Torsten J. Gerpott

Attitudes and Behaviors of Mobile Network Operator Customers

Contributions toward empirically founded marketing strategies for mobile navigation and Internet services

Rainer Hampp Verlag

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Attitudes and Behaviors of Mobile Network Operator Customers. Contributions toward empirically founded marketing strategies for mobile navigation and Internet services

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The market for mobile voice communication approaches its saturation level in many industrialized nations. Prices for mobile voice telephony have been and still are under pressure. Against this background, mobile network operators (MNO) are searching for new services which may bring them back to previous revenue growth trajectories. Among these potential innovations are *mobile Internet* (*MI*) services in general and *mobile* network-based *navigation services* (*MNS*) in particular. Unfortunately, to date, these kinds of offerings have not been adopted as fast and are not used as extensively as expected by MNO in Germany, but also in other countries around the world.

During the past few years, these subscription and usage gaps have triggered quite a number of practitioner publications and scholarly contributions on critical factors explaining consumers' initial MI or MNS adoption decisions and subsequent use behaviors. Regrettably, much of this writing is purely speculative and does not incorporate empirical data on attitudes and behaviors of MNO customers in Germany in the context of customer acceptance of MI and MNS offerings. In light of this gap the present book contains an assortment of five empirical papers on MI and MNS acceptance drivers among German-speaking mobile communication consumers.

The articles are of interest to both practitioners involved in the development of marketing strategies for MI and MNS as well as business and consumer psychology scholars who are concerned with better understanding the demand for innovative mobile service offerings from a residential customer's perspective.

Keywords: Acceptance, Consumer behavior, Customer preferences, Germany, Mobile communication service marketing, Mobile Internet, Mobile navigation, Technology adoption

Dr. Torsten J. Gerpott is a university professor of business administration at the *Mercator School of Management Duisburg (Germany)*. He directs the chair of telecommunications management at this school. Since 1982 he has published more than 320 professional articles and eight books. In July 1996 *Prof. Gerpott* founded DIALOG CONSULT GmbH and has established this firm as a leading management consulting company with a clear focus on the telecommunication industry. He is an internationally renowned speaker at conferences on business trends in telecommunications and information technology markets.

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Preface

The introduction of voice telephony over mobile cellular radio communication networks is a success story. The worldwide number of users of this service has exceeded the threshold of four billion within less than 20 years. Today there are numerous countries in which the number of active SIM cards surpasses the number of inhabitants. Thus, the market for mobile voice communication approaches its saturation level in many industrialized nations. In addition, prices for mobile voice telephony have been and still are under pressure.

Against this background, mobile network operators (MNO) are searching for new services which may bring them back to previous revenue growth trajectories. Among these potential innovations are *mobile Internet* (*MI*) services in general and *mobile* network-based *navigation services* (*MNS*) in particular. Unfortunately, to date, these kinds of offerings have not been adopted as quickly and are not used as extensively as expected by MNO in Germany, but also in other countries around the world.

During the past few years, these subscription and usage gaps have triggered quite a number of practitioner publications and scholarly contributions on critical factors explaining consumers' initial MI or MNS adoption decisions and subsequent use behaviors. Regrettably, much of this writing is purely speculative and does not incorporate empirical data on attitudes and behaviors of MNO customers. Empirical research has mainly been conducted in countries other than Germany, although Germany is the largest mobile communications market in terms of subscribers and revenues throughout Europe. This lack of MI or MNS studies concentrating on Germany is problematic since cultural differences between Germans and residents of other countries in which previous MI/MNS customer research took place (mostly Korea, Taiwan, China, Singapore, North America, Finland, Sweden, Netherlands) raise doubts whether extant findings may be generalized without qualifications to Germany.

In light of the paucity of empirical work on attitudes and behaviors of mobile communication consumers in Germany in the context of customer acceptance of MI and MNS offerings I initiated several empirical investigations in Germany which aimed at narrowing the research gap sketched above. The present book contains an assortment of papers which summarize major findings from these data collections.

The publication of the articles in this reader was supported by *Deutsche Forschungsgemeinschaft* (*DFG*) through the funding of a subproject in the *DFG Sonderfor-*

schungsbereich 627 "Umgebungsmodelle für mobile kontextbezogene Systeme" (environmental models for mobile context-related systems – NEXUS). This support is gratefully acknowledged. Furthermore, I wish to emphasize that the visual appearance of this book would have been much less professional without the hard work of my secretary *Monika Bunn*. Finally, I am indebted to *Sabrina Berg* and *Mirko Gropp* for their help in organizing the collection of data which I analyze in the five papers presented in this book.

As always, feedback on my writing is very welcome both from practitioners and academic scholars. In the digital age it should not come as a surprise that I would like to suggest that your comments best reach me via e-mail (torsten.gerpott@uni-due.de), which I am more and more accessing not with the help of my desktop computer but via my smart handset while being on the move.

Duisburg, December 2009

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Contents

Acronym guide

2G	Second generation mobile cellular network
3G	Third generation mobile cellular network
AMOS	Analysis of moment structures
ANOVA	Analysis of variance
β	Standardized regression coefficient
CDMA	Code division multiple access
DOI	Diffusion of innovation
DSL	Digital subscriber line
EDGE	Enhanced data rates for GSM evolution
EM	Expectation maximization
GPS	Global positioning system
GSM	Global system for mobile communications
H	Hypothesis
HSPA	High speed packet access
IE	Information economic
IEEE	Institute of electrical and electronics engineers
IM	Instant messaging
IP	Internet protocol
IS	Information systems
IT	Information technology
ITU	International telecommunication union
KB	Kilobyte
LBS	Location-based services
LISREL	Linear structural relationships
M	Mean
MB	Megabyte
MDS	Mobile data services
MI	Mobile Internet
MMS	Multimedia message service

MNO	Mobile network operator
MNS	Mobile navigation service
n	Number of valid cases/observations
OLS	Ordinary least squares
PC	Personal computer
PDA	Personal digital assistant
PLS	Partial least squares
Q	Question
r	*Pearson* product-moment correlation
SBM	Standortbezogene oder -bewusste Mobilfunkdienste (location-based or -aware mobile services)
S	Standardabweichung (standard deviation)
SD	Standard deviation
SIM	Subscriber identity module
SMS	Short message service
SRI	Self-report/-assessment of customer in standardized telephone interview
τ–*b*	*Kendall* rank-order correlation
TAM	Technology acceptance model
TITF	Task-individual-technology-fit
UMTS	Universal mobile telecommunications system
USB	Universal serial bus
VoIP	Voice over Internet protocol
WAP	Wireless application protocol
WiMAX	Worldwide interoperability for microwave access
WLAN	Wireless local area network
WMAN	Wireless metropolitan area network
WWW	Worldwide web

Einflussfaktoren der Adoptionsbereitschaft von standortbezogenen Mobilfunkdiensten*

– Eine empirische Untersuchung privater Mobilfunkkunden –

Torsten J. Gerpott

* Die Gewinnung der in dieser Arbeit ausgewerteten empirischen Daten erfolgte im Rahmen eines von der *DFG Deutschen Forschungsgemeinschaft* finanzierten Teilprojektes des SFB Sonderforschungsbereichs 627 „Umgebungsmodelle für mobile kontextbezogene Systeme – NEXUS“. Mein Dank gilt der *DFG* für diese Unterstützung.

Zusammenfassung

Ein innovativer Angebotstyp, von dem sich Mobilfunknetzbetreiber erhoffen, dass sie mit ihm bedeutende Umsätze erzielen können, sind standortbezogene Mobilfunkdienste (SBM). Bislang mangelt es an empirischen Untersuchungen zu Einflussfaktoren der Bereitschaft zur Übernahme (= Adoption) von SBM, die deutschsprachige private Mobilfunkkunden betrachten. Einschlägige englischsprachige Arbeiten weisen erhebliche Beschränkungen auf. Die vorliegende Studie analysiert deshalb auf Basis einer schriftlichen Befragung von 1.097 deutschsprachigen Personen, die privat Kunde eines Mobilfunknetzbetreibers sind, inwiefern kundenbezogene Merkmale geeignet sind, Unterschiede bei geäußerten Adoptionsbereitschaften im Hinblick auf mobile standortsensitive Pull-Informations-, -Navigations- und Transaktionsdienste zu erklären. Die in der Stichprobe beobachteten Ausprägungen von drei empirisch unterscheidbaren Adoptionsdimensionen (SBM-Nutzungswahrscheinlichkeiten, -Zahlungsbereitschaften, -Aufwandsbereitschaften) deuten darauf hin, dass SBM sich ohne effektive Anstrengungen von Mobilfunknetzbetreibern zur Steigerung der Adoptionsbereitschaft im deutschen Privatkundenmarkt kaum zu einem gewichtigen Umsatzträger entwickeln dürften. Korrelations- und Regressionsanalysen liefern Indizien dafür, dass die erfassten Adoptionsbereitschaftsaspekte am stärksten durch (1) eine Angebotsausrichtung auf Zielgruppen mit hohem Bedarf an „Unterwegs-Informationen“, (2) eine Gewinnung von „early adopters“ als Promotoren und (3) Maßnahmen zur Verringerung des „gefühlten“ Datenmissbrauchsrisikos positiv beeinflusst werden können.

Schlüsselwörter: Adoption; Angebotsinnovationen; Kundenverhaltensabsichten; Mobilfunkmarkt; Standortbezogene Mobilfunkdienste; Technologieakzeptanz.

Abstract

Many mobile network operators (MNO) expect that location-based services (LBS) are an innovative offering, which could generate substantial revenues in the future. To date, there is a dearth of empirical research on factors influencing an individual’s willingness to adopt LBS which draws on samples of German-speaking residential mobile communication customers. The pertinent English-language literature is not as scare but suffers from a number of shortcomings. Therefore, the present paper provides an empirical investigation exploring the extent to which various customer-related characteristics explain variance in individual intentions to adopt mobile location-sensitive pull information, navigation and transaction services. The analysis is based on a written survey of 1,097 German-speaking retail customers of MNO. Three adoption dimensions (LBS use probabilities, willingness to pay for LBS, readiness to bear efforts in order to be able to use LBS) were distinguishable in the sample. The values obtained for

these dimensions suggested that LBS are unlikely to evolve into an important revenue generator in the German retail mobile communication market unless MNO exert strong target-oriented efforts to increase mobile consumers' adoption intentions. Correlation and regression analyses indicated that MNO could achieve the most significant increases in the adoption intention dimensions captured by (1) gearing LBS offers to target groups with strong needs for "on the move information" (e.g., timetables), (2) motivating early adopters of LBS to act as peer-to-peer service promoters and (3) implementing measures to reduce consumers' data abuse and privacy concerns.

Keywords: Adoption; Behavioral consumer intentions; Innovative offerings; Location-based services; Mobile communication market; Technology acceptance.

I.1 Untersuchungseinordnung und -anliegen

Gerade auf Märkten mit nicht mehr stark wachsenden Umsätzen liegt es für Unternehmen nahe, die eigene Wettbewerbsposition durch innovative Angebote zu verbessern. Dieses Vorgehen ist in vielen Industrieländern auch bei Unternehmen zu beobachten, die Mobilfunknetze betreiben und Mobilfunkdienste absetzen. Speziell in Deutschland reagierten die vier lizensierten Mobilfunkanbieter auf einen seit dem Jahr 2005 auf Gesamtmarktebene eingetretenen Umsatzrückgang bei Mobilfunkdiensten in Höhe etwa 3–4% p.a.[1] u.a. damit, dass sie beträchtliche netztechnische Investitionen tätigten und Vermarktungsbemühungen starteten, um ihren Kunden über Sprachtelefonie und den „Short Message Service (SMS)“ hinaus neue Möglichkeiten der Datenübertragung anbieten zu können und die Nachfrage von mobilen Datendiensten zu stimulieren. Entsprechend nahm in Deutschland der Umsatz mit „echten“ mobilen Datendiensten (ohne SMS) in den letzten Jahren deutlich zu und machte 2009 fast 14% der mit Mobilfunkdiensten insgesamt erzielten Umsätze aus.[2] Auch für die nähere Zukunft werden für den deutschen Mobilfunkmarkt weitere starke Umsatzsteigerungen mit mobilen Datendiensten erwartet.[3]

Eine Art von mobilen Datendiensten, von denen Mobilfunknetzbetreiber sich versprechen, dass sie mit ihnen bedeutsame Umsätze erzielen werden, sind *standortbezogene* oder *-bewusste Mobilfunkdienste* (*SBM*). SBM zeichnen sich dadurch aus, dass sie darauf zielen, durch (automatische) Verknüpfungen der Kenntnis der aktuellen geographischen Position des (eingeschalteten) mobilen Endgerätes eines Kunden mit anderen standortspezifisch zugeschnittenen Informations-, Transaktions- oder Kommunikationsmöglichkeiten für den Mobilfunkkunden einen Mehrwert zu schaffen.[4] Zu den im Schrifttum häufig genannten SBM-Anwendungsbeispielen gehören:[5]

– Angaben zu innerhalb einer Maximalentfernung relativ zum Kundenendgerät befindlichen unbeweglichen oder beweglichen Objekten (z.B. Ladenlokal, in dem ein gesuchtes Produkt zu einem wettbewerbsfähigen Preis verfügbar ist, befreundete Person),

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1 Vgl. Bundesnetzagentur (2007), S. 283; Dialog Consult (2009), Abb. 2.

2 Vgl. Dialog Consult (2009), Abb. 2 und 19.

3 S. BITKOM (2008), S. 6.

4 S. für viele Barnes (2003), S. 59-66; Kaasinen (2003), S. 70; Spiekermann (2004), S. 10-13; Chang et al. (2006), S. 1145 u. (2007), S. 277.

5 Vgl. zu SBM-Beispielen und -Systematisierungen u.a. Spiekermann (2004), S. 15; Fritsch/Muntermann (2005), S. 145; Bauer et al. (2006), S. 186; Vrcek et al. (2008), S. 290f.; Lee et al. (2009), S. 119f.

– Wegeführungshilfen/Navigation bis zum Erreichen eines Zielobjektes durch den Kunden,
– Übermittlung des aktuellen Kundenstandortes an andere Personen/Organisationen, um z.B. den Beteiligten ein „reales“ Zusammentreffen zu erleichtern, um (werbende) Hinweise auf Leistungsangebote von Händlern/Produzenten in Kundennähe zu geben oder um bei Un-/Notfällen des Kunden ihm schnell Hilfe zuteil werden zu lassen.

SBM werden auch als eine Variante von *kontextabhängigen/-sensitiven/-adaptiven* Telekommunikationsdiensten für mobile Endgeräte/Nutzer eingeordnet, weil sie den räumlichen Standort als ein Merkmal der Anwendungssituation berücksichtigen, der durch Einbezug weiterer Kontextdimensionen (z.B. Tageszeit, physikalische Bedingungen am Endgerätestandort wie Temperatur oder Licht, statische oder dynamische Nutzercharakteristika wie Geschlecht, Produktpräferenzen, Gesundheitszustand) zur Diensteanpassung ergänzt werden kann.[6]

Angesichts der Vielfalt der Optionen zur Gestaltung neuer SBM stehen insbesondere Mobilfunknetzbetreiber und -endgerätehersteller vor der Aufgabe, zu erkunden, welche SBM-Arten den Präferenzen ihrer Kunden am besten entsprechen.[7] Zudem sind für sie Erkenntnisse dahingehend wichtig, von welchen kunden- und angebotsseitigen Faktoren die Bereitschaft zur erstmaligen Nachfrage eines innovativen SBM (= *Adoption*) signifikant beeinflusst wird.[8] Die *Adoptionsbereitschaft* muss zwar nicht identisch mit der tatsächlichen Adoptionshandlung sein, aber die Erklärung der Ausprägung dieser Bereitschaft ist dennoch für die Praxis wichtig, da sie eine der stärksten Determinanten der tatsächlichen erstmaligen Nachfrage darstellt.[9]

Aus den vorliegenden wissenschaftlichen SBM-Studien geht klar hervor, dass beim derzeitigen Stand der geringen praktischen Erfahrungen von Mobilfunkkunden mit SBM so genannte „*Push*“-Dienste wesentlich eher als unerwünscht

[6] Vgl. Gupta et al. (2004), S. 36; Wehrmann (2004), S. 88-101; Bauer et al. (2008), S. 207f.; Sheng et al. (2008), S. 351f.

[7] S. Köhne et al. (2005), S. 17; Wehmeyer/Müller-Lankenau (2005), S. 3f.

[8] Im Schrifttum wird häufig undifferenziert von Adoption und Akzeptanz gesprochen, wohingegen wir eine Unterscheidung zur Präzisierung des Untersuchungsgegenstands für sinnvoll halten. Entsprechend wird hier *Adoption* als ein Element bzw. eine Phase im Akzeptanzprozess verstanden, der bzw. die (1) die Bildung von Einstellungen zu einer innovativen Leistung bei potenziellen Kunden, (2) den erstmaligen Kauf bzw., bei TK-Diensten, die Anschlusshandlung (= Adoption) und (3) die fortgesetzte Nutzung(sintensität/-dauer) nach der Adoption umfasst. S. übereinstimmend z.B. Kollmann (1998), S. 67f.; Shih/Venkatesh (2004), S. 59f.; Hong et al. (2006), S. 1819f.

[9] S. Hong et al. (2006), S. 1822f.

eingestuft werden. Bei solchen Anwendungen sind die Kunden *nicht* einzelfallbezogen Initiator des Diensteabrufs, sondern es werden ihnen nach einer einmaligen Zustimmungserklärung zur Dienstebereitstellung ohne direkte Aufforderung Daten (z.B. mobile Werbung/Einkaufsgutscheine) übermittelt oder es werden Angaben zum aktuellen eigenen Standort Dritten verfügbar gemacht (= „*Tracking*/*Tracing*"-SBM). Umgekehrt ist die prinzipielle Adoptionsbereitschaft bei SBM größer, mit denen Mobilfunkkunden den Abruf standortabhängiger Informationen oder von Hilfen zum Ansteuern eines Zielortes in jedem einzelnen Anwendungsfall selbst kontrollieren („*Pull*"-SBM).[10] Die eigene Untersuchung konzentriert sich deshalb auf derartige *Pull-Dienste*, die Mobilfunknetzbetreiber unter Rückgriff auf netz- und/oder endgerätegestützte Ortungstechniken anbieten können.

Bislang liegen zwar zahlreiche betriebswirtschaftlich ausgerichtete Publikationen vor, die auf Basis von Befragungen oder Beobachtungen von Mobilfunknutzern kundenseitige Einflussfaktoren der Adoptionsbereitschaft von mobilen Datendiensten *ohne* Standortbezug betrachten.[11] Da (1) nach vorliegenden empirischen Erkenntnissen aber Einflussfaktoren der Adoptionsbereitschaft mobiler Datendienste *angebotsspezifisch* variieren[12] und (2) bei SBM zudem besondere Aspekte wie Wahrnehmungen hinsichtlich der Bedrohung der eigenen Privatsphäre durch solche Dienste als zusätzliche Adoptionsdeterminanten in Betracht kommen, ist eine Übertragung von Adoptionsbefunden für mobile Datendienste im allgemeinen oder für bestimmte Dienste *ohne* Standortbezug (z.B. Musikbereitstellung) auf SBM *nicht* ungeprüft sinnvoll. Analysiert man daher den empirischen Forschungsstand speziell für die hier fokussierten Pull-SBM, aber auch für andere SBM-Varianten, so ist festzustellen, dass diesbezüglich die empirische Befundbasis deutlich dürftiger ausfällt. Übersicht 1 profiliert zusammenfassend die Methodik und Hauptergebnisse der einschlägigen quantitativ ange-

[10] S. zur Unterscheidung von Push- und Pull-SBM sowie zu geäußerten Präferenzunterschieden potenzieller SBM-Nutzer zwischen den beiden SBM-Typen Barkuus/Dey (2003), S. 710; Kaasinen (2003), S. 77; Fritsch/Muntermann (2005), S. 153; Köhne et al. (2005), S. 20; Wehmeyer/Müller-Lankenau (2005), S. 12f.; Xu/Teo (2005), S. 72; Bauer et al. (2006), S. 184 u. 188; Bouwman et al. (2007b), S. 25; Fälsch (2007), S. 235-239; Vrcek et al. (2008), S. 295.

[11] S. zuletzt etwa Groeppel-Klein/Königstorfer (2007); Ha et al. (2007); Kim et al. (2007); Bina et al. (2008); Hong et al. (2008); Kim et al. (2008); Vlachos/Vrechopoulos (2008); Bouwman et al. (2009); Kim/Garrison (2009); Kuo/Yen (2009).

[12] S. Nysveen et al. (2005a), S. 343f.; Bouwman et al. (2007a), S. 147; Hong et al. (2008), S. 440.

