-depth reading and outdoor reading An iPod for reading		The possibility to read much more text	
Compability	Format and size		Bigger screens results in less mobility	Bigger screens enables better layout that supports newspaper reading	
	Functionality	Easier to target audiences due to unique ID and database	Lacks support for additional functionality, e.g. phone, calender, camera		Lack of color decreases the value of the sevice
Complexity	Usability			Bigger screen allows more form features, which gives a more nuanced reading experience	
	Navigation		Lacks the standard system and buttons that is developed by different mobile developers		

Table 10. Discussion of influencing factors

The e-newspaper is in its infancy, making it hard to compare to the mature mobile devices, though, the unique qualities of the device offer at least three advantages compared to other mobile channels. *First*, it allows more form features than other mobile services, due to the bigger screen of the device which influence the usability of the service, still being highly portable and mobile. *Second*, due to the unique identity of the e-paper device and the structure of the database that handles the distribution and subscription, it is easier to target individuals with advertising. *Third*, it has the potential of becoming “the iPod of reading” due to its

high readability, including content like books, manuals, maps, magazines, newspapers and personal documents, and could revolutionize the mobile market for the newspaper industry.

On the down side, in this early stage of development it lacks several functionalities compared to a mobile phone, e.g. some of the most essential attributes like color, multimedia and interactivity are not supported. At this moment, due to the fact that the device does not support GSM, 3G or HSDPA, it does not support updated news anytime and anywhere if there is no WLAN coverage. Nonetheless, the e-newspaper has the potential of merging the best from two worlds, i.e. readability, overview and navigation from print, and constant updates, multimedia and interactivity from the web, generating an advantage compared to other mobile media.

However, in spite of lacking functionality, most of the users would consider migrating to an e-newspaper already today or within 2-5 years, if certain demands are fulfilled. In sum, the central attributes from a user adoption perspective to launch a successful e-newspaper, are summarized as detailed descriptions of the influencing factors in Table 11.

Influencing factors		Detailed description
Relative advantage	Mobility	Availability of news, anytime, anywhere in a format that allows laidback reading
	Interactivity	Possibility to experience multimedia content on demand, and to interact with the service by e.g. adding comments to articles and to do the crossword puzzle and submit it via a "click"
	Readability	Providing a digital reading experience that is similar to ink on paper, also allowing for outdoor reading in sunlight
Compability	Format and size	Providing a suitable format and size with enough form features to create a newspaper feeling
	Functionality	Providing indications of the availability of updated news as well as additional functionality, e.g. save and print, and calender functions
Complexity	Usability	Providing feedback to users, offer proper pagination and a refresh rate that is acceptable, allowing for diverse form features
	Navigation	Provide easy to use built-in hardware support for navigation, allowing for navigation design solutions in display area

Table 11. Detailed descriptions of influencing factors

By empirically identifying the influencing factors, enhancing or inhibiting the e-newspaper introduction, mapped into relative advantage, compability and complexity, and then comparing them to mobile devices, we argue that the identified factors are relevant and applicable for m-commerce adoption research. The only factor that could be regarded as specific for the e-paper device is *readability*, though mobile phone producers like Motorola has incorporated an e-paper display [7], indicating that this factor will become important as well. The relative advantage using services on mobile devices compared to traditional mediums are the *mobility* and *interactivity* of these services and devices. To fulfill

the users' compability regarding existing habits, *format and size* are important and challenging when delivering services displayed on small screens. The *functionality*, i.e. to provide key functionality in the compared innovation is also generic. Finally, the factors mapped into complexity are also universal for all mobile services and devices. It is well known that there are *navigational* challenges when designing services on small screens and because of the wide array of interaction models and hardware layout of mobile devices, there is also challenges providing services on mobile devices with good *usability*.

