

ADOPTION OF MOBILE COMMUNICATION TECHNOLOGY: AN EMPIRICAL STUDY ON FEMALES WORKING IN ELDERLY CARE

Sell, Anna, Turku Center for Computer Science (TUCS), Lemminkäinenengatan 14A, 20520 Åbo, Finland, asell@abo.fi

Patokorpi, Erkki, Institute for Advanced Management Systems Research (IAMS), Åbo Akademi University, Lemminkäinenengatan 14B, 20520 Åbo, Finland, epatokor@abo.fi

Walden, Pirkko, Institute for Advanced Management Systems Research (IAMS), Åbo Akademi University, Lemminkäinenengatan 14B, 20520 Åbo, Finland, pwalden@abo.fi

Anckar, Bill, Institute for Advanced Management Systems Research (IAMS), Åbo Akademi University, Lemminkäinenengatan 14B, 20520 Åbo, Finland, banckar@abo.fi

Abstract

The Finnish municipal open care service in Turku applied mobile communication technology in order to cut costs and increase the efficiency of its elderly care. The home help staff was given a number of Nokia Communicators for the purpose of ordering groceries for their elderly and disabled customers. In this paper we present and discuss our empirical findings of the adoption of mobile communication technology by an all-female population. The results contradict some assumptions generally made in literature about the impact of age and experience on technology adoption.

Keywords: Mobile technology, technology adoption, technology acceptance, elderly care.

1 INTRODUCTION

In today's business world, mobility is seen as a key ingredient for success. Companies need to move faster, operate more efficiently, and deliver better service. But mobility will not only play an important role in the private sector, it will also do so in the public sector. This is especially true in Finland where the public sector has the principal responsibility for providing for welfare services. The number of old people is constantly increasing, whereas at the same time less money is spent on municipal care (Hellström & Hallberg 2001). Old people are the biggest, and steadily growing, customer group of open care services in Finland. The national social policy is to favour and develop municipal service forms, which let the old people stay at home as long as possible. However, due to a general lack of resources, there is no hope of hiring more staff to better meet the increased demands. This means that there is a huge pressure to produce more without increasing costs.

Social services all over the country are facing the dilemma of performing their constantly growing service obligations with stagnant resources. In Turku, a city of 160.000 inhabitants in South-western Finland, the situation is no different. Home-helpers are trained persons visiting their clients on a regular basis. They are employed by the city of Turku, performing a variety of tasks ranging from training the physical and mental health of the elderly to common housekeeping tasks, including daily shopping. With few exceptions the home-helpers are female. It is estimated that it takes on average 45 minutes for a home-helper to do the shopping for their clients. The shopping is reducing the total time spent on mental and physical health care as well as on housekeeping tasks.

In order to make the home-helpers' work more effective the city of Turku decided to try, over a 15-month period, Internet-based shopping.¹ The social welfare office, which operates in the four districts (Northern, Southern, Eastern and Western), decided to run the e-shopping trial only in the Northern and Western districts. After the test period the city of Turku decided to continue the Internet grocery shopping service for the elderly and disabled including also the Eastern and the Southern districts for the period of 1.2.2001 – 31.12.2002.

We were given a one-of-a-kind possibility to study the adoption process as the city of Turku decided to acquire Nokia Communicators (<http://www.nokia.com>) for the home-helpers. The home-helpers, being constantly on the move, were expected to make the grocery orders for the elderly and disabled mainly through the communicator. The communicator is a wireless communications device which combines a mobile phone and Internet, communication by email, SMS, and fax. The communicator empowers the home-helpers to make the orders when on the move and whenever they find it convenient, thus adding more flexibility in their job performance.

Little is known about the consumers' willingness to adopt mobile communication technology, and the factors that influence their adoption decisions and value perceptions relating to m-technology (Anckar et. al. 2003, Pedersen 2003, Eikebrokk & Sjørebrø 1998). Even less is known with regard to gender, and practically nothing is known when considering employees' adoption decisions on mobile communication technology. The welfare office trained its personnel to use PDAs in home care in November, 2002. A qualitative study regarding experiences of a trial use of PDAs is available but reveals very little about the adoption process as the main focus was to describe how the use of the new mobile device will influence work (Vuokko & Järvinen 2003).

