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Mobile business application for service and maintenance processes: Using ex post evaluation by end-users as input for iterative design

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ABSTRACT

Although mobile technologies are increasingly used for business purposes, many companies have found it difficult to successfully implement them. Not only do the rapid technological changes increase the risks of companies' investments into mobile technologies, but many such applications have also failed to gain user acceptance. In contrast to the consumer domain, there are very few empirical studies of mobile applications' effectiveness from the perspectives of professional end users. Furthermore, designing mobile business applications has become an increasingly iterative and incremental activity, and ex post evaluations by actual users can provide crucial feedback to an iterative design process. In this study, we seek to contribute to establishing a design cycle that closely links the building and the evaluation of mobile business applications. Our objectives are to (1) gain a better understanding of mobile business applications' success by means of ex post evaluations from end users, and to (2) leverage these empirical insights to inform the design of mobile business applications. We conducted the study in collaboration with DEKRA Automotive, which offers expert services in the automotive sector with experience in mobile business applications. Our primary contribution is a systematic approach to using ex post evaluation as input for the iterative design of mobile business applications. We suggest an adapted version of the D&M information system (IS) Success Model, which has process quality as an additional construct, as a basis for ex post evaluations of a mobile business application by its end users. Furthermore, we illustrate how a performance-based analysis of the empirical results enables one to derive priorities and recommendations for future design iterations. Our results reveal that system quality and process quality are the main determinants of individual benefits of using mobile business applications. Our findings thus contradict other studies that identify information quality as a significant motivator of (consumer-oriented) mobile data services. We conclude that a mobile business application's design should focus on process quality, emphasizing functional support for operational tasks in a specific work context while ensuring system quality, which is largely affected by technology platform choices.

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1. Introduction

Mobile devices such as personal digital assistants (PDAs), tablet computers, and smartphones have become widespread and provide users with real-time access to information and services from anywhere and at any time. With the increasing proliferation of mobile technologies, the traditional application areas of computing have broadened to encompass a variety of scenarios, such as m-commerce, mobile banking, and entertainment services [1]. Companies see great potential in utilizing mobile technologies to help business users to perform their tasks more quickly and with higher quality while they are away from their stationary office [2,3]. However, in practice, companies' adoption of mobile business applications has long lagged behind expectations. On the one hand, investments in mobile business applications are risky, owing to rapid technological

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changes. In their early phases, emerging mobile platforms and devices target individual users and often do not fulfill the requirements of corporate information technology (IT). On theother hand, many companies have found it difficult to successfully implement mobile applications and to gain user acceptance. In contrast to the consumer domain, there is a dearth of empirical insights into the adoption of mobile business applications and their effectiveness from the perspectives of business users. To date, "the debate has largely failed to embed glowing accounts for technological potential in a sound discussion of organizational realities" [4, p. 243].

This gap in the research motivates our study. Building on design science research and the current discourse on design evaluation [5–7], we argue that mobile business applications, as innovative IT artifacts, should be evaluated using utility as a primary criterion for end users. Since designing mobile business applications has become an increasingly iterative and incremental activity, ex post evaluations of mobile business applications can provide crucial feedback to an iterative design process. Thus, our primary objective is to assess mobile business applications' success in the organizational context based on empirical data from actual users. Our secondary objective is to demonstrate how these empirical insights might inform mobile business applications' design. We thereby contribute to establishing a design cycle that closely links artifact building and artifact evaluation. We collaborated with DEKRA Automotive, a subsidiary of the German-based company DEKRA AG that offers expert services in the automotive sector with extensive experience of mobile business applications in service and maintenance processes. Our contribution is a systematic approach for leveraging ex post evaluations from the perspective of end users for the iterative design of mobile business applications: we propose to evaluate mobile business applications based on an adapted version of DeLone and McLean's IS success model, which has process quality as additional construct. Although the IS success model is an established theoretical framework that has been used to explain the success of various IS types [8], to our knowledge, it has not yet been used to analyze the success of mobile business applications. The empirical analysis of the resulting performance – effect matrix allows us to derive priorities for improving the design of the mobile solutions.

This paper – a significantly revised and extended version of a conference paper [9] – is structured as follows: in the next section, we review previous research on mobile applications' design and adoption, highlighting the research gap we intend to address. We then introduce DEKRA AG's research context and its approach to mobile business applications' design and implementation. We then explain our evaluation framework. In the following sections, we present the three-step approach we took: model development, ex post evaluation, and the performance-based model analysis as input for iterative design. We conclude by summarizing our findings and implications as well as presenting an outlook on future research opportunities.

2. Mobile applications' design, success, and adoption

2.1. Design of mobile applications

Mobile computing comprises all activities, processes, and applications that are conducted via wireless and mobile communication networks. Mobile technologies have not only broadened computing's traditional application areas but also made application design and development processes more complex and demanding than in the past [10]. Although all applications need usable interfaces, good interface design of mobile applications is particularly challenging. This is not only due to the size of the mobile front-ends in general and the diversity of the segment of mobile devices, which comprises smartphones, PDAs, and tablets with differing hardware capabilities, operating systems, and/or software platforms [11]. It is also due to restrictions of the various environments in which mobile applications are executed (Table 1), as opposed to *traditional applications*, which are executed on relatively stable desktop PCs. Thus, researchers have introduced *contextuality* [10,12,13] to describe the various circumstances in which mobile devices are used and to emphasize the situatedness of human interactions that involve mobile devices.

One dimension of context is a *computing environment*'s characteristics, which include (a) the networking infrastructure's properties (latency, bandwidth, disconnections, and cost), (b) the individual devices' properties (memory capacity, battery lifetime, processing power, input/output, and communication capabilities), and (c) the properties of the operating systems (user interface, security, and program execution). A computing context's characteristics and restrictions should be considered while designing mobile applications. For instance, limited input capabilities dictate the need for less typing on the keyboard. Besides the computing context, user mobility demands that the *operational environment*'s properties are considered when designing mobile applications. On the one hand, the outside environment (noise levels, brightness, and temperature) imposes restrictions when using mobile applications. On the other hand, the parameters that comprise an application's operational environment (e.g., the location) may enhance the mobile application with information that might benefit users. As a third domain, the *user context* influences a mobile application's design in terms of user interface, functionality, and content. Users of mobile business applications vary vastly regarding qualities, such as computer literacy, preferences, and skills, which must be taken into account. Finally, user activities and interactions drive the need for mobile support and interaction modalities.

2.2. Empirical studies on mobile service adoption and success

For users, mobile computing is associated with unique value factors such as ubiquity, instant connectivity, personalization, and timeliness [14]. Exploring and evaluating mobile computing's use and requirements from the perspectives of end users has thus attracted much interest from researchers. Table 2 presents selected

Table 1
Context Domains (derived from Benou and Vassilakis [12] and Tarasewich [10]).

Computing domain			Environment domain	User domain	
Communication network	Mobile device	Operating system	Operational environment	User skills and preferences	User activities
WLAN	Smartphone	Windows Mobile	Brightness	Age	Tasks and goals of mobile users
UMTS	Personal digital assistant (PDA)	Windows 7 Phone	Noise levels	Gender	Information requirements
Bluetooth	Mobile Internet device (MID)	Android	Temperature	Computer literacy	Work processes
Mobile ad hoc network	Ultra-mobile PC (UMPC)	iOS	Wet conditions	User preferences	Events
	Tablet PC	...	Vibrations	...	...
...	...		...		

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