MAKING USE OF MOBILE DEVICES IN E-COMMERCE
Overcoming Organizational Barriers through User Participation

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Abstract: Mobile devices offer great potentials for the design of business processes. However, realizing these potentials in practice is still problematic. While technologies are nowadays widely available, the problems still lie in the management of organizational change. In this paper, we analyze the contribution of user participation to the successful implementation of mobile business processes. We present the results of five case studies conducted in the IT-Service sector. The work gives empirical evidence that user participation (a) leads to reduced adoption and transition barriers and (b) improvements of business metrics.

1 INTRODUCTION

Mobile devices in information and communication technology have raised great expectations during the past years (Wang et al., 2005; Gumpp & Pousttchi, 2005). Following the discussion in academia and industry, expectations go far beyond cost cutting. In particular new business models (and hence new ways of market reach) are inspired by mobile devices. This is grounded by a number of recent studies (cf. Kornak et al. 2004; Basole 2005; ; 2007). In more detail, the potentials of mobile devices for business process management include (a) the release of workforce from desktop IT-Systems, (b) replacement of paper-based processes, and (c) access to corporate resources and automated online information request (cf. Basole, 2005; Basole & Rouse, 2007).

In practice, however, the successful implementation of mobile business processes is still a serious problem. Previous research has argued that successful adoption and implementation of any emerging devices, such as mobile devices, often requires fundamental changes of a company's organisation (cf. Taylor & McAdam, 2004; Rouse, 2006). In fact, although mobile technology is widely available nowadays, most projects fail in establishing sustainable business processes that are efficiently applied in the business processes of a company. In our research, we focus on the role of user participation when implementing mobile business processes. According to research in software- and usability engineering (e.g., Gibson 1977; Nielsen 1993; Barki & Hartwick, 1989, Nielsen, 2003; Thurnher 2007, etc.) user participation is expected to have a positive effect on the efficient use of mobile devices in practice. However, little empirical research is available that looks at the effects of user participation in introducing mobile devices. In particular, also the costs of user participation have to be taken into account and weighed against potential benefits. From a normative perspective (cf. Hartman et al., 2000; Ward & Peppard, 2002), different levels of user participation have to be distinguished and analysed regarding their value contribution in a specific organisational context.

With this paper, we present the results of five case studies in the IT service sector. In these studies, we analysed the impact of user participation in different projects on introducing mobile devices from 2005 to 2007. We anticipate that user participation within

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Table 1: KPI Definition and Measurement Approach.

KPI	Definition
Time to Bill	Duration [in days] from task completion to invoice submission.
SLA-Rate	Service Success Rate [in %] is defined as the ratio of the duration from service request to fulfilment of the request related to the agreed (in the customer contract) SLA.
Paper-handling time	Paper handling time [in days] is the duration from task completion until the submission of performance data (working-, driving-time and number of used spare-parts) to head-office.
Payback Period	The payback period [in years] is defined as the amortization time of mobile tool integration (development and deployment costs) vs. reduced cost through mobile tool usage.
Tool Acceptance	Attitudes towards usage and intentions to use the technology. This includes adoption and transition barriers from the paper-based to the mobile tool supported process. Tools acceptance is based on interviews and mapped to a nominal scale [1 .. low, 2 .. high end user acceptance]

the development process of a mobile tool leads to faster adoption and acceptance of mobile devices. We investigate different degrees of user participation and report on their value contribution by means of key performance indicators. The results are presented as follows: In chapter 2 related work in the field of mobile devices is reflected, particularly distinguishing different levels of user participation. On that basis the research design applied in our work is introduced in chapter 3. The major findings of our work are presented in chapter 4 and further discussed in chapter 5. We conclude with a summary and an outlook to future research given in chapter 6.