Übersicht 1: Empirische Studien zur Adoption von standortbezogenen Mobilfunkdiensten (SBM)

Autor(en)[a]	Stichprobe/Erhebungsmethodik	Hauptergebnisse
Barkuus/Dey (2003)	• 16 Besitzer eines Mobiltelefons im Alter von 19 bis 35 Jahren (Durchschnitt: 23,7 Jahre) • Schriftliche Befragung • Vignetten für vier SBM • Mittelwertvergleiche	• *Positionsbewusste Dienste*, die den eigenen Standort berücksichtigen, rufen weniger Datenmissbrauchsbedenken hervor als *positionsverfolgende Dienste*, die den eigenen Standort oder den anderer Personen verfolgen, um ihn an Dritte zur Schaffung von Kontaktmöglichkeiten weiterzugeben • Je *nützlicher* ein SBM wahrgenommen wird, desto häufiger besteht die Absicht, den Dienst zu nutzen • „… people, in general, are not overly concerned about their privacy when using location-based services“ (S. 712)
Xu/Teo (2004)	• 256 Studenten der Betriebswirtschaftslehre einer Universität in Singapur • Online-Gruppenbefragung im April 2004 • Vignetten für einen SBM (mobile Push-Werbung, Gutscheinangebot) • Varianzstrukturanalyse mittels PLS (R^2 Nutzungsabsicht = 0,312)	• *Datenmissbrauchsbedenken* gegenüber dem SBM-Anbieter beeinflussen die Dienstenutzungsabsicht signifikant negativ • Die Neigung, neue Dinge auszuprobieren (*allgemeine Innovationsbereitschaft*), beeinflusst die Dienstenutzungsabsicht signifikant positiv
Heijden/Ogertschnig/ Gaast (2005)	• 123 Mobilfunkkunden in den Niederlanden (Durchschnittsalter: 25,5 Jahre; 56,1% Studenten) • Online-Befragung • Vignetten für einen SBM (Reiseinformationen) • Varianzanalyse	• Die *Nützlichkeit* der (per SMS) bereitgestellten Informationen beeinflusst die Dienstenutzungsabsicht signifikant positiv und viel stärker als der *Spaß, der durch den Rückgriff auf den Dienst hervorgerufen wird* • Bedenken hinsichtlich der mit dem Dienst verbundenen *Risiken* bzw. die *Kontextrelevanz* der durch den Dienst bereitgestellten Informationen beeinflussen die wahrgenommene Dienstenützlichkeit signifikant negativ bzw. positiv
Pura (2005)	• 279 Kunden eines finnischen Anbieters standortbezogener Informationen auf SMS-Basis (45,5% jünger als 30 Jahre) • Online-Befragung • Beabsichtigte zukünftige Nutzung des SBM • Kovarianzstrukturanalyse mittels LISREL	• Der *Wert ortsspezifischer Informationen*, die *Bequemlichkeit* der Dienstenutzung und die *Preiswürdigkeit* des Dienstes beeinflussen die Absicht, den SBM auch zukünftig zu nutzen, signifikant positiv
Xu/Teo (2005)	• 84 Studenten der Informatik einer Universität in Singapur • Online-Gruppenbefragung im Januar 2005 • Vignetten für einen SBM (mobile Push-Werbung, Gutscheinangebot) • Varianzstrukturanalyse mittels PLS (R^2 Nutzungsabsicht = 0,238)	• *Datenmissbrauchsbedenken* gegenüber dem SBM-Anbieter beeinflussen die Dienstenutzungsabsicht signifikant negativ • Der *Unterhaltungs- und Informationswert* der Werbung sowie die *allgemeine Innovationsbereitschaft* beeinflussen die Dienstenutzungsabsicht signifikant positiv

Übersicht 1: Empirische Studien zur Adoption von SBM (Fortsetzung II)

Autor(en)[a]	Stichprobe/Erhebungsmethodik	Hauptergebnisse
Xu/Teo/Tan (2005)	• 176 Nutzer eines Mobiltelefons in Singapur im Alter von 20 bis 49 Jahren (60,1% jünger als 30 Jahre) • Online-Befragung • Vignette für einen SBM (mobile Push-Werbung, Gutscheinangebot) • Varianzstrukturanalyse mittels PLS (R^2 Nutzungsabsicht = 0,552)	• *Datenmissbrauchsbedenken* gegenüber dem SBM-Anbieter beeinflussen die Dienstenutzungsabsicht signifikant negativ • *Vertrauen* in den SBM-Anbieter, *Begeisterung für Gutscheinwerbung* und *Innovationsbereitschaft im Hinblick auf Informationstechniken* beeinflussen die Dienstenutzungsabsicht signifikant positiv
Chang et al. (2006)	• 180 Personen in Taiwan mit Erfahrungen in der Nutzung des stationären Internet und mit Reiseerfahrungen (53,3% im Alter von 20–25 Jahren) • Schriftliche Befragung • Vignette für einen SBM (Reiseinformationen) • Regressionsanalyse	• *Dienstenützlichkeit* und *-benutzerfreundlichkeit* sowie *Vertrauen in die Funktionsfähigkeit der Technik des Diensteanbieters* (insbesondere bezüglich der Vermeidung von Datenmissbrauch) beeinflussen die Einstellung zum SBM signifikant positiv
Fang/Chan/Brzezinski/Xu (2006)	• 101 Alumni einer Universität in den USA im Alter von 20–50 Jahren • Schriftliche Gruppenbefragung • Vignetten für 12 Aufgaben, die mit Hilfe eines PDA zu bewältigen waren, davon eine Aufgabe mit SBM Bezug (Filmauswahl und Ticketkauf im Kino mit minimaler Entfernung zum eigenen Standort) • Regressionsanalyse (R^2 Nutzungsabsicht = 0,137)	• Die *Nützlichkeit* des SBM beeinflusst die Dienstenutzungsabsicht mittels des PDA signifikant positiv, hingegen wirken sich *Datenmissbrauchsbedenken nicht* signifikant auf die Absicht aus, den SBM zukünftig zu nutzen
Junglas/Spitzmüller (2006)	• 470 Studenten der Betriebswirtschaftslehre einer Universität in den USA • Online-Befragung • Text- und Videovignetten für vier SBM-Varianten (Navigation, Notruf, Werbung, „friend finder“) • Varianzstrukturanalyse mittels PLS (R^2 Nutzungsabsicht = 0,420 und 0,429)	• *Dienstenützlichkeit*, *Vertrauen in den SBM-Anbieter* und die *Sicherheit vor dem Missbrauch personenbezogener Daten* beeinflussen die Dienstenutzungsabsicht signifikant positiv • *Bedenken hinsichtlich der mit SBM verbundenen Risiken* beeinflussen die Dienstenutzungsabsicht signifikant negativ • *Bedenken bezüglich des nicht autorisierten Zugangs* zu und der *nicht autorisierten Nutzung von personenbezogenen Daten* sowie bezüglich der *Genauigkeit/ Fehlerhaftigkeit von Standortinformationen* beeinträchtigen die Dienstenutzungsabsicht signifikant negativ; hingegen wirken sich *Bedenken bezüglich der Sammlung von Standortinformationen durch den eigenen Mobilfunkanbieter nicht* signifikant auf die Nutzungsabsicht aus

Übersicht 1: Empirische Studien zur Adoption von SBM (Fortsetzung III)

Autor(en)[a]	Stichprobe/Erhebungsmethodik	Hauptergebnisse
Bouwman/Carlsson/Molina-Castillo/Walden (2007a)	• 484 Nutzer eines Mobiltelefons in Finnland • Postalische Befragung im Frühjahr 2004 • Beabsichtigte zukünftige Nutzung eines SBM (Reiseinformationen/-navigation) • Kovarianzstrukturanalyse mittels LISREL (R^2 Nutzungsabsicht = 0,10)	• Das *Ausmaß der bisherigen SBM-Nutzung,* der *Informationswert* sowie die „*flexibility*“ des Dienstes beeinflussen die Absicht, den SBM auch zukünftig zu nutzen, signifikant positiv • Die *Offenheit gegenüber neuen Mobilfunkdiensten* wirkt sich indirekt positiv auf die Absicht aus, den SBM auch zukünftig zu nutzen
Chang et al. (2007)	• 129 Personen in Taiwan mit überwiegend langjähriger Mobilfunkerfahrung (61,2% im Alter von 20–30 Jahren) • Online-Befragung vom 18.04.2006 bis zum 07.05.2006 • Vignette für einen SBM (Reiseinformation/-navigation) • Regressionsanalyse	• *Datenmissbrauchsbedenken, Bedenken hinsichtlich der Qualität der bereitgestellten Informationen, die Höhe der erwarteten Dienstepreise/-kosten* sowie *Bedenken hinsichtlich der eigenen Kompetenz, den Dienst sinnvoll einsetzen zu können*, beeinflussen die Absicht, den SBM zukünftig zu nutzen, signifikant negativ
Junglas (2007); Junglas/Watson (2008)	• 58 Studenten der Informatik einer Universität in den USA (93,2% im Alter von 19–23 Jahren) • Laborexperiment mit Befragung jeweils vor und nach der Bewältigung von Aufgaben mit versus ohne Erleichterung durch standortbezogene Informationen • Dienst zur Standortfindung einer sich bewegenden Person/eines Büros • Varianzanalyse	• Endgeräte (PDA) mit SBM-Funktionen werden bei Anwendungen/*Aufgaben mit dynamischen Standortbezügen* als signifikant *nützlicher* und *bedienerfreundlicher* bewertet als bei Anwendungen/Aufgaben ohne solcher Bezüge • Die Bewertung der Nützlichkeit und Bedienerfreundlichkeit des SBM nimmt *nach dem tatsächlichen Endgeräteeinsatz* im Vergleich zur Einstufung *vor der Nutzung* generell zu (unabhängig davon, ob Anwendungen/Aufgaben mit Standortbezug genutzt/bewältigt wurden oder nicht)
Kwon/Choi/Kim (2007)	• 206 Führungs- und Informationssystemfachkräfte sowie Studenten der Betriebswirtschaftslehre einer Universität in Südkorea (72,7% im Alter von 20–29 Jahren • Schriftliche Befragung • Vignette für einen SBM (standortbezogene Angebotsinformationen zur Erleichterung eines geplanten Einkaufs) • Kovarianzstrukturanalyse mittels LISREL (R^2 Nutzungsabsicht = 0,565)	• *Dienstenützlichkeit* und *-benutzerfreundlichkeit* beeinflussen die Absicht, den SBM zukünftig zu nutzen, signifikant positiv • Die Neigung, neue Produktangebote auszuprobieren (*allgemeine Innovationsbereitschaft*) und die wahrgenommene *eigene Kompetenz zur Nutzung des SBM* beeinflussen die Benutzerfreundlichkeitseinschätzung für den SBM signifikant positiv • Die wahrgenommene *Beanspruchung/Verärgerung durch die Nicht-Bewältigung von Aufgaben*, deren Bearbeitung durch den SBM erleichtert werden soll, wirkt sich auf die Benutzerfreundlichkeits-(Nützlichkeits-)bewertung signifikant negativ (positiv) aus

Übersicht 1: Empirische Studien zur Adoption von SBM (Fortsetzung IV)

Autor(en)[a]	Stichprobe/Erhebungsmethodik	Hauptergebnisse
Bauer/Haber/Reichardt/ Bökamp (2008)	• 586 deutschsprachige Personen mit einem Durchschnittsalter von 38,5 Jahren • Online-Befragung • Vignette für einen SBM (Navigationsinformationen) • Kovarianzstrukturanalyse mittels LISREL (R^2 Nutzungsabsicht = 0,64)	• *Bewertungen der Dienstenützlichkeit, Erwartungen hinsichtlich der technischen Funktionsfähigkeit* des Dienstes und die *Bewertung des Dienstes durch Referenzpersonen/-gruppen* beeinflussen die Dienstenutzungsabsicht signifikant positiv • Bewertungen der *Dienstenützlichkeit* werden durch den *Spaß an dessen Nutzung*, dessen *Informationswert* und dessen *Preiswürdigkeit* signifikant positiv beeinflusst
Sheng/Nah/Siau (2008)	• 100 Studenten einer Universität in den USA (52% im Alter von 18–25 Jahren) • Schriftliche Befragung • Vignette für einen SBM (standortbezogene Wetterinformationen, z.T. ergänzt durch systeminitiierte Unwetterwarnungen) • Regressionsanalyse	• *Datenmissbrauchsbedenken* beeinflussen die Absicht, den SBM zukünftig zu nutzen, anwendungssituationsübergreifend signifikant negativ • *Die Stimmigkeit zwischen dem SBM-Informationsangebot und dem Informationsbedarf der Nutzer* in deren Lebensalltag beeinflusst die Dienstenutzungsabsicht signifikant positiv
Lee/Chen/Wang/Chang (2009)	• 196 Personen in Taiwan mit Erfahrungen in der SBM-Nutzung (62,2% im Alter von 21–26 Jahren; 41,8% Studenten) • Online-Befragung vom 04.12.2006 bis zum 21.03.2007 • Vignette für einen SBM (Reiseinformationen/-navigation) • Kovarianzstrukturanalyse mittels LISREL (R^2 Nutzungsabsicht = 0,303)	• *Dienstenützlichkeit* und *-benutzerfreundlichkeit* beeinflussen die Einstellung zum SBM signifikant positiv, *Datenmissbrauchsbedenken*, *Kosten-* bzw. *Preisaspekte* und *Endgerätemerkmale* haben hingegen *keine* signifikanten zusätzlichen SBM-Einstellungseffekte • Die Einstellung zum SBM bzw. die Dienstebewertung beeinflussen die Dienstenutzungsabsicht signifikant positiv
Tsai et al. (2009)	• 56 Studenten einer Universität in den USA • Feldexperiment über vier Wochen mit Befragung vor der Installation eines (positionsverfolgenden) Dienstes, der den eigenen Standort auf Anfrage anderen Personen übermittelt („person finder/ tracker“), und nach Diensteeinstellung • Einsatz von einer Dienstevariante ohne und einer Variante mit der Möglichkeit sich zu informieren, wer wann den eigenen Standort abgefragt hat (= Feedback) • Varianz- und Regressionsanalysen (R^2 Nutzungsabsicht (binär) = 0,57)	• Die Einstellung gegenüber der Möglichkeit, durch Freunde oder durch Fremde lokalisiert zu werden, ist bei Personen mit *Feedback hinsichtlich der Standortabfrager nach* der Dienstenutzung besser als *vor* der Nutzung; eine entsprechende Verbesserung tritt bei Personen ohne solches Feedback nicht ein • *Einstellungen von Freunden* zum „person finder“-Dienst und die Wahrnehmung der eigenen *Kompetenz im Umgang mit neuen (Informations-)Techniken* beeinflussen die Bereitschaft, die Nutzung des Dienstes fortzusetzen, signifikant; hingegen wirken sich *Datenmissbrauchsbedenken nicht* signifikant auf die Nutzungsabsicht aus

Übersicht 1: Empirische Studien zur Adoption von SBM (Fortsetzung V)

Autor(en)[a]	Stichprobe/Erhebungsmethodik	Hauptergebnisse
Xu/Gupta (2009)	• 176 Studenten einer Universität in Singapur • Online-Befragung • Vignette für einen SBM (Taxibestellung) • Varianzstrukturanalyse mittels PLS (R^2 Nutzungsabsicht = 0,498 bzw. 0,389 für Personen mit bzw. ohne SBM-Nutzungserfahrungen)	• *Dienstenützlichkeit* und *-benutzerfreundlichkeit* sowie die *Offenheit gegenüber neuen informationstechnischen Angeboten* beeinflussen die Absicht, den SBM zukünftig zu nutzen, signifikant positiv • *Bedenken hinsichtlich einer Verletzung der eigenen Privatsphäre* durch den SBM wirken sich nicht direkt, wohl aber indirekt über weniger positive Benutzerfreundlichkeits- und Nützlichkeitsurteile für den SBM auf dessen Nutzungsabsicht aus
Xu/Oh/Teo (2009)	• 82 Studenten einer asiatischen Universität • Online-Gruppenbefragung • Vignette für einen SBM (mobile Push-Werbung, Gutscheinangebot) • Varianzstrukturanalyse mittels PLS (R^2 Nutzungsabsicht = 0,28)	• Der *Unterhaltungs- und Informationswert* bzw. der *Ablenkungseffekt* der Werbung beeinflussen die Dienstenutzungsabsicht signifikant positiv bzw. negativ
Xu/Yuan (2009)	• 183 Taxikunden in einer chinesischen Großstadt • Schriftliche Befragung im Jahr 2006 • Vignette für einen SBM (Taxibestellung) • Mittelwertvergleiche	• Die SBM-Nutzungsabsicht wird signifikant von *allgemeinen Situationsmerkmalen* (Aufenthaltsort, Wetter, Tageszeit) und *persönlichen Umständen* (z.B. Termindruck, eingeschränkte Beweglichkeit infolge von Krankheit o.ä.) beeinflusst

a) Die Auflistung der Studien erfolgt chronologisch nach dem Publikationsjahr in aufsteigender Reihenfolge und innerhalb eines Jahres alphabetisch nach dem ersten Autorennamen.

legten Arbeiten.[13] Alles in allem weisen die bisherigen empirischen kundenzentrierten SBM-Adoptionsstudien erhebliche Verbesserungspotenziale u.a. im Hinblick auf die inhaltliche Trennschärfe der Operationalisierung potenzieller Einflussfaktoren und abhängiger Adoptionskriterien, die Spannweite der berücksichtigten Determinanten und Adoptionsaspekte, die Stichprobengröße sowie den Einbezug deutschsprachiger Mobilfunkkunden auf. In dieser Situation besteht das Anliegen der eigenen Untersuchung darin, unter Rückgriff auf eine größere Stichprobe von in Deutschland lebenden Personen, die privat Kunde eines Mobilfunknetzbetreibers sind, für ein breiteres Spektrum von kundenbezogenen Faktoren empirisch zu analysieren, inwieweit sie geeignet sind, Unterschiede bei geäußerten Adoptionsbereitschaften im Hinblick auf mobile standortsensitive Pull-Informations, -Navigations- und Transaktionsdienste zu erklären.

I.2 Theoretische Grundlagen und Untersuchungshypothesen

In der betriebswirtschaftlichen Forschung zur Adoptionsbereitschaft von mobilen Datendiensten insgesamt und von (Pull-)SBM als einer Teilmenge dieser Diensteklasse wird weitaus am häufigsten auf das „Technology Acceptance Model“ (TAM) von Davis (1989) zurückgegriffen, um Einflussfaktoren der Nutzungsabsicht abzuleiten.[14] Dieser konzeptionelle Bezugsrahmen, der eine Anwendung allgemeinerer psychologischer Theorien zur Verhaltenserklärung („Theory of Reasoned Action“, „Theory of Planned Behavior“) darstellt,[15] wurde ursprünglich zur Erklärung der (Erst-)Nutzung neuer Informationstechniksysteme durch Unternehmensmitarbeiter entwickelt. Das TAM postuliert, dass die individuelle Absicht zur erstmaligen Übernahme/Anwendung einer informationstechnischen Innovation von deren wahrgenommener „Nützlichkeit“ („usefulness“) und deren wahrgenommener „Bedienfreundlichkeit“ („ease of use“) abhängt.[16]

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[13] Nicht einbezogen wurden hier Arbeiten, die im Wesentlichen Kundenpräferenzen für verschiedene SBM-Varianten ermitteln, also sich auf angebotsseitige Einflussgrößen der SBM-Adoption beschränken. Beispiele für entsprechende Studien sind Kölmel/Wirsing (2002); Köhne et al. (2005); Wehmeyer/Müller-Lankenau (2005); Bauer et al. (2006 u. 2007). Weiter wurden qualitative Analysen (z.B. Kaasinen 2003) oder methodisch intransparente quantitative Untersuchungen (z.B. Hahn/Fritsch 2005) ausgeklammert.

[14] So auch Pura (2005), S. 513; Fang et al. (2006), S. 126f.

[15] S. Davis et al. (1989), S. 983-985; Dishaw/Strong (1999), S. 10; Groeppel-Klein/Königstorfer (2007), S. 74; Kwon et al. (2007), S. 485.

[16] Vgl. Davis et al. (1989), S. 985.

Dieser vermeintlich „elegante“ Erklärungsansatz hat zahlreiche Schwachstellen. So weist das TAM erstens tautologische oder triviale Züge auf, weil es offensichtlich ist, dass in Befragungen Personen, die einen innovativen Mobilfunkdienst als nützlich und leicht verwendbar einstufen, gleichzeitig auch eher aussagen, dass sie beabsichtigen, den Dienst nachzufragen, wenn er zukünftig auf dem Markt verfügbar sein sollte.[17] Ohne Erweiterung durch Faktoren, welche ihrerseits das Ausmaß der wahrgenommenen Nützlich-, Werthaltig- oder Vorteilhaftigkeit sowie Bedienbarkeit von mobilen Datendiensten im Allgemeinen und von SBM im Besonderen erklären, bleibt das TAM inhaltsleer.

Zweitens ist das TAM mit der Konzentration auf nur zwei adoptionserklärende Konstrukte bei Kunden, die in privaten Anwendungszusammenhängen ohne hierarchische Zwänge freiwillig über die Nutzung eines mobilen Datendienstes entscheiden, zu eng angelegt. Für die Stärke der Adoptionsbereitschaft kommt es gerade bei Kunden, die Mobilfunkdienste als Privatpersonen nachfragen, nicht primär darauf an, inwieweit ein neues Angebot und die damit verbundene Technologie abstrakt als vorteilhaft wahrgenommen werden. Relevanter ist vielmehr, inwieweit ein neuer Dienst geeignet ist, den jeweiligen Kunden merkliche Erleichterungen bei der Bewältigung *konkreter, häufiger auftretender Alltagssituationen* anzubieten.[18] Weiter lässt das TAM individuelle, eher psychologische Kundencharakteristika wie die Beeinflussung der Adoption durch (vermutete) Erwartungen im sozialen Umfeld einer Person, deren Aufgeschlossenheit gegenüber neuen Leistungsangeboten generell und mobilen Datendiensten im Besonderen oder die Einschätzung von mit einer Dienstenutzung verbundenen Risiken und der Vertrauenswürdigkeit des Diensteanbieters außer Acht.[19] Wenn es aber nicht ausreicht, sich auf die „perceived usefulness“ und „perceived ease of use“ als Adoptionsdeterminanten zu beschränken, dann erscheint es sinnvoll, das TAM zur Ableitung von Hypothesen nicht in den Vordergrund zu rücken, sondern direkt auf anderen konzeptionellen Argumentationsrahmen aufzubauen.

Drittens akzentuiert das TAM mit der (wahrgenommenen) Bedienfreundlichkeit ein Angebotsmerkmal, dessen valide Messung praktische (Test-)Erfahrungen mit dem mobilen Datendienst, um dessen Adoptionsbereitschaft es geht, voraus-

[17] Vgl. Bouwman et al. (2007a), S. 149.

[18] S. Pura (2005), S. 514; Fang et al. (2006), S. 147; Groeppel-Klein/Königstorfer (2007), S. 74f.; Bouwman et al. (2007a), S. 149f. u. (2009), S. 314.

[19] S. als Beispiele für Studien zur Adoption mobiler Datendienste oder von SBM mit entsprechenden TAM-Erweiterungen Xu et al. (2005); Kwon et al. (2007); Bauer et al. (2008); Kuo/Yen (2009).

setzt. Es ist stark zu bezweifeln, dass solche Erlebnisse realitätsnah in Befragungen messbar sind, die in der bisherigen Forschung mit wenigen Ausnahmen auf SBM-Beschreibungstexte ohne oder mit Fotos der Endgeräteoberfläche[20] oder auf kurze multimediale SBM-Vorstellungen am PC[21] Bezug nehmen und *nicht* am Ende einer sich über mehrere Wochen erstreckenden praktischen Diensteerprobungsphase stehen.[22]

Alles in allem ist das TAM als Grundlage für die Formulierung von auch für die praktische Gestaltung der SBM-Vermarktung hilfreichen Hypothesen zu Einflussfaktoren der SBM-Adoptionsbereitschaft bei privaten Mobilfunkkunden weniger geeignet, da der Bezugsrahmen zu allgemein, zu unvollständig und ohne Pilotversuche kaum umfassend überprüfbar ist.

