Value-in-Use of Mobile Technologies

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Abstract: Mobile and ubiquitous technologies are considered one of the currently developed technology innovations with greater market potential in the coming future. Such technologies integrate a whole set of IT-based applications used in the private or working environment of individuals and provide extensive service capacities to support users in carrying out several activities and (work) processes. Characteristically for these kinds of technologies, value is created mainly through the use of technologies rather than ownership. Drawing from the Service-Dominant Logic and considering existing typologies of consumer value, this paper tries to lay a foundation for a potential approach to measure value in use of mobile and ubiquitous technologies. Additionally, data from an open access internet blog on mobile technology usage was further used as a first field source for gaining explorative insights into users' daily activities with mobile technologies and applications by means of a qualitative content analysis. This leads to proposing an initial set of value dimensions that help to better understand how mobile and ubiquitous technologies create value to the user during the usage processes.

1 Introduction

Within the last few decades a number of technological innovations have shown a remarkable impact on the way people live today and how they will live in the near future. WEISER [We91] proposed the concept of 'ubiquitous computing', a concept in which the increasing availability of processing power would be accompanied by its decreasing visibility to improve people's lifestyle. Early forms of ubiquitous networks are apparent in the widespread use of mobile phones. For millions of people mobile phones have become an integral and intimate part of their everyday life [ITU05]. The immense growth in the amount of applications available for smart phones and the number of downloads per year emphasise the importance of the mobile phone market and the mo-

bile internet.[1] Despite the enormous amount of downloads a study by Localytics found that 26% of the applications are downloaded, just used once, and are then discarded.[2] This clearly illustrates, that an application's success cannot be merely traced back to the number of downloads, but should rather be related to the real usage process as well.

The question arises how to assess the value of mobile and ubiquitous technologies? Especially to understand and improve what comes after a download, as even companies put a lot of money in the corresponding development and distribution process. Generally, the revised information systems (IS) success model [DM03] or the extended technology acceptance model (TAM2) [VD00] could be applied. However, these approaches are limited providing true customer dimensions and are not without criticism [Se97; Bu10]. To assess the value of mobile and ubiquitous technologies approaches from other fields of research must be considered as well. One promising candidate is the so called Service-Dominant Logic (SD-Logic) developed by VARGO AND LUSCH [VL04], taking into account one important aspect of mobile and ubiquitous technologies: *value is not only created by technology ownership but mainly by technology usage*! Thus, in accordance with the findings above, enabling adequate, value-creating usage processes plays a decisive role for the market success of such technologies [WHM10].

The SD-Logic is well known meanwhile and the aspect that value mainly emerges through usage processes is widely recognised conceptually. However, the value-in-use concept still lacks a clear operationalisation and empirical validation of the SD-Logic is still missing [Os10; Sw07; WPB07]. By using the SD-Logic as a lens to our concept and analysis as well as by closer investigating the value-in-use through identifying relevant value dimensions during the usage of mobile technology, we aim at reducing this research gap in a particular context.

Consequently, the main objective of this paper is to obtain an initial set of value dimensions that help to better understand how mobile and ubiquitous technologies create value during their usage processes. In order to develop such an approach for capturing the value as described in the SD-Logic, we firstly describe the basic idea behind this logic and the shift from value-in-exchange to value-in-use involved. The analysis of prior research that has been done regarding different value dimensions so far will subsequently serve as a conceptual basis (Section 2). Moreover, as proof-of-concept of our conceptual considerations, we focus at gaining explorative insights into the customer usage phenomenon by means of a qualitative content analysis of an internet blog regarding peoples' experience with smart phones and corresponding applications. By that, we empirically test identified value dimensions on a small sample size in terms of their applicability and develop categories that help to better understand mobile technologies'

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[1] Apple, for instance, currently offers more than 500.000 applications via its App Store with over 18 Billion downloads until October 2011 (c.f.
http://www.tuaw.com/2011/10/04/more-than-18-billion-apps-downloaded-from-app-store/).
[2] http://www.localytics.com/blog/2011/first-impressions-matter-26-percent-of-apps-downloaded-used-just-once/

usage (Section 3). Finally, we discuss in section 4 the main research results, the limitations of our study, and opportunities for further research.

2 Theoretical Background

In this section, we provide a brief introduction of the areas we will investigate, with the objective of developing a theoretical basis for understanding value-in-use of mobile and ubiquitous technologies. Taking into account this quite new service-centred perspective the relation to and separation from different value concepts will be discussed in the following as well as mobile and ubiquitous technologies in order to classify our targeted technologies.

