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User Requirements for Location Based Services

An analysis on the basis of literature

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Abstract

The high global penetration of mobile telephony provides a strong basis for the development and diffusion of mobile business applications. Especially for location based services, i.e. mobile services that consider the user's current location to add value to the service provided, a high potential to become a major market success is seen. Nevertheless the development of mobile business and location based services has so far been lagging behind expert expectations. One of the reasons for this disappointing development is the failure of application developers to center their efforts on potential users and their needs and demands.

The following paper therefore reviews the existing literature on user requirements in mobile business and location based services. A definition and characterization of location based services is given and a framework to categorize existing location based services is developed. Additionally, usefulness and usability are put in concrete terms as they are identified as the main determinants of end-user acceptance of location based services. Security concerns of potential users of location based services are analyzed and further limitations of the diffusion of location based services are discussed.

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1. User Orientation in Mobile Business

The rapid growth of mobile telephony has provided a solid foundation for the development of mobile business applications. According to the International Telecommunication Union (ITU) today about 1.5 billion people around the globe use mobile communications, i.e. one fourth of the world's population is familiar with mobile telephony (TNS Infratest 2005, p. 132). In Western Europe the penetration of mobile telephony reached 84% in 2003. In 2004 according to the numbers of the European Information Technology Observatory (EITO) 95% of the British people owned a mobile phone. In Spain (97%) and Italy (100%) almost full penetration was reached. In Germany 87% of the population currently uses mobile telephony. Compared to other European countries Germany thus lacks behind. However, Germany's penetration rate still tremendously exceeds those of the USA (60%) and Japan (67%) (TNS Infratest 2005, p. 135). For this reason and due to its size the German mobile communications market is expected to take a leading role in the future development of mobile telephony and mobile business.

In recent years many experts have proclaimed that the growth and scale of mobile business will exceed that of electronic business. Nevertheless the uptake of mobile business applications has so far lagged behind expectations. Among the most important reasons for this disappointing development is the failure of application providers to center the application development on the user and his needs and requirements (Lee, Benbasat 2003, p. 49). Instead application developers have based their efforts on existing technology and striven to create what is technologically possible instead of what is needed or wanted by potential users. It is mainly for that reason that most of the mobile business applications yet introduced have not been able to create a market pull. The development of mobile business has so far rather been illustrative of a classic case of technology push (Kleijnen, de Ruyter, Wetzels 2004, p. 52). To make use of the great potential assigned to mobile business applications it will be essential for application providers to turn their focus away from technology towards the needs and desires of potential users of mobile business (Crisler et al. 2004, p. 56). In order for mobile services to succeed it will be decisive to deeply analyze consumer needs and requirements and develop all applications precisely around potential users and their demands.

The Mobile Business Research Group of the University of Mannheim has therefore taken a systematic approach to integrate researchers from different disciplines. As part of the SALSA project, the initial goal of which is to develop a software architecture that supports location based and context-based applications, the marketing research group therefore focuses on analyzing the user requirements concerning location- or context-based services.

The following paper summarizes the first results of a review of existing literature on mobile business applications and location based services that addresses the needs and requirements of potential users. For this purpose chapter 2 will first give an introduction to location based services and provide the reader with a definition of the main characteristics. Additionally in chapter 2 a scheme for categorizing different types of location based services will be proposed. Chapter 3 focuses on the user and his requirements. It will be argued that usefulness and usability are the main determinants of end-user acceptance of innovative location based services. In addition, chapter 3 will introduce some of the main security issues of location based services as security is a point of major concern to most potential users. Chapter 4 focuses on other limitations that, in addition to the lack of user focus, still hinder the diffusion of mobile business and location based service applications. In chapter 5 the major findings of the paper are summarized and implications for current implementations and future research are formulated.

2. Location Based Services

2.1 Characteristics of Location Based Services

Location based services can be defined “as services that integrate a mobile device’s location or position with other information so as to provide added value to a user” (Spiekerman 2004, p. 10). The main characteristic of location based services thus is the **localization** feature. As location based services are a subset of mobile business applications they are additionally qualified by the other main characteristics of mobile business, i.e. mobility, ubiquity and personalization. The **mobility** of mobile devices allows the user to avail mobile business applications from anywhere. As most mobile users also have their device in stand-by mode most of the time and are thus permanently reachable, **ubiquity** is another valuable feature of mobile business applications (Wiedmann, Buckler, Buxel 2000, pp. 10). Finally **personalization** is considered an important attribute of mobile business applications. Mobile devices are rarely used by several persons and through its SIM-card each device is clearly attributable to its owner. Mobile phones are therefore deemed as a perfect medium to offer personalized and customized services (Wirtz, Mathieu 2001, p. 617; Lee, Benbasat 2004, p. 90).