Ein zweiter Argumentationsstrang zur Erklärung der Adoption von SBM bei Privatkunden lässt sich durch Rückgriff auf das Konzept des „Task-Individual-Technology-Fit“[23] [= TITF] entwickeln, das zunächst unabhängig vom TAM in die betriebswirtschaftliche Forschung zur Technologieakzeptanz eingeführt wurde. Das TITF-Konzept hebt ab auf „the degree to which the functionality of a [new] technology matches the task as well as the abilities of the individual who performs the task“[24]. Es wurde zunächst zur Erklärung der Akzeptanz neuer informationstechnischer Hard- und Software durch „Anwender“ in Unternehmen eingesetzt und später auch auf innovative mobile Datendienste erweitert, die von Privatkunden genutzt werden (sollen). Das TITF-Konzept kann zwar auch als eine Facette der „usefulness“ einer Leistung eingeordnet werden, wird aber aufgrund seiner leichteren Konkretisierbarkeit als besser zur Erklärung der SBM-Adoption geeignet eingestuft als das genannte TAM-Konstrukt.[25]

Das im TITF-Konzept angesprochene Niveau der *individuellen „abilities“* für den Umgang mit SBM wurde in vier der 17 in Übersicht 1 enthaltenen Studien als Einflussgröße analysiert. Kwon et al. (2007) ermittelten einen signifikanten, indirekten Effekt dahingehend, dass die Selbsteinstufung der SBM-Nutzungskompetenz durch Kunden positiv auf die Wahrnehmung der Bedienfreundlich-

[20] S. etwa Xu/Teo (2004); Chang et al. (2006 u. 2007); Fang et al. (2006); Sheng et al. (2008).
[21] S. Junglas/Spitzmüller (2006); Bauer et al. (2008); Lee et al. (2009).
[22] S. als Ausnahmen Junglas (2007); Tsai et al. (2009).
[23] Goodhue/Thompson (1995), S. 218.
[24] Junglas et al. (2008), S. 1048; s.a. Dishaw/Strong (1999), S. 11f.; Gebauer et al. (2006), S. 3; Pousttchi/Wiedemann (2007), S. 6f.; Sheng et al. (2008), S. 365f.
[25] S. Dishaw/Strong (1999), S. 11; Fang et al. (2006), S. 146.

keit wirkt, die ihrerseits die Adoptionsbereitschaft positiv beeinflusst. Chang et al. (2007) und Tsai et al. (2009) fanden jeweils einen signifikanten direkten positiven Effekt der wahrgenommenen eigenen Kompetenz im Umgang mit neuen Informationstechniken oder mit SBM auf die SBM-Adoptionsbereitschaft. Bei Xu/Teo (2005, S. 87) korrelierte die Variable „prior experience of using mobile applications" zwar positiv, aber nicht statistisch signifikant mit der Adoptionsbereitschaft für einen SBM. Die SBM-spezifischen Ergebnisse werden durch zahlreiche andere Studien ergänzt, in denen zwischen Indikatoren der Quantität und Qualität der bisherigen Mobilfunkdienstenutzung durch eine Person und deren Adoptionsbereitschaft für mobile Datendienste (ohne Standortsensitivität) signifikante positive Zusammenhänge beobachtet wurden.[26] Deshalb lautet unsere Hypothese (H):

> H_1: Das Ausmaß der aktuellen Nutzung von Mobilfunkdiensten generell und speziell von mobilen Datendiensten beeinflusst die Adoptionsbereitschaft von SBM signifikant positiv.

Eng verbunden mit dem eben diskutierten Einflussfaktor ist ein Konstrukt, das in der betriebswirtschaftlichen Forschung zu mobilen Datendiensten/SBM zumeist als persönliche *Innovationsneigung* (englisch: „personal innovativeness") angesprochen wird. Es umschreibt die Disposition von Kunden entweder allgemein als früher Übernehmer für innovative Leistungsangebote von Unternehmen empfänglich zu sein oder spezifischer ihre Offenheit gegenüber neuen Mobilfunkdiensten.[27] Kunden, die bereits intensiv etablierte Mobilfunkdienste (Sprachtelefonie, SMS) nachfragen, sollten auch eine überdurchschnittliche Offenheit gegenüber innovativen Mobilfunkangeboten aufweisen, weil ihr Verhalten darauf hindeutet, dass mobile Kommunikationsmöglichkeiten für sie besonders wertvoll sind. Signifikante Korrelationen zwischen Indikatoren der leistungsunspezifischen oder auf informationstechnische Angebote bezogenen persönlichen Innovationsneigung und der Adoptionsbereitschaft von mobilen Datendiensten wurden u.a. von Hung et al. (2003), Lu et al. (2005a), Yang (2005), Pagani (2007), Lu et al. (2008) und Kuo/Yen (2009) identifiziert. Speziell für SBM wurden in fünf Arbeiten überwiegend signifikante direkte oder indirekte positive Zusammenhänge zwischen der Offenheit von Mobilfunknutzern gegenüber innovativen Angeboten generell oder dem Bezug von informationstechni-

[26] S. etwa Pedersen (2005), S. 216; Yang (2005), S. 271; Han et al. (2006), S. 223; Yoo/Moon (2006), S. 583; Kwon et al. (2007), S. 486; Lee et al. (2007), S. 107; Broeckelmann/Groeppel-Klein (2008), S. 156f.; Dickinger/Kleijnen (2008), S. 33; Kim et al. (2008), S. 402; abweichend Brown et al. (2003), S. 385-390.

[27] Vgl. Yang (2005), S. 263; Groeppel-Klein/Königstorfer (2007), S. 80; Pagani (2007), S. 710-712.

schen Innovationen im Besonderen einerseits und der SBM-Adoptionsbereitschaft andererseits gefunden.[28] Insgesamt spricht die empirische Befundlage somit für die Position, dass die „domain-specific … willingness to try out any new mobile service“[29] eine (mit dem TITF-Konstrukt der individuellen „ability“ korrelierte) signifikante Einflussgröße der SBM-Adoptionsbereitschaft ist. Entsprechend prüfen wir folgende Hypothese:

H_2: Die Offenheit gegenüber neuen Mobilfunkdiensten beeinflusst die Adoptionsbereitschaft von SBM signifikant positiv.

Der im TITF-Konzept weiter betonte Grad der Unterstützung von (privaten) Mobilfunknutzern durch SBM-Funktionalitäten bei der Bewältigung ihrer Alltagsroutinen wurde (überraschenderweise) bislang nur in drei der in Übersicht 1 profilierten SBM-Studien einbezogen. Das Laborexperiment von Junglas (2007) und die szenariobasierten Befragungen von Heijden et al. (2005), Sheng et al. (2008) sowie Xu/Yuan (2009) deuten darauf hin, dass die SBM-Adoptionsbereitschaft hoch ist, wenn für eine Person unterwegs standortabhängige Informationen hilfreich sind, um Aufgaben effizienter zu erfüllen. Besteht diese Art von Informationsbedarf nicht, dann ist die SBM-Adoptionsbereitschaft (auch nach einem Ausprobieren eines Dienstes) niedriger. Allgemeiner gesprochen ist zu vermuten: Je häufiger Personen sich nicht an einem stationären Arbeitsplatz oder in ihrer Wohnung aufhalten, sondern „unterwegs“ sind, desto größer ist die Wahrscheinlichkeit, dass standortbezogene Informationen, Navigationsmöglichkeiten und Transaktionsangebote mit ihrem „lifestyle“[30] in dem Sinn kompatibel sind, dass sie es ihnen erleichtern, ihr Leben gemäß den eigenen Interessen zu gestalten, SBM also für sie einen „Mehrwert“.[31]

Empirische Indizien zur Stützung dieser Annahme sind etlichen Studien zu entnehmen, welche die Adoptionsbereitschaft für mobile Datendienste ohne explizite Beschränkung auf Angebote mit Standortbezug untersucht haben.[32] Die Wirkung von häufig erlebten Alltagssituationen mit *Bedarf an standortabhängigen „Unterwegs-Informationen“* lässt sich aus konzeptioneller Sicht damit be-

[28] S. Xu/Teo (2004 u. 2005); Xu et al. (2005); Bouwman et al. (2007a); Kwon et al. (2007); Xu/Gupta (2009).

[29] Groeppel-Klein/Königstorfer (2007), S. 80.

[30] Teo/Pok (2003), S. 491; Wu/Wang (2005), S. 725; Rao/Troshani (2007), S. 65.

[31] Vgl. a. Pura (2005), S. 513f.; Gebauer et al. (2006), S. 19; Sheng et al. (2008), S. 353.

[32] S. Liang et al. (2003), S. 384f.; Lee et al. (2005), S. 138-145; Pura (2005), S. 525; Robra-Bissantz (2005), S. 31; Fang et al. (2006), S. 137-147; Lee et al. (2007), S. 104-109; Lee/Jun (2007), S. 344-351; Pousttchi/Wiedemann (2007), S. 11f.; Kim (2008), S. 391f.; Kim et al. (2008), S. 402f.; Kim/Garrison (2009), S. 329f.; Mallat et al. (2009), S. 194.

gründen, dass eine größere (wahrgenommene) Relevanz derartiger Informationen für das Privat- und Berufsleben von Mobilfunkkunden bei ihnen eher Aktivitäten zur Beschaffung von detaillierterem Wissen über SBM auslöst. Der bessere Informationsstand über SBM sowie deren Vorteilspotenziale und die Tendenz, bereits getätigte „Suchaufwendungen" nicht durch Ablehnung von SBM als ungerechtfertigt einstufen zu wollen (Dissonanzvermeidung), erhöhen wiederum die geäußerte SBM-Adoptionsbereitschaft.[33] Aus den vorgetragenen Argumenten ergibt sich die Hypothese:

H_3: Die erlebte Häufigkeit des sich oft spontan ergebenden Bedarfs an standortabhängigen „Unterwegs-Informationen" beeinflusst die Adoptionsbereitschaft von SBM signifikant positiv.

Über die sich aus dem TITF-Konzept ergebenden drei Einflussfaktoren der Adoptionsbereitschaft innovativer Angebote hinaus werden in der Forschung zu mobilen Datendiensten/SBM noch *weitere dienstespezifische Variablen* untersucht, die signifikante Effekte auf die Nutzungsabsicht haben könnten. Hierzu gehört erstens die Empfänglichkeit von Mobilfunkkunden für Anreize, mit denen die Netzbetreiber es ermöglichen, SBM unentgeltlich oder zu niedrigeren Preisen als „Normalnutzer" zu beziehen. Interpretiert man die SBM-Nachfrage eines Kunden als einen ökonomischen Austauschakt mit dem Anbieter „whereby the consumer's personal information is given in return for value such as … discounts"[34], dann kann der Nutzen-Kosten-Saldo bzw. Netto-Wert eines SBM aus Kundensicht dadurch erhöht werden, dass die Netzbetreiber „incentives like discounts or additional or exclusive services"[35] offerieren.[36] Je mehr die Einwilligung in die Nutzung persönlicher Daten (wie der aktuelle Standort) durch Mobilfunknetzbetreiber für SBM von Kunden als legitime eigene Leistung für reduzierte SBM-Preise oder andere Gegenleistungen des Anbieters wahrgenommen wird, desto größer sollte folglich auch deren SBM-Adoptionsbereitschaft ausfallen.[37] Die zu testende Hypothese lautet somit:

H_4: Die Bereitschaft zur Freigabe persönlicher Daten an SBM-Anbieter für Gegenleistungen beeinflusst die SBM-Adoptionsbereitschaft signifikant positiv.

[33] S. Kim (2008), S. 389; Kim/Garrison (2009), S. 325.
[34] Xu/Teo (2005), S. 74.
[35] Bauer et al. (2007), S. 461.
[36] S.a. Kölmel/Wirsing (2002), S. 96; Xu (2009), S. 27f.
[37] Vgl. Chellappa/Sin (2005), S. 184f.; Sheng et al. (2008), S. 353f.; Sultan et al. (2009), S. 312 u. 315.

Zweitens werden als potenzielle Adoptionsdeterminanten mobiler Datendienste bzw. von SBM Kundeneinschätzungen von *Risiken* dieser Art von Mobilfunkdiensten erörtert.[38] Dabei werden unter Risiken Kundenwahrnehmungen bezüglich unsicherer materieller oder immaterieller Verluste, Nachteile oder Schäden, die durch die Nutzung von SBM verursacht werden könnten, verstanden. Die Adoptionsrelevanz solcher Risikobeurteilungen hängt prinzipiell ab von der Bedeutung, die Kunden bestimmten Arten von Verlusten für ihre private und berufliche „Lebensqualität" beimessen, und von der vermuteten Wahrscheinlichkeit, dass eine spezifische Verlustart realisiert wird.[39]

Die hier am stärksten beachtete SBM-Risikoart ist die *Gefährdung der Privatsphäre* durch den Verlust der Kontrolle über persönliche (Standort-)Daten, die auch als „perceived privacy risk"[40] bezeichnet wird. Mit diesem Konstrukt hebt man auf Kundenbedenken dahingehend ab, dass SBM-Anbieter (1) mehr personenbezogene Daten sammeln als für ihre Dienste zwingend notwendig sind, (2) personenbezogene Daten für andere/unbekannte Zwecke jenseits der SBM-Bereitstellung nutzen, (3) personenbezogene Daten unzureichend gegen den unbefugten Zugang durch Dritte sichern und (4) aufgrund technischer Probleme fehlerbehaftete personenbezogene Daten erzeugen.[41] In sieben Studien wurden signifikant negative Korrelationen zwischen dem *wahrgenommenen Risiko des Missbrauchs persönlicher Daten*, die zur SBM-Bereitstellung erhoben werden, und der SBM-Adoptionsbereitschaft festgestellt.[42] In vier anderen SBM-Untersuchungen wurden hingegen keine entsprechenden Assoziationen beobachtet.[43] In Arbeiten, die sich mit der Erklärung der Adoptionsbereitschaft von neuen mobilen Datendiensten ohne Standortsensitivität beschäftigen, wurden überwiegend signifikante negative Wirkungen des wahrgenommenen Risikos eines Missbrauchs persönlicher Daten auf die Absicht, den jeweiligen Dienst zukünf-

[38] S. z.B. Teo/Pok (2003), S. 491; Fritsch/Muntermann (2005), S. 154f.; Köhne et al. (2005), S. 20; Wehmeyer/Müller-Lankenau (2005), S. 16; Wu/Wang (2005), S. 722; Bauer et al. (2006), S. 183 u. (2007), S. 461; Groeppel-Klein/Königstorfer (2007), S. 77; Chen et al. (2008), S. 35f.; Im et al. (2008), S. 2.

[39] S. Mitchell (1999), S. 183f.; Heijden et al. (2005), S. 4.

[40] Xu et al. (2005), S. 899.

[41] Vgl. Smith et al. (1996), S. 192; Xu/Teo (2004), S. 801; Pura (2005), S. 512; Siegmund/Buse (2008), S. 243f.; Xu/Gupta (2009), S. 138.

[42] S. Xu/Teo (2004 u. 2005); Heijden et al. (2005); Xu et al. (2005); Junglas/Spitzmüller (2006); Chang et al. (2007); Sheng et al. (2008); vgl. weiter Kölmel/Wirsing (2002), S. 96; Fritsch/Muntermann (2005), S. 154f.

[43] Vgl. Barkuus/Dey (2003); Fang et al. (2006); Lee et al. (2009); Tsai et al. (2009); Xu/Gupta (2009); s. zu ähnlichen Indizien auch Siegmund/Buse (2008), S. 244f.

tig zu nutzen, berichtet.[44] Angesichts dieser Befundlage ist folgende Hypothese vertretbar:

> H_5: Bedenken hinsichtlich des Missbrauchs persönlicher Daten, die im Zusammenhang mit SBM erhoben werden, beeinflussen die SBM-Adoptionsbereitschaft signifikant negativ.

Eine zweite, bislang in der Forschung weniger berücksichtigte Risikoart ergibt sich daraus, dass für Privatkunden, stärker als für Personen, bei denen der Arbeitgeber in Anspruch genommene Mobilfunkdienste zahlt, die mit SBM-Einsätzen verursachten Nutzungskosten bzw. verbundenen Nutzungspreise für die Adoptionsbereitschaft solcher Dienste von erheblicher Bedeutung sein könnten. Wenn Kostenaspekte in Studien zur Akzeptanz mobiler Datendienste Beachtung finden, wird häufig auf die wahrgenommene Preiswürdigkeit i.S. des Preis-Leistungsverhältnisses abgehoben.[45] In der eigenen Untersuchung wird *nicht* auf dieses Konstrukt zurückgegriffen, weil die meisten Mobilfunkkunden aufgrund der bislang geringen Verbreitung von SBM und der sehr heterogenen Preiskonzepte von deutschen Mobilfunknetzbetreibern für solche Dienste[46] noch über keine gefestigten Vorstellungen hinsichtlich der Preiswürdigkeit von SBM verfügen dürften. Stattdessen werden *kostenbezogene Risikoeinschätzungen* betrachtet. Bei diesen „cost concerns“[47] geht es darum, inwieweit Mobilfunkkunden Bedenken haben, dass sie infolge von vorab nur schwer präzise vorhersehbaren eigenen SBM-Nutzungshäufigkeiten und -Preisbildungsverfahren der Netzbetreiber Kosten zu tragen bzw. Rechnungsbeträge zu zahlen haben, die unerwartet hoch ausfallen und deshalb als „shock“[48] empfunden werden.

In der SBM-Adoptionsforschung findet man in drei Studien Anhaltspunkte dafür, dass sich von Kunden vermutete *SBM-Kostenrisiken* signifikant negativ auf die Nutzungsbereitschaft solcher Dienste auswirken.[49] Die SBM-Untersuchung von Lee et al. (2009) spricht demgegenüber nicht für die Existenz eines solchen Effektes. Etlichen Arbeiten zu mobilen Datendiensten ohne Kontextbewusstsein sind Indizien dafür zu entnehmen, dass sich Kundeneinschätzungen bezüglich

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[44] S. etwa Teo/Pok (2003), S. 495; Lu et al. (2005b), S. 21; Luarn/Lin (2005), S. 885; Wu/Wang (2005), S. 725f.; Wang et al. (2006), S. 169; Lu et al. (2007), S. 23f.; Bina et al. (2008), S. 304; Lu et al. (2008), S. 60; Vlachos/Vrechopoulos (2008), S. 287; abweichend dagegen Pousttchi/Wiedemann (2007), S. 11.

[45] S. z.B. Turel et al. (2007), S. 71; Bauer et al. (2008), S. 213.

[46] S. Fritsch/Muntermann (2005), S. 151-153.

[47] Groeppel-Klein/Königstorfer (2007), S. 77.

[48] Narayanan et al. (2007), S. 3.

[49] S. Pura (2005); Chang et al. (2007); Bauer et al. (2008).

der Kostenhöhe und -unsicherheit dieser Leistungen signifikant negativ auf die Bereitschaft, sie zu nutzen, auswirken.[50] Angesichts der Gesamtheit der Ergebnisse vertreten wir die Hypothese:

> H_6: Bedenken hinsichtlich unerwartet hoher Kosten oder Rechnungen aufgrund von SBM-Nutzungen beeinflussen die SBM-Adoptionsbereitschaft signifikant negativ.

Als dritte Risikoart bei mobilen Datendiensten/SBM werden in der Literatur *technische Fehlfunktionen* oder Funktionsschwächen der Netze oder der Endgeräte, auf welche die Dienste zurückgreifen, diskutiert.[51] In der SBM-Forschung werden Aspekte technischer Funktionsrisiken unter divergierenden Überschriften erörtert. So identifizieren Bauer et al. (2008) „erleichternde Bedingungen" als signifikante Adoptionsdeterminante und verstehen darunter „den Grad, mit dem eine Person überzeugt ist, dass ihr die notwendige technische Infrastruktur zur Verfügung steht, um Location Based Services zu nutzen" (S. 210). Chang et al. (2007) heben als technische Funktionsrisiken Kundenbedenken im Hinblick auf Qualitätsdefizite standortbezogener Daten (z.B. Unvollständigkeit) hervor und beobachten für sie einen signifikanten negativen SBM-Adoptionseffekt. Chang et al. (2006) und Lee et al. (2009) hingegen rücken potenzielle technische Funktionsmängel von SBM-Endgeräten in den Vordergrund, wobei sich die Risikoeinschätzungen von Mobilfunkkunden bezüglich der Endgeräte in beiden Studien *nicht* als signifikante Adoptionseinflussfaktoren erweisen. Diese Befundsituation spricht insgesamt dafür, anzunehmen, dass Risikoeinschätzungen von Kunden im Hinblick auf technische SBM-Funktionsmängel, die über Fehlfunktionen auf Endgeräteseite hinausgehen, sich signifikant negativ auf die SBM-Adoptionsabsicht auswirken. Anders formuliert lautet unsere Hypothese:

> H_7: Bedenken hinsichtlich technischer Funktionsmängel von SBM beeinflussen die SBM-Adoptionsbereitschaft signifikant negativ.

Ein im Kontext von wahrgenommenen Risiken technischer Innovationen wie SBM häufig aufgegriffenes Konstrukt, für das angenommen wird, dass es über Verlusterwartungen hinaus eigenständige Effekte auf die Adoptionsbereitschaft hat, ist das Vertrauen, welches Kunden dem Anbieter der Innovation zum Zeitpunkt der Übernahmeentscheidung entgegenbringen. Im Hinblick auf SBM ist

[50] S. Hung et al. (2003), S. 54; Luarn/Lin (2005), S. 885; Wu/Wang (2005), S. 726; Kim et al. (2007), S. 120; Turel et al. (2007), S. 68; Bina et al. (2008), S. 303f.; Kuo/Yen (2009), S. 108; abweichend hingegen Kleijnen et al. (2004), S. 212.

[51] Z.B. ungenaue Navigationsinformationen; s. Chae et al. (2002), S. 39f.; Lu et al. (2003), S. 363f.; Spiekermann (2006), S. 165-167; Bina et al. (2008), S. 300.

also das *Kundenvertrauen in den eigenen Mobilfunknetzbetreiber* als Adoptionsdeterminante in Betracht zu ziehen. Dabei wird in der betriebswirtschaftlichen Literatur mit Vertrauen gegenüber einem Innovationsanbieter (wie einem Mobilfunknetzbetreiber) typischerweise die Stärke der Überzeugung von Kunden bezeichnet, dass den eigenen Interessen von dem Anbieter bei dessen Handeln insbesondere in Geschäftssituationen, in denen er über die Möglichkeit verfügt, den Kunden zu schaden (die Kunden also „verwund-/übervorteilbar" sind) in wohlmeinender, fairer sowie integrer Weise Rechnung getragen wird und zwar selbst dann, wenn der Kunde nicht in der Lage ist, den Anbieter zu überwachen.[52] Die Investition von Vertrauen in den eigenen Mobilfunknetzbetreiber ist für Kunden ein Mittel zur Verringerung der wahrgenommenen Risiken bei Überlegungen zur Adoption eines komplexen Mobilfunkdienstes, für den sie noch über keine eigenen praktischen Nutzungserfahrungen verfügen und der ihnen deshalb in opportunistischer Weise von ihrem Mobilfunknetzbetreiber aufgedrängt werden könnte.[53]

In einer ersten Gruppe von Studien zur Adoption mobiler Datendienste oder von Einkaufsangeboten über das stationäre Internet wird das Kundenvertrauen in den Diensteanbieter/Verkäufer als eine Determinante von Risikowahrnehmungen bezüglich der Angebotsinnovation eingeordnet, die ihrerseits Effekte auf die Adoptionsbereitschaft haben.[54] Eine zweite Gruppe von Arbeiten argumentiert hingegen, dass sich das Vertrauen von Kunden in ihren Diensteanbieter direkt auf die Adoptionsbereitschaft innovativer Leistungen ihres bisherigen Geschäftspartners auswirkt.[55] Schließlich findet man eine dritte Gruppe von Untersuchungen, die sowohl direkte als auch indirekte Adoptionseffekte des Vertrauens in den Diensteanbieter zum Zeitpunkt einer Übernahmeentscheidung postulieren.[56]

Hinsichtlich der Ausprägungen des Kundenvertrauens in SBM-Anbieter gibt es divergierende Ansichten. So meinen Bauer et al. (2006, S. 183), dass es sehr

[52] S. für viele Mayer et al. (1995), S. 712; Gefen et al. (2003), S. 55-60; Grabner-Kräuter/Kaluscha (2003), S. 785-802; Pavlou (2003), S. 106f.

[53] S. Mayer et al. (1995), S. 725f.; Mitchell (1999), S. 174; Gefen et al. (2003), S. 54f.; Pavlou (2003), S. 111f.; Köhne et al. (2005), S. 21; Xu et al. (2005), S. 899; Bauer et al. (2007), S. 461; Wong/Hsu (2008), S. 81-83.