2.1 Mobile and Ubiquitous Computing

Mobile computing is the use of existing portable computers and wireless technology to control the transmission of information wirelessly between networks [FZ94]. Portable devices enable specific functions, also known as mobile services [We04]. These mobile services often include contextual information, that means that they are able to take into account the user's specific location. There are currently a number of localized situation dependent mobile services, also known as location-based services, which are becoming widely available. Among other things, these services provide support to humans, machines and also to other mobile services by determining their location [n.a.01; Sp04; We04] leading to (situation dependent) mobile computing [Mü99].

The concept of *ubiquitous computing* was introduced by WEISER [We91] to describe a vision in which many computers are integrated invisibly into the user's environment. In ubiquitous computing, the use of multiple computers represents a key difference from other mobile technologies, in which a single computer, in the form of a mobile device, is foregrounded in the user experience. Ubiquitous computing is not limited to a single device which is attached to a single user, but rather is made possible by the interaction and integration of several different devices. Expanding beyond one-to-one connections leads to a system of networks that transmits data between several (mobile) devices automatically ('everywhere computing'). This even so called *machine-to-machine (M2M)* communication provides value on various levels as well. For example a car's microchip tells the engine how to operate under changing conditions so that the car can achieve the best fuel economy; same for smart metering solutions, helping to improve management of power, natural gas or water consumption.

2.2 Service-Dominant Logic

For several decades exchange has been beyond doubt the fundamental construct in marketing [Al65; Ba75]. During that time marketing mainly concentrated on the distribution and exchange of commodities and manufactured products in economies [Ma27; Sm04]. This good-centred model of economic exchange understood the units of output, embedded with value in the production process, as the central components of exchange [MHV09]. A Goods-Dominant Logic (GD-Logic) assumes that the firm 'produces' value and that customers ('consumers') are exogenous to value creation.

However, new approaches have emerged that have shown a revised marketing logic focusing on intangible resources, the co-creation of value, and relationships [Sh77; SP00; Ru98]. These new perspectives direct marketing towards a more comprehensive and inclusive dominant logic with an integrative view of goods and services [VL04]. This directly relates to GUMMESSON who claims that: "Customers do not buy goods or services: They buy offerings which render service which create value, the traditional division between goods and services is long outdated. It is not a matter of redefining services and seeing them from a customer perspective; activities render services, things render services. The shift in focus to services is a shift from the means and the producer perspective to the utilization and the customer perspective" [Gu95, 250-251].

These new approaches are demonstrating a change from the GD-Logic, in which tangible output and discrete transactions were central, to the SD-Logic, in which intangibility, exchange processes, and relationships are prominent [VL04]. In this service-centred view 'service' is defined as: "The application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself" [VL04, 2]. Thus, in the SD-Logic value emerges during the consumption experience as value-in-use whereas in the GD-Logic the value was embedded in a product from economics and exists as value-in-exchange.

The growing integration of information and communication technology (ICT) into objects of everyday life and the growing mobility of communication will create an increasing transparency of people's processes in their daily lives. By gaining insights into consumers' usage processes and receiving direct feedback, companies will be able to immediately interfere and support users in carrying out various activities, processes, or applications. In this way suppliers can offer their services exactly at the point of use where, according to the SD-Logic, value is created [WHM10].

2.2 Value Concepts

Concluding from above there are two general meanings of value implicated by the shift from a goods-centred perspective to a service-centred perspective, 'value-in-exchange' and 'value-in-use', which reflect different ways of thinking about value and value creation. Whereas in the GD-Logic the roles of "producers" and "consumers" are distinct, and value creation is often considered as a series of activities performed by the firm, the SD-Logic focuses on value that is "always co-created, jointly and reciprocally, in inter-

actions among providers and beneficiaries through the integration of resources and application of competences" [VMA08, 146].

Generally we can distinguish between unidimensional and multidimensional consumer value concepts [SI07]. Whereas unidimensional models often assess consumer value based on a trade-off between benefits and sacrifices on a single dimension, multidimensional models often conceptualize consumer value with the help of consumers' needs and resort to a list of dimensions [Wa04]. Many authors have argued that the unidimensional trade-off models are narrow or arcane and too simplistic in that they ignore the multidimensionality of the value construct [SNG91; MMR01; SS01]. Even though the multidimensional concepts overcome some problems of the unidimensional concepts, a majority of the multidimensional approaches are based on measuring consumer value only at a certain point in time [Wa04; Pe02; dR97] implicating that the consumer perceives the usage process also at one certain point in time. However, according to the SD-Logic value is created through the whole usage process. To capture the consumer value on a process based orientation the investigation of events or happenings during the supplier-consumer-relationship might be a possible approach [WF06]. In the context of consumers' events, perceived experiences may further serve as a parameter to evaluate those events pertaining to consumers' needs. Experiences are one fundamental aspect within the SD-Logic. Thus, under the SD-Logic products (GD-Logic) firstly became offerings [VL04] and finally through a further adjustment experiences [LV06].