Customization also is the main goal of another type of mobile business applications, which is usually referred to as context-based or **context-aware services**. Location based services can be regarded as a subset of context-aware services. Applications that are context-aware can not only customize themselves based on where a user is, but also on other elements of the user’s personal context (Jagoe 2002, p. 2). To grasp the basic idea of context-aware services, it is therefore necessary to gain a clear understanding of the concept of context itself. Context is information used to deliver a service, which is not explicitly input by the user, but is used to add value to the service by adapting it to the user’s current situation. The most basic context information is the user’s location. However, to be able to precisely adapt services to the user’s current needs and preferences it is necessary to account for further types of context data. Examples of other comprehensive context information are (Scheer et al. 2002, p. 100):

- **environmental context:** the environmental conditions of the current location (e.g. weather, altitude, light),

- **activity context:** the activity, the user is currently involved in (e.g. shopping, travelling, sports, business),
- **temporal context:** the current time or time period (e.g. time of day, season),
- **personal context:** individual preferences and characteristics (e.g. non-smoker, health conditions, sportsman, business man, main fields of interest).

Adapting a service to the user's current context is important as people have different needs in different usage contexts. A tourist visiting a city, for example, will have information requirements clearly different from those of a business traveller to the same city (Scheer et al., p. 100). Hence, it is not sufficient to just adapt services to the user's location, but in order to add real value to the service, it needs to be tuned to the user's personal preferences and usage situation, i.e. his context (Kaasinen 2003, pp. 70). If the service is implemented with reference to the user's context, his search and information costs are reduced and the relevance of the information is increased (Buellingen, Woerter 2004, p. 1407). The high quality and value of such a service will increase the user's acceptance and willingness-to-pay for such a service (Figge 2004, p. 1417).

Some of the context information, as for example time, can automatically be discovered and included by the device. Other information, as for example weather, has to be obtained from service providers before it can be integrated automatically into the service request (Link, Schmidt 2002, pp. 146). The data about the user's activity and personal context is added from a personal profile. This profile contains **active data**, which the user has to provide actively before the first time he uses the service. It is usually collected through a computer-assisted self application system (CASE), which supports the user in specifying a detailed profile (Arbanowski et al. 2004, p. 66). In addition, **passive data** is stored in the profile. This type of data comprises all customer information from which future customer demand can be inferred. Passive data should enable the service to precisely predict time and type of the user's future demand. To acquire passive data methods of adaptive personalization can be used. Adaptive personalization uses artificial intelligence and statistical techniques to construct a model of an individual's interests (Billsus 2002, p. 35). For this purpose, methods of explicit ratings, i.e. the direct evaluation of objects by users, should be complemented by the use of implicit

ratings, i.e. ratings that infer a user's interest implicitly from his actions (Claypool et al. 2001, p. 33). Rule-based systems¹, endorsement systems², collaborative filtering³ are methods to be used for this purpose (Arbanowski et al. 2004, pp. 65). Concerning passive data a trade-off exists, which has to be balanced. On the one hand, users profit from the collection of passive data in that the service can be adapted more precisely to their context and preferences without having to provide much data by themselves. On the other hand, users usually feel uncomfortable if their usage behaviour is traced. This phenomenon is often referred to as the "Big Brother Syndrome" (Coursaris, Hassanein 2002, p. 262). For the collection of passive data, however, the user has to allow the tracing of his usage behaviour. He thus has to trade off the value of customization of services and the cost of his usage behaviour being traced.

2.2 Types of Location Based Services

A commonly accepted classification framework for location based services has not yet been established. Several authors have developed different schemes to systemize existing and potential location based services (Barnes 2003; Giaglis, Kourouthanassis, Tsamakos 2003; Samsioe, Samsioe 2002; Schilcher, Deking 2002; Mitchell, Whitmore 2003; Ahlke 2002; Kölmel 2004; Felten 2002; Elliott, Philipps 2004; Faggion, Tracheris 2004). We, however, found none of these frameworks adequately covering the range of existing and potential location based services. In this paper we therefore propose another possible system of classifying location based services according to the main value they offer potential users. We differentiate tracking services, navigation services, information services, community services, entertainment services and transaction services.

Tracking services are services that monitor the exact whereabouts of either people or objects. They are applicable in the business-to-consumer as well as in the business-to-business market (Giaglis, Kourouthanassis, Tasamakos 2003, p. 70). An example of a people tracking service in a private context is the tracking of children or elder people. People tracking in the business-to-business-context can be performed to locate field personnel. Object tracking is especially interesting in the corporate market to, for example, track products within a supply chain. Special types of tracking service are emergency services. In existing frameworks emergency

¹ By observing an individual's usage behaviour rules about his usage pattern and preferences can be inferred.

² User provides feedback to a service used and thus allows for the prediction of future usage intentions.

³ By inferring from the usage patterns of other users the usage behaviour of an individual can be predicted.

services have often formed a separate category. We, however, find tracking to be the core value of emergency services and therefore categorize them as tracking services. Emergency services locate an individual who is unaware of his location or is unable to reveal it because of an emergency situation (accident, breakdown, injury, criminal attack) (Giaglis, Kourouthanassis, Tasamakos 2003, p. 69).

Navigation services address mobile users' needs for directions within their current geographical location. Within the navigation services category we distinguish regular and specialized routing services. "Regular routing services" let the user locate any fixed destination and provide him with detailed directions toward it. "Specialized routing services" are services that navigate the user to a particular type of product or service provider they preselected when initiating the service request. Both types of navigation services may be extended to take into account the current traffic conditions and propose alternative routes. Navigation services can also be implemented as services for indoor navigation (Giaglis, Kourouthanassis, Tasamakos 2003, p. 70).