2 RELATED WORK

The Standish Group investigated a set of industry projects (365 industrial responses involving more then 8300 applications) and the main reasons for project failure. The most important reasons for project interruption were: (1) lack of management support and (2) a lack of user involvement (Standish Group, 2001). Obviously, strong *user participation* during mobile tool development is necessary to fulfil individual requirements of the target user group and to address the need of the mobile devices within business processes. The investigation of positive impacts of *user involvement* and *user participation* on system acceptance has been done extensively within the ICT literature over the last 30 years of ICT research, e.g., (Kaasinen, 2005; Nielsen, 2003; Pedersen, 2002; Ives & Olson, 1986; Lucas 1974). The terms *user participation* and *user involvement* are often used inter-changeably in the Information System literature. However, in other disciplines, the concepts are accorded separately and have distinct meanings (Barki & Hartwick, 1989). In order to address this anomaly, Barki and Hartwick argue that the term user participation be utilized to refer to development-related activities and behaviours of users and their representatives during the development process, and that user involvement be used to refer to the subjective psychological state that reflects the level of importance and personal relevance of the information system to users. These researchers also argue that user participation is one of the more important concepts, of user involvement. *User participation leads to increased system acceptance by:* (a) developing realistic expectations about system capabilities (Gibson, 1977), (b) providing an arena for bargaining and conflict resolution about design issues, Leading to system ownership by users (Robey & Farrow 1982) (c) decreasing user resistance to change (Lucas, 1974) (d) committing users to the system (Lucas, 1974). Whereas the importance of user participation has been pointed out in the literature in the last decades (e.g., Lucas, 1974; Barki & Hartwick, 1989, Nielsen, 1999; Nielsen, 2003; Pousttchi & Thurnher 2007) the integration of users within the software development processes is still not considered entirely throughout the industry and especially within the IT-Service sector. The development of tools is possible without user participation in the design process – but deployment will be more cumbersome due to adoption and acceptance barriers amongst end users (Henneman, 1999). Whereas linking usability considerations and user participation to the impact on business metrics have been investigated, e.g., by Nielsen, 2003; in depth investigations targeted at mobile applications in the IT-Service sector are missing so far. Nielsen (2003) stated in his report that he estimates "… spending about 10% of a project's budget on usability activities doubles usability".

The next section describes the research design, the case study companies and the KPIs which have been investigated.

Table 2: Case Studies Description.

Company	Provided Service	# users	Country	Degree of User Participation
1)Telecommunication Service	Technical customer service	Large (12,000)	Germany	Little involvement; mainly in device selection and testing
2)Municipal Utility Company	Technical customer service	Medium (1,000)	Germany	User participation in all phases
3)IT-Service Provider	Technical customer service	Small (40)	Austria	User participation in all phases
4)Toll Collection & Railway Maintenance	Technical customer service	Mini (7)	Austria	Little user involvement; mainly in the device selection phase
5)Machine Construction	Technical customer service	Large (3,500)	Germany	User participation in all phases

3 RESEARCH DESIGN

To investigate the impact of user participation and KPIs within mobile business processes, we applied case study research as it is appropriate for examining practice-based problems, since it allows a researcher to capture the knowledge of practitioners and investigate *business impact* of methods or systems (Anda, 2003; Benbasat et al., 1987; Creswell, 2002; Eisenhardt, 1989). Where there is no ideal number of cases which should be investigated in case study research, Eisenhardt suggests conducting four to ten case studies: "With fewer than four case studies it is often difficult to generate theory with much complexity and its empirical grounding is likely to be unconvincing, unless the case has several mini-cases". (1989 p. 545) With more than ten cases it becomes difficult to cope with the complexity and saturation degree is already achieved (cf. Eisenhardt, 1989). Within this paper 5 case studies have been undertaken in order to meet the suggestions of Eisenhardt (1989) from a research perspective.

The studies were carried out in the IT-Service sector. A basic IT-Service process starts with a service request from the customer. Those requests are classified according to predefined *Service Level Agreements (SLAs)* with the customer. Dispatching of the service requests is then arranged by the dispatching/head-office department of the IT-Service company. Then service technicians execute service tasks (e.g., repair, installation and maintenance of office machines). IT-Service technicians are, e.g., engineers who work on the customers' side. Technicians are called either periodically (e.g., continuous support for a set of devices) or on-demand if unexpected events occur e.g., machine break-down). After service task execution the technicians have to capture and transmit job related data (e.g., working- and driving time, number of used spare parts). In the paper-based process this has been done on a paper-form which was transmitted to a desktop-system (normally at the end of a working week by the technician or head-office staff). When job data was available head-office/finance department could start with the billing process (prepare and send bill to the customer). Through the application of mobile devices an improvement of KPIs within the mobile business process is expected. The KPIs under investigation are depicted in Table 1. Despite the numerous above mentioned value propositions and the need of including the end user within software development of mobile devices - within industry projects user involvement is still not applied widely (e.g., Nielsen 1993; Barki & Hartwick 1989; Thurnher 2007) . In order to investigate and clarify the value contribution of user participation within the development process of mobile solutions we formulated the following research questions (RQ).