[54] S. z.B. Fang et al. (2006), S. 130; Mahatanankoon et al. (2006), S. 672; Mallat (2007), S. 425; Xu (2009), S. 32f.

[55] S. z.B. Gefen et al. (2003), S. 60f; Kaasinen (2003), S. 77; Chellappa/Sin (2005), S. 190; Lee (2005), S. 175; Groeppel-Klein/Königstorfer (2007), S. 78; Pousttchi/Wiedemann (2007), S. 5f.; Chen et al. (2008), S. 35.

[56] S. z.B. Pavlou (2003), S. 118 u. 122; Xu et al. (2005), S. 905; Junglas/Spitzmüller (2006), S. 7.

niedrig ausgeprägt sei.[57] Kaasinen (2003, S. 77) und Junglas/Watson (2008, S. 69) vertreten die entgegengesetzte Position. Speziell für SBM wurden Adoptionseffekte des Kundenvertrauens in den eigenen Mobilfunknetzbetreiber empirisch nur von Xu et al. (2005) und Junglas/Spitzmüller (2006) mit dem Ergebnis untersucht, dass dieser Faktor über Risikowahrnehmungen für einen SBM hinaus eigenständige signifikante Wirkungen auf die Bereitschaft, SBM zu nutzen, hat. Angesichts dieser Befunde und aufgrund der erheblichen Zahl von Arbeiten ohne SBM-Bezug, deren Ergebnisse denen von Xu et al. (2005) ähneln, vertreten wir die Hypothese:

> H_8: Das Vertrauen, das dem eigenen Netzbetreiber von Mobilfunkkunden entgegengebracht wird, beeinflusst die SBM-Adoptionsbereitschaft signifikant positiv.

Ein zweiter Weg, den Kunden zur Verringerung der Unsicherheit bezüglich des „Wertes" von innovativen SBM neben der Investition von Vertrauen in den eigenen Netzbetreiber beschreiten können, liegt in der Berücksichtigung der Einschätzung solcher Dienste durch Verwandte, Freunde, Bekannte und die Medien sowie der mit diesen Bewertungen verbundenen Erwartungen Dritter, dass man selbst den neuen Dienst nutzt.[58] Dieser Aspekt wird in der englischsprachigen betriebswirtschaftlichen Forschung zur Adoption mobiler Datendienste als „social influence"[59], „social norm"[60] oder „subjective norm"[61] bezeichnet.

In der empirischen Forschung wurden Einflüsse der Bewertung von SBM durch das soziale Umfeld von Mobilfunkkunden auf die SBM-Adoptionsbereitschaft in zwei Arbeiten analysiert. Tsai et al. (2009) stellten in einem Feldexperiment fest, dass die Bereitschaft, einen standortsensitiven „person finder"-Dienst zukünftig weiter zu nutzen, sehr stark von der Beurteilung dieses Dienstes durch Freunde beeinflusst wird. Ähnlich beobachteten Bauer et al. (2008) einen signifikant positiven Einfluss der wahrgenommenen Bewertung der Übernahme eines Navigationsdienstes durch das soziale Umfeld von Mobilfunkkunden auf deren Adoptionsbereitschaft für diesen Dienst. Übereinstimmende Resultate sind etlichen Studien zur Nutzungsabsicht neuer mobiler Datendienste ohne Standortbewusstsein und innovativer technischer Leistungsangebote durch Privatkunden

[57] S. ähnlich Fritsch/Muntermann (2005), S. 154f.
[58] Vgl. Bauer et al. (2007), S. 461.
[59] Groeppel-Klein/Königstorfer (2007), S. 78f.; Rao/Troshani (2007), S. 67.
[60] Dickinger et al. (2008), S. 7.
[61] Pura (2005), S. 513; Bauer et al. (2008), S. 209.

generell zu entnehmen.[62] Abweichende Ergebnisse dahingehend, dass die Innovationsbewertung im sozialen Umfeld von Kunden folgenlos für deren Adoptionsbereitschaft bleibt, sind dagegen selten.[63] Deshalb lautet unsere Hypothese:

H_9: Unterstützende Bewertungen von SBM durch das soziale Umfeld von Mobilfunkkunden beeinflussen die SBM-Adoptionsbereitschaft signifikant positiv.

I.3 Empirische Erhebungsmethoden und -befunde

I.3.1 Stichprobe

Die Datenerhebung umfasste eine im April und Mai 2008 durchgeführte schriftliche Befragung von deutschsprachigen Personen, die privat Kunde eines Mobilfunknetzbetreibers waren. Das Erhebungsinstrument enthielt Fragen/Items mit überwiegend vorgegebenen, abgestuften Antwortmöglichkeiten. Es war vor der Haupterhebung einem Pretest unterzogen und aufgrund der dabei gemachten Beobachtungen im Hinblick auf Verständlichkeit und Eindeutigkeit verbessert worden. Zur Gewinnung von Teilnehmern konnten im Internet Links zum Fragebogen auf der Webpräsenz eines in Deutschland agierenden Mobilfunknetzbetreibers sowie auf einigen Portalen mit hohen Besucherzahlen platziert werden. Auf diese Weise war es möglich, 2.236 Personen dazu zu motivieren, online mit der Bearbeitung des Fragebogens zumindest zu beginnen. Aus dieser Menge werden in die nachfolgenden Analysen nur die 989 Individuen einbezogen, die mindestens 70% der Fragen im (umfangreichen) Erhebungsinstrument bearbeitet hatten.[64] Durch diese Auswahl soll darauf hingewirkt werden, primär Personen zu berücksichtigen, die sich ernsthaft mit den Fragebogeninhalten beschäftigt haben. Der Mittelwert bzw. Median der Bearbeitungszeit der einbezogenen Online-Respondenten belief sich auf 29 bzw. 26 Minuten.

Weiterhin wurde eine Papierversion des Erhebungsinstruments ebenfalls im zweiten Quartal 2008 an zwei deutschen Universitäten Studenten zum Ausfüllen im Rahmen von Vorlesungen ausgehändigt und an Mitglieder eines gemeinnützigen Vereins zur Förderung betriebswirtschaftlicher Forschung mit Bezug zur Telekommunikationsbranche per Post verschickt. So konnten 143 zusätzliche

[62] S. etwa Hung et al. (2003), S. 54; Teo/Pok (2003), S. 495; Kleijnen et al. (2004), S. 212; Lu et al. (2005a), S. 250; Nysveen et al. (2005a), S. 336f. u. (2005b), S. 252; Pedersen (2005), S. 216; Schepers/Wetzels (2007), S. 93-99; Bina et al. (2008), S. 299; Dickinger et al. (2008), S. 8; Hong et al. (2008), S. 440; López-Nicolás et al. (2008), S. 362; Lu et al. (2008), S. 60; Yang/Jolly (2009), S. 506f.

[63] S. Groeppel-Klein/Königstorfer (2007), S. 84; Dickinger/Kleijnen (2008), S. 33.

[64] Vgl. zur Begründung des Schwellenwertes Wirtz (2004), S. 110f.

Fragebogenrückläufe erzielt werden, von denen 108 die o.g. 70%-Bearbeitungsschwelle überschritten. Die 989 Online- und 108 Papier-Respondenten unterschieden sich nicht signifikant bezüglich der in den Untersuchungshypothesen angesprochenen Variablenbeziehungen. Deshalb werden anschließend Befunde für die Gesamtstichprobe der 1.097 Mobilfunkkunden berichtet.

69,0% der Respondenten waren Männer (n = 995). 2,1% gaben an, nicht älter als 18 Jahre zu sein, 43,4% erreichten ein Alter zwischen 19 und 25 Jahren, 47,2% zwischen 26 und 45 Jahren und 7,3% waren mindestens 46 Jahre alt (n = 1.020). 33,4% der Teilnehmer vermerkten auf die Frage nach dem höchsten erreichten Bildungsabschluss, ein (Fach-)Abitur abgelegt zu haben, 40,2% berichteten, ein (Fach-)Hochschulstudium absolviert zu haben und 26,4% gaben andere Abschlussarten (z.B. Berufsausbildung) an (n = 932). 96,4% der Respondenten lebten in Deutschland, 3,3% in Österreich oder der Schweiz und 0,3% in anderen Staaten (n = 926).

27,8% der Respondenten berichteten, dass ihre aktuellen Monatsausgaben für Mobilfunkdienste nicht höher als 15 Euro waren; bei 42,8% erreichten sie mindestens 15 Euro, aber weniger als 35 Euro; 17,6% stuften diese Ausgaben mit mindestens 35 Euro, aber weniger als 55 Euro ein und 11,8% bezifferten sie mit mindestens 55 Euro (n = 929; s.a. unten Variable I.3 in Tabelle 3). 80,0% der Teilnehmer bezogen eine monatliche Rechnung von ihrem Mobilfunkanbieter (= „Postpaid-Kunden"), 20,0% nutzten Mobilfunkdienste über vorausbezahlte Guthabenkarten (= „Prepaid-Kunden") (n = 876). Von den 447 Personen, die ihren aktuellen Mobilfunkanbieter in ein offenes Antwortfeld (ohne Vorgaben) eintrugen, nannten 51,0% den Netzbetreiber, der unsere Studie durch einen Link auf seiner Homepage unterstützte, 42,8% entfielen etwa zu gleichen Teilen auf die übrigen drei in Deutschland aktiven Mobilfunknetzbetreiber und 6,2% führten weitere Anbieternamen (z.B. Service Provider, Netzbetreiber aus Österreich) an.

Die Beschreibung der Studienteilnehmer im Hinblick auf ihre sozio-demographische Struktur und grundlegende Aspekte ihres Verhaltens als privater Mobilfunkkunde lässt erkennen, dass die eigene Stichprobe einerseits weder für die (erwachsene) Bevölkerung in Deutschland noch für die Grundgesamtheit der Privatkunden von Mobilfunkanbietern als statistisch repräsentativ angesehen werden darf. Andererseits handelt es sich aber auch *nicht* um ein Sample, das wie in etlichen SBM-Adoptionsstudien,[65] ausschließlich oder mehrheitlich Stu-

[65] S. Xu/Teo (2004); Heijden et al. (2005); Xu/Teo (2005); Junglas/Spitzmüller (2006); Junglas (2007); Sheng et al. (2008); Tsai et al. (2009).

denten umfasst. Insgesamt ist davon auszugehen, dass sich an unserer Befragung primär Personen beteiligt haben, die von ihrem Geschlechts-, Alters- und Bildungsprofil her den typischen „early adopters“ von innovativen Mobilfunkdiensten nahe kommen dürften.

Außerdem geht es in der eigenen Studie nicht um die möglichst genaue Abbildung der Ausprägungsverteilungen von Variablen in einer Grundgesamtheit mit Hilfe einer Stichprobe, sondern um Zusammenhänge zwischen Konstrukten. Deshalb hängt ihre wissenschaftliche Aussagekraft auch nicht von der Repräsentativität der Respondenten für die Grundgesamtheit der Bevölkerung oder privater Mobilfunkkunden in Deutschland ab. Wesentlich bedeutsamer für ihre wissenschaftliche Brauchbarkeit ist die Qualität der Variablenmessungen und die Angemessenheit der statistischen Methoden, die zur Analyse potenzieller Zusammenhänge zwischen den Untersuchungskonstrukten zum Einsatz kommen.[66] Um diesbezüglich eine Beurteilung der eigenen Arbeit zu ermöglichen, wird im Folgenden die Operationalisierung der abhängigen und unabhängigen Variablen sowie die statistische Auswertung der Daten beschrieben.

I.3.2 Variablenoperationalisierung

I.3.2.1 Adoptionsbereitschaft von standortbezogenen Mobilfunkdiensten

Weil es sich bei SBM zur Zeit um innovative Angebote handelt, für die Mobilfunkkunden (noch) nicht über praktische Nutzungserfahrungen verfügen, besteht in der empirischen Literatur weitgehend Einigkeit, dass die Adoptionsbereitschaft von SBM nicht abstrakt/generell abgefragt werden sollte. Stattdessen ist es gängige Forschungspraxis, über Beschreibungen von SBM-Einsatzszenarien Konsumenten Vorstellungen von SBM-Anwendungsmöglichkeiten bzw. vom SBM-Nutzen zu vermitteln, um auf dieser Basis die Stärke ihrer Bereitschaft zur (Erst-)Nachfrage/Übernahme von SBM zutreffender erfassen zu können.[67] Dementsprechend wurden im eigenen Erhebungsinstrument fünf verschiedene Anwendungsszenarien für mobile standortsensitive Pull-Informations-, Navigations- und Transaktionsdienste beschrieben (s. im Anhang Tabelle A1). Nach Vorstellung eines Szenarios wurden die Probanden jeweils gefragt, mit welcher Wahrscheinlichkeit sie den SBM nutzen würden. Zur Beantwortung standen

[66] S. im Ergebnis übereinstimmend East/Uncles (2008), S. 935-937 u. 942.

[67] Vgl. Xu/Teo (2004), S. 799 u. (2005), S. 78; Heijden et al. (2005), S. 5f.; Fang et al. (2006), S. 133-137; Junglas/Spitzmüller (2006), S. 5; Kwon et al. (2007), S. 489; Bauer et al. (2008), S. 214; Sheng et al. (2008), S. 355f.; Xu/Gupta (2009), S. 142; Xu et al. (2009), S. 163.

stets sechs abgestufte Optionen mit den Endpolen „sehr unwahrscheinlich“ (kodiert als 1) und „sehr wahrscheinlich“ (kodiert als 6) zur Verfügung.

Neben dieser einstellungsähnlichen Adoptionsfacette werden im Schrifttum Bereitschaften, monetäre oder nicht-materielle Opfer zu erbringen, um innovative Mobilfunkdienste nutzen zu können, als weitere verhaltensnähere/konkrete Adoptionsaspekte erörtert, die sich auf SBM übertragen lassen.[68] Deshalb wurde von uns zum einen die monetäre Opferbereitschaft berücksichtigt, indem die Teilnehmer für jedes der fünf SBM-Szenarien gebeten wurden, einen frei wählbaren Euro-Betrag anzugeben, den sie bereit wären, in der beschriebenen Situation für die einmalige Nutzung des entsprechenden SBM zu bezahlen (s. im Anhang Tabelle A1). In der betriebswirtschaftlichen Methodenliteratur ist strittig, ob bzw. in welchen Situationen sich die Validitäten von Zahlungsbereitschaftsmessungen über direkte szenariobasierte Fragen, die auch als „kontingenter Bewertungsansatz“ bezeichnet werden, und von Messungen über weniger direkte und zumeist komplexere Verfahren, wie Conjoint-Erhebungen, Auktionen oder Lotterien, unterscheiden.[69] Die hier getroffene Entscheidung zugunsten von direkten Zahlungsbereitschaftsabfragen ist dadurch motiviert, auf diese Weise eine Begrenzung des Erhebungsaufwands sowie eine Erhöhung der Beantwortungsmotivation erreichen zu können, ohne klare Validitätsnachteile in Kauf nehmen zu müssen.[70]

Zum anderen wurde die prinzipielle Bereitschaft, nicht-monetäre Opfer für eine SBM-Nutzung zu erbringen (z.B. Laden von Software auf ein mobiles Endgerät), über sieben Indikatoren solcher „Aufwendungen“, die im Zusammenhang mit SBM von Bedeutung sein können, losgelöst von den fünf SBM-Szenarien erfasst.[71] Die Teilnehmer gaben jeweils an, wie sicher sie eine bestimmte Anstrengung auf sich nehmen würden, um SBM nutzen zu können (s. im Anhang Tabelle A1). Hierbei wurden sechs abgestufte Antwortmöglichkeiten von „keinesfalls“ (kodiert als 1) bis „ganz sicher“ (kodiert als 6) vorgegeben.

Tabelle 1 informiert über die Mittelwerte und Standardabweichungen der 17 Items mit Bezug zur SBM-Adoptionsbereitschaft in der Stichprobe.

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[68] S. z.B. Yoo/Moon (2006), S. 576-579; Papies/Clement (2007), S. 88; Siegmund/Buse (2008), S. 231-237.

[69] Vgl. Völckner (2006), S. 43-47 u. 53.

[70] Vgl. im Ergebnis ähnlich Königstorfer (2008), S. 133.

[71] S. auch die Operationalisierung eines ähnlichen Aufwandsbereitschaftskonstruktes bei Gerpott/Kornmeier (2009), S. 19f.

Tabelle 1: Deskriptive Statistiken und varimaxrotierte Faktorladungen der Einzelfragen zur Messung von Adoptionsdimensionen

		Statistiken[b]			Varimaxrotierte Ladungen Hauptkomponentenfaktorenanalyse[a]					
					Fallweiser Ausschluss (n = 783)			„Expectation Maximization" Imputation (n = 1097)		
Einzelfragen[c]		M	S	n	F1	F2	F3	F1	F2	F3
1.	NW Navigation Urlaub	3,96 [4,00]	1,67	1092	12	04	73	04	13	74
2.	NW Preisvergleich Kauf LCD-Fernsehgerät	3,27 [3,00]	1,85	1089	10	08	64	11	11	64
3.	NW Navigation Kundenadresse Geschäftsreise	4,17 [5,00]	1,73	1083	13	19	68	18	15	69
4.	NW Identifikation und Buchung Hotel Geschäftsreise	3,91 [4,00]	1,67	1086	08	10	77	12	09	78
5.	NW Stauumgehung private PKW-Fahrt	3,47 [4,00]	1,79	1077	12	06	72	08	09	71
6.	ZB Navigation Urlaub	0,87 [0,50]	1,23	1052	07	81	05	79	09	07
7.	ZB Preisvergleich Kauf LCD-Fernsehgerät	0,63 [0,25]	1,05	1014	04	78	09	80	05	08
8.	ZB Navigation Kundenadresse Geschäftsreise	1,04 [0,50]	1,54	1012	03	86	05	87	05	07
9.	ZB Identifikation und Buchung Hotel Geschäftsreise	1,04 [0,50]	1,49	1016	07	79	10	81	09	12
10.	ZB Stauumgehung private PKW-Fahrt	0,64 [0,29]	1,01	999	10	73	17	75	09	16
11.	Erwerb neues Mobiltelefon für NM SBM	2,59 [2,00]	1,61	1026	64	00	26	00	64	26
12.	Laden von Software auf Mobiltelefon für NM SBM	4,20 [4,00]	1,52	1028	47	–01	46	–04	49	46
13.	Abschluss neuer Mobilfunkvertrag für NM SBM	1,94 [1,00]	1,29	1024	79	05	06	06	80	05
14.	Abschluss Zusatzvertrag zu Mobilfunkvertrag für NM SBM	2,77 [3,00]	1,57	1013	78	08	17	04	77	19
15.	Abschluss dienste- oder regionenbezogene Zusatz-Abos für NM SBM	2,31 [2,00]	1,42	1027	63	14	14	14	65	15
16.	Netzbetreiberwechsel für NM SBM	2,16 [1,00]	1,51	999	65	02	–04	08	66	–02
17.	Abschluss Zusatzvertrag mit Drittanbieter für NM SBM	2,23 [2,00]	1,42	1003	72	07	13	08	73	14

a) Es wurden die Faktoren mit Eigenwerten > 1 extrahiert und rotiert. Es werden nur die erste und zweite Nachkommastelle für Faktorladungen gezeigt. Lesebeispiel: 74 = 0,74. Durch die Faktorenlösung erklärter Varianzanteil = 55,53% bei fallweisem Ausschluss bzw. 56,79% bei Imputation fehlender Werte.

b) In dieser und allen folgenden Tabellen gilt: M = (arithmetischer) Mittelwert; S = Standardabweichung; n = Fallzahl. Angaben in eckigen Klammern in der Mittelwertspalte = Median.

c) NW = Nutzungswahrscheinlichkeit. ZB = Zahlungsbereitschaft (Angabe in Euro). NM SBM = Nutzungsmöglichkeit standortbasierter Mobilfunkdienste. Antwortvorgaben für Einzelfragen 1–5 jeweils 6-Punkte-Kontinuum mit den Endpolen „sehr unwahrscheinlich" (= 1) bis „sehr wahrscheinlich" (= 6). Antwortvorgaben für Einzelfragen 11 bis 17 jeweils 6-Punkte-Kontinuum mit den Endpolen „keinesfalls" (= 1) bis „ganz sicher" (= 6). S. zu den Einzelfragen im Detail Tab. A1 im Anhang.

Die 17 Einzelindikatoren wurden einer Hauptkomponentenfaktorenanalyse unterzogen. Bei fallweisem Ausschluss von Teilnehmern mit fehlenden Werten bei den Adoptionsitems verringert sich die Zahl der auswertbaren Fälle um 28,6% auf 783 Mobilfunkkunden. Tests für die Befragten mit mindestens einer fehlenden Antwort für die 17 Adoptionsindikatoren ergaben, dass die Antworten nicht vollständig, sondern nur bedingt zufällig fehlten.[72] Deshalb ist im vorliegenden Datensatz eine Voraussetzung für einen Ersatz fehlender durch systematisch geschätzte Antwortwerte (= *Imputation*) erfüllt. Entsprechend wurden für die 17 Adoptionsindikatoren Imputationen fehlender Werte unter Einsatz des im *SPSS 16*-Softwarepakets implementierten „Expectation Maximization" (EM) Algorithmus vorgenommen.[73] Der (so wieder wie ursprünglich) 1.097 Fälle umfassende Gesamtdatensatz wurde ebenfalls einer Faktorenanalyse nach der Hauptkomponentenmethode unterworfen.

In Tabelle 1 werden die varimaxrotierten Ladungen der 17 Adoptionsbereitschaftsindikatoren auf den in den zwei Analysen jeweils extrahierten drei Faktoren mit Eigenwerten > 1 gezeigt. Die fünf szenariobezogenen SBM-Nutzungswahrscheinlichkeiten, die fünf szenariobezogenen Zahlungsbereitschaftsangaben und die sieben nicht-monetären Aufwandsbereitschaftsindikatoren für die (prinzipielle) SBM-Nutzungsmöglichkeit wiesen in beiden Analysen ihre höchsten Ladungen jeweils auf unterschiedlichen Faktoren auf. Die Ergebnisse der Faktorenanalysen sprachen also dafür, Adoptionsbereitschaftsaspekte über drei getrennte Skalen abzubilden. Deshalb wurden die fünf Nutzungswahrscheinlichkeiten (Indikatoren 1–5 in Tabelle 1), die fünf Zahlungsbereitschaften (Indikatoren 6–10 in Tabelle 1) und die sieben Aufwandsbereitschaften (Indikatoren 11–17 in Tabelle 1) jeweils per Durchschnittsbildung zu drei unterschiedlichen Skalen zusammengefasst.

Wie Tabelle 2 zu entnehmen ist, überschreiten die anhand des *Cronbach* α Koeffizienten gemessenen internen Konsistenzreliabilitäten der drei Skalen jeweils klar den in der Literatur geforderten Mindestwert von 0,70.[74] Die *Pearson*-Korrelationen der drei Skalen liegen zwischen 0,17 und 0,40; sie erreichen da-

[72] S. zu dieser Unterscheidung von Ursachen für unvollständige Antworten Schafer/Graham (2002), S. 149-152; Backhaus/Blechschmidt (2009), S. 272.