When using **information services** the user requests his location to be determined in order to receive precise information relating to his immediate environment (Dru, Saada 2001, p. 71). Some of these services offer the user to directly reply to the information provided. E.g. a service offering information about local events may allow for directly ordering tickets for the proposed events. We label these types of services "interactive information services". Information services that only provide location-aware information without offering the opportunity for a direct reply, for example a tourist guide, we name "regular information service". In today's society information and information flow have become very important in consumers' personal and professional lives. It can therefore be expected that, similar to the explosion of demand for information over the internet, users will also increasingly demand information over their mobile devices (Coursaris, Hassanein 2002, p. 262). Information services are therefore assigned a high potential to become successful mobile business applications.

Another possible application field of mobile business is to ease communication of distributed people through **communication services**. Especially in a business-to-business-context mobile communication services can help colleagues to constantly stay connected even if they are working in different locations. Hence, mobile business applications can facilitate the

opportunistic and spontaneous interaction of distributed work groups. Opportunistic interactions are often the main mechanism by which relevant news and updates are distributed within a group and by which personal relationships are developed, which in turn motivate the group members. This type of interaction is therefore essential for a group to timely produce high quality results (Isaacs, Walendowski, Ranganthan 2002, p. 179). Mobile communication applications can thus provide a strong benefit for distributed work groups.

However, the ease of communication is not only of high value in the business-to-business-context. Facilitating connectivity can also be a service of interest for private groups of people, such as a family or a circle of friends (Jarvenpaa et al. 2003, p. 42; Coursaris, Hassanein 2002, p. 261). Community services allowing a group of people to permanently stay connected and communicate with each other can be of high value in today's fast moving society. However, a constant connectedness can also be regarded as being under the control of other people. Additionally the constant connectedness might lead users to feel under pressure as the sender of a message usually expects immediate feedback and thus interrupts the receiver in his current action (Jarvenpaa et al. 2003, p. 43). While users favour the opportunity of being permanently connected with their family and friends, they simultaneously see their personal freedom endangered if being constantly reachable. Users are therefore likely to feel a constant tension between connectedness and freedom. The challenge of developing mobile communication services thus is to address this tension by including application features that allow the user to manage the trade-off between connectedness and freedom.

Entertainment services are services that provide an entertainment value to the user. Examples of location based entertainment services are location based games or location based storytelling services. By including the current position of a player as a component of a game or a story it is no longer abstract but becomes a part of the user's life making the game or the story much more thrilling. Location-aware entertainment services thus provide a much higher entertainment value than regular entertainment services (Samsioe, Samsioe 2002, p. 421). Flirting or dating applications can also be classified as entertainment services as they also provide hedonic value.

Lastly we define **transaction services** as all services that initiate and/or execute economic transactions. We therefore integrate location based advertising as well as location-based billing into this category. The opportunity to localize consumers offers advertisers the

opportunity to engage in location based advertising, i.e. to target consumers depending on their current environment and to adapt the advertising message according to their current context. Location based billing refers to the opportunity of service providers to dynamically charge users of a particular service depending on their location when using or accessing the service (Giaglis, Kourouthanassis, Tasamakos 2003, p. 71).

<u>Category</u>	<u>Sub-category</u>	<u>Main Value</u>	<u>Example</u>
<u>Tracking services</u>	People tracking	Tracking private people or personnel	www.trackyourkid.de www.fleetonline.net
	Object tracking	Tracking objects (products, vehicles, material etc.)	www.teletransport.it
<u>Navigation services</u>	Regular routing services	Localizing and navigating towards fixed objects	www.falk.de
	Specialized routing services	Localizing and navigating towards specialized product and service providers	www.vindigo.com
	Indoor routing services	Localizing and navigating indoors	www.cebit.de
<u>Information services</u>	Regular information services	Delivering local information	www.yellowmap.de
	Interactive information services	Delivering local information including direct reply mechanism	www.mobiloco.de
<u>Communication services</u>	B2C communication services	Easing communication of distributed friends, family members and unknown others with same interests	www.mobiloco.de
	B2B communication services	Easing communication of distributed employees	www.cas.de
<u>Entertainment services</u>		Providing added entertainment value by adapting to location	www.in-duce.net
<u>Transaction services</u>	Location based advertising	Location based initiation of economic transactions	www.mobiloco.de
	Location based billing	Location based execution of economic transactions	www.toll-collect.de

Table 1: Categories of Location Based Services

3. User Requirements

3.1 Usefulness

One of the reasons for the slow diffusion of mobile business and location based service applications is their failure to clearly provide added value to the user (Wirtz, Olderog, Heithecker 2003, p. 74). According to *Rogers Theory of the Diffusion of Innovations* users only show willingness to adopt innovations if these clearly provide an additional value compared to already existing offerings (Rogers 2003, p. 229). This has been proven in various empirical studies (e.g. Bauer et al. 2005, p. 189). In order to be able to accelerate the adaption and diffusion of mobile business and location based service applications it is therefore necessary to gain an understanding and precisely analyze what makes innovative mobile services useful to consumers.

