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Determinants of self-report and system-captured measures of mobile Internet use intensity

An empirical comparison among German mobile communications customers

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Abstract

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Most research on the first adoption and subsequent use (= acceptance) of Internet access through cellular networks and profitable appliances (= mobile Internet) has followed a similar pattern. It has employed survey responses of mobile network operator [MNO] customers to explain consumers' stated future use (continuance) intentions or claimed use intensities related to mobile Internet [MI] access by various beliefs about MI (e.g., perceived relative advantage, usefulness, ease of use). However, there is ample evidence suggesting that MI use intentions and self-reported use intensities are only weakly correlated with actual MI use. Therefore, the present paper develops hypotheses on how the ability of different types of variables to account for variance in MI use intensity may vary depending on whether subjectively estimated or objectively captured use serves as the criterion variable. In doing so it also reflects on the research need to supplement frequently studied perceptual constructs by previously largely ignored straightforward descriptors of verifiable MI use case features as predictors of MI use intensity. The hypotheses are tested by analyzing actual MI use behaviors of 300 adopters in Germany, whose objective use data (mobile IP traffic) was extracted from an MNO's billing engine. This "system-captured" criterion measure is integrated

with MI adopter responses collected by means of a standardized telephone survey. Results show that the predictors are more strongly correlated with self-rated than with system-captured MI use intensity. Up to 38% of the variance explained in self-rated use may be attributed to artifactual covariance between variables caused by common measurement methods. Factual MI use case features (MI tariff type and appliance class, fixed Internet home access availability) are better able to account for variance in both self-rated and actual MI use intensity than MI related beliefs. The findings imply that variable relationships observed in earlier MI and information system (IS) acceptance studies are likely to have been inflated by common method biases and thus may have provided spurious support for the conceptual frameworks tested. Implications of the results for future MI and IS acceptance research and for MNO seeking to forecast and to influence the MI use intensity of their customers are discussed.



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1. Introduction

Mobile Internet (MI) is a topical subject which scholars and practitioners define in a variety of ways. Some authors (e.g., Yoo & Moon, 2006; Lee et al., 2007; Shin, 2007; Song, Koo, & Kim, 2007; Verkasalo, 2008a) indicate that, in a broad sense, the MI notion includes access to the Internet through *any* wireless technology such as WLAN/WiFi (e.g., IEEE 802.12), WMAN/WiMAX (e.g., IEEE 802.16), or second- or third-generation (2G or 3G) cellular mobile networks (e.g., GSM, W-CDMA/UMTS, CDMA-2000). However, the majority of publications agrees that it is most appropriate to characterize MI in a less extensive sense as follows: MI encompasses *packet-switched and IP-based access* to a broad assortment of advanced or value-added data services (e.g., web browsing, email) *through 2.5G or 3G cellular mobile communication networks with high transmission speeds* (Minges, 2005; Groeppel-Klein & Koenigstorfer, 2007; Kim, Chan, & Gupta, 2007; Lee et al., 2007; López-Nicolás, Molina-Castillo, & Bouwman, 2008; Bouwman et al., 2009; ITU, 2009). This definition does not differentiate between MI *services* and mobile *bearer solutions* (e.g., HSPA). Instead, it treats them as a holistic bundle because, from an MNO customer perspective, MI access and services are components of one offer which may create value for the consumer only if the elements are inextricably intertwined (Hong & Tam, 2006). MI tries to provide the same “look and feel” as wired Internet access variants at fixed locations (DSL, cable modem, phone dial-up) or as wireless technologies with strongly limited geographical reach such as WLAN/WiFi. MI distinguishes itself from other Internet access platforms by including the option to use the Internet anywhere (“ubiquitous communication”) even while being on the move.

This study confines itself to MI services accessed by customers of cellular mobile network operators (MNO) via a portable device, i.e., it follows the “narrow” understanding of MI. The reasons behind this choice are twofold. First, in many countries, the extension of cellular networks with regard to their data transmission capabilities is currently the most common strategy pursued by MNO to provide customers with MI access. Secondly, compared to other Internet access platforms, and especially so from a customer standpoint, MI is unique and novel as it promises to augment previous Internet experiences with the dimension of location independence in the context of using the Internet.

Even the narrower MI concept underlying the present research still subsumes a large set of enabling cross-sectional hard- and software technologies. They create the foundation for a wide range of communication, information content, entertainment, and commercial transaction services for private or business purposes. MI is *not* identical with but rather a subset of *mobile data services (MDS)* which the literature also occasionally labels as “advanced” or “value-added” mobile non-voice services (e.g., López-Nicolás, Molina-Castillo, & Bouwman, 2008; Kuo, Wu, & Deng, 2009). MDS do not only cover IP-based delivery of applications known from the conventional Internet but additionally the entirety of more or less established variants of text messaging (SMS, MMS) and WAP-based applications delivered by MNO (Bina, Karaiskos, & Giaglis, 2008; Hong et al., 2008; Lee, Shin, & Lee, 2008; Kuo, Wu, & Deng, 2009).