		Extrinsic		Intrinsic	
Self-orientated	Active	ECONOMIC VALUE	EFFICIENCY (output/input, convenience)	HEDONIC VALUE	PLAY (fun)
	Reactive		EXCELLENCE (quality)		AESTHETICS (beauty)
Other-orientated	Active	SOCIAL VALUE	STATUS (success, impression management)	ALTRUISTIC VALUE	ETHICS (virtue, justice, morality)
	Reactive		ESTEEM (reputation, materialism, possessions)		SPIRITUALITY (faith, ecstasy, rapture, sacredness, magic)

Figure 1: Typology of Consumer Value [Ho96; Ho06]

A consumer value model that captures diverse aspects of the consumers' experiences is HOLBROOK'S [Ho96] typology of consumer value. According to HOLBROOK, his value typology is able to capture the essence of the SD-Logic and even extends the grasp beyond that provided by VARGO AND LUSCH'S more confined service-centred approach [Ho06]. He defines customer value as an *interactive relativistic preference experience*. This means that value involves a relationship between a subject ('consumer') and an

object ('product'), value is comparative, situational, and personal, value refers to a judgment of preference, and value is provided not in an object, a product, or a possession but rather in a consumption experience [Ho06]. Within his model HOLBROOK [Ho96] classifies consumer value into three dimensions: *extrinsic/intrinsic*, *self-orientated/other-orientated*, and *active/reactive*. By combining these three dimensions he presents eight dimensions to define the typology of consumer value that are again classified into the four value categories *economic*, *hedonic*, *social*, and *altruistic* value (Figure 1). The *economic value* distinguishes between the dimensions *efficiency* and *excellence*. *Efficiency* includes the get-versus-give aspects of consumption and considers consumer's monetary cost, time, and effort regarding a consumption experience. *Excellence* involves the degree to which a market offering is perceived to be able to accomplish certain goals.

Social value connects the dimension status (influencing one's own social status, making a favourable impression on others) with the dimension esteem (improving one's own social reputation) .The *hedonic value* highlights the importance of having fun (play) and the self-orientated appreciation of an object (aesthetics). The *altruistic value* embraces the dimensions ethics (usage based on virtue and moral aspects) and spirituality (passive appreciation, admiration or adoration of the other) [Ho96].

3 First Measurement of Value-in-Use of Mobile Technologies

In the following section we try to gain insights into people's usage processes with mobile technologies and thereby aim at capturing the value-in-use of such technologies. We chose smart phones as our research object firstly because of their current importance and potential in the mobile technology market and secondly because they represent a perfect technology to picture usage processes as they provide extensive applications to support users carrying out various activities in their daily life. As a field source we used data from an open access internet blog on mobile technology usage launched by the newspaper 'Der Tagesspiegel[3]' and the mobile network operator 'Base[4]'. Via this project the two companies followed average users through their daily activities with smart phone technologies and applications and tried to answer the following questions: "how is mobile internet changing people's everyday life?", "which applications are meaningful?", "which applications are mainly for the fun of it and what will soon be forgotten?". Over a time period of six weeks eight users (five women, three men, average age 43 years, pupil, student, employee, pensioner, and professor) reported as so called 'mobile scouts' on their usage with smart phone applications. Every week the mobile scouts received a new task on which they were asked to report in the mobile scout blog. Weekly tasks varied from organising, navigation, social networking, etc. to a final feedback regarding the usage process.

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[3] http://www.tagesspiegel.mobile-scouts.de/
[4] http://www.base.de/

In this paper we focus on analysing blog statements concerning the weekly user task *navigation*. At this point in time the scouts had already familiarized themselves with using the smart phones and developed enough knowledge on handling and features of their phone. Regarding this task the mobile scouts received the following instruction: "Getting from A to B quickly – also in this matter your smart phone is able to support you! You have a business appointment, a date at night, a spontaneous meeting – look up your way using your smart phone and be navigated to your destination."

By using the data from the mobile scout blog we can develop a first understanding of how people experience mobile technologies and choose the most important aspects that create value to the consumers during their usage processes. Based on this we deduce a first approach to extract relevant dimensions for assessing value-in-use.