Generally usefulness of mobile services is generated by the main characteristics arising from the use of mobile devices as transaction medium. **Ubiquity** and **mobility** allow for the permanent use of the service and make the user independent of location and time. It enables him to perform time urgent tasks anytime and anywhere (Venkatesh, Ramesh, Massey 2003, p. 56). His flexibility and efficiency are increased. Additionally it gives him the opportunity to satisfy spontaneous needs while on the move (Anckar, D’Incau 2002). Especially flexibility and efficiency are of great value to users today as society is constantly changing and becoming more and more dynamic. Another main characteristic of today’s society is the mass of information that users are exposed to. As location based services show a high degree of **personalization** they can help users to filter relevant information and overcome the constant information overload (Bieber, Giersich, Kirste 2001, p. 565; Lee, Benbasat 2003, p. 52).

In order to successfully implement location based services it is necessary to understand what **type of content** is valuable for the user to be provided by these services. The type of content that can most valuably be delivered through mobile business or location based services applications is dynamic content. Dynamic content is content that frequently changes and therefore needs to be permanently actualized. Due to its frequent changes dynamic content checked before in other media (e.g. newspaper, TV, radio, www) can become worthless while the user is on the move. Examples of this type of content are weather forecasts, last-minute

ticket deals, delayed timetables of public transport etc. (Kaasinen 2003, p. 74). This type of content is only useful for the user if permanently updated and made available to him (Cheverst et al. 2000, p. 2). The mobile phone is the only medium that perpetually accompanies the user and thus is the only medium that can keep users updated on frequently changing content. Mobile business applications are by nature ubiquitous and are deemed to be perfectly suited for delivering dynamic content. Content is also highly valuable to the user if it is comprehensive content. Users dislike having to collect pieces of content from different sources. They prefer having all necessary information ready in one place. In order to add value to a location based service it is therefore necessary to not only provide the user with basic content but with enriched content. The value of location based services can greatly be increased if, for example, the user is not only informed about the location of the nearest gas station but also about its opening hours, shopping facilities, availability of fresh bakery products, car wash, current gas prices, credit card acceptance etc. Similarly information of the location of a restaurant can be enriched by also informing the user about the type of the cuisine, the opening hours, non-smoking seating, number of free seats etc. (Enichlmaier, Staufer-Steinocher 2002, p. 42).

In addition to ensuring these valuable characteristics of location based services in general, it is also important to analyze how each of the specific types of services categorized in chapter 2 can fulfil relevant users' needs and thus be useful to him. For **tracking services** to be valuable it is decisive that they deliver precise positioning data. Especially in the case of emergency services fast performance also is a prerequisite for the service to be useful. **Navigation services** can only be useful if their content is continuously actualized and always up-to-date. Changing traffic information always needs to be included accurately to lead the user the most efficient way (Kaasinen 2003, p. 74). For **information services** it is important that only desired information is delivered and that the information is correct, comprehensive and up-to-date. In this context the information generated by other users can be especially valuable. The opinions and recommendations of other users often better suit the information needs of users than the more general information provided by service providers. Letting users participate in the provision of information can thus add to the value of an information service. Additionally the opportunity to contribute to an information service creates a sense of community among its users and can promote communication services as well (Kaasinen 2003, p. 76). Hence, such a service can not only fulfil a user's functional needs for information, but

also his social needs for belonging. In the context of location based services users could, for example, attach pieces of information to a certain location enabling other users to later access this information at the location similar to a post-it, graffiti or public sign or poster. The main challenge concerning this type of information service is to balance the trade-off between creating an open information space and still enabling users to find relevant information in that space (Espinoza et al. 2001, p. 1). Users dislike the sense of being overwhelmed by information. While opening an information service to all users can certainly add great value to the service, the risk of providing too much information needs to be addressed. In this context customization, again, becomes highly relevant, as users will only find information – whether provided by other users or the service provider – valuable, if it is customized to their information needs.

For being useful **communication services** need to allow for efficient and smooth communication. For mobile chatting services it is particularly important that they quickly perform message exchange. **Entertainment services** are still considered as being suitable only for a niche market. It is therefore difficult to formulate general guidelines to ensure the usefulness of these types of services. Further empirical research needs to be conducted to identify the measures that add value to entertainment services. For **transaction services** it is most important that high security standards are met. They need to guarantee the reliable and immediate transfer of sensitive data.

In addition to usefulness usability is mentioned as one of the main drivers of acceptance of innovations (Davis 1986, p. 24). This is also valid for mobile commerce applications and location based services (Coursaris, Hassanein (2002), p. 270; Venkatesh, Ramesh, Massey 2003, p. 55). The following chapter therefore analyzes how usability can be ensured for location based services.

3.2 Usability

3.2.1 User Interface

Only if users find an application easy and comfortable to use will they employ it. Generally novice users will find an application more approachable if they perceive it as polite and friendly (Cheverst et al. 2000). All notifications of the application should therefore be formulated in a polite and friendly manner. Users also wish for a low installation time and

want to devote minimal time to getting familiar with the application (Bieber 2001, p. 68). According to *Rogers' Theory of the Diffusion of Innovations* newly developed services should therefore not only be **compatible** to existing technology, but should also be compatible to a potential user's existing knowledge and experience with similar services (Rogers 2003, p. 243). It is therefore advisable to align the usage practices of mobile business applications with existing practices of mobile communications and electronic business applications. This will facilitate the user's entrance into the use of mobile business applications.