RQ: What impact does user participation - in the development phase of mobile tools - have on business process key performance indicators after deployment?

Expecting an improvement on the identified KPIs, we focus on the degree of change (KPI improvement). For instance, we expect a correlation regarding the degree of user participation and positive impact on KPIs.

For data gathering CEO, CTO, project managers and end users of the mobile application were questioned with semi-structured questionnaires in face-to-face or via telephone interviews. Interviews lasted 1 hour to 1.5 hours. The interviewees of the case studies were selected based on their role in the organization and their level of experience with existing system and processes. Moreover, interviewees were selected according to their functions within the mobile application project (El-Amrani et al., 2006).

Table 2 provides an overview of the case study companies and shows the varying degrees of user

participation within the mobile tool development process. Moreover, it depicts that the companies are comparable in terms of their provided service but vary in their location (Austria/Germany) and the number of IT-Service technicians (# users). All five case studies were longitudinal studies in the IT-Service sector within different industries and lasted from 6 to 15 months. Interviews were transcripted and fed back to the interviewees in order to reduce possible errors and clarify misunderstandings. We applied a semi-structured questionnaires (30 questions) in face-to-face or phone interviews. In total we conducted 14 interviews; 6 persons had a business - and 8 a technical background. 10 interviews were face-to face interviews and 4 telephone interviews.

In the following section major findings of our work will be summarized.

4 FINDINGS

It was notable, that KPI improvements in percent reached similar values in all case study companies e.g., paper-handling time, time to bill, etc. before and after mobile tool integration. Findings related to our RQ are:

RQ: What impact does user participation - in the development phase of mobile tools – have on business process key performance indicators after deployment?

We could observe that a higher degree of user participation led to a faster / higher improvement of KPIs and vice versa within companies with a lower degree of user participation (e.g., only device selection phase) a lower acceptance rate and a smaller improvement of KPIs (e.g., longer payback period) could be identified. The business process improvement values are mainly given in percent as absolute numbers referred to company sensitive data.

In the following paragraphs further information on the results will be given referring to each of the key performance indicators listed in Table 1. **Time to Bill:** As head-office staff has faster (directly after job completion or at the end of a working day) job data access the time to bill could be reduced considerably by 75 to 50%, including single item billing and total accounts. In the case study companies (case 2, 3 and 5) with user participation in all phases of mobile tool development the time to bill increased by approx. 75% (e.g. from 21 working days down to 5 working days). **SLA-Rate:** The SLA-rate increased by 30 to 40%. This means that in 30 to 40% of all service cases the technician can execute the job within the agreed SLA-time period (e.g., within 24 hours after service request receipt). This is due to improved information e.g., the service order, problem description and spare-part availability, as well as customer reachability. Again in companies with a higher degree of user participation the improvement was 40% whereas in case 1 and 4 it only reached a 30% improvement. **Paper-handling time:** The reduced paper-handling time for the technicians was approx. 55-80% (from 30 minutes for job data capturing per job down to 5 minutes). This was due to the fact that double data entry could be eliminated completely (entering the paper-based form into a desktop-system). This improvement was observed in all case study companies whereas transition time (switching from the paper-based to the mobile tool supported process) was considerably longer in those cases with lower degrees of user participation (2-3 months: case 2, 3 and 5; versus 6 months: case 1 and 4). **Payback Period:** The payback period in the Telecom Company was 2.5 years and in the Utility- and IT Service Company was 1.5 years. In the Toll Collection Company it took 1.6 years. And in the Machine Construction Company only 1.3 years. Shorter payback periods were observed in cases with a high degree of user participation. During the interviews we found this was due to smoother adoption and transition phases of the mobile tool supported workflow. The time for double process execution, paper-based and mobile was reduced by about 6 months in cases with user participation in all development phases. **Tool acceptance:** Tool acceptance varied in the case study companies according to the degree of user participation versus user involvement. We could observe that, the higher the degree of user participation in the development process of the mobile tool, the higher the acceptance and intension of mobile tool usage after deployment. In case study companies with little user involvement tool acceptance and workflow change were cumbersome. In Case Study Company 2, 3 and 5 we observed a high user participation and high user acceptance, while in Case Study Company 1 and 4 we observed little user involvement and low user acceptance. Table 3 provides an overview of the Case Study findings. Values are indicated in a Likert-Scale (user participation, acceptance): 1 = low; 5 = high and improvement values in per cent (%). The Time to Bill is indicated in days, comparing the former paper-based process duration in days to the mobile tool supported duration.