Worldwide MNO set strong hopes on MI as a market with phenomenal subscriber and revenue growth (BITKOM, 2009; IDATE,

2009). Nevertheless, the vast majority of MNO subscribers to date has never used MI yet. Especially in many Western countries, MI acceptance is considerably lagging behind the showcase markets in South Korea, Japan and Singapore (Minges, 2005; Funk, 2007; ITU 2009). Recent surveys suggest that only a small proportion of MNO customers who are already equipped with devices which possess the technical capability of accessing MI effectively use this capacity (Economides & Grousopoulou, 2008; Koivumäki, Ristola, & Kesti, 2008; Mohr, 2008). In addition, a considerable share of MI subscribers fails to use it intensively or even completely ceases to apply MI after the initial adoption (Lee et al., 2007; Kim, Lee, & Kim, 2008; Lee, Shin, & Lee, 2008; Verkasalo, 2008b).

During the past few years these subscription and use intensity gaps have triggered extensive scholarly research on critical factors influencing a customer's *initial* MI or advanced MDS adoption decisions in various academic fields, such as innovation, information systems (IS) and telecommunications management. Current examples of this category of *pre-adoption* investigations are Hong & Tam (2006), Kim, Chan, & Gupta (2007), Lee, Cheung, & Chen (2007), Chen (2008), López-Nicolás, Molina-Castillo, & Bouwman (2008), Lu et al. (2008), Chen, Yen, & Chen (2009), Kim & Garrison (2009) and Kuo & Yen (2009). Furthermore, there is a swiftly growing number of studies which explore drivers of the continuation and the intensity of MI use *after* customers have adopted it. Hong, Thong, & Tam (2006), Bouwman, et al. (2007), Lee et al. (2007), Hong et al. (2008), Kim, Lee, & Kim (2008), Kim, Lee, & Kim (2008), Koivumäki, Ristola, & Kesti (2008), Bouwman et al. (2009), Kim, Choi, & Han, (2009), Kuo, Wu, & Deng (2009) and Mallat et al. (2009) rank among recent

instances of research which emphasizes the explanation of *post-adoption* customer use behaviors.

Pre-adoption research typically focuses on the explanation of variations in stated behavioral intentions to utilize MI in general or specific categories of MI-based services (e.g., m-gaming, instant messaging) in the future. In a similar vein, post-adoption studies generally seek to explain variance in the claimed behavioral intentions to continue the use of MI or other advanced mobile data services (e.g., MMS). Both strands of research typically capture their dependent criteria through responses of MNO customers (frequently student samples) collected in standardized surveys. However, there is ample evidence suggesting that consumers' self-stated behavioral intentions are poor predictors of their actual buying and use behaviors for all kinds of goods (Chandon, Morwitz, & Reinartz, 2005; Seiders et al., 2005; Trommsdorff, 2009, pp. 152-154), as well as for telecommunication and IS services in particular (Szajna, 1996, p. 89; Kim & Malhotra, 2005, p. 187; Verkasalo, 2008a, pp. 47, 52). Thus, most extant use intention work in the fields of MI access and services or MDS has presumably not captured and explained variance in the true use of these goods but rather variance in attitudes towards the offerings (Bouwman et al., 2007, p. 149; Sharma, Yetton, & Crawford, 2009, pp. 483-484).

Fewer post-adoption investigations construe their dependent MI or MDS acceptance measures from MNO customers' stated intensity, frequency and/or duration of certain categories of mobile communication behaviors such as running a video stream, browsing news websites, or employing a search machine portal (e.g., Fogelgren-Pedersen, 2005; Sugai, 2007; Turel, Serenko, & Bontis,

2007; Bina, Karaiskos, & Giaglis, 2008; Economides & Grousopoulou, 2008; Koivumäki, Ristola, & Kesti, 2008; Lee, Shin, & Lee, 2008; Oh et al., 2008; Wei, 2008; Westlund & Bohlin, 2008; Bouwman et al., 2009). The accuracy of customers' MI-related self-estimates of their use frequencies, duration, or changes must not be taken for granted. Studies with this kind of criteria mostly asked participants to remember facets of past MI or MDS use behaviors. It may be argued that such retrospective measures share very limited variance with actual behavior data. Mobile communication activities do not resemble critical incidents in a person's everyday life. Therefore, subjective intensity estimates concerning these actions are prone to substantial errors because they simply overstrain a respondent's memory capacities. In fact, Kim & Malhotra (2005) detected that two self-report scale formats of the use frequency of a web-based information site accounted for a maximum of just 30% of the variance of an objective site-use frequency measure. Furthermore, in a recent comparison of objective traffic data and survey-based use statements for almost 3,600 Korean MDS customers, Kim, Lee, & Kim found "that more than one-third of all respondents failed to report their past [MDS] usage accurately" (Kim, Lee, & Kim, 2008, p. 124). To date, MI/MDS acceptance work almost never reflects on the application of remedial actions which aim at improving the accuracy of self-reports of past MI or MDS behaviors (e.g., phrasing of questions, design of response options, recourse to customer diaries to register user actions at several occasions; c.f., Kim & Malhotra, 2005; Thulin & Vilhelmson, 2007). If anything, it typically relies on quite general participants' self-ratings of their use behaviors on ambiguous response formats (normally "agree - disagree" scales; c.f., Sharma,