In this paper we will report on an empirical study on female employees' willingness to adopt mobile communication technology. We will work through several well-known adoption models in order to illustrate what previous research has focused on and what tools it has used when studying technology adoption and user experiences of technology use.

¹ A similar test was carried out by the cities of Helsinki and Espoo.

2 TECHNOLOGY ACCEPTANCE

Three fields of research deserve brief description here: technology adoption and use; mobile applications and services; and health care and social service technology. The term technology acceptance, in contrast to terms like technology adoption and diffusion, is as a rule connected to Davis' so-called Technology Acceptance Model (TAM). Davis' more than a decade old TAM Model was initially applied for predicting user acceptance of computers but has in the course of the years been used in a growing number of new fields of information and communication technology (ICT). The TAM model rests on two variables: perceived usefulness and perceived ease of use, which are derived from empirical studies, and convincingly validated in Davis (1989, see also Davis et al. 1989). Davis' theory has the undeniable merit of simplicity, and, according to an estimate presented by Legris et al. (2003), empirical testing has shown that TAM successfully predicts 40% of a system's use. Nevertheless, some recent critics (e.g. Pedersen & Nysveen 2003, Anckar et al. 2003, cf. Venkatesh et al. 2003) have pointed out that dividing user perceptions of technology adoption to two essentially utilitarian categories will necessarily leave out many things that significantly affect user perceptions. Further, age, gender, experience and voluntariness are significant moderators of acceptance (Venkatesh et al. 2003). In our study we have explored age and experience as well as computer literacy in relation to attitudes towards the technology at hand.

Mobile applications and services in Europe are still after all these years mostly in a tentative state. The respective failure to get people adopt WAP services in Europe serves to show that we do not know much about what makes people adopt mobile services and what are their experiences of actual use. The situation is somewhat different in Japan where the success of the I-Mode has given opportunities to study extended and routine use of mobile services (see e.g. Teo & Pok 2003). All the same, the research on mobile services and technology in general is scarce and the suitability of the old technology acceptance models to mobile technology is not self-evident.

Pedersen et al. (2003, see also Pedersen & Ling 2003, Pedersen et al. 2002) have extended the TAM model in a way, which we find generally useful. According to Pedersen et al., especially the entertainment and self-expressiveness aspects of user acceptance are neglected in the TAM model. Pedersen et al. introduce the last-mentioned of these, that is, self-expressiveness, as an additional determinant of TAM. Self-expressiveness is a non-utilitarian, derived motivational determinant, which influences technology adoption. Pedersen et al. say that because the users of mobile services are usually younger as well as skilful and experienced in technology use, the determinant of ease of use influences probably less their technology adoption behaviour than could be expected on the basis of TAM. A more challenging system may sometimes be more attractive to these users. Over and above what Pedersen says, we believe that one more reason for caution when using the TAM model is that nowadays not just young but even elderly people have more experience of ICT and more informed preconceptions of what to expect when facing new technology. Along with the diffusion of ICT to ever new walks of life, usefulness and ease of use have become less suitable to catch the gist of technology adoption. Some ICT applications and services for instance in socializing and entertainment are sometimes by some users seen as an extension of their body or personality. It is clear that here utilitarian attributes fall short of satisfactorily describing, explaining or predicting user behaviour (see e.g. Oksman & Rautiainen 2001).

Anckar et al. (2003) have questioned the suitability of the TAM model to the consumers' choice of a commercial channel. M-commerce applications and services are often competing with alternative applications and services. Consequently, one needs to take into account the existence of alternative technologies, which put consumers in a multiple-choice situation. Secondly, because m-commerce encompasses both transactional and non-transactional dimensions, one needs to distinguish between different levels of user adoption of m-commerce. Perhaps the most pertinent piece of criticism presented by Anckar et al. is that the TAM model ignores the potential existence of perceived critical benefits and barriers to the use of technology. Consumers' perception of value takes place by their weighing the benefits against the barriers to the use of mobile applications or services, although there

is empirical evidence indicating that perceived benefits are more significant determinants of adoption decisions than perceived barriers (Anckar et al. 2003).