Table 3: Findings.

Company	1) Telco	2) Utility	3) IT-Service	4) Toll Coll.	5) Mach. Const.
User Participation	1	4	5	2	5
Time to Bill (days)	4	5	14	3	11
SLA-Rate (%)	25%	35%	45%	20%	40%
Paper-handling (%)	55%	70%	80%	60%	75%
Payback period (years)	2.5	1.5	1.5	1.6	1.3
Acceptance	2	4	5	1	4

From the results in Table 3 it can be concluded that the higher the user participation in the development was, the higher was tool acceptance. Higher acceptance lead to faster transition times (changing from the paper-based to the mobile tool supported process) and that impacted KPIs positively e.g., lead to higher improvements in the Time to Bill.

Some ideas on the contribution these results might add to research will be discussed in the following chapter.

5 DISCUSSION

The findings presented in this paper provide valuable insights in the field of mobility supported business process and the role of user participation. However, we are aware that the case study approaches suffers from a number of shortcomings.

In order to overcome the limitations of case study research a rich description of the context of the study is provided, which can be used for generalization to similar settings. For the research purpose of this paper a single case study would not have been appropriate due to several problems linked to this research approach. Lee stats four major problems of case study research (a) “making controlled observations”, (b) “making controlled deductions“, (c) “allowing for replicability” and (d) “allowing for generalizability” (Eisenhardt, 1989).

The major strength of case study research is the possibility of studying a phenomenon in depth in a realistic (work) context. Weaknesses are related to a lack of control, which leads to problems with generalizing the results. Moreover, the data collected may be interpreted in different ways, and the intervention of the researcher may affect the organization studied. Therefore, it may be difficult to analyze causes of the observations made in the study. Several practical challenges face the researcher when undertaking a case study. For example, it may be difficult for the organization to find time to participate, and they may be unwilling to give the researcher access to all their projects. This may lead to a bias in the selection of projects and cases studied. The organization may expect quick and easily applicable results, which may run counter to the goals and practice of the research (Anda, 2003). In order to overcome the limitations of case study research a rich description of the context of the study is provided, which can be used for generalization to similar settings.

6 CONCLUSIONS

With this paper we presented the results from five industry case studies analysing the impact of user participation on the success of introducing mobile devices in business processes. In our examination within the IT-Service sector 2 out of the 5 companies had a low degree of user participation. 3 companies had user participation within all phases of mobile tool development and business process redesign. The study gives evidence that user participation within the development process of mobile tools (a) leads to reduced adoption and transition barriers as well as (b) improvements of business metrics, especially the return on investment.

These findings may provide a basis for further research on the issue of managing organisational change driven by innovative technologies. Working with the results, however, we should consider that the nature of case study research brings along some limitations. In particular, we should be aware that the results may be different when addressing other context situations. Further research will therefore focus on studies in diverse industry settings to foster the generalizability of the results.

REFERENCES

Anda B., “Empirical studies of construction and application of use case models,” PhD Thesis, University of Oslo, 2003.

Barki H. and Hartwick J., “Rethinking the concept of user involvement,” *MIS Quarterly*, Vol. 13, No. 1, pp. 53–63, 1989.

Basole R. and Rouse W. B., *Towards the Mobile Enterprise: Readiness and Transformation.* IDEA Group Publishing, 2007.