However, while it is surely worthwhile to be geared to electronic business applications when developing mobile business applications, it is certainly also necessary to precisely adapt the application to the **special conditions of the mobile framework**. Electronic business applications were developed for personal computers that feature superior and larger screens and input devices as well as faster CPUs and higher bandwidth access to the Internet (Hess et al. 2005, p. 12). It is therefore necessary to analyze and question whether what has successfully been implemented for electronic business applications can easily be transferred to mobile business. *Lee and Benbasat (2004)* analyze the existing research on mobile application interface design on the basis of the 7Cs⁴ of electronic business. Especially the mobile setting of the application and the constraints of mobile devices significantly affect the requirements for mobile interface design across all 7Cs. Constraints of mobile devices are mainly their small display, screen and limited input facilities (Venkatesh, Ramesh, Massey 2003, p. 55). The mobile setting, for instance, causes the user to devote only partial attention to the operation of the service. He might be distracted by surrounding noise and other actions. The ability to operate a service with only a few keystrokes therefore is essential for location based services to be usable (Al-Hawamdeh 2004, p. 253). *Lee and Benbasat* consider these special conditions of mobile commerce and develop the 7Cs of mobile interface design.

Because of the limitations caused by the devices and technology as well as by the special requirements of the mobile setting usability is an even more important issue in the context of mobile business than it is for electronic business (Venkatesh, Ramesh, Massey 2003, p. 55). This is especially true for specific target groups who are less experienced in using electronic

⁴ The 7Cs refer to the seven design elements of a customer interface in electronic business applications (context, content, community, customization, communication, connection, commerce).

business applications or other new technologies, but for whom mobile services can be of high value. It might, for example, be necessary to design special interfaces for elder people to enable them to use a location based service such as an emergency service. For this reason interface design issues should be paid precise attention to and it should be considered to develop different designs for different user segments. However, the superior goal of keeping the interface and navigation consistent, transparent and intuitively usable is applicable and valid for all user segments (Yom 2002, p. 177; Kaasinen 2003, p. 77).

3.2.2 Search Functions

There are also high demands on search functions. Empirical studies found that users of small screens follow links less frequently (Buyukkokten et al. 2000, p. 430). It is therefore essential for mobile business applications to provide **comfortable and effective** search functions as users will not accept having to follow several links before receiving the requested information. As typing in text is still quite cumbersome on mobile devices, the application should also assist the user when typing in search requests. In this context customization again becomes very important as it might help to offer one-click-requests or customized pull-down menus (Yom 2002, p. 178). A keyword entry support also is a desirable feature, which will ease searching for the user. Allowing the user to enter keywords by voice can also be a possibility to deal with the limitations of mobile devices. Generally voice-based navigation is considered a promising development that can enhance the diffusion of mobile business applications (Al-Hawamdeh 2004, p. 253). By considering former search requests as well as the personal profile of the user the application should also be able to anticipate the search word the user wants to type in, even if he only provides the first letters (Buyukkokten, Garcia-Molina, Paepcke 2000). However, to ensure the user's sense of being in control of the application he should also be able to overrule the automatic suggestions.

Despite the quite complex search procedures requested by users, they also want services to be executed quickly. When developing mobile business applications it is therefore essential to keep in mind the **technological capacities**. Users will not accept services that offer all usability features but take a long time to be completed. The features of mobile business applications should therefore be limited, if the capacity of transmission rates and mobile devices is not sufficient to perform the service in a timely manner (Manber, Patel, Robison 2000, p. 36; Buellingen, Woerter 2004, p. 1407).

3.2.3 Result Presentation

Due to the obstacles of mobile devices not only the search itself should be very focused and request little user input, but also the search results should be very well-structured (Jones 1999). Especially if results are drawn from different providers, consistency in the display of offers is a prerequisite for a clear information structure. As scrolling on mobile devices is perceived as cumbersome, the user should ideally be able to see all necessary information for a service in a single view (Kaasinen 2003, p. 77). As in the case of several search results being offered this is rather difficult to implement, yet accordion summarization can be an effective way to display search results. **Accordion summarization** first provides only basic information, but allows expanding the result list to provide further information (Buyukkokten, Garcia-Molina, Paepcke 2001, p. 213). Giving the user the possibility to access further information as exhaustively as he needs is an important factor to make a service valuable (Kaasinen 2003, p. 75). Once the information has been requested and downloaded it should remain available to the user even when being offline. If users have to reconnect every time they want to review information, they won't perceive the service as very valuable (Coursaris, Hassanein 2002, p. 261).

3.3 Security

Among the main barriers for the diffusion of mobile business and location based service applications are the fears and concerns of the users toward these types of applications. Some of these concerns are rooted in a lack of confidence in technical security and need to be considered when developing mobile business and location based service applications. When addressing user concerns referring to technical risks, it is, however, necessary to realize that objective technical security is not the decisive factor to be focused. What is decisive is the **user's personal perception** of the security of an application. The main determinant of the user acceptance of mobile business applications is his subjective assessment of the risks involved (Schindler 2002, p. 63). In addition, a dislike of mobile business and location based service applications is rooted in a general uneasiness of the fact that technology is entering more and more parts of an individual's life. The following chapter aims at highlighting some of the major challenges developers of mobile business applications need to address in order to gain the users' trust and confidence in mobile applications and location based services.