[73] S. zu diesem Verfahren einführend Schafer/Graham (2002), S. 162-165; Wirtz (2004), S. 113f. und als Beispiel für ein ähnliches Vorgehen in der SBM-Forschung Pura (2005), S. 521.

[74] S. Himme (2009), S. 489.

Tabelle 2: Deskriptive Statistiken der drei Skalen zur Erfassung von Adoptionsdimensionen für standortbezogene Mobilfunkdienste (SBM)

	Statistiken[a]			Korrelationen[b]		
Adoptionsskalen	**M**	**S**	**n**	**A1**	**A2**	**A3**
A1. Szenariobezogene SBM-Nutzungswahrscheinlichkeiten[c]	3,76 [3,80]	1,28	1061	(78)	24	40
A2. Szenariobezogene SBM-Zahlungsbereitschaften[d]	0,83 [0,50]	0,99	950	22	(85)	17
A3. Aufwandsbereitschaften für (prinzipielle) SBM-Nutzungsmöglichkeit[e]	2,58 [2,43]	1,01	901	29	17	(82)

a) Angaben in eckigen Klammern in der Mittelwertspalte = Median.
b) Werte oberhalb der Hauptdiagonale = *Pearson*'sche Produkt-Moment-Korrelationen *r*. Werte unterhalb der Hauptdiagonale = *Kendall*'sche Rangkorrelation τ–*b*. Eingeklammerte Werte auf der Hauptdiagonale = *Cronbach*'sche interne Konsistenzreliabilität α. Es werden nur die erste und zweite Nachkommastelle berichtet. Lesebeispiel: 40 = 0,40. Aufgrund fehlender Werte gilt: $796 \leq n \leq 934$. Jede ausgewiesene Korrelation ist statistisch auf dem 0,1%-Niveau (zweiseitig) signifikant.
c) Mittelwert der Einzelfragen 1 bis 5 gemäß Tab. 1. S.a. Tab. A1 im Anhang.
d) Mittelwert der Einzelfragen 6 bis 10 gemäß Tab. 1. S.a. Tab. A1 im Anhang.
e) Mittelwert der Einzelfragen 11 bis 17 gemäß Tab.1. S.a. Tab. A1 im Anhang.

mit ein Niveau, das ebenfalls dafür spricht, die drei Facetten der SBM-Adoptionsbereitschaft *getrennt* in den weiteren Zusammenhangsanalysen/Hypothesentests zu betrachten.

Der Mittelwert der Skala der szenariobezogenen SBM-Adoptionswahrscheinlichkeiten von 3,76 (s. Variable A1 in Tabelle 2) deutet zwar auf ein nicht unerhebliches SBM-Nutzungsinteresse unter den Studienteilnehmern hin. Dieses geht aber keineswegs mit hohen SBM-Zahlungsbereitschaften (Mittelwert = 0,83 Euro; s. Variable A2 in Tabelle 2) oder hohen nicht-monetären Aufwandsbereitschaften für eine SBM-Nutzung (Mittelwert der entsprechenden Skala A3 in Tabelle 2 = 2,58) einher.

I.3.2.2 Potenzielle Einflussfaktoren der Adoptionsbereitschaft

Die Operationalisierungen möglicher Einflussfaktoren der SBM-Adoptionsbereitschaft werden in der Reihenfolge vorgestellt, in der die Arten von Determinanten in den eigenen Untersuchungshypothesen aufgegriffen wurden.

Das *Ausmaß der aktuellen Nutzung von Mobilfunkdiensten* generell und speziell von mobilen Datendiensten wurde über fünf Variablen erfasst, die auf verschiedene Merkmale des Mobilkommunikationsverhaltens eingehen. Der genaue Wortlaut der Fragen, die sich ähnlich auch in anderen Mobilfunkstudien fin-

den,[75] ist im Anhang (s. dort Tabelle A2, Variablen I.1 bis I.5) dokumentiert. Aus Tabelle 3 ist zu entnehmen, dass zwischen den beiden Indikatoren des monatlichen Ausgabenanteils für mobile Datendienste und der Nutzungshäufigkeit mobiler (UMTS-)Datendienste die mit Abstand höchste Korrelation (r = 0,67 bzw. τ–b = 0,61) innerhalb des Blocks der Mobilkommunikationsverhaltensvariablen bestand.[76] Um Multikollinearitätsprobleme zu vermeiden, wird deshalb nachfolgend in multivariaten Analysen nur die als Durchschnitt von zwei Itemausprägungen erfasste Nutzungshäufigkeit mobiler Datendienste (*Cronbach's* α = 0,65), nicht aber die Ausgabenanteilsangabe berücksichtigt (s. Variablen I.5 bzw. I.4 in Tabelle 3).

Die *bisherige Offenheit gegenüber neuen Mobilfunkdiensten* wurde über den Mittelwert von zwei Items gemessen, die sich an in der Literatur gebräuchlichen Operationalisierungen orientieren.[77] Die zwei Indikatoren wiesen in der eigenen Stichprobe mit einem *Cronbach* α von 0,64 eine noch akzeptable interne Konsistenzreliabilität auf (s. jeweils Variable II in Tabelle A2 des Anhangs und in Tabelle 3).

Zur Erfassung der *Bedarfshäufigkeit standortbezogener Informationen* gaben die Teilnehmer für sieben Informationsarten (z.B. Wegbeschreibungen) an, wie häufig sie im Monat „Unterwegs-Alltagssituationen" erleben, in denen für sie die Verfügbarkeit der jeweiligen Information nützlich sein könnte (s. im Detail im Anhang in Tabelle A2 Variable III). Die sieben Items luden in einer Faktorenanalyse durchweg auf einem zugrunde liegenden, latenten Konstrukt, so dass sie per Durchschnittswertbildung zu einer Skala zusammengefasst wurden, welche den Unterwegs-Bedarf an Information reliabel abbildet (*Cronbach's* α = 0,73; s. Variable III in Tabelle 3).

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[75] S. etwa Yoo/Moon (2006), S. 583; Broeckelmann/Groeppel-Klein (2008), S. 154-156; Kim et al. (2008), S. 398.

[76] Die Antwortabstufungen der Variablen im Block Mobilkommunikationsverhalten, aber auch in den weiteren sechs Blöcken in Tabelle 3, können bei Anlegung eines strengen Maßstabs nicht als intervall-, sondern nur als ordinalskaliert interpretiert werden. Da in der empirischen SBM-Forschung aber eine so rigide Vorgehensweise nicht üblich ist und die hier unter Einsatz statistischer Verfahren für intervallskalierte Maße gewonnenen Zusammenhangsbefunde materiell nicht von denen abweichen, die man erhält, wenn ordinale Korrelationen/Regressionen berechnet werden, halten wir es für vertretbar, sämtliche unabhängige Variablen in Tabelle 3 (sowie die drei abhängigen SBM-Adoptionsdimensionen gemäß Tabelle 2) statistisch wie intervallskalierte Größen zu behandeln.

[77] S. etwa Lu et al. (2005a), S. 264; Xu et al. (2005), S. 909; Pagani (2007), S. 714; Königstorfer (2008), S. 49; López-Nicolás et al. (2008), S. 363; Lu et al. (2008), S. 363; Xu/Gupta (2009), S. 147.

Tabelle 3: Deskriptive Statistiken und Interkorrelationen der potenziellen Bestimmungsgrößen von SBM-Adoptionsdimensionen

Untersuchungsvariablen[c]	Statistiken[a] M	S	n	Korrelationen (265 ≤ n ≤ 1027)[b] I.1	I.2	I.3	I.4	I.5	II	III	IV	V.1	V.2	V.3	VI	VII
I. Mobilkommunikationsverhalten																
1. Tatsächliche SBM-Nutzung in den letzten 18 Monaten (1 = Ja; 0 = Nein)	0,19	0,39	1005	–	02	19***	37***	40***	36***	14***	06	–18***	–17***	–15***	06	35***
2. Erreichbarkeitsausmaß auf dem Mobiltelefon	1,64 [2,00]	0,54	927	02	–	15***	09*	12***	16***	04	13***	–04	01	02	10**	04
3. Mittlere Monatsausgaben für Mobilfunkdienste	3,91 [3,00]	2,10	929	16***	12***	–	31***	39***	33***	15***	17***	–21***	–16***	–02	07*	16**
4. Ausgabenanteil für Mobilfunkdatendienste	1,68 [1,00]	0,93	918	33***	09**	28***	–	67***	50***	17***	15***	–22***	–23***	–11**	10**	32***
5. Nutzungshäufigkeit von (UMTS-)Mobilfunkdatendiensten	1,25 [1,00]	1,31	990	32***	09**	30***	61***	(65)	59***	20***	16***	–29***	–24***	–10*	15***	35***
II. Bisherige Offenheit gegenüber neuen Mobilfunkdiensten	3,27 [3,50]	1,52	1027	30***	13***	25***	41***	46***	(64)	23***	16***	–22***	–21***	–13***	18***	25***
III. Bedarfshäufigkeit standortabhängiger Informationen	1,91 [1,86]	0,54	1040	12***	04	11***	14***	15***	17***	(73)	29***	–23***	–07	–03	02	24***
IV. Abgabebereitschaft persönlicher Daten an SBM-Anbieter für Gegenleistungen	2,86 [2,50]	1,57	1012	05	11***	13***	15***	13***	12***	23***	(90)	–44***	–07	–02	18***	25***
V. SBM-Risikoeinschätzungen																
1. Datenmissbrauch	4,30 [4,33]	1,00	493	–16***	–04	–16***	–20***	–21***	–16***	–18***	–33***	(80)	49***	36***	–25***	–38***
2. Unerwartete Kosten/Rechnungshöhe	5,02 [5,50]	1,06	928	–15***	02	–10**	–19***	–15***	–15***	–07**	–08**	39***	(73)	44***	–05	–30***
3. Technische Funktionsmängel	3,43 [3,50]	1,04	692	–13***	00	–01	–08*	–07*	–09**	–04	–02	25***	32***	(65)	–12**	–15**
VI. Vertrauen gegenüber eigenem Mobilfunknetzbetreiber	4,34 [4,67]	1,18	880	05	07*	05	10**	12***	14***	01	12***	–15***	–03	–07*	(87)	14**
VII. SBM-Bewertung im sozialen Umfeld	2,35 [2,25]	1,18	402	29***	05	11**	24***	27***	18***	18***	18***	–29***	–27***	–09*	09*	(85)

a) Angaben in eckigen Klammern in der Mittelwertspalte = Median.

b) Werte oberhalb der Hauptdiagonale = *Pearson*'sche Produkt-Moment-Korrelationen *r*. Werte unterhalb der Hauptdiagonale = *Kendall*'sche Rangkorrelationen τ–*b*. Eingeklammerte Werte auf der Hauptdiagonale = *Cronbach*'sche interne Konsistenzreliabilität α bei Multi-Item-Skalen. Es werden nur die erste und zweite Nachkommastelle sowie gegebenenfalls ein negatives Vorzeichen ausgewiesen. Lesebeispiel: –18 = –0,18. Die statistische Signifikanz einer Korrelation wird wie folgt gekennzeichnet:
* $p \leq 0{,}05$ ** $p \leq 0{,}01$ *** $p \leq 0{,}001$ (zweiseitig).

c) Zur Erläuterung der Operationalisierung der 13 potenziellen Einflussfaktoren s. Tab. A2 im Anhang.

Die *Bereitschaft, bei Gegenleistungen eines SBM-Anbieters, persönliche Daten an ihn abzugeben*, wurde über zwei von uns entwickelte Aussagen gemessen (s. im Anhang in Tabelle A2 Variable IV), die mit einem *Cronbach* α von 0,90 eine konsistente Konstrukterfassung ermöglichten (s. Variable IV in Tabelle 3).

Zur Operationalisierung von *Bedenken hinsichtlich des Missbrauchs persönlicher Daten*, die im Zusammenhang mit der SBM-Nutzung anfallen können, wurden sechs Indikatoren herangezogen, deren Wortlaut im Anhang in Tabelle A2 (Variable V.1) dokumentiert ist und die in Anlehnung an Items zur Messung dieses Konstruktes in früheren (SBM-)Studien[78] formuliert wurden. Eine Faktorenanalyse zeigte, dass die sechs Items Einschätzungen des Datenmissbrauchsrisikos eindimensional erfassten, so dass sie per Mittelwertbestimmung zu einer Skala mit einer hohen internen Konsistenzreliabilität (*Cronbach's* $\alpha = 0{,}80$) verschmolzen werden konnten (s. Variable V.1 in Tabelle 3).

Die Messung des mit einer SBM-Nutzung für Kunden verbundenen *Risikos, hohe und schwer prognostizierbare Kosten/Rechnungsbeträge hinnehmen zu haben*, erfolgte über zwei Items (s. im Anhang Tabelle A2, Variable V.2), die von uns unter Rückgriff auf Forschungsarbeiten zur Preisgestaltung für Telekommunikationsdienste[79] neu entwickelt wurden. Die beiden Indikatoren ermöglichten mit einem *Cronbach* α von 0,73 (s. Variable V.2 in Tabelle 3) eine Konstrukterfassung mit hinreichender Konsistenzreliabilität.

Wahrgenommene *technische Funktionsrisiken* von SBM wurden über die durchschnittliche Bewertung von vier Aussagen abgebildet, die sich an entsprechenden Skalen in früheren Arbeiten[80] orientieren und mit einem *Cronbach* α von 0,65 eine noch hinnehmbare interne Konsistenzreliabilität erreichten (s. jeweils Variable V.3 in Tabelle A2 des Anhangs und in Tabelle 3).

Das *Vertrauen, das die Teilnehmer ihrem derzeitigen Mobilfunknetzbetreiber entgegenbringen*, wurde über den Mittelwert von drei Indikatoren erfasst, die sich an entsprechende Konstruktmessungen in den SBM-Studien von Xu et al. (2005) und Junglas/Spitzmüller (2006) sowie in Arbeiten zum Online-Kaufver-

[78] Z.B. Smith et al. (1996), S. 170; Xu/Teo (2004), S. 801 u. (2005), S. 88; Junglas/Spitzmüller (2006), S. 5f.; Königstorfer (2008), S. 49; Sheng et al. (2008), S. 375; Xu/Gupta (2009), 147f.

[79] S. Gerpott (2007), S. 17 und die dort zitierte Literatur.

[80] Insbesondere Chang et al. (2006), S. 1150 u. (2007), S. 283; Königstorfer (2008), S. 49; Lee et al. (2009), S. 127.

halten[81] anlehnen und die mit einem *Cronbach* α von 0,87 in der eigenen Stichprobe das Vertrauenskonstrukt mit guter interner Konsistenzreliabilität widerspiegeln (s. jeweils Variable VI in Tabelle A2 des Anhangs und in Tabelle 3).

Zur Erfassung der *Bewertung von SBM im sozialen Umfeld* der Respondenten dienten vier Items, die sich in früheren Studien zur Adoptionsbereitschaft mobiler Datendienste bewährt haben[82] und für die in der eigenen Erhebung mit einem *Cronbach* α von 0,85 ebenfalls eine hohe interne Konsistenzreliabilität zu verzeichnen war (s. jeweils Variable VII in Tabelle A2 des Anhangs und in Tabelle 3).

Tabelle 3 berichtet deskriptive Statistiken und Interkorrelationen der erfassten 13 potenziellen Bestimmungsgrößen der SBM-Adoptionsbereitschaft, für die im Folgenden analysiert wird, inwieweit sie entsprechend der neun Untersuchungshypothesen in der Lage sind, die (Varianz in den) Ausprägungen der drei unterschiedlichen Adoptionsdimensionen statistisch zu erklären.

I.3.3 Empirische Befunde zu den Untersuchungshypothesen

Um die Hypothesen zu prüfen, wurden zum einen für die 13 möglichen Einflussfaktoren deren bivariaten *Pearson*'sche Produkt-Moment-Korrelationen (r) und *Kendall*'schen Rangkorrelationen (τ–b) mit den drei Dimensionen der SBM-Adoptionsbereitschaft bei paarweisem Ausschluss von Teilnehmern mit einem fehlenden Wert für mindestens eine der beiden jeweils relevanten Variablen berechnet. Tabelle 4 weist für jedes der drei Adoptionskriterien die entsprechenden 26 Korrelationen aus.

Weiter wurden standardisierte Gewichtungsfaktoren (β) für jede potenzielle Determinante in multivariaten (Kleinste-Quadrate-)Regressionen bestimmt, in denen jeweils eine der drei Adoptionsdimensionen als abhängiges Kriterium verwendet wurde. Dabei wurden für jedes Kriterium zwei Regressionsvarianten realisiert, die sich hinsichtlich des Umgangs mit bei einzelnen Variablen fehlenden Antworten von Teilnehmern unterscheiden. Bei der ersten Variante wurde *vor* der Analyse eine EM-Imputation fehlender Werte für die als intervallskaliert behandelten 11 möglichen Einflussfaktoren und die drei abhängigen Adoptions-

[81] Z.B. Gefen et al. (2003), S. 84f.; s.a. die Zusammenfassung bei Grabner-Kräuter/Kaluscha (2003), S. 801f.

[82] S. z.B. Lu et al. (2005a), S. 264; Nysveen et al. (2005a), S. 339; Hong et al. (2008), S. 443; Königstorfer (2008), S. 49.

Tabelle 4: Korrelations- und Regressionsanalysen zur Identifikation signifikanter Bestimmungsgrößen der drei SBM-Adoptionsdimensionen

Potenzielle Bestimmungsgrößen[c]	A.1 SBM-Nutzungswahrscheinlichkeiten[a] Korrelation[b] *r*	*τ–b*	Reg. *β*[d]	A.2 SBM-Zahlungsbereitschaften[a] Korrelation[b] *r*	*τ–b*	Reg. *β*[d]	A.3 SBM-Aufwandsbereitschaften[a] Korrelation[b] *r*	*τ–b*	Reg. *β*[d]
I.1 Tatsächliche SBM-Nutzung (1 = Ja; 0 = Nein)	19*** (974)	16***	05 (17**)	–01 (876)	–01	–05 (08)	11** (822)	09**	–07* (–09)
I.2 Erreichbarkeitsausmaß auf Mobiltelefon	09** (893)	08*	04 (06)	06 (809)	01	03 (06)	05 (770)	04	00 (07)
I.3 Mittlere Mobilfunkmonatsausgaben	14*** (895)	10***	01 (04)	03 (810)	05*	–00 (–01)	16*** (771)	12***	04 (04)
I.4 Ausgabenanteil Mobilfunkdatendienste	21*** (884)	17***	–	–00 (797)	02	–	22*** (769)	18***	–
I.5 Nutzungshäufigkeit Mobilfunkdatendienste	21*** (955)	17***	–04 (–12)	–01 (860)	02	–03 (02)	19*** (837)	14***	–04 (–11)
II. Offenheit gegenüber neuen Mobilfunkdiensten	29*** (993)	21***	14*** (11)	–00 (896)	01	–08 (–19*)	23*** (858)	16***	08* (16*)
III. Bedarfshäufigkeit standortabhängige Informationen	44*** (1006)	33***	32*** (38***)	12*** (904)	12***	16*** (12)	27*** (852)	22***	12*** (11)
IV. Abgabebereitschaft Daten für Gegenleistungen	35*** (978)	26***	13*** (14*)	12*** (879)	13***	–00 (09)	31*** (858)	24***	09** (18**)
V.1 Risiko SBM-Datenmissbrauch	–30** (482)	–21***	–09** (–10)	–24*** (431)	–21***	–11* (–27**)	–34*** (449)	–25***	–10* (–15)
V.2 Risiko unerwartete SBM-Kosten/-Rechnungshöhe	–10** (898)	–09***	05 (09)	–12*** (811)	–12***	–04 (–04)	–21*** (809)	–19***	–06 (–10)
V.3 Risiko technische SBM-Funktionsfähigkeit	–12** (670)	–08**	–03 (–06)	–09* (614)	–07**	00 (–08)	–11** (623)	–08**	00 (10)
VI. Vertrauen gegenüber eigenem Mobilfunknetzbetreiber	11*** (853)	09***	01 (–00)	08* (772)	09***	03 (05)	06 (764)	03	–01 (–01)
VII. SBM-Bewertung im sozialen Umfeld	37*** (385)	27***	15*** (23***)	15*** (353)	15***	06 (01)	49*** (359)	34***	32*** 39***
			R^2-Regression 30*** (47***)			R^2-Regression 06*** (17**)			R^2-Regression 23*** (37***)

a) Es werden nur die erste und zweite Nachkommastelle sowie gegebenenfalls ein negatives Vorzeichen ausgewiesen. Lesebeispiel: –01 = –0,01.

b) Angabe in Klammern = Fallzahl der bivariaten Korrelation. Korrelationen beruhen auf den tatsächlichen Antworten *vor* „Expectation-Maximization-Imputation"/Schätzung fehlender Werte.

c) Zur Verbesserung der Darstellungsverständlichkeit entspricht die Nummerierung der 13 Variablen in dieser Spalte derjenigen in Tab. 3. S. zur Operationalisierung dieser Variablen auch Tab. A2 im Anhang.

d) Die Variable I.4 wurde aus den Regressionen ausgeklammert, um die Multikollinearität der Prädiktoren zu verringern. *Vor* der Regression wurde eine EM-Imputation fehlender Werte bei den 11 als intervallskaliert angenommenen potenziellen Bestimmungsgrößen (I.2, I.3, I.5 bis VII.) und den drei Adoptionsdimensionen vorgenommen, um so einen Datensatz mit 1097 Antworten für jede der 14 Variablen zu erzeugen. Da für die kategoriale Variable I.1 keine EM-Imputation sinnvoll ist und für sie nur Antworten von 1005 Befragten vorliegen, gilt für jede der drei Regressionen n = 1005. Die in dieser Spalte eingeklammerten Werte sind die β- (bzw. R^2-)Koeffizienten, die sich bei einem Imputationsverzicht für die drei Variablen V.1, V.3 und VII ergeben, bei denen jeweils mehr als 30% der Befragten einen fehlenden Wert aufweisen. Für jede dieser drei Regressionen gilt n = 219.

* $p \leq 0{,}05$ ** $p \leq 0{,}01$ *** $p \leq 0{,}001$ (zweiseitig).

kriterien vorgenommen.[83] Da der Ersatz fehlender Antworten durch per EM-Algorithmus gewonnene Schätzwerte methodisch dann als unproblematisch gilt, wenn bei einer Variablen weniger als 30% der Befragten fehlende Werte aufweisen[84] und diese Voraussetzung für drei Variablen im eigenen Datensatz nicht erfüllt ist (s. Variablen V.1, V.3 und VII. in Tabelle 4), wurde für jedes Adoptionsbereitschaftskriterium eine zweite Regressionsvariante umgesetzt. In dieser Analyse wurden die β-Gewichte der 12 Prädiktoren bestimmt, die sich ergeben, wenn auf die EM-Imputation für die o.g. drei Variablen mit einem (zu) hohen Anteil fehlender Antworten verzichtet wird, also nur Mobilfunkkunden berücksichtigt werden, die für jedes der drei Konstrukte keinen fehlenden Wert aufweisen. Tabelle 4 sind dementsprechend für die drei Adoptionskriterien jeweils 24 β-Gewichte zu entnehmen.[85]

Konform mit *Hypothese 1* waren die bivariaten Korrelationen zwischen den fünf Indikatoren des aktuellen Nutzungsausmaßes von Mobilfunk(daten)diensten durchweg positiv und statistisch signifikant. Die bivariaten Befunde für das Adoptionskriterium der SBM-Aufwandsbereitschaft (s. Variable A.3 in Tabelle 4) stützen ähnlich insgesamt H_1. In multivariaten Regressionsanalysen leisteten die fünf Mobilkommunikationsverhaltensaspekte hingegen nicht in analyseübergreifend konvergierender Weise einen eigenständigen Beitrag zur Erklärung der Varianz der beiden Adoptionsdimensionen der SBM-Nutzungswahrscheinlichkeit und -Aufwandsbereitschaft. Im Widerspruch zu H_1 war zwischen den fünf Indikatoren der aktuellen Mobilfunknutzung und der SBM-Zahlungsbereitschaft kein eindeutiges Muster signifikanter positiver Assoziationskoeffizienten festzustellen. Alles in allem widersprechen damit die Befunde H_1 in dem Sinn, dass die Intensität der bisherigen Nutzung von Mobilfunk(daten)diensten wohl eher nicht direkt und nicht mit relativ zu anderen Faktoren herausragend starken Effekten auf die SBM-Adoptionsbereitschaft Einfluss nimmt.