3.1 Procedure of Content Analysis

As the data obtained from the blog was not generated by an own survey carried out and only provides a small sample size, we do not aim at conducting any quantitative statistical analyses. Thus, the data was analysed by means of a qualitative content analysis, a method appropriate for analysing recorded communication. Mayring [Ma10] puts forward three distinct analytical procedures for the interpretation of such material: Summary, explication, and structuring. The summary, which was used in the present study, attempts to reduce the material in such a way as to preserve the essential content and by abstraction to create a manageable corpus which yet reflects the original material. The procedure of summary implicates an inductive category development, which has proven to be quite fruitful to the qualitative content analysis [Ma10]. The inductive category development aims at a naturalistic, object-related reflection of the material without being biased by any pre-assumptions [Ma10]. With regard to the main objective of this paper it seems to be an adequate means to reveal evaluation dimensions, which, according to the value as described in the SD-Logic, may appear within people's usage processes with smart phones.

3.2 Results of Analysis

After the analytical steps of the summary procedure (including paraphrasing, generalising, bundling) there were a great many of evaluation dimensions and criteria revealed that may serve as a basis for assessing the value-in-use of mobile technologies. Table 1 shows the corresponding results, which are presented in descending order of frequency of occurrence. This approach is based on the assumption that an increased occurrence of elements goes along with an increased relevance [BT95].

Evaluation Basis	Evaluation Dimension / Criteria	Rel. Frequency	Abs. Frequency
Route Guidance	Efficiency/Speed, Adaptability, Orientation/Transparency, Inspiration/Novelty, Recognition of Obstacles	43.1%	41
Data Information	Accuracy of Reality, Speed, Clearness, Travel Time, Length of Route, Oversupply, Expedience	14.8%	14
Locating	Reliability, Speed, Data Security, Orientation/Security	13.7%	13
Voice Response	Stream of Speech, Grammar, Friendliness, Fear of Adaption	10.5%	10
Handling	Weight Savings, Fixing/Storage, Changes of Settings	8.4%	8
Situation/Place	Independency, Time Savings	4.2%	4
Entering of Destination	Barrier-free, Clearness	3.2%	3
Social Interaction	Ubiquity, Neglect of Social Interaction	2.1%	2
Totals		**100.00%**	**95**

Table 1: Evaluation dimensions and criteria of value-in-use

The most frequently evaluated aspect was the *route guidance* (43.1%). Within this evaluation the speed of reaching a destination, choosing the shortest route, the recognition of obstacles (such as congestion, road closure, etc.), and the adaptability to changes were evaluation dimensions found most often. The inspiration/novelty dimension relates to the new routes and interesting discoveries, which are perceived as hedonic aspects during the navigation. Orientation/transparency mostly refers to a feeling of security and not-being-lost. The second most frequently evaluated aspect was *data information* (14.8%), data available during the navigation can be differentiated by the kind of information (length of route, travel time), the quality (accuracy of reality, speed), and the quantity (oversupply, expedience). Also the *locating* via GPS was mentioned quite often (13.7%). Besides the reliability also the speed of the locating service was evaluated. Based on the knowledge about the own position a feeling of security arose, which was sometimes also accompanied by fear regarding data privacy. The next most frequently evaluated aspect was the *voice response* (10.5%), which was perceived as robot-like, unfriendly, and not able to speak German. As a further evaluation basis the *handling* of the smart phone while navigating was discussed (8.4%), which addresses the interaction during the usage process, the fixing/storage in the car as well as the weight savings. Also the *situation* and the *place* served as another evaluation basis (4.2%). Here the users compared their usage to the alternative of having no smart phone and experienced a feeling of independency and mentioned the time saved. The aspect of entering the destination (3.2%) related to a barrier-free handling and the possibility of a clear entering. A last evaluation object refers to *social aspects* (2.1%), which concern the disregard of social interaction but also the possibility to be reached anytime and anywhere (ubiquity).

3.3 Discussion of Results

Even though the evaluation dimensions resulted from a qualitative content analysis with inductive category development the similarity of the extracted dimensions to HOLBROOK's typology of consumer value is evident. Thus, the dimensions efficiency/speed, reliability, time, and weight savings (Table 1) can clearly be assigned to HOLBROOK's *economic value*. This is supported by the following sample statements of 'mobile scouts':

> „*Once in Teltow [district], the woman [navigation voice] really wanted to lead me on the main thoroughfare; she did not know the well developed and traffic light-free Oderstrasse!"*

> "*The navigation app led me directly from the underground station Franzoesische Strasse to my front door.*"

Hedonic value is covered by aspects like inspiration/novelty as well as by the friendliness of the voice. The following quotation describes an inspiring situation during the navigation process:

> "*Also on the map I've seen that there is quite a lot water near Pichelsdorf [district] and this area is certainly worth a trip better planned.*"

The *social value* can be found in the dimension orientation/transparency, the perceived independence, the fear of adapting the way of speaking, and the concern of social isolation due to a lack of social interaction. The two statements refer to the orientation/transparency and the independency perceived:

> „*[…] I would have survived this adventure safely without Fons [phone's nickname], but with him I felt a lot safer, because I always knew where I was.*"

> „*Even if I wanted, there would have been no time for making a detour via the local internet. I felt completely independent and I can tell you: That was a great feeling!*"

Altruistic value is picked up by the consideration of both barrier-free data entering and data security. Following posts by the mobile scouts illustrate the relevance of these aspects:

> „*[…] however, I wonder how anonymously I am actually using the iPhone on the road. But somewhere, there is certainly a way to deactivate this [locating service]…*"

> „ *[…]. Those are the only reasonably barrier-free accessible apps, although the Galaxy cannot be operated barrier-free.*"

Finally, HOLBROOK's four basic value dimensions (*economic*, *hedonic*, *social*, and *altruistic*) seem to sufficiently reflect the extracted evaluation dimensions (Table 1) of smart phone usage. Thus, our approach may act as a first framework for assessing consumer value of mobile technology usage. As demonstrated in Table 1 the evaluation dimensions are in each case related to a specific basis or object of evaluation. To give an example 'speed' as a criteria of the value dimension 'efficiency' (economic value) on the one hand refers to the time needed to locate the position by GPS (Locating) and on the other hand applies to length of time to a destination (Route Guidance).

In order to increase the perceived value-in-use of mobile technologies practitioners should therefore always reveal the concrete evaluation basis and link these to HOLBROOK's [Ho96; 06] four global value dimensions. Also from the results it is evident that some of the evaluation objects are based on rather hard aspects such as product features or attributes (e.g., handling, data entering) whereas others are more related to soft aspects (e.g., social interaction). Besides focussing exclusively on a technological perspective it is thus recommended to more and more concentrate on users' needs that are reflected in the context of the usage processes of mobile technologies.

4 Conclusion and Further Research

Value of information systems (IS) and information and communication technology (ICT) is not that easy to assess. Most commonly general IS performance measurements approaches or IS success models, e.g., [DM03], are applied. However, these models mainly focus on net benefits taking into account several influences, e.g., user satisfaction or use / intention to use, but do not asses the (actual) value-in-use. This is all the more important, since value is not only created by owning modern ICT – especially mobile and ubiquitous technologies – but mainly by using them [VL04].

So, it is quite feasible to assess the value of mobile technologies following approaches from other fields of research or disciplines. For that reason we analysed the appropriateness of the SD-Logic [VL04] in general and related costumer value concepts like HOLBROOK's [Ho96; Ho06] typology of consumer value in particular with regard to mobile technologies. The results of our work offer first insights into which dimensions and corresponding criteria could be applied to determine the value-in-use. We identify how people experience mobile technologies and we choose the most important aspects that create value to the consumers during their usage processes. These results are naturally a first step to bridge the research gap mentioned in the beginning, providing an initial set of dimensions – *economic*, *hedonic*, *social*, and *altruistic* (Table 1) – to measure value-in-use of mobile technologies.

The results of the present study originate a highly explorative approach with only a small sample size and therefore should be treated with caution from different points of view. The internet blog statements show only parts of the usage processes, relevant aspects may not have been written down by the mobile scouts. The study is based on the usage of smart phones and on only one specific application (navigation). Thus, the results cannot be generalised, but this was not the main purpose of the analysis. Yet, the study provided first insights into the evaluation dimensions and criteria which are used during the usage of mobile navigation applications and may serve as a basis to assess the value-in-use of mobile technologies.

The next step to capture the value-in-use of mobile and ubiquitous technologies in a more comprehensive manner must be the development of a fundamental value-in-use framework. Aspects like the different extent of customer integration in terms of knowledge or skills through which customers, by integrating them into their usage processes, are able to

contribute to value creation, may lead to a variation of value-in-use. Considering these aspects, as well as underlying needs of users, which may play a different role within different usage processes can contribute to a broader, more dynamical examination of value-in-use of mobile technologies. According to WOODRUFF [Wo97] a suitable instrument for analysing the customer value considering customers' needs is the Means-Ends-Approach [Gu82]. The statements obtained through that approach must be analysed again by means of a content analysis to extract the direct and indirect consequences of the usage as well as relevant value dimensions. The content analysis therefore seems to be particularly suitable for approaching the subject matter of value-in-use in the future.

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