3.3.1 Protection of Personal Data

Consumers generally hesitate to release personal data. They mainly fear the misuse of their personal data in the sense that it is used for purposes they not explicitly gave permission to (Diezmann 2001, p. 159; Möhlenbruch, Schmieder 2002, p. 76). The main concern is that personal data is forwarded to other commercial institutions, which make use of it for advertising purposes (Coursaris, Hassanein 2002, p. 261). As users are already flooded with advertising messages by e-mail, mail and telephone, this vision evokes great uneasiness (Jagoe 2003, p. 89). Some users also fear their personal data being given to governmental institutions and see the “Big Brother”-vision coming partly true (Pflug, Meyer 2002, p. 413; Turowski, Pousttchi 2004, p. 101). Nevertheless the value of services can greatly be enhanced through personalization. In order to be able to personalize services, providers need personal data from the user. There will thus always be a **trade-off** between the value of personalized services and the uneasiness of providing personal data (Manber, Patel, Robison 2000, p. 37). It will therefore be necessary for service providers to stress the value of personalization. If users acknowledge the added value of personalized services and learn to appreciate the customization, they will have a valid incentive to release personal data (Müller, Aschmoneit, Zimmermann 2002, p. 368; Spiekerman 2004, p. 16).

Additionally service providers need to strive to gain users’ trust. Data protection and the generation of **trust** and confidence are considered the main conditions for the acceptance of mobile business applications (“safe harbour principle”) (Buellingen, Woerter 2004, p. 1407). A mutual basis of trust has to be established for mobile business applications by all parties belonging to the mobile business value chain (Mueller, Aschmoneit, Zimmermann 2002, p. 363). Especially because trust in mobile devices and services is still generally low, it will be indispensable to not only implement but also communicate all security measures of an application to enhance user confidence (Turowski, Pousttchi 2004, p. 117; Mueller, Aschmoneit, Zimmermann 2002, p. 363). In this context trusted third party, trust-intermediates and branding may be effective instruments to reduce the global risk perception of mobile business applications (Gerpott 2002, p. 64; Henkel 2002, p. 330). Additionally it is recommended to clearly inform the user about the terms and conditions of the requested service, completely list all costs at an early stage, and provide the user with the full business address of the service

provider. This information will enhance the user's trust in the service and its provider (Strobborn et al. 2004, p. 1435).

Acquiring personal data is not only critical from the user perspective, but also from a **legal** point of view. As location data is considered a subset of personal data this is also true for data about the user's position. When implementing location based services it is thus highly recommended to consult legal experts to ensure that the collection of data complies with legal restrictions. Personal data, hence location data, in Germany is subject to the BDSG (Bundesdatenschutzgesetz = Federal law of data protection). It may only be collected if permitted by the user or a legal institution. In the case of pull location based services, where the user explicitly requests a service, his location data becomes usage data and its collection is thus legally permitted. Nevertheless the user should be alerted that his location is detected (Steinmassl et al. 2004, p. 140; Spiekerman 2004, pp. 18). However, if not required for billing purposes, the usage data is to be deleted right after the service has been completed. If the service provider intends to store the data and use it for the customization of future services, he needs to acquire the user's permission (Steinmassl et al. 2004, p. 140).

For tracking services data security restrictions are even more severe. As the location data for the person being tracked is no usage data, it is illegal to collect this data without the permission of the person being tracked (Steinmassl et al. 2004, p. 141). Hence, tracking services have to ask for **permission** before every tracking procedure. They should also elaborately inform tracked users about the service and the service provider and give them easy access to the list of users who are allowed to track their position. Lastly users should be able to easily abort the service procedure (Spiekerman 2004, p. 19). All in all tracking services can be expected to evoke strong uneasiness among users, as users usually dislike the feeling of others being able to permanently track their whereabouts. In the context of tracking needy persons (children, elderly, sick people), however, tracking applications are certainly conceivable as in this case they also provide a strong value for the person tracked.

Finally consumers are also concerned with the fact that mobile phones are much more likely to be stolen than fixed-installed systems. For data security this means that not only the personal data stored in the databases of the service provider is subject to protection. The information stored on the mobile phone, such as messages, addresses, calendars, services

used, recent search requests etc., also need to be protected in case someone other than the owner gets to use the mobile device (May 2001, p. 229). In this case, however, personal data, especially location data, can again be of high value as it might allow the localization of the device and thus the localization of the stealer (Pflug, Meyer 2002, p. 414).