In the health care sector new technology has generally been applied as a means to increasing efficiency and saving time and money (see e.g. Goolspy 2001). A case of documented technology adoption and use closest to our case is the one made in Sweden. In Sweden the Nokia Communicators have been tested for home care service purposes. The staff received their schedules by e-mail, and also the presence control and reporting was made with the help of the communicator. The results were not promising. The home help workers felt lonely and experienced stress due to slow connections. The communicator was also thought to be bulky. No real time savings were achieved (Andersson 2002).

3 THE EMPIRICAL STUDY

Home help employees' use of the online shopping technology has certain special features, which need to be taken into consideration. First, the ordering can be done via several channels: PC (online), communicator or fax. Therefore one has to take into account the fact of a channel choice, which makes the adoption situation essentially a multiple-choice situation. Our study seeks to cover the user preferences regarding channel choice. Second, the home help employees order for a third person, and thus they are not the primary users of e-commerce. However, the home help employees are the primary users of the online ordering technology. Third, not all home help employees use the ordering technology. Hence the need for some sort of a user segmentation. We have divided the users into adopters (i.e. those who actually use the ordering technology) and non-adopters (i.e. those who do not use the system) and have limited our analysis only to those home helpers who have at the very least tried using the communicator. Fourth, the communicator is a mobile device but it was used as a static device in the sense that the home help employees did not carry it around with them but placed their order by the communicator in the recess quarters. Due to device shortage they had to be shared between several home helpers. Hence one has to be careful when considering how, if at all, the features connected to advanced mobility in research literature will apply. On the other hand, the communicator in the case at hand was *mobile within the perimeters of the recess quarters* which significantly distinguishes it from the truly static desktop PC. Mobile technologies are not intended or used only for usage "on the road". Mobility is helpful even in a fixed sphere of usage. Mobile technologies aid users on the move, but are also used as a *means for staying in the same place* (Fortunati 2001), e.g. on your comfortable sofa or at the lunch table in the recess quarters. Incidentally, features like ubiquity, flexibility, localization and mobility are in actual fact rarely fully functional as we still use the more modest 2G and 2.5G networks instead of the more advanced, and more distant, 3G (see Anckar et al. 2003).

The online shopping system was implemented first in two service districts for one year, and after this test period extended to all four service districts. Consequently there was a lengthy period during which experiences built up and were communicated to others.

The study was conducted on a population of 600 home-helpers working in the elderly and disabled home care in Turku, a city of 170.000 inhabitants in South-western Finland. Questionnaires were designed to evaluate their usage of and attitudes towards the Nokia Communicator and distributed to the home-helpers through their managers. 195 of the employees responded, approximately 32% of the entire population, thereof 193 women and two men. The two men have been excluded in this analysis. In reporting the study, the Nokia Communicator is interchangeably referred to with the terms *mobile device* and *communicator*.

The median age of the respondents is 47 years, ranging from 19 to 62 years. 36% of the respondents are older than 50 years old, and 71% are 40 years old or above. The respondents have worked in this line of work from 1 month to 30 years, median value being 13 years. The group of workers studied is special in many ways. The age structure is on the older side, the group is comprised only of women, the average education level among the workers is comparatively low and their salaries are low.

3.1 Research hypotheses

Venkatesh et al. (2003) present evidence that age has an effect on adoption of technology, in the sense that effort expectancy is especially important for older workers and those with limited experience with a system, and that performance expectancy is especially important for younger workers. On the basis of this we formulated hypotheses H1 and H2.

H1: *Employees in the youngest age category (- 29 years) have a more positive attitude towards using the communicator than employees in the three older age categories (30-64 years).*

H2: *Employees who have had an opportunity to use the communicator for a longer time have a more positive attitude towards use than those who have used it for a shorter time.*

Venkatesh et al. (2003) call for research on e.g. computer literacy and social or cultural background and their influence on acceptance. We hypothesise that computer literacy is a factor affecting attitudes and adoption of technology and have formulated H3, H4 and H5 to test for this effect.