Hypothese 2 wird dagegen für die Adoptionsdimensionen der Nutzungswahrscheinlichkeiten und der Aufwandsbereitschaften weitgehend bestätigt, da die bivariaten Korrelationen des Merkmals der individuellen Offenheit gegenüber

[83] Für die kategoriale Variable „tatsächliche SBM-Nutzung“ (s. Variable I.1 in Tabelle 4) ist eine EM-Imputation nicht sinnvoll, da der Algorithmus ein höheres Messniveau erfordert. Bei der Variablen I.4 „Ausgabenanteil Mobilfunkdatendienste“ wurde auf den Einbezug in die Regression und damit die Imputation wegen ihrer deutlichen Korrelation mit der Variablen I.5 „Nutzungshäufigkeit Mobilfunkdatendienste“ verzichtet; vgl. oben Kap. I.3.2.2.

[84] S. Wirtz (2004), S. 110f.

[85] Tests auf Multikollinearität der 12 Prädiktoren in den Regressionen sowie auf „einflussstarke Ausreißerfälle“ ergaben, dass die Regressionsergebnisse durch diese beiden Fehlerquellen nicht verzerrt wurden.

neuen Mobilfunkdiensten mit diesen beiden Kriterien durchweg positiv ausfielen und von den vier ausnahmslos positiven β-Gewichten drei ebenfalls statistische Signifikanz erreichten (s. Variable II in Tabelle 4). Anders waren drei der vier Zusammenhangsmaße für diesen Einflussfaktor mit der SBM-Zahlungsbereitschaft nicht signifikant. Das β-Gewicht der persönlichen Innovationsneigung bei Mobilfunkdiensten war für das Zahlungsbereitschaftskriterium in der auf 219 Fällen basierenden Regression ohne Imputation für die drei Variablen mit jeweils hohen Anteilen fehlender Antworten (vgl. Fußnote d in Tabelle 4) sogar signifikant negativ. Insgesamt sind unsere Befunde für die SBM-Nutzungswahrscheinlichkeiten und -Aufwandsbereitschaften, nicht jedoch für die SBM-Zahlungsbereitschaften mit H_2 vereinbar.

Im Einklang mit *Hypothese 3* waren in der Stichprobe die vier bi- und multivariaten Assoziationskennzahlen für die Bedarfshäufigkeit standortabhängiger Informationen mit dem Kriterium der SBM-Nutzungswahrscheinlichkeiten signifikant positiv (s. Variable III in Tabelle 4). Bei den zwei weiteren SBM-Adoptionsbereitschaftsdimensionen wirkte sich die Häufigkeit, mit der die Teilnehmer „unterwegs“ im Alltag einen akuten Informationsbedarf zu decken haben, jeweils nur in der Regression, in der auf eine Imputation für die o.g. drei „Problemkonstrukte“ verzichtet wurde, nicht auf dem 5%-, wohl aber auf dem 10%-Niveau signifikant positiv auf das abhängige Kriterium aus. Vom Betrag her erreichten die Assoziationskoeffizienten der Informationsbedarfsskala und den SBM-Nutzungswahrscheinlichkeiten sowie -Aufwandsbereitschaften höhere Werte als die Zusammenhangsmaße für alle übrigen möglichen Einflussfaktoren. In einer Gesamtschau ist festzuhalten, dass die Befunde für die Haltbarkeit von H_3 sprechen.

Hypothese 4, wonach Mobilfunkkunden, die eine starke Neigung äußern, persönliche Daten für SBM-Anbieter freizugeben, wenn sie dafür von ihm Gegenleistungen erhalten, auch eine hohe SBM-Adoptionsbereitschaft aufweisen, ist mit den beobachteten Assoziationen für die beiden Kriterien A.1 und A.3 in Tabelle 4 uneingeschränkt sowie für die SBM-Zahlungsbereitschaften bei Beschränkung der Betrachtung auf bivariate Korrelationsmaße vereinbar (s. Variable IV in Tabelle 4). Zur *Hypothese 5*, die signifikant negative Effekte von Datenmissbrauchsbedenken im Zusammenhang mit SBM auf die Adoptionsbereitschaft solcher Dienste postulierte, erbrachten die Analysen mehr konforme als widersprechende Indizien (s. Variable V.1 in Tabelle 4): Die 12 Assoziationskoeffizienten hatten ausnahmslos das erwartete negative Vorzeichen und 10 Koeffizienten waren mit Irrtumswahrscheinlichkeiten von höchstens 5% statis-

tisch signifikant. In der Regression für das Kriterium der SBM-Aufwandsbereitschaften, in der auf eine Werteimputation für die drei hinsichtlich des Anteils fehlender Antworten problematischer Einflussfaktoren (s. Fußnote d in Tabelle 4) verzichtet wurde, verfehlte das β-Gewicht der Datenmissbrauchsbedenken von –0,15 mit einer Irrtumswahrscheinlichkeit von 6,1% die gängige 5%-Schwelle für als signifikant eingestufte Ergebnisse knapp. Lediglich für das Kriterium A.1 wies das Konstrukt der Datenmissbrauchsbedenken in der imputierten Regressionsgleichung keinen eigenständigen Varianzerklärungsanteil auf. Insgesamt stützen die Befunde somit H_5 weitgehend.

Die Resultate in Tabelle 4 mit Bezug zu den *Hypothesen 6* und *7* sind jeweils wesentlich weniger klar hypothesenkonform, da nur die sechs bivariaten Korrelationen zwischen dem wahrgenommenen SBM-Kosten-/-Rechnungsrisiko (H_6) bzw. technischem Funktionsrisiko (H_7) und den drei Adoptionsbereitschaftskriterien mindestens auf dem 1%-Niveau statistisch signifikant negativ ausfielen (s. Variablen V.2 und V.3 in Tabelle 4). In den sechs Regressionen erreichten die β-Gewichte für beide Prädiktoren jeweils durchweg keine statistische Signifikanz. In einer Gesamtschau sprechen die Ergebnisse abweichend von H_6 und H_7 eher dafür, dass Wahrnehmungen von SBM-Kosten-/-Rechnungs- und technischen Funktionsrisiken relativ zu anderen Determinanten, wenn überhaupt, höchstens schwache Effekte auf SBM-Adoptionsbereitschaftsdimensionen haben.

Mit *Hypothese 8* aufgegriffene Zusammenhänge zwischen dem Vertrauen eines Mobilfunkkunden in den eigenen Netzbetreiber und den Adoptionsbereitschaftskriterien waren in der eigenen Stichprobe nicht konsistent und nicht signifikant gleichermaßen in den bi- und multivariaten Analysen für jede Adoptionsdimension zu beobachten (s. Variable VI in Tabelle 4). Nur die positiven bivariaten Korrelationen zwischen dem Vertrauenskonstrukt und den SBM-Nutzungswahrscheinlichkeiten sowie -Zahlungsbereitschaften erwiesen sich als statistisch signifikant. Insgesamt schlägt sich damit – im Widerspruch zu H_8 – ein stärkeres Vertrauen in den eigenen Mobilfunknetzbetreiber nicht in herausragend deutlicher Weise in einer höheren SBM-Adoptionsbereitschaft nieder.

Gemäß *Hypothese 9* sollten unterstützende Meinungen zu SBM im sozialen Umfeld von Mobilfunkkunden sich positiv auf die SBM-Adoptionsdimensionen auswirken. Für die beiden Adoptionskriterien der SBM-Nutzungswahrscheinlichkeiten und -Aufwandsbereitschaften fand H_9 in unserem Datensatz uneingeschränkte Unterstützung (s. Variable VII in Tabelle 4). Für die Adoptionsdimen-

sion der SBM-Zahlungsbereitschaften waren zwar die bivariaten *Pearson*- und *Kendall*-Korrelationen des „social norm“ Konstruktes signifikant positiv, nicht aber die β-Gewichte in den multivariaten Regressionen. Alles in allem ist somit – im Einklang mit H_9 – die SBM-Bewertung im sozialen Umfeld von Mobilfunkkunden einer der gewichtigsten Einflussfaktoren von SBM-Adoptionsbereitschaftsdimensionen, soweit es nicht um den „monetären Opferwillen“ für SBM geht.

Losgelöst von den Untersuchungshypothesen offenbaren die Regressionsergebnisse in Tabelle 4, dass bei einer Operationalisierung der SBM-Adoptionsbereitschaft über szenariobezogene SBM-Nutzungswahrscheinlichkeitsangaben mit 30% bzw. 47% (Analyse mit vollständiger bzw. eingeschränkter Imputation) ein höherer Anteil der Kriteriumsvarianz erklärt wurde als bei einer Messung von Adoptionsbereitschaft über Absichtserklärungen im Hinblick auf die Übernahme/Überwindung verschiedener „Mühen“/Barrieren, um SBM nutzen zu können, für die 23% bzw. 37% der Kriteriumsvarianz durch die Prädiktoren gebunden werden (s. Zeile „R^2-Regression“ in Tabelle 4). Für beide Kriterien liegen die erklärten Varianzanteile im unteren bzw. mittleren Drittel des Wertebereichs von 0,10 bis 0,64, der in früheren SBM-Studien berichtet wurde (s. Übersicht 1). Demgegenüber sind für die Adoptionsdimension der SBM-Zahlungsbereitschaften mit einem erklärten Varianzanteil von 6% bei vollständiger und 17% bei teilweiser Imputation fehlender Antworten die Effekte der untersuchten Konstrukte deutlich schwächer. Diese R^2-Unterschiede sprechen dafür, dass es für ein besseres Verständnis von SBM-Zahlungsbereitschaften hilfreich ist, andere potenzielle Einflussfaktoren aufzugreifen als sie üblicherweise in den Studien genannt werden, welche sich bei der Auswahl potenzieller Adoptionsdeterminanten konzeptionell primär durch das TAM leiten lassen und das Konstrukt der SBM-Adoptionsbereitschaft empirisch ähnlich wie Einstellungen von Kunden zu SBM messen.

I.4 Implikationen für die Unternehmenspraxis und die betriebswirtschaftliche Forschung

I.4.1 Schlussfolgerungen für die Praxis

In der vorliegenden Arbeit wurden Befragungsdaten von 1.097 deutschsprachigen Mobilfunkkunden ausgewertet, um signifikante kundenseitige Einflussfaktoren von Adoptionsbereitschaftsäußerungen dieser Personen im Hinblick auf standortsensitive Pull-Informations-, -Navigations- und Transaktionsanwendungen auf Mobilfunkendgeräten zu identifizieren. Bei Konfrontation der Teilneh-

mer mit fünf SBM-Anwendungsszenarien war in der Stichprobe im Mittel durchaus eine nicht unerhebliche Bereitschaft vorhanden, SBM in den jeweiligen Situationen zu nutzen (s. Variable A.1 in Tabelle 2). Die Befragten waren selten willens, absolut hohe Preise für SBM zu zahlen, bei 50% überschritt die geäußerte durchschnittliche Zahlungsbereitschaft über die fünf Szenarien hinweg nicht den Betrag von 0,50 Euro pro Nutzung (s. Variable A.2 in Tabelle 2). Auch die Bereitschaft zur Übernahme von nicht-monetären Aufwendungen, um SBM nutzen zu können, war bei den befragten Mobilfunknutzern eher schwach ausgeprägt; lediglich das Laden von Software auf das mobile Kundenendgerät erwies sich als eine „Mühe“, die man i.d.R. auf sich nehmen würde, um SBM zu nutzen (s. Items 11–17 in Tabelle 1 sowie Variable A.3 in Tabelle 2). Ohne effektive Anstrengungen von Mobilfunknetzbetreibern zur Steigerung der SBM-Adoptionsbereitschaft von Privatkunden dürften SBM somit nicht zu einem „hero service“ werden, der wesentliche Beiträge zur Entwicklung des Privatkundengeschäfts von Mobilfunknetzbetreibern leistet.

Die präsentierten Korrelations- und Regressionsanalysen sprechen dafür, dass die erfassten Adoptionsbereitschaftsdimensionen von den betrachteten Einflussfaktorkategorien am eindeutigsten und stärksten von der erlebten Häufigkeit des (sich spontan ergebenden) Bedarfs an standortsensitiven „Unterwegs-Informationen“ (vgl. H_3), von unterstützenden Meinungen zu SBM im sozialen Umfeld von Mobilfunkkunden (vgl. H_9) und von Bedenken hinsichtlich des Missbrauchs von bei SBM anfallenden personenbezogenen Daten (vgl. H_5) beeinflusst werden. Die deutlichen Assoziationen des individuellen „Unterwegs-Informationsbedarfs“ mit den Adoptionsdimensionen bestätigen konzeptionelle „Task-Technology-Fit“-Überlegungen: Aus ihnen ergibt sich, dass bei der Entwicklung von über bloße Sprachtelefonie hinausgehenden Mobilfunkdiensten wie SBM nicht lediglich technische Möglichkeiten zu erweitern/beachten sind, sondern mindestens in gleichwertigem Ausmaß der Blick auf die Kundenprobleme/-aufgaben/-situationen zu richten ist, zu deren Bewältigung es technische Lösungen als Basis neuer Diensteangebote zu konzipieren gilt. Folglich ist Mobilfunknetzbetreibern davon abzuraten, von Anfang an undifferenziert die Gesamtheit ihrer Privatkunden mit SBM anzusprechen. Stattdessen sind gezielt Kunden(segmente) zu identifizieren und für SBM zu sensibilisieren, für die spezifische Kategorien von „Unterwegs-Informationen“ wertvoll sind, weil sich bei ihnen häu-

fig spontan ein Bedarf an solchen standortsensitiven und eventuell erst aktuell neu entstandenen Wissensbeständen ergibt.[86]

Um den Nutzen/Wert von SBM in diesen Zielgruppen zu verdeutlichen, sind dann auch nicht abstrakt technische Leistungsmerkmale von SBM wie die Genauigkeit der Standortermittlung oder die Aktualisierungshäufigkeit von dynamischen Daten (z.B. Verkehrsmittelverspätungen) hervorzuheben. Vielmehr sollten an Kunden „illustrative examples depicting some specific critical situations where location-based services are especially valuable“[87] kommuniziert werden. Darüber hinaus lassen sich in Zielgruppen mit hohem Bedarf an „Unterwegs-Informationen“ nach Beobachtungen von Junglas (2007, S. 401) und Tsai et al. (2009, S. 7) SBM-Adoptionschancen dadurch verbessern, dass diese Mobilfunkdiensteklasse Kunden für eine Testphase (kostenlos) einige Wochen zur Verfügung gestellt wird. Hierdurch können die Zielgruppenmitglieder den persönlichen Dienstenutzen konkret erfahren und so kann ihre Motivation zur dauerhaften SBM-Nachfrage gestärkt werden.

Die deutlichen Assoziationen zwischen den wahrgenommenen SBM-Bewertungen im sozialen Umfeld von Mobilfunkkunden und geäußerten SBM-Nutzungswahrscheinlichkeiten und -Aufwandsbereitschaften legen die Schlussfolgerung nahe, dass SBM-Anbieter Anreize für „early adopter“ von SBM schaffen sollten, in ihrem Familien- und Freundeskreis über (positive) Erfahrungen mit SBM zu berichten.[88] Hier ist zu prüfen, inwieweit aus der Kundenakquisition von Publikumszeitungen/-zeitschriften seit langem bekannte „Leser werben Leser“ Programme auch auf den Privatkundenmarkt für SBM übertragbar sind.

Schließlich ist aus unseren Ergebnissen abzuleiten, dass Maßnahmen, die Senkungen des „gefühlten“ Missbrauchsrisikos personenbezogener Daten, die im Zusammenhang mit SBM entstehen, bewirken, erhebliche Bedeutung zukommt, um die Adoptionsbereitschaft von SBM zu steigern.[89] Zwar bewirken in Deutschland § 96 und § 98 des Telekommunikationsgesetzes, dass personen- und standortbezogene Daten von Mobilfunkkunden, die bei SBM anfallen, nur

[86] Vgl. ähnlich Heijden et al. (2005), S. 9; Pura (2005), S. 526-529; Fang et al. (2006), S. 147; Groeppel-Klein/Königstorfer (2007), S. 85; Sheng et al. (2008), S. 365f.

[87] Pura (2005), S. 526.

[88] So auch Bauer et al. (2007), S. 466 u. (2008), S. 218; Chang et al. (2007), S. 285; Lee et al. (2009), S. 130.

[89] Vgl. auch Kölmel/Wirsing (2002), S. 96; Fritsch/Muntermann (2005), S. 154f.; Heijden et al. (2005), S. 9; Xu/Teo (2005), S. 83; Junglas/Spitzmüller (2006), S. 7-9; Junglas/Watson (2008), S. 69; Sheng et al. (2008), S. 366; Xu/Gupta (2009), S. 145-147.

mit expliziter Kundeneinwilligung und eng zweckbezogen von Anbietern zur Bereitstellung von SBM herangezogen werden dürfen.[90] Diese Vorgabe scheint aber angesichts der beobachteten Ausprägungen des wahrgenommenen SBM-Missbrauchsrisikos (s. Variable V.1 in Tabelle 3) nicht auszureichen, um einschlägige Kundenbefürchtungen zu zerstreuen. Hier ist zwar zu erwarten, dass SBM-Anbieter diese Befürchtungen in den relevanten Zielgruppen z.T. reduzieren können, wenn Kunden konkrete SBM-Vorteile persönlich erlebt haben.[91] Darüber hinaus sollten SBM-Anbieter erkunden, inwieweit durch von unabhängigen, vertrauenswürdigen Institutionen erteilte Testate im Hinblick auf das von einem Anbieter erreichte Datenschutzniveau bei SBM oder durch technische Maßnahmen, wie etwa die dezentrale Speicherung von Standort- und persönlichen Präferenzdaten nur auf Kundenendgeräten anstelle einer zentralen Lagerung bei Mobilfunknetzbetreibern, Datenmissbrauchsbedenken von Kunden im Zusammenhang mit SBM verringerbar sind.[92]

I.4.2 Forschungsperspektiven

Wie bei jeder betriebswirtschaftlichen Arbeit, die sich auf Kundenbefragungsdaten stützt, ergeben sich auch im Fall der eigenen Studie aus den Schwachstellen eines solchen Untersuchungsdesigns Hinweise auf das Ausmaß der bei der Ableitung von Praxisimplikationen aus den Beobachtungen sinnvollen Vorsicht und auf Ansatzpunkte für die weitere Forschung. Fünf Punkte sind u.E. diesbezüglich besonders hervorhebenswert.

Eine *erste Beschränkung* ergibt sich daraus, dass in unserer Erhebung – wie auch in den meisten früheren SBM-Adoptionsstudien (s. Übersicht 1) – mit verbal umrissenen SBM-Anwendungsszenarien gearbeitet wurde, die „not .. real-world enough for the participants“[93] gewesen sein könnten. In der weiteren Forschung sollten deshalb SBM potenziellen Nachfragern zumindest multimedial am Computer demonstriert werden[94] oder besser noch ihnen testweise über mehrere Wochen im Alltagsleben zur Verfügung gestellt werden.[95]

[90] S. Jandt (2007), S. 78.

[91] S. Barkuus/Dey (2003), S. 711; Chellapa/Sin (2005), S. 196-198; Spiekermann (2006), S. 175; Tsai et al. (2009), S. 7; Xu (2009), S. 31f.

[92] Vgl. Xu et al. (2005), S. 899-901.

[93] Kwon et al. (2007), S. 496.

[94] Etwa wie bei Bauer et al. (2008), S. 214f.

[95] Etwa wie bei Tsai et al. (2009).

Ein *zweites Defizit* der eigenen Arbeit kann darin gesehen werden, dass als abhängige Kriterien nur Adoptionsverhaltens*absichten*, nicht aber die *tatsächliche* Adoption sowie das SBM-Nutzungsausmaß über längere Zeiträume herangezogen wurden. Zwar ist diesbezüglich mit Groeppel-Klein/Königstorfer (2007, S. 75) einzuwenden: „When individuals decide to adopt a technological innovation, *anticipated* use … [is] of great importance." Nichtsdestotrotz ist die Adoptions*bereitschaft* nicht die alleinige Determinante des Adoptions*verhalten*s. Folglich sind Untersuchungen begrüßenswert, welche die Absicht, SBM zu nutzen, die tatsächliche Erst-Adoption von SBM und das SBM-Nutzungsverhalten als zeitlich nacheinander zu erfassende abhängige Kriterien einbeziehen.

Drittens erwies sich in der eigenen Studie die wahrgenommene Häufigkeit des Bedarfs an „Unterwegs-Informationen" als einer der wichtigsten Erklärungsfaktoren für die Ausprägungen der SBM-Adoptionsdimensionen. Die Messung dieses Konstruktes erfolgte nicht auf hohem Detailniveau und enthielt mit der Informationskategorie „Kontostand" auch einen Indikator ohne Standortbezug (s. Variable III in Tabelle A2 im Anhang). Zukünftige Arbeiten sollten deshalb die Detailschärfe der Abbildung dieses Konstruktes erhöhen (z.B. durch Differenzierung des Anfalls von Informationsbedarf bei einem Nutzeraufenthalt inner- oder außerhalb von Gebäuden oder bestimmten Regionen). Sie sollten zudem erkunden, inwieweit sich die von Mobilfunkkunden wahrgenommene/berichtete und die über Beobachtungen objektiviert gemessene Bedarfshäufigkeit decken.

Viertens wurden die im TITF-Konzept angesprochenen individuellen Fähigkeitsvoraussetzungen für die SBM-Adoption über Indikatoren der aktuellen Nutzung von Mobilfunk(daten)diensten operationalisiert, die wenig zur Erklärung der Adoptionskriterienvarianz beizutragen vermochten. Bevor man aus diesem Resultat bzw. dem geringen Bewährungsgrad von *Hypothese 1* die Schlussfolgerung zieht, dass es bei der SBM-Adoption viel mehr auf den „Task-Technology-Fit" als auf den „Individual-Technology-Fit" ankommt, ist zu empfehlen, andere Maße für individuelle Fähigkeiten im Umgang mit innovativen Mobilfunkdiensten wie z.B. praktische Erfahrungen mit der Konfiguration von Mobilfunkendgeräten auf ihre Erklärungsrelevanz für Adoptionskriterien hin zu testen.