3.3.2 Protection of Privacy

Another major concern of users is the fear of their privacy being unprotected (Jarvenpaa et al. 2003, p. 43; Dean 2002, p. 258). Users are already annoyed by being spammed through unwanted regular and electronic mail. **Spamming** is an intrusion into an individual's privacy as it dispatches unwanted messages to the user's personal mailbox and thus enters his personal space. Users fear that the diffusion of mobile commerce applications will also introduce the spamming problem to the mobile phone (Coursaris, Hassanein 2002, p. 261). As the mobile phone is an even more personal device than regular or electronic mailboxes, mobile spamming will be regarded as an even stronger intrusion into the individual's privacy (Jarvenpaa et al. 2003, p. 42). Furthermore the small display sizes of mobile phones usually force the user to notice every incoming message, i.e. even unwanted messages, which will offend him even more (Bliemel, Fassott 2002, p. 15; Spiekerman 2004, p. 16). Another common user concern is that spamming will lead to an overloading of the application and result in a denial of service (Turowski, Pousttchi 2004, p. 103). Many users have already experienced their electronic mailboxes being blocked by unwanted messages causing their e-mail application not to be usable. For the mobile phone, which is often used to communicate urgent messages, a similar denial of service will be intolerable for users.

3.3.3 Transaction Security

As for mobile commerce applications it will be necessary to also perform transactions over the mobile phone, transaction security is another major concern of potential mobile users (Picot, Neuburger 2002, p. 61; Mustafa, Oberweis, Schnurr 2002, p. 367). Secure transactions are a prerequisite for commitment, which is in turn a prerequisite for contracting, which again is an **essential for successful business applications** (Scheer et al. 2002, p. 101). For mobile commerce applications to find acceptance it will therefore be crucial to ensure secure transactions. This is especially true for transactions involving matters the user does not, in any case, want to get lost or be visible to unauthorized others. This could be the case for sensitive

business data or if substantial amounts of money are transferred. Generally users prefer easy and fast processing for smaller amounts and are willing to accept a lower level of security. For larger amounts, however, their main concern clearly is the security of the payment (Entenmann 2001, p. 274; Diezmann 2001, p. 159). In this case they are also willing to accept more complex and slower transaction procedures.

Concerning transaction security users mainly fear the **interference of third parties**. They are afraid of unauthorized parties intercepting the transaction process to copy, delete or alter data. In the short run, such a third-party attack may lead to financial loss on behalf of the user or on behalf of the service provider. However, the long-term effects of such an unauthorized interference can be even more severe. Users will lose confidence and trust not only in the application itself, but also in the service provider and in the whole concept of mobile commerce (Turowski, Pousttchi 2004, p. 100). Generally users perceive security risks rising with the degree of interaction and the sensitivity of information exchanged. Applications that involve a lower degree of interaction and are less personalized evoke lower security concerns than services that require a lot of interaction and the transfer of personal information (Coursaris, Hassanein 2002, p. 260). Ensuring transaction security thus is one of the major prerequisites for mobile commerce applications to win long-term acceptance and become a major market success. To increase users' trust in payment over the mobile phone it is also recommendable to allow for an easy handling of the payment procedure as well as for the reversal of payment transaction and reimbursement guarantees (Henkel 2002, p. 329).

3.3.4 Sense of Control

Lastly consumers also have a great fear that is not connected to any technological concerns or the application itself. It is rather rooted in the user's perception of the overall technological advancement that more and more enters his personal life. Many users feel a loss of control of what is happening with and around them and this feeling again evokes great uneasiness (Jarvenpaa et al. 2003, p. 43). It is thus not recommendable to suppose the mobile business user as being a rational economic man, who will greatly appreciate the highest degree of personalization as delivering the most relevant services and thus being most valuable. If the application is "too intelligent" always providing the user with the exact right service at the exact right time, he will develop a feeling of being totally controlled by technology. Users do not want the applications to lead to a predestined and over-controlled environment, in which

they are completely managed and controlled by their mobile device (Kaasinen 2003, p. 76). It will therefore be necessary to develop a context-aware application that personalizes services as much as possible without letting the user feel out of control. The collection of context data will thus have to be in the user's control not only for legal reasons. Only if the compilation of this type of data clearly relates to a specific service request and is controlled by the user, will he accept this vital component of mobile business applications in general and location based services in particular (Wimmer 2001, p. 213). To address the user's concern of losing control of his environment he should be given the **opportunity to overrule the system's suggestions** (Wimmer 2001, p. 213). In addition, users should always be able to select the senders they accept messages from and to control the type and amount of personal information they want to reveal to any particular sender or service provider (Arbanowski et al. 2004, pp. 65; Kaasinen 2003, p. 75).

4. Limitations

4.1 User

One of the major limitations of mobile business diffusion also is that users yet have only **little knowledge** about the applications and services offered. As consumers are only able to express needs and requirements if they have had the chance to experience the service, an exact analysis of user needs concerning mobile business applications is still difficult (Möhlenbruch, Schmieder 2002, p. 79). Many users are inexperienced with mobile services other than phoning and using simple data services such as SMS (Bliemel, Fassott 2002, p. 4). Additionally the mobile communications market is currently experiencing two conflicting trends: the variety and complexity of mobile devices and wireless services is increasing, while the spectrum of users broadens. This means that more and more inexperienced users have to deal with more and more complex devices and services (Crisler 2004, p. 60). When developing mobile business applications it also has to be considered that not all users of mobile phones have experience with using the internet (Möhlenbruch 2002, p. 79). While it appears reasonable to gear mobile business navigation towards electronic business navigation, it has to be borne in mind that some users are not familiar with electronic business navigation at all.