H3: *Those with good computer experience, defined as persons using computers daily or weekly, find using the mobile device easier than those with less computer experience.*

H4: *Those with limited computer experience, defined as persons who do not use computers or have only tried, find using the mobile device more complex than persons who have good computer experience.*

H5: *Those with good experience using the computer think using the mobile device is more pleasant, than those with less experience of computers.*

We used the one-way Anova procedure to test for significant differences in means between different user groups in regard to their attitude to using the communicator, except in testing hypothesis 5 where the independent samples t-test was used. In testing H5, the respondents were divided into two groups only. To find the differing values after the one-way Anova, Tamhane's T2 test was applied to the material as a post hoc test. Tamhane's T2 was chosen due to significant differences between variances in the different groups and due to the relative conservativeness of the test.

The respondents rated the communicator on a 5-point Likert scale (ranging from 5-Completely agree to 1-Completely disagree). The communicator is rated on 5 dimensions:

- Using the communicator is HANDY (H1, H2)
- Using the communicator is an UNNECESSARY WORK STAGE (H1, H2)
- Using the communicator is EASY (H3)
- Using the communicator is COMPLEX (H4)
- Using the communicator is PLEASANT (H5)

Significance is noted on the .05 -level.

4 RESULTS AND DISCUSSION

Hypothesis 1:

The respondents were divided into four age groups, -29, 30-39, 40-50 and 51-64 years. Significant differences on the two dimensions *Handy* and *Unnecessary work stage* could not be found between the different age groups. Therefore, hypothesis 1 suggesting that the youngest age group would have a more positive attitude than the other age groups *could not be accepted*.

The fact that the communicator had already been in use for a significant length of time can have reduced or eradicated the differences between the age groups. Also, the effect of performance expectancy is more relevant for men (Venkatesh et al. 2003) and in our all-females material not as noticeable. Since usage was mandatory and determined from above, it is also conceivable that social

influence has smoothed out differences between age groups. Social influence is defined here as “the degree to which an individual perceives that important others believe he or she should use the new system” (Venkatesh et al. 2003). Social influence is especially important for older women at early stages of using the specific technology (Venkatesh et al. 2003). The support and encouragement of important others, in this case different levels of management, might have had a positive effect on the attitudes of the older workers.

Hypothesis 2:

The employees were divided into two groups by the districts they work in, districts where the communicators have been in use for three years, and districts where the communicators have been in use for 1,5 years or less. We found *partial support for hypothesis 2*, in that respondents from the districts that had been using the mobile devices for a shorter time, were significantly less of the opinion that the mobile device is handy to use, but no more likely to think that using the mobile device is an unnecessary work stage.

This is in line with Venkatesh et al. (2003) stating that effort expectancy (handiness) is more salient with limited exposure to the technology, whereas performance expectancy (unnecessary work stage) is not influenced by the amount of exposure. Some support for the hypothesis can be found in Table 1, in which it is shown that a majority of those who currently use the communicator desire to use it also in the future, whereas respondents using other tools would favour their current tool of use also in the future.

Hypothesis 3:

The respondents were divided into groups according to how often they use computers; Daily, Weekly, Monthly, Less than monthly, I have only tried and I don't use computers. Observed differences between the groups in regard to how easy they found using the communicator to be were not statistically significant. Therefore, there was *no evidence to support hypothesis 3* suggesting that employees with more computer use experience would find using the communicator easier.

In retrospect, it is natural that individuals with more computer experience do not necessarily find the communicator easier to use than others. Computer users are used to large screens and comfortable keyboards; interaction with the communicator is not remotely as comfortable due to limited screen space and a miniature keyboard. One could hypothesise that the communicator usage training provided has been successful in making the communicator seem approachable and easy-to-use to those without prior experience of computers.

Hypothesis 4:

Those with limited computer use experience found using the mobile device significantly more complex than users with good computer experience. Thus, *the results supported hypothesis 4*.

Interacting with the communicator is done with logic familiar to computer users, i.e. using menus, finding applications or files and input are all done in an intuitive way to those used to the logic of e.g. Windows and Word. Users who do not have experience using computers start using the communicator from a completely different level – they need to digest concepts such as electronic mail, Internet, double-clicking etc. which are not self-evident to users without computer experience. They also need to learn to understand the general logic of using the software, what to do when a mistake has been typed, etc. which is already innate to a computer-user. It is natural, that when a non-computer user is faced with a myriad of new terms and a whole new world of technology-usage, using the technology can appear complex.