Basole R., "Mobilizing the enterprise: A conceptual model of transformational value and enterprise readiness," in *Proceedings of the 2005 American Society for Engineering Management Conference*, Virginia Beach, VA, 2005.

Benbasat I., Goldstein D. K., and Mead M., "The case research strategy in studies of information systems," *MIS Quarterly*, Vol. 11, No. 3, pp. 369–386, 1987.

Creswell J. W., *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*, 2nd ed. Sage Publications, Inc., 7 2002.

Eisenhardt K. M., "Building theories from case study research," *Academy of Management Review*, Vol. 14, No. 4, pp. 532–550, 1989.

El-Amrani R., Rowe F., and Geffroy-Maronnat B., "The effects of enterprise resource planning implementation strategy on cross-functionality", *Information Systems Journal*, Vol. 16, No. 1, pp. 79–104, January 2006.

Gibson H. L., "Determining user involvement," *Journal of System Management*, pp.

20–22, 1977.

Gumpp A. and Pousttchi K., "The Mobility-M-Framework for application of mobile technology in business processes," in *GI Jahrestagung (2)*, ser. LNI, Cremers A. B., Manthey R., Martini P., and Steinhage V., Eds., Vol. 68. GI, 2005, pp. 523–527.

Hartman A., Sifonis J. G., and Kador J., *Net Ready: Strategies for Success in the*

E-Conomy. McGraw-Hill, 2000.

Henneman R. L., "Design for usability: Process, skills, and tools," *Journal of Information Knowledge System Management*, Vol. 1, No. 1, pp. 133–144, 1999.

Hofstede G., *Cultures and Organizations - Software of the Mind. Intercultural Cooperation and Its Importance for Survival: Software for the Mind*. Mcgraw-HillProfessional, 1991.

ITIL , "Einführung in ITIL," Tech. Rep., 2005.

Ives B. and Olson M. H., "User Involvement and MIS Success: A review of Research", *Management Science*, Vol. 30, No. 5, pp. 586–603, 1984.

Kaasinen E., *User acceptance of mobile services - value, ease of use, trust and ease of adoption*. VTT Publications, 2005.

Keen P. G. W., "Information system and organizational change," *Communications of the ACM*, Vol. 24, No. 1, pp. 24–33, 1981.

Kornak A., Teutloff J., and Welin-Berger M., *Enterprise Guide to Gaining Business Value from Mobile Technologies*. Wiley, 2004.

Lucas H. C., "Systems quality, user reaction and the use of information systems," *Management Informatics*, Vol. 3, No. 4, pp. 207–212, 1974.

Nielsen J., "Usability return on investment," Nielsen Norman Group Report, http://www.nngroup.com/reports/roi/, Report, 2003.

Nielsen J., *Usability Engineering*. New York: AP Professional, 1993.

Pedersen P., Methlie L., and Thorbjrnsen H., "Understanding mobile commerce enduser adoption: a triangulation perspective and suggestions for an exploratory service evaluation framework," in *HICSS-35*, Hawaii, US, 2002, pp. 1–8.

Pousttchi K. and Thurnher B., "Adoption and impact of mobile-integrated business processes - comparison of existing frameworks and analysis of their generalization potential," in *Proceedings of Internationale Tagung Wirtschaftsinformatik*, Oberweis A., Weinhardt C., Gimpel H., Koschmider A., Pankratius V., and Schnizler B., Eds. eOrganisation: Service-, Prozess-, Market-Engineering. 8. Internationale Tagung Wirtschaftsinformatik. Bd. 1, Karlsruhe, 2007, pp. 273–290.

Robey D. and Farrow D., "User involvement in information system development: A conflict model and empirical test," *Management Science*, Vol. 1, pp. 73–85, 1982.

Rouse W. B., *Enterprise Transformation: Understanding and Enabling Fundamental Change*, Wiley Series in Systems Engineering and Management ed. Wiley-Interscience, 2006.

The Standish Group, "Chaos report," online, 2001.

Wang Y., van de Kar E., Meijer G., and Hunteler M., "Improving business processes with mobile workforce solutions," *ICMB*, Vol. 1, pp. 94–102, 2005.

Ward J. and Peppard J., *Strategic Planning for Information Systems*. John Wiley & Sons, 2002.