Fünftens wurden in die eigene Studie fast ausnahmslos Mobilfunkkunden aus Deutschland einbezogen. Da die Adoptionsbereitschaft innovativer Telekommunikationsangebote auf der Ebene des einzelnen Konsumenten wahrscheinlich auch durch „Makrovariablen" wie die kulturellen oder volkswirtschaftlichen

Rahmenbedingungen in einem Land beeinflusst wird,[96] sind Untersuchungen von Interesse, welche die vorgelegte Studie in anderen Kultur- und Wirtschaftsräumen, die sich von Deutschland wesentlich unterscheiden, replizieren.

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[96] Vgl. Sheng et al. (2008), S. 367.

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Anhang

Tabelle A1: Operationalisierung der Adoptionsdimensionen

A.1 Szenariobezogene SBM-Nutzungswahrscheinlichkeiten (1–5)[a]

- **Navigation Urlaub** (1)
  „Sie befinden sich auf einer **Urlaubsreise** in einer Ihnen fremden Stadt und suchen ein Museum. Ihr Handy bietet Ihnen die Möglichkeit, eine Auswahl von Sehenswürdigkeiten mit dazugehörigen **Kurzbeschreibungen** aufzurufen und Sie **zum gewünschten Museum zu navigieren**."
- **Preisvergleich Kauf LCD-Fernsehgerät** (2)
  „Sie unternehmen einen **Einkaufsbummel** und sehen dabei ein neues LCD-Fernsehgerät, das Sie vielleicht kaufen möchten. Ihr Handy bietet Ihnen die Möglichkeit zu prüfen, wo und zu welchem **Preis** andere Händler in einem Umkreis von 5 km das gleiche Gerät anbieten."
- **Navigation Kundenadresse Geschäftsreise** (3)
  „Sie sind **beruflich** zu Fuß in einer fremden Stadt unterwegs und verspätet auf dem Weg zu einem wichtigen Kunden. SBM ermöglichen Ihnen, den entsprechenden **Stadtplan sowie eine Navigationsroute** auf Ihr Handy zu laden und die zu erwartende Verspätung zu ermitteln."
- **Identifikation und Buchung Hotel Geschäftsreise** (4)
  „Sie sind aus **beruflichen Gründen** mit dem Auto in eine **fremde Stadt** gefahren und suchen eine **Unterkunft für die Nacht**. SBM bieten Ihnen die Möglichkeit, **freie Zimmer im Umkreis** zu finden, Ihnen das günstigste Angebot herauszufiltern und dieses auch zu buchen."
- **Stauumgehung private PKW-Fahrt** (5)
  „Sie sind **privat** mit dem Auto auf der Autobahn unterwegs. Auf dem Weg zu Ihrem Ziel **staut sich der Verkehr** an mehreren Punkten Ihrer Reiseroute. SBM bieten Ihnen die Möglichkeit, die benzinsparendste **Alternativroute** vorzuschlagen und Ihnen im Stau immer den optimalen Spurwechsel anzuzeigen."
- Zu jedem der fünf Szenarien wurde folgende Frage gestellt: „Wie wahrscheinlich ist es, dass Sie SBM in dieser Situation nutzen würden?" (s. zu den Antwortvorgaben/-kodierungen Tab. 1, Fußnote c).

A.2 Szenariobezogene SBM-Zahlungsbereitschaften (6–10)

- Nach der Frage zur situativen Nutzungswahrscheinlichkeit von SBM wurde jeweils außerdem erhoben: „Wie viel wären Sie bereit, in dieser Situation für die einmalige Nutzung des entsprechenden SBM zu bezahlen (*bitte Euro-Betrag eintragen*)?"

Tabelle A1: Operationalisierung der Adoptionsdimensionen (Fortsetzung)

A.3 Aufwandsbereitschaften für (prinzipielle) SBM-Nutzungsmöglichkeiten (11–17)

- „**Um SBM nutzen zu können, bin ich prinzipiell bereit**, …
  - „ein **neues Mobiltelefon** zu erwerben." (11)
  - „**zusätzliche Software** auf mein Mobiltelefon zu laden." (12)
  - „vor der Nutzung einen **neuen Mobilfunkvertrag** abzuschließen." (13)
  - „vor der Nutzung einen **Zusatzvertrag** zu meinem bestehenden Mobilfunkvertrag abzuschließen." (14)
  - „**zusätzlich** zu meinem bestehenden Mobilfunkvertrag für spezifische SBM (z.B. Restaurantführer) oder Regionen (z.B. Lokalnachrichten) **Abonnements** abzuschließen." (15)
  - „meinen **Netzbetreiber** zu **wechseln**." (16)
  - „einen **Zusatzvertrag** mit einem **Drittanbieter** (z.B. Google, Xing, Yahoo etc.) abzuschließen." (17)
- Antwortvorgaben/-kodierungen gemäß Tab. 1, Fußnote c.

a) Fette Hervorhebungen entsprechen dem Layout im eingesetzten Erhebungsinstrument. Zahlen in Klammern beziehen sich auf die in Tab. 1 verwendete, analoge Nummerierung.

Tabelle A2: Operationalisierung von potenziellen Bestimmungsgrößen von SBM-Adoptionsdimensionen

I. Mobilkommunikationsverhalten[a]

1. „Haben Sie in den letzten 18 Monaten SBM genutzt?" (2 Antwortvorgaben: „ja" oder „nein").
2. „Wie ist Ihre tägliche Erreichbarkeit auf Ihrem Mobiltelefon?" (3 Antwortvorgaben: „nie" (= 0), „tagsüber" (= 1), „24 Stunden" (= 2)).
3. „Wie hoch sind zur Zeit Ihre durchschnittlichen monatlichen Ausgaben für Mobilfunkdienste?" (9 Antwortvorgaben: „Bis zu 5 €" (= 1), „5–15 €" (= 2), „15–25 €" (= 3), „25–35 €" (= 4), „35–45 €" (= 5), „45–55 €" (= 6), „55–65 €" (= 7), „65–75 €" (= 8), „> 75 €" (= 9)).
4. „Wie hoch ist bei Ihren monatlichen Ausgaben für Mobilfunkdienste der Anteil für Mobilfunkdatendienste?" (6 Antwortvorgaben: „0%" (= 1), „bis 10%" (= 2), „bis 25%" (= 3), „bis 50%" (= 4), „bis 75%" (= 5), „höher als 75%" (= 6)).
5. Durchschnitt der Antworten auf zwei Fragen „Wie oft nutzten Sie in den letzten 12 Monaten typischerweise (a) „Mobilfunkdatendienste" und (b) „ein/e UMTS-Mobiltelefon/-Datenkarte?" (5 Antwortvorgaben: „nie" (= 0), „seltener" (= 1), „monatlich" (= 2), „wöchentlich" (= 3) „täglich" (= 4).

II. Bisherige Offenheit gegenüber neuen Mobilfunkdiensten: Durchschnitt des Zustimmungsgrades zu zwei Aussagen: (a) „In meinem Freundeskreis bin ich gewöhnlich der Erste, der neue Mobilfunkdienste nutzt" und (b) „Im Allgemeinen bin ich zögerlich, wenn es darum geht, neue Mobilfunkdienste zu nutzen" [Kodierung umgekehrt] mit jeweils 6-stufiger Antwortvorgabe von „stimme gar nicht zu" (= 1) bis „stimme voll und ganz zu" (= 6).

III. Bedarfshäufigkeit standortabhängiger Informationen: „Wie häufig pro Monat erleben Sie Alltagssituationen, wenn sie unterwegs sind, in denen Ihnen die folgenden Informationen nützlich sein könnten?" Durchschnitt der Häufigkeitseinstufungen für sieben Informationsarten („Wegbeschreibungen", „Geoinfos (Wetter, etc.)", „Fahrplandaten von Bus und Bahn", „Vertragsdaten", „Kontostand", „Standort anderer Personen", „Ticketservice") mit jeweils 4-stufiger Antwortvorgabe „nie" (= 1), „1–5x" (= 2), „6–10x" (= 3), „öfter" (= 4).

IV. Abgabebereitschaft persönlicher Daten an SBM-Anbieter für Gegenleistungen: Durchschnitt des Zustimmungsgrades zu zwei Aussagen: Um SBM nutzen zu können, bin ich (a) „bereit, persönliche Daten an SBM-Anbieter freizugeben, wenn ich dafür kostenlos zusätzliche Dienste in Anspruch nehmen kann" und (b) „bereit, persönliche Daten an SBM-Anbieter freizugeben, wenn ich dafür Einkaufsgutscheine oder Guthaben-Gutschriften auf meiner Telefonrechnung erhalte" mit jeweils 6-stufiger Antwortvorgabe wie bei Variable II in dieser Tabelle.

Tabelle A2: Operationalisierung von potenziellen Bestimmungsgrößen von SBM-Adoptionsdimensionen (Fortsetzung)

V. SBM-Risikoeinschätzungen

1. **Datenmissbrauch**: Durchschnitt der Bewertung von sechs Aussagen: Meiner Meinung nach … (a) „sind meine standortbasierten Daten bei meinem SBM-Anbieter in sicheren Händen“ [Kodierung umgekehrt], (b) „muss ich zur sinnvollen Nutzung eines SMB zu viele persönliche Daten (z.B. Wohnort, Alter, Einkommen) preisgeben“, (c) „ist es für Dritte sehr leicht, sich unbefugt Zugang zu meinen persönlichen Daten zu verschaffen, wenn ich SBM nutze“, (d) „stellen die Anbieter von SBM sicher, dass für Dritte nur diejenigen persönlichen Daten einzu-sehen sind, die ich für diesen Zweck freigebe (analog zu z.B. Myspace, Xing, StudiVZ, ICQ, etc.)“ [Kodierung umgekehrt], (e) „besteht die Gefahr, dass Anbieter mobiler Datendienste meine Daten zu Werbe-/Konsum-zwecken missbrauchen“, (f) „ist die Nutzung von SBM mit einem höheren Betrugsrisiko verbunden als die Nut-zung anderer mobiler Datendienste (z.B. WAP)“ mit jeweils 6-stufiger Antwortvorgabe von „völlig falsch“ (= 1) bis „völlig richtig“ (= 6).
2. **Unerwartete Kosten/Rechnungshöhe**: Durchschnitt der Bewertung von zwei Aussagen: Meiner Meinung nach … (a) „besteht die Gefahr, dass durch die Nutzung von SBM meine Mobilfunkrechnung höher als von mir akzeptiert ausfällt“ und (b) „ist die Nutzung von SBM mit Kosten verbunden, die nur schwer einzuschätzen sind“ mit jeweils 6-stufiger Antwortvorgabe wie bei Variable V.1 in dieser Tabelle.
3. **Technische Funktionsmängel**: Durchschnitt der Bewertung von vier Aussagen: Meiner Meinung nach … (a) „ist zu erwarten, dass SBM aufgrund von technischen Problemen (z.B. GPS-Ortungsprobleme, niedrige Bandbreite etc.) nicht richtig funktionieren“, (b) „sind heutige Mobiltelefone für die Nutzung von SBM ungeeignet“, (c) „besteht die Gefahr, dass aufgrund von Übertragungsfehlern falsche Standortdaten verarbeitet werden und somit nicht die standortpassenden Dienste angeboten werden“, (d) „ist die Nutzung eines SBM mit einem Verlust an Bequemlichkeit verbunden, da ich viel Zeit zur Konfiguration des Handy aufbringen muss“ mit jeweils 6-stufiger Antwortvorgabe von „keinesfalls“ (= 1) bis „ganz sicher“ (= 6).

VI. Vertrauen gegenüber eigenem Mobilfunknetzbetreiber: Durchschnitt des Zustimmungsgrades zu drei Aussagen: Mein Mobilfunknetzbetreiber (a) „nutzt seine Kunden unfair aus“ [Kodierung umgekehrt], (b) „verhält sich nicht vorhersehbar“ [Kodierung umgekehrt], (c) „ist vertrauenswürdig“ mit jeweils 6-stufiger Antwortvorgabe wie bei Variable II in dieser Tabelle.

VII. SBM-Bewertung im sozialen Umfeld: Durchschnitt der Stellungnahmen zu vier Aussagen: (a) „Die Medien berichten häufig positiv über SBM“, (b) „Die Mehrheit meiner Freunde und Arbeitskollegen beurteilt die Verwendung von SBM positiv“, (c) „Die Nutzung eines SBM ist in meinem sozialen Umfeld ein positives Zeichen für Fortschrittlichkeit“, (d) „Einige meiner Freunde und Bekannte haben mir empfohlen, SBM auszuprobieren“ mit jeweils 6-stufiger Antwortvorgabe von „nie“ (= 1) bis „immer“ (= 6).

a) Nummerierung der Variablen in dieser Tabelle entspricht derjenigen in Tab. 3.

Pricing and collection preferences for navigation service offers by mobile network operators*

– A conjoint analysis –

Torsten J. Gerpott

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Abstract

Navigation services based on the infrastructure of mobile network operators (MNO) are among the offerings which many MNO consider promising in order to increase their revenue streams arising from innovative non-voice services. A substantial number of previous studies has found that price levels of actual or hypothetical new mobile data applications such as mobile navigation services (MNS) are significantly negatively related to consumer service adoption. This "insight" is neither intriguing nor helpful as an input to designing MNO pricing and settlement policies. Therefore, the present investigation attempts a closer conceptual and empirical look at pricing approach and collection procedure preferences for potential MNS offers of MNO in a sample of 583 German-speaking mobile communications customers. It applies the conjoint analysis method to assess effects of three pricing approach and four collection procedure attribute levels on consumer preferences in the context of fictitious MNS provided by MNO. The results revealed that the two focal attributes have a rather similar importance in shaping participants' MNS evaluations. At the aggregate sample level respondents favor MNS accompanied by a flat rate scheme and which incorporated the charges for the services in the invoice which MNO send anyway to their postpaid subscribers. Currently uncommon collection procedures (e.g., credit card or direct debit payment) have no strong positive or even considerable negative impacts on consumers' appreciation of MNS offers. The sample contains three internally homogeneous segments characterized by diverging pricing and collection preferences. The findings suggest that MNO might be well advised to introduce MNS not only based on flat rate schedules but also with use-frequency or data-transfer volume dependent tariffs because there exists a small but probably affluent group of consumers to whom such pricing schemes are appealing.

Keywords: Collection procedure; Conjoint analysis; Customer preferences; Location-based services; Mobile network operator; Mobile service innovations; Navigation services; Pricing approach.

II.1 Study background and purpose

In the recent past service revenues of mobile network operators (MNO) have been stagnating or even decreasing in many industrialized countries. For instance, in Germany turnover generated by mobile communication services fell by 2.5% in 2007 compared to 2006 and by 0.9% in 2008 relative to the previous year.[1] Therefore, MNO are searching for service innovations which extend their offerings beyond simple voice transfer in order to support them in returning to previous business growth trajectories. Among these potential innovations are location-based services (LBS). LBS aim at generating additional value for mobile users by automatically tying data concerning the current geographical position of a mobile device (and its owner) to location-specific information, commerce and communication offerings.[2] In practice, LBS embrace spatial context-specific advertisements, information on static or moving objects (e.g., automatic teller machine, gas station, friend) within a defined range, rescue/emergency support as well as services which support users by providing instructions on how to move from their present position to a destination complemented by itineraries or other travel-related data such as traffic congestion hints.[3]

Sales of portable navigation devices which are not connected to 2G or 3G base stations of MNO but to the orbital *NAVSTAR Global Positioning System* (GPS) have climbed substantially over the past few years.[4] This market success may be taken to indicate that consumers perceive a strong benefit from having routing information on-hand while being on the move. As a consequence, MNO may take advantage of this user need by integrating mobile navigation offerings based on technologies embedded in their 2G or 3G network elements (and in customer premises equipment with the ability to process mapping data provided by the MNO infrastructure) into their service portfolio. In fact, the two largest MNO in Germany for instance, *T-Mobile Germany* and *Vodafone D2* have already introduced mobile navigation services (MNS) under the brand names *NaviGate* and *Navigator*.

It is almost tautologic that the commercial success or failure of MNS largely depends on the degree to which potential consumers believe that such services are useful in helping them to master their private and professional life tasks. There-

1 Gerpott (2009).
2 Barnes (2003); Spiekermann (2004); Chang et al. (2007); Kargin et al. (2009).
3 Spiekermann (2004); Fritsch/Muntermann (2005); Lee et al. (2009).
4 Canalys (2009).

fore, from a management perspective it is pivotal to identify what attributes MNS need to provide in order to be accepted by mobile subscribers. This logic has triggered quite a number of empirical studies on factors influencing mobile communication customers' willingness to adopt LBS in general and MNS supplied by their MNO in particular. Mostly following the "technology acceptance model" introduced by Davis (1989) these investigations have identified perceived usefulness and ease of use/usability of various LBS variants, individual privacy concerns, perceptions of service-related opinions held by social reference groups and propensity to try out innovative offerings as factors significantly influencing LBS acceptance.[5]

Taking into account that MNO intend to create new revenue streams from MNS it is simply astonishing that extant work has only superficially explored pricing schemes and has almost completely ignored collection issues in the context of MNS offerings of MNO. Previous research indicates that the MNS value-to-price ratio a mobile subscriber perceives is significantly positively and that the price level and cost concerns are significantly negatively affecting consumers' willingness to adopt LBS.[6] These findings are hardly illuminating to management practitioners because it is obvious that customer acceptance and MNO losses are likely to be maximized by providing mobile communications services for free. Thus, additional empirical research is sorely needed which focuses from a customer perspective on the utility of various MNS pricing and money collection options between which MNO can choose.

The purpose of the present paper is to contribute toward closing this research gap. In the next chapter, I briefly review the sparse mobile LBS pricing and collection literature to specify this study's research questions. Then, I address the methods of my empirical investigation and subsequently present my findings. In the final chapters I discuss managerial implications of the results and draw conclusions for further research.

[5] Xu/Teo (2004); Heijden et al. (2005); Pura (2005); Xu/Teo (2005); Xu et al. (2005); Chang et al. (2006); Junglas/Spitzmüller (2006); Chang et al. (2007); Junglas (2007); Kwon et al. (2007); Bauer et al. (2008); Sheng et al. (2008); Lee et al. (2009); Xu et al. (2009); Xu/Yuan (2009).

[6] Pura (2005); Bouwman et al. (2007); Chang et al. (2007); Bauer et al. (2008); Lee et al. (2009); Reuver/Haaker (2009); Xu/Yuan (2009).

II.2 Previous work and present research questions

There are several basic pricing schemes which aim at generating MNS revenues from end customers.[7] First, MNO have the option to charge a subscription or flat fee for enabling mobile communications customers to resort to MNS on their portable devices regardless how often they actually use the services during the accounting period (typically a calendar month). From a customer perspective this pricing approach has the advantage that it avoids cost/bill surprises or a "usage shock"[8] which could occur as customers draw on the service much more frequently than expected. Further, a flat rate circumvents a "taxi meter effect"[9]. This means that unpleasant emotions are reduced by flat rates and enhanced by pay per use schemes "because consumers attribute the cost and, thus, the pain of paying to consumption at the time of usage. In contrast, paying a flat fee decouples consumption from payment because the costs are mentally prepaid … Thus, usage, which has been paid for beforehand, can be enjoyed as if it were free"[10]. Finally, flat rates entail an option value which is unrelated to the actual use of the MNS because they provide the consumer with the possibility of using a service extremely frequently without incurring additional financial losses and thereby insuring users against the risk of high costs.[11] The probably most important downside of flat pricing schedules is that occasional MNS consumers may be deterred from the service because their subjectively projected (low) MNS use frequency does not justify the (higher) expenses caused by a flat tariff. Further, subscribers may decline this pricing approach because their mobile voice tariff is minutes of use based implying that they are not familiar with non-linear pricing schedules and correspondingly perceive them as unfair.

Secondly, MNO can establish an event-based pricing model which includes a charge for each application of the MNS, i.e., a pay per use tariff. The key feature of this approach is that frequency of service use is *directly* and *visibly* linked to the total amount charged for it. This policy may be particularly beneficial for subscribers who only sporadically need the service. Reversely, pay per use frequency schemes possess disadvantages which are equal to the aforementioned advantages of flat rate schedules.

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[7] Cf. Kleijnen et al. (2004); Fritsch/Muntermann (2005); Lambrecht/Skiera (2006); Bauer et al. (2007).

[8] Narayanan et al. (2007), p. 3.

[9] Lambrecht/Skiera (2006), p. 213.

[10] Lambrecht/Skiera (2006), pp. 213-214.

[11] Kridel et al. (1993).

Thirdly, MNO can introduce a pricing approach which charges users according to the data volume transferred during a service use session. This procedure makes sure that navigation inquiries, which trigger the exchange of small data volumes over the network and thusly consume only a small fraction of its load capacity, are available at lower rates than service applications which entail the transfer of a significant bulk of information (e.g., moving pictures). An important disadvantage of tariffs based on data volumes is that users may find it difficult to forecast the data transfer volumes caused by various MNS applications with the consequence that they may reject the service because of its lack of cost predictability and resulting high cost risks. Again, subscribers may also be reluctant to accept data volume tariffs because they are uncommon for mobile voice services, at the same time implying that users are unlikely to be acquainted with this pricing approach.

Only few LBS or MNS studies provide information concerning customer evaluations of or preferences for the three pricing schemes sketched above. In a web-based survey of 479 mobile communication subscribers in Germany conducted in 2002 Kölmel and Wirsing (2002) found that more users preferred a pay per use schedule than a flat rate scheme for LBS. Köhne et al. (2005) explored pricing scheme assessments of 51 university students in Germany for a location-based information service in a tourism setting. They observed that subjects preferred a pay per use schedule over a monthly flat subscription approach. Kleijnen et al. (2004) investigated pricing schemes in the context of consumers' willingness to adopt mobile gaming services. Their analysis of data from a sample of 99 residents of the Netherlands suggested that the utility of a flat rate is higher than the value of a schedule linking charges to data transfer volumes. The latter pricing approach is in turn preferred to a scheme based on minutes of service usage.

To sum, previous findings on pricing schedule preferences for LBS in general and MNS in particular are sparse and do not provide a clear picture. Hence, the present study's first research question (Q) is phrased as follows:

Q_1: What are the "typical" utilities which private mobile service subscribers assign to various pricing approaches in the context of MNS offerings?

MNO can draw on different modes of collecting a user's financial liabilities for MNS. These collection modes are in large part independent of the service pricing approaches. Main collection variants – differing in the timing of a cus-

tomer's service-related deposit – are advance/prepaid and retrospect/postpaid settlements. In the case of prepaid arrangements the customer obtains a credit amount which entitles him to use an MNS in the future. Postpaid collection means that MNO impose charges generally at regular time intervals for actual service usage or for the option of having had recourse to services in the past. Postpaid collection modes for MNS include payment via one's mobile (voice) communication bill, direct debiting or credit card.[12]

Customer preferences for various collection modes are likely to be influenced by an individual's familiarity with various settlement options because options which users are well acquainted with imply lower risk and use effort perceptions.[13] Unfortunately, no previous study has explored collection procedure preferences for LBS and MNS. Thus, the present investigation's second research question reads:

> Q_2: What are the "typical" utilities which private mobile service subscribers assign to various collection procedures in the context of MNS offerings?