What also needs to be considered while developing mobile business applications is the fact that the user is on the move and can often devote only partial attention to the device and service (Lee, Benbasat 2003, p. 50). His first and foremost ambition of being mobile is to overcome geographical distances. Hence, using mobile applications is only the second order activity of the user (Hess et al. 2005, p. 10). Additionally **environmental factors** (e.g. background noise, illumination, weather) may disturb the usage situation (Kaasinen 2004, p. 75). It is also necessary to keep in mind that users often use mobile service applications during “niche times”, e.g. when waiting for public transports. They thus often only devote five minutes or less to the use of the application (Stanoevska-Slabeva 2003, p. 4). The usage of mobile business applications should therefore not be too demanding, easily apprehensible and quick to use.

4.2 Industry

Even though the mobile communications industry has a strong interest in the diffusion of mobile business applications it still causes one of the major restraints of a widespread diffusion of mobile business: the **lack of standardization**. The emerging network environment is expected to become increasingly heterogeneous as investment strategies of established operators as well as of new entrants are more and more uncoordinated and even divergent. Interoperability will therefore become a crucial challenge determining the success of new wireless business models (Arbanowski 2004, p. 64; Pflug, Meyer 2002, p. 414). Additionally the structure of the wireless value network slowly begins to change. Traditionally business models for mobile services have been characterized by a strong dependency on the underlying network infrastructure, resulting in a rather closed model with the mobile network operator as the central gatekeeper (Arbanowski 2004, p. 64). With the changes of market conditions mentioned above this network structure is slowly changing, letting other members of the network (device manufacturer, content providers, etc.) gain influence and power.

4.3 Technology

Technical restrictions for the development of mobile business applications mainly result from **restraints of the devices** on the one hand and from limitations of data transmission on the other. Mobile devices are limited in their input and output capabilities. The keyboards are rather small and text input thus remains uncomfortable (Buyukkokten et al. 2000, p. 430). Additionally mobile devices only feature small screens forcing mobile business applications to display information in a small, hard-to-read space (Bliemel, Fassott 2002, p. 15). The restrictions of input and output facilities certainly limit the usability of mobile devices. However, portability is another major requirement for mobile devices vindicating the lack of usability (Gebauer, Shwa 2004, p. 22). To ensure portability of mobile devices limited battery performance is another constraint that needs to be accepted. Additionally mobile devices are restricted by their small storage capacity and limited processing power (Buyukkokten, Garcia-Molina, Paepcke 2000; Stanoevska-Slabeva 2003, p. 3; Lee, Benbasat 2003, p. 49). These technical limitations lower the usability of mobile business applications causing consumers to sparsely appreciate such applications (Jarvenpaa et al. 2003, p. 42).

Concerning **data transmission** the major constraint results from the fact that reception quality and speed can greatly vary depending on location (e.g. indoor – outdoor, municipal – rural) and that in some areas data retrieval and transmission is not possible at all (Bliemel 2002, p. 15; Henkel 2002, p. 330). Users are also concerned about loss of connectivity during the performance of a service leading to a loss of data (Coursaris/Hassanein 2002, p. 261; Al-Hawamdeh 2004, p. 253). Additionally the yet limited speed of data transmission has to be considered when developing mobile business applications as people will not accept services that require excessive amounts of time to access content, which slow down or even disrupt because of too large amounts of data (Buyukkokten, Garcia 2000).

5. Summary and implications

As the remarks of this paper show, there are many different issues to be addressed when accounting for the user perspective while developing mobile business applications. The user concerns as well as the lack of trust and confidence in the concept of mobile business certainly are the major obstacles that need to be overcome in order for mobile business applications to diffuse. One way to overcome these issues is to provide services that offer a high value to the user. In order to be able to implement such a service it is necessary to address user requirements from the very beginning on. However, little sophisticated empirical research has so far been conducted on this issue. The remarks of this paper are mainly based on conceptual papers and partly on research results that were transferable from the electronic business context.

Nevertheless this paper might be a helpful guide for more technology-oriented projects to at least partly grasp the perspective of a common mobile business user. More specific insights on user requirements will be gained from the empirical research that will be conducted as part of the SALSA project.

The following table summarizes the main points that should be kept in mind during the development of mobile business and location based service applications as they represent the main challenges concerning the user acceptance of mobile applications:

<p>Ensuring usefulness:</p> <ul style="list-style-type: none">• Correct content• Precise content• Dynamic content• Up-to-date content• Comprehensive content• Desired content• Smooth and efficient communication
<p>Ensuring usability:</p> <ul style="list-style-type: none">• Immediate and fast service performance• Easily understandable and usable service• Consistent, transparent, intuitively usable user interface• Effective search assistance• Concise and consistent result presentation
<p>Addressing user concerns:</p> <ul style="list-style-type: none">• Protection of personal data• Protection of privacy• Ensuring transaction security• Guaranteeing sense of control
<p>Limitations/challenges:</p> <ul style="list-style-type: none">• Inexperienced users• Usage situation: on the move, distraction, minimal time and attention• Lack of technical standardization• Changing market conditions• Device constraints: limited input (keyboard) and output (display) capabilities, limited battery performance, small storage capacity, limited processing power• Transmission constraints: varying reception quality, limited speed

Table 2: Major issues of user orientation in mobile business

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