Hypothesis 5:

The observed differences between the groups were not statistically significant. Therefore, there was *no evidence supporting hypothesis 5* suggesting that employees with more computer use experience would find using the mobile device more pleasant than those with less experience.

Considering again the physical limitations of the communicator, it is understandable that computer users do not find the communicator anymore pleasant to use than others. It would have been feasible, though, that better proficiency in usage would have made the usage more pleasant due to less problems and anxiety. The results might have looked different, if the communicator usage would have only been starting at the time of measurement, but now all user groups had had sufficient time to become more proficient users.

Table 1 shows the future preferred tool of the employees, sorted by tool currently in primary use (some of the respondents use a mix of tools, e.g. occasionally faxing in their orders even though primarily sending them via communicator). The majority of respondents are currently primarily communicator users (114, n=184). The figures can be seen as an indicator of satisfaction with the tool currently in use, e.g. the group of 57.5% of computer users that would also in the future use the computer can reasonably be concluded to be satisfied with their tool, or at the very least to have a higher opinion of the tool than of the other available tools.

It is interesting to note that a scant majority of the communicator users would choose the communicator as their future tool, whereas very few in the other groups would switch from their current tool to the communicator. A number of the respondents using other tools than the communicator, especially computers, have migrated from the communicator, perhaps due to the e.g. higher level of usage comfort, and it is therefore understandable that these respondents do not wish to "go back a step". Force of habit seems to be a powerful influence on the future intention to use a tool; in all user groups except one (centralised ordering), the currently used tool scores highest also as the future tool. This is explained in part by self-selection; the respondents have had freedom to choose their tool (constrained by available equipment) and have presumably gravitated towards a tool of their liking, e.g. those choosing to fax their orders feel that hand-writing is most natural and easy for them. Not all of the users of other tools have even tried the communicator, though. Reluctance in these cases might be explained at least in part by preconceived opinions, negative word of mouth and simply resistance to change, reluctance to use technology or fear. The majority of those currently using centralised ordering (i.e. the orders are collected and centrally processed by only one person) would like to use a computer for their orders in the future. This group might be in part explained by new workers who are not yet allowed to process the orders independently, but will do so in the future.

38.6% of the communicator users would like to use a computer in the future. Considering the age structure of the respondents, one should not forget physical considerations which often accompany advanced age and their effect on technology use. First signs of deteriorating eye sight, joint stiffness in hands and fingers, neck and shoulder pains as well as fading motor skills can present themselves before one reaches the end of one's working life, and all can have an influence on the desire to use a mobile device which might force the user to strain for instance her eyes or fingers uncomfortably.

		Preferred future tool						Total	
		Communicator	Computer	Fax	Centralised ordering	Phone	Other		
Main tool used at the moment	Communicator	Count	48	44	2	8	6	6	114
		% within Current tool	42,1%	38,6%	1,8%	7,0%	5,3%	5,3%	100,0%
	Computer	Count	2	23	1	5	4	5	40
		% within Current tool	5,0%	57,5%	2,5%	12,5%	10,0%	12,5%	100,0%
	Fax	Count		2	5	1	1	1	10
		% within Current tool		20,0%	50,0%	10,0%	10,0%	10,0%	100,0%
	Centralised ordering	Count		7	1	3	3	1	15
		% within Current tool		46,7%	6,7%	20,0%	20,0%	6,7%	100,0%
	Other	Count		4				1	5
		% within Current tool		80,0%				20,0%	100,0%
Total (n=184)		Count	50	80	9	17	14	14	184
		% within Current tool	27,2%	43,5%	4,9%	9,2%	7,6%	7,6%	100,0%

Table 1. Future tool preference sorted by tool currently in primary use.

5 CONCLUSION

Our intention in this study was to shed some further light on the process of technology adoption by investigating a population with many distinguishing features, e.g. consisting solely of females with relatively high median age, using technology in the context of elderly care. Using previous research in the field of technology acceptance and adoption we formulated five hypotheses on the mechanisms of age, experience and computer literacy in connection to technology acceptance. We found evidence supporting only one of our hypotheses, according to which inexperienced computer users found using communicator significantly more complicated than experienced computer users. The fact that not even age was found to be a statistically significant determinant of user behaviour may partly owe to the special characteristics of the population and the point of measurement. Nevertheless, the subsequent discussion gave many insights which might prove useful in further studies on mobile technology acceptance and adoption, e.g. on the role of computer literacy. For instance, the force of habit seems to be a good indicator of willingness to adopt new technology. The relative ease of the migration of users to devices with familiar principles of functionality should not be overlooked when planning ICT for special user groups. It would be interesting to study the same factors in connection to technology acceptance on a different, more average user population.