The previous two research questions should not be taken to imply that mobile consumers' preferences for pricing schemes and collection modes are necessarily homogeneous. On the contrary, previous research on customer evaluations of innovative (location-aware) mobile data services indicates that various customer segments may exist which differ from each other in terms of their valuation of service features such as pricing schedules and collection procedures.[14] Consequently, the following third research question is addressed in my work:

> Q_3: To what extent is it possible to identify several segments among private mobile service subscribers diverging with regard to their pricing and collection preferences for MNS offerings and, if so, what demographic, communication profile and attitudinal differences are discernible between the segments?

[12] Bauer et al. (2007).

[13] Kristoffersen et al. (2008).

[14] Fritsch/Muntermann (2005); Köhne et al. (2005); Bauer et al. (2007); Bouwman et al. (2007); Xu/Yuan (2009).

II.3 Methods

II.3.1 Research approach

Stated customer preferences for various product features can be collected either directly or indirectly. Direct sequential probing for the importance of individual features in shaping a person's buying decisions suffers from at least two shortcomings. First, it does not capture the complexity of real customer choice situations. Secondly, it may artificially draw a person's attention to characteristics of an offering which would otherwise not be considered in a real decision situation. Conjoint analysis avoids these shortcomings by presenting hypothetical scenarios (vignettes or conjoints) to consumers who are then asked for holistic assessments of the various stimuli introduced. Thus, the present research is based on a conjoint-analytical approach. This design selection is in line with the application of conjoint analysis in an increasing number of studies in the domain of new mobile data communication services.[15]

The present research approach follows the five standard steps for the conduct of limit conjoint analysis.[16] First, based on the conceptual considerations summarized in the preceding chapter pricing approach and collection procedure for MNS were chosen as the current study's focal attributes of potential innovative MNO offerings. Secondly, attribute levels were determined by means of a literature review and discussions with eight managers employed by the four MNO in Germany (i.e., two experts per MNO). According to these expert interviews, flat rate, pay per use and pay per data transfer volume schemes are practically relevant levels for the pricing scheme dimension of MNS. Further, the managers unequivocally suggested that collection via prepaid arrangements, one's established (monthly) mobile communication bill, direct debiting and credit card should be taken as potential alternatives to pay for MNS. Thirdly, 12 full profile stimuli combining the levels of the two focal MNS characteristics were constructed and verbally described. Along with brief explanations of the stimuli's attributes and their levels these vignettes were presented to the study participants by means of a web-based online-survey tool.

Fourthly, participants were asked to rank the 12 vignettes based on their perceived attractiveness by assigning scores ranging from 1 for the best offer to 12 for the least attractive one. In addition, they were instructed to state up to which

[15] E.g., Kleijnen et al. (2004); Köhne et al. (2005); Bauer et al. (2007); Bouwman et al. (2007); Nam et al. (2008).

[16] Green/Srinivasan (1978); Voeth/Hahn (1998); Backhaus et al. (2008).

rank they would actually subscribe to the MNS, i.e., to *limit* the stimuli which they considered as relevant in their personal subscription decision (including non as well as all of the MNS options). Preference scores for each vignette were calculated, as suggested by Voeth and Hahn (1998, p. 121), by deducting the stated rank from the limit-card position and by adding a constant of 0.5 to this difference. For instance, if a subject assigned the second rank to an MNS with a flat rate pricing scheme and debit entry as the mode of collection and indicated that she would subscribe to the first five (of the 12) offers in her ranking, the preference score of this stimulus amounts to 3.5 (= 5 – 2 + 0.5). Fifthly, individual preference score data were analyzed with the aid of the "Conjoint" module of *SPSS16.0* which estimates (unstandardized) part-worth utilities for each attribute level based on ordinary least squares regression. Part-worth utilities reveal the contribution of an attribute level to an individual's preference for MNS offerings. Standardized part-worth utilities were additionally computed according to Backhaus et al. (2008, p. 471). This index eases interindividual comparisons of attribute level utilities because it controls for mean MMS stimuli assessment differentials between subjects. Following the procedure of previous investigations[17] the individual standardized part-worths of the respondents were taken to classify participants by hierarchical cluster analysis that was also conducted using *SPSS16.0*. The squared *Euclidian* distance was applied to assess the preference difference between subjects. *Ward's* minimum variance method was employed to specify clusters with the objective of identifying benefit segments of respondents who significantly differ with regard to the standardized part-worth utilities they assign to the attribute levels under study.[18] The 'elbow-criterion' for the determination of the appropriate number of clusters and inspections of the *SPSS*-dendograms suggested that a three-cluster-solution was most appropriate in the present data set.

The online survey tool also included questions regarding three demographic characteristics (gender, age, highest formal educational level) and four current mobile communication profile aspects (type of MNO contract, type/generation of cellular network currently used, current average monthly amount spent on MNO services, frequency of use of mobile data services within the past 12 months). Finally, attitudinal items related to mobile service costs and innovations as well as to perceptions of the frequency of geographic direction needs while being on the move were part of the web-based questionnaire. Additional

[17] E.g., Kleijnen et al. (2004); Köhne et al. (2005); Bauer et al. (2007); Bouwman et al. (2007).

[18] Backhaus et al. (2008).

information on the measurement of the attitudinal variables will be given in the results section below.

II.3.2 Study participants

An Internet survey of MNO customers in Germany was conducted in April and May 2008 to address the research questions. Participants were guided to the survey site by links which were placed on the web pages of a German MNO and of several online portals which are visited by a substantial number of consumers. The data collection was part of a larger research project on end-user views of new context-aware MNO services. The project was financed by the *DFG Deutsche Forschungsgemeinschaft* (= German National Science Foundation). People were asked to participate in the study only if they had privately used at least mobile voice services during the three months preceding the survey. 989 different individuals responded to as many as 70% of the items included in the questionnaire. Of these participants 583 provided complete rank orders of the 12 conjoint analysis stimuli (see above chapter II.3.1). These 583 persons form the sample analyzed in the remainder of the present paper.

Table 1 reports descriptive statistics pertaining to three demographic characteristics of the sample (gender, age, education) and four mobile communication profile features of the participants (see variables 4–7 in Table 1). The sample represents the population of residential MNO subscribers in Germany neither in demographic nor in mobile communication behavior respects. Male, young and academically educated individuals are overrepresented in the sample compared to the total MNO subscriber population in Germany. Further, communication profile variable distributions among the participants suggest that respondents spend more on mobile communication services in general and are more inclined to draw on 3G-/UMTS-based data services in particular than the average residential MNO customer in Germany. Thus, it has to be concluded that survey respondents were to a large proportion recruited from the universe of early adopters of innovative mobile non-voice services.

Fortunately, this sample composition does not pose a threat to the substantive significance of the present study's results since its main focus is to explore the *relative* utilities of various pricing approach and collection procedure attribute levels. The scientific value of this kind of investigation mainly depends on the appropriateness of the research design and its variable measurements and not on

Table 1: Respondent characteristics

	Frequencies	
	Absolute	**(%)**
1. Gender (n = 565)[a]		
– Male [= 0][b]	387	(68.5%)
– Female [= 1]	178	(31.5%)
2. Age (n = 577)		
– Less than 26 years [= 0]	276	(47.8%)
– 26 to 35 years [= 1]	184	(31.9%)
– 36 to 45 years [= 1]	79	(13.7%)
– More than 45 years [= 1]	38	(6.6%)
3. Highest formal educational level (n = 579)		
– No university degree [= 0]	351	(60.6%)
– University degree [= 1][c]	228	(39.4%)
4. Type of contract with MNO[d] (n = 543)		
– Prepaid [= 0]	102	(18.8%)
– Postpaid [= 1]	441	(81.2%)
5. Type of network currently used (n = 576)		
– GSM (2G) [= 0]	241	(41.8%)
– UMTS (3G) [= 1]	37	(6.4%)
– Both GSM and UMTS [= 1]	183	(31.8%)
– Don't know [= 0]	115	(20.0%)
6. Current average monthly amount spent on MNO services (n = 576)		
– Less than 5 EUR [= 0]	35	(6.1%)
– 5 to 25 EUR [= 0]	264	(45.8%)
– 26 to 45 EUR [= 1]	166	(28.8%)
– More than 45 EUR [= 1]	111	(19.3%)
7. Frequency of use of mobile data services within past 12 months (n = 573)		
– Never [= 0]	228	(39.8%)
– Less than once a month [= 0]	162	(28.3%)
– Once a month [= 1]	54	(9.4%)
– Once a week [= 1]	64	(11.2%)
– Once a day [= 1]	65	(11.3%)

a) n = number of valid answers/cases.
b) Figure in squared brackets = Coding of attribute value for analysis in Table 4.
c) Including degrees obtained at universities of applied sciences ("Fachhochschulen").
d) MNO = Mobile network operator.

its generalizability to a hypothetical population of mobile users.[19] As indicated earlier, the conjoint-analytical approach is a well-established method for exploring consumer preferences which implies that the present research design can be qualified as being adequate. Further, the survey sample can in any event be regarded as representative for those customers who typically are most likely to adopt MNS at an early stage. It is just this consumer segment for which MNO currently have to select MNS pricing schedules and collection procedures in order to stimulate initial demand for this new category of service offerings.

II.4 Results

II.4.1 Research questions 1 and 2

To address research questions 1 and 2, Table 2 shows mean, median and standard deviation statistics of the unstandardized and standardized part-worth utilities of the seven attribute levels of the 583 study subjects derived from the con-

[19] See East/Uncles (2008), pp. 935-937.

joint-analytical section of my questionnaire. In addition, for each attribute level it contains the proportion of respondents who have a positive unstandardized part-worth. The unstandardized absolute part-worths depict the extent to which attribute levels increase or decrease the total utility of an MNS offering. Table 2 also allows insights into the relative importance or salience of the two attributes studied in explaining the stated MNS preferences on the aggregate sample level. The relative importance percentage reflects the attribute's power to induce a preference variation as compared to the other attribute included in the conjoint design. It is calculated for each participant by dividing an attribute's part-worth span with the sum of all attributes' spans. The relative attribute importance in the sample is the arithmetic average of the individual values of this statistic.[20]

In conjoint analysis the correlation between the stated ranks of the (12) stimuli given and the ranks estimated by an aggregation of the utility constant plus part-worths for each stimulus provides an indication of the overall fit of the preference model estimation with the researcher's data set.[21] As can be taken from Table 2 (footnote a), this correlation amounted to 0.99 (*Pearson's r*) and 0.94 (*Kendall's τ–b*) respectively which suggests that the fit of the estimated preference model with the data is very good.

According to my findings (see "RI" column in Table 2), a change of the pricing approach's attribute level had only a very slightly stronger impact (52.1%) on an MNS's perceived overall utility of an average respondent than a change of the collection procedure (47.9%). Table 2 also reveals that the average constant utility of an MNS offering was negative (–1.32) and that about 65% of the sample had a negative constant. This implies that about two of three respondents would not use the "typical" MNS offering included in the conjoint analysis (i.e., limit card position < stated rank for an MNS vignette) unless its benefit is enhanced by a positively laden pricing approach or/and collection procedure attribute level exceeding the negative constant preference score.

The attribute level part-worth utilities in Table 2 indicate that the average participant most strongly prefers an MNS of an MNO which is accompanied by a flat rate schedule of 4.95 EUR per month and is settled via the customers' bill prepared anyway by her MNO (total utility = –1.32 + 1.05 + 1.53 = 1.26). Fur-

[20] Backhaus et al. (2008), p. 472.
[21] Green/Srinivasan (1978); Backhaus et al. (2008).

Table 2: Conjoint analysis results for pricing approach and collection procedure

Attribute/Attribute level	RI (%)	Part-worth utilities (n = 583)[a]						
		Unstandardized				Standardized[b]		
		M	Median	SD	S > 0	M	Median	SD
I. Pricing approach	52.06%							
1. Flat rate (4.95 EUR per month)		1.05	1.00	2.49	72.38%	0.37	0.36	0.29
2. Pay per use (0.49 EUR per route)		–0.12	0.00	2.13	60.21%	0.25	0.22	0.24
3. Pay per data transfer volume		–0.93	–0.75	2.27	40.48%	0.18	0.05	0.22
II. Collection procedure	47.94%							
1. Prepaid		–0.26	–0.17	2.00	43.05%	0.23	0.16	0.24
2. Mobile communications bill		1.53	1.50	1.59	85.76%	0.40	0.34	0.24
3. Debit entry		0.25	0.50	1.46	61.06%	0.28	0.25	0.21
4. Credit card		–1.52	–1.50	2.01	21.96%	0.11	0.00	0.17
Constant		–1.32	–2.00	3.41	34.99%			

a) n = number of cases. RI = Relative Importance. M = Mean. SD = Standard Deviation. S > 0 = Share of respondents with positive part-worth utility. Model fit statistics: *Pearson*'s $r = 0.99$ ($p \leq 0.001$). *Kendall*'s τ–$b = 0.94$ ($p \leq 0.001$).

b) Standardized utilities were calculated according to Backhaus et al. (2008), p. 471. This transformation ensures that the sum of the maximum (minimum) part-worth utilities across the two attributes is equal to 1 (0) for each individual.

thermore, an MNS with a pay per use scheme of 0.49 EUR per route request for which charges are collected via the mobile communications bill achieves a positive, but fairly small utility score of 0.09 (= –1.32 – 0.12 + 1.53). Overall preference scores of an average respondent were negative for the remaining 10 MNS pricing-collection attribute level combinations. On an aggregate level subjects especially rejected MNS with a pay per transfer volume schedule settled by credit card (total utility = –3.77).

II.4.2 Research question 3

II.4.2.1 First part

The first part of research question 3 addresses the issue of preference heterogeneity among mobile subscribers and of the existence of distinct user groups with internally similar part-worths for MNS pricing approach and collection procedure attribute levels. The substantial standard deviations of the attribute level's standardized part-worth utilities reported in Table 2 suggest that the heterogeneity prerequisites for conducting a cluster analysis suited to identify diverging

preference segments have been met in this study's sample. Assuming that respondents with similar part-worths also are homogeneous with regard to their preference structures[22] the cluster analysis of the 583 participants delivered three pricing and collection benefit segments (see chapter II.3.1 for methodological details of this analysis). Means and standard deviations of the part-worth utilities for each attribute level in the three clusters are displayed in Table 3. One factorial analyses of variance (ANOVA) support the selection of the 3-cluster-solution because the average of the part-worth scores of the attribute levels differed significantly at $p \leq 0.001$ for six of the seven levels and achieved a marginal statistical significance of 7.1 percent for the remaining seventh attribute level (credit card collection, see Table 3).

The 246 individuals in cluster 1 (42.2% of the total sample) gave flat pricing the top priority in their decision to use an MNS offer of their MNO. The mode of collection for on MMS had only a very limited impact on the overall utility of the various conjoint stimuli. Therefore, members of cluster 1 are labeled "*flat pricing supporters*". 245 participants in cluster 2 (= 42.0%) strongly base their intention of accepting an MNS offering on the collection procedure tied to such a service. A mobile communications bill settlement had the strongest effect on MNS acceptance in this cluster. For an average respondent in cluster 2, it was the only collection procedure attribute level whose mean unstandardized part-worth (2.34) exceeded the average negative constant utility of –1.68 (see Table 3). While a mobile communication bill collection procedure was clearly preferred by cluster 2 members, debit entry and prepaid settlements also had a recognizable impact on MNS acceptance. The mean unstandardized part-worths of these two attribute levels clearly exceeded the respective values of the other two segments indicating that these two collection options were less rejected by cluster 2 members than by the remaining study participants. The attribute level "credit card" had a relatively low MNS acceptance impact and was least preferred by subjects in cluster 2 as compared to the two other benefit segments. None of the pricing approach attribute levels had a strong effect on MNS utility perceptions of cluster 2 members. Therefore, individuals in cluster 2 are specified as "*collection-oriented customers*" with a strong preference in favor of paying MNS charges via a collection procedure based on one's already existing mobile communications bill.

[22] Bauer et al. (2007).

Table 3: Cluster part-worth utility comparisons

Attribute/ Attribute level	Cluster Statistics[a] Cluster 1 (n = 246) "Flat Pricing Supporters" M	SD	Cluster 2 (n = 245) "Collection-Oriented Customers" M	SD	Cluster 3 (n = 92) "Use Pricing Supporters" M	SD	ANOVA Mean Comparison F-Statistic[b]	p ≤
I. Pricing approach								
1. Flat rate	0.65_x [3.06]	0.15	0.19_y [0.49]	0.16	0.06_z [2.35]	0.14	785.49	0.001
2. Pay per use	0.30_x [–0.49]	0.24	0.12_y [–0.24]	0.13	0.45_z [1.17]	0.25	104.50	0.001
3. Pay per data transfer volume	0.10_x [–2.57]	0.17	0.13_x [–0.26]	0.14	0.50_y [1.68]	0.25	196.43	0.001
II. Collection procedure								
1. Prepaid	0.10_x [–0.54]	0.11	0.40_y [0.06]	0.27	0.13_z [–0.35]	0.13	167.78	0.001
2. Mobile communications bill	0.25_x [1.05]	0.13	0.62_y [2.34]	0.19	0.22_x [0.64]	0.13	434.31	0.001
3. Debit entry	0.16_x [0.15]	0.12	0.43_y [0.42]	0.20	0.17_x [0.09]	0.14	193.86	0.001
4. Credit card	0.09_x [–0.65]	0.12	0.12 [–2.82]	0.21	0.13_y [–0.38]	0.17	2.66	0.071

a) Standardized part-worth mean values with varying subscripts (*x, y, z*) differ significantly at p ≤ 0.05 (two-tailed) in a pairwise *t*-test. Figures in squared brackets = Unstandardized part-worth arithmetic average. The mean unstandardized constant part-worth utility across the 12 MNS stimuli was –0.98 (SD = 3.33) in cluster 1, –1.68 (SD = 3.35) in cluster 2 and –1.32 (SD = 3.41) in cluster 3.

b) df = 2,580.

92 subjects in cluster 3 (= 15.8%) mainly considered whether an MNS offer embraces a pay per use or per data volume pricing schedule and obviously prefer these pricing approaches relative to the other two segments. The presence of a flat rate had almost no and the three collection attribute levels also had only a rather limited importance for this cluster's decision on MNS use. Hence, respondents in cluster 3 are labeled "*use pricing supporters*".

II.4.2.2 Second part

The second part of research question 3 concerned the exploration of demographic, communication profile, and attitudinal differences between the previously described three segments with heterogeneous pricing scheme and collection procedure attribute level part-worths. As can be seen from Table 4, the three clusters were significantly different with regard to gender, age, currently used network technology (2G vs. 3G) and use frequency of mobile data services. As

Table 4: Comparisons of demographic and communication profile characteristics across the three pricing and collection preference clusters

Characteristics[b]	Cluster Statistics[a] Cluster 1 "Flat Pricing Supporters"	Cluster 2 "Collection-Oriented Customers"	Cluster 3 "Use Pricing Supporters"	Distribution Comparison χ^2-Statistic[c]	p ≤
1. Gender: Proportion female	$31.1\%_x$ [241]	$36.2\%_x$ [235]	$20.2\%_y$ [89]	7.64 [565]	0.022
2. Age: Proportion above 25 years	$48.8\%_x$ [244]	$49.4\%_x$ [241]	$68.5\%_y$ [92]	11.69 [577]	0.003
3. Educational level: Proportion with university degree	37.0% [246]	38.6% [241]	47.8% [92]	3.40 [579]	0.183
4. Contract type: Proportion postpaid	84.0% [231]	78.9% [227]	80.0% [85]	2.07 [543]	0.355
5. Network technology: Proportion 3G users	$45.1\%_x$ [244]	$29.2\%_y$ [240]	$43.5\%_x$ [92]	14.28 [576]	0.001
6. MNO services spending: Proportion with at least 26 EUR per month	50.6% [245]	44.4% [239]	51.1% [92]	2.29 [576]	0.318
7. MDS use frequency: Proportion using at least once a month	$37.9\%_x$ [243]	$25.0\%_y$ [240]	34.4% [90]	9.50 [573]	0.009

a) Figure in squared brackets = Number of respondents with valid answers included in the analysis. Percentage values with varying subscripts (*x, y*) differ significantly at $p \leq 0.05$ (two-tailed) in a pairwise χ^2-test.

b) MNO = Mobile network operator. MDS = Mobile data services. Additional measurement information concerning demographic and communication profile characteristics is reported in Table 1.

c) df = 2.

compared to cluster 2 members (collection-oriented customers), flat pricing enthusiasts (cluster 1) were more likely to already own advanced devices which enable them to draw on 3G networks and to report a higher frequency of use of mobile data services. Relative to the use pricing supporters in cluster 3, the flat pricing and collection-oriented customer segments (clusters 1 and 2) contained a significantly higher share of females and of individuals not exceeding the age threshold of 25 years. Further, use pricing fans in cluster 3 were significantly more inclined to utilize a device capable of operating in 3G networks than the collection-oriented members of cluster 2. In summary, a unique communication profile characteristic of collection-oriented customers relative to both other clusters was their propensity to stick to devices which are limited to work in 2G networks. In contrast, use-pricing supports significantly differed from the two other segments both in terms of gender (male) and age (older).

To explore potential attitudinal differences a between pricing and collection procedure segments, five constructs of this sort were measured by the questionnaire. The first construct, *bill surprise concerns*, deals with the extent to which an individual is afraid that MNS use might lead to higher than expected costs. The variable was measured by averaging responses to the two items "I believe that the use of LBS entails the risk that my mobile communication spending is higher than what I feel to be acceptable" and "I believe that the use of LBS causes costs which are hard to predict". For each of the items, which had been adopted from Gerpott (2007), six ordered *Likert*-type answer categories were provided which ranged from "completely wrong" (coded as 1) to "completely true" (coded as 6). The internal consistency reliability for the bill surprise concerns measure was satisfactory (*Cronbach's* $\alpha = 0.71$).

The second attitudinal construct, *openness for new mobile services*, reflects the degree to which an individual assumes to be an early adopter of new mobile service offerings. Previous research suggests that this "domain-specific innovativeness"[23] is an individual predisposition which helps to explain customer differences in the willingness to try out new LBS offerings.[24] Openness for new mobile services was measured by averaging responses to two items which previous work[25] identified as qualified indicators of this construct. Items were accompanied by six response options scaled from "completely disagree" (coded as 1) to "completely agree" (coded as 6). The *Cronbach* α reliability statistic for the measure reached a satisfactory level of 0.70.

The third measure focuses on a respondent's perceived *frequency of geographic direction needs while being on the move*. It was added to the survey because earlier investigations suggest that MNS preferences are influenced by the degree to which the service actually fits with an individual's lifestyle and the information needs caused by this style.[26] The construct was captured by the question "How often per month do you experience everyday situations, while you are on the move, in which geographic direction information would be helpful to you?". Four answer categories were provided, namely "never" (coded as 1), "1–5 times" (coded as 2), "6–10 times" (coded as 3) and "more than 10 times" (coded as 4).

[23] Pagani (2007), p. 709.
[24] Xu/Teo (2004 and 2005); Xu et al. (2005); Kwon et al. (2007).
[25] Lu et al. (2005); Xu et al. (