By using Rogers' framework in this context, exploring enhancements and inhibitions of an upcoming mobile innovation, the perceived attributes maps quite naturally against positive and negative aspects that could affect the intention to adopt. Generally speaking when applying the framework, attributes mapped into relative advantage compared to other innovations, will always contain enhancements. Attributes mapped into compability and complexity can contain both enhancements and inhibitions compared to other innovations. In our study, all but one attribute mapped into compability and complexity, are inhibitions compared to other channels. However, many of the inhibitions in our study, presented in these two fields in Table 9, are in some way related to the fact that we investigated an innovation in a pre-adoption phase, using prototypes with missing functionality and early versions of an e-newspaper plagued with technical bugs. The iRex iLiad are according to us a device that focus on delivering a functional e-paper solution not really aimed for newspaper reading. One example is the layout of the hardware (i.e. buttons, switches, etc.), that makes it complicated for the service providers to deliver a natural newspaper interface mapping to the hardware. The company seems to allocate their recourses on the technical problems and overlooking the usability aspects of the device. This is quite normal in early stages of an innovation, but will according to our study negatively affect the intention to adopt. Our study shows that by using Roger's framework, enhancements and inhibitions that affect the intention to adopt, can be identified early in the process. By examining the pre-adoption phase using Rogers's perceived attributes, the developers of both devices and services, can be guided in what way to allocate their recourses early in the process, helping them delivering a successful innovation. In Table 12, we summarize implications for further e-newspaper development derived from both empirical results and comparison to other channels.

Influencing factors		Implications for device producers	Implications for service producers
Relative advantage	Mobility	Support more communication standards to enable "always connected" Better support for security standards	Special section, always updated
	Interactivity	Faster refresh rate to enable animations and multimedia content Back channel to allow interactivity	Multimedia content by choice adds value Possibility to make a contribution to the debate adds value
	Readability		
Compatibility	Format and size	Flexible display allows bigger display, still being very portable	Providing a more traditional newspaper layout would increase "the newspaper feeling"
	Functionality	Needs added functionality, e.g. save and print Stability issues needs to be addressed Needs color display	The ability of updating just some pages, not the entire edition. Indication of news flashes when always connected
Complexity	Usability	Different use of buttons needs explanation Better feedback to users. Faster refresh rate would reduce the "computer stress syndrome"	Providing functional pagination
	Navigation	Better hardware support for navigation solutions	Needs a standardization that maps to the hardware navigational support A standardization that supports learnability is needed

Table 12. Practical implications

Even though one can argue that applying IDT qualitatively on a small sample, using multiple data collection methods and early prototypes could be questionable, we argue that it worked well as an analytical tool to identify influencing factors in this pre-adoption phase. By studying the pre-adoption of the e-newspaper in two stages, we had the possibility to compare our results. Even if the evaluations are not fully comparable, we find it interesting that the results are quite similar. Many of the perceived attributes were identified in the first stage, and then complemented in the second stage, providing a picture of influencing factors. Furthermore, similarities were found regarding the intention and reasons to adopt the e-newspaper. Even if the results regarding the intention to adopt is not statistically substantiated, our descriptive statistics reveal an interesting pattern, which in both cases showed a similar willingness to adopt as well as similar reasons for future replacement of the traditional newspaper. Moreover, these results indicate the value of using prototypes and early versions of an innovation examining the pre-adoption phase.

To conclude, besides discussing implications for further e-newspaper development, we have contributed to existing adoption and mobile commerce research by:

- a) performing a study in two stages of the pre-adoption phase, with prototypes and early versions of an e-newspaper, using Rogers' (1995) perceived attributes as a theoretical foundation. We found the perceived attributes applicable in this setting, also implying its relevance to the m-commerce field. By comparing the results of the two stages, we found them very comparable, indicating the relevance of the results,

- b) studying the pre-adoption of an innovation from both a technical as well as service-based perspective, revealed implications for further development for both device and service providers, and
- c) empirically examining the perceived attributes of the artifact, identifying and discussing factors influencing intention to adopt, i.e. *mobility, interactivity, readability, format and size, functionality, usability, and navigation* and by comparing them to other mobile channels pointing out the relevance for m-commerce research.

When the e-newspaper hit the European market, we intend to conduct a study concerning adoption and preferences. By studying the post-adoption phase, we could make a comparison with the results of the pre-adoption phase, adding to the research by Karahanna *et al.* (1999), with perceptions from the pre- and post adoption phases of an innovation concerning both technology and services.

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