References

- Anckar, B., C. Carlsson, and P. Walden (2003). "Factors Affecting Adoption Decisions and Intents in Mobile Commerce: Empirical Insights". *16th Bled eCommerce Conference. eTransformation*, 886-900.
- Andersson N. (2002). Helping the helpers. *Cameo – an information appliance for home care service. NordiCHI*, October, 19-23.
- Davis, F.D. (1989). "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology". *MIS Quarterly*/ September 1989, 319-340.
- Davis, F.D., R.P. Bagozzi and P.R. Warshaw (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science*, Vol 35, No 8, August 1989.

- Eikebrokk, T.R., and Ø. Sørebrø (1998). Technology Acceptance in Situations with Alternative Technologies. Norsk konferanse for organisasjoners bruk av informasjonsteknologi (Norwegian conference on organisations use of information technology), Oslo, Norway, 17-19 July, 1998, 89-97.
- Fortunati, L. (2001). "The Mobile Phone: An Identity on the Move". *Personal and Ubiquitous Computing* (2001) 5: 85-98.
- Goolsby, K. (2001). "Cure for a Healthcare Administrative Malady". White Paper. Outsourcing Center. www.outsourcing-center.com.
- Hellström, Y. and I.R. Hallberg (2001). Perspectives of elderly people receiving home help on health, care and quality of life. *Health and Social Care in the Community* 9(2), 61-71.
- Legris, P., J. Ingham, and P. Collette (2003). "Why do people use information technology? A critical review of the technology acceptance model". *Information & Management* 40 (2003), 191-204.
- Oksman, V and P. Rautiainen (2001). "Perhaps It Is a Body Part." How the Mobile Phone Became an Organic Part of the Everyday Lives of Children and Adolescents. A Case Study of Finland. The 15th Nordic Conference on Media and Communication Research, Reykjavik 11-13th August, 2001. Available at www.nordicom.gu.se/nordic_conference/iceland/papers/twelve/VOKsman.rtf. Visited 10.07.2003.
- Oksman, V. and P. Rautiainen (2001) "Extension of the Hand: Children and Teenagers' Relationship with the Mobile Phone. A Case Study of Finland." Available at <http://keskus.hut.fi/opetus/s38001/s01/materiaali/4/rautiainen.pdf>. Visited 9.07.2003.
- Pedersen P.E. and Herbjørn Nysveen (2003). Usefulness and self-expressiveness: extending TAM to explain the adoption of a mobile parking service". 16th Bled eCommerce Conference. Transformation, 705-717.
- Pedersen, P.E. and R. Ling (2003). Modifying adoption research for mobile Internet service adoption: Cross-disciplinary interactions. Proceedings of the 36th Hawaii International Conference on System Sciences.
- Pedersen, P.E, L.B. Methlie and H. Thorbjørnsen (2002). Understanding mobile commerce end-user adoption: a triangulation perspective and suggestions for an exploratory service evaluation framework. Proceedings of the 35th Hawaii International Conference on System Sciences.
- Sell, A., E. Patokorpi, B. Anckar and P. Walden (2003). Outsourcing Public Sector Services to Electronic Commerce Players. Forthcoming in proceedings of the 37th Hawaii International Conference on System Sciences.
- Teo, T.S.H. and S.H. Pok (2003). Adoption of WAP-enabled mobile phones among Internet users. *Omega* 31 (2003), 483-498.
- Venkatesh V., M.G. Morris, G.B. Davis and F.D. Davis (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly* Vol.27 No.3 September 2003.
- Vuokko Riikka and Sinikka Järvinen, Experiences from an Implementation Project – Time Management and Control in Home Care, in Pirkko Walden et al.(2003), *ICT and Services: Combining Views from IS and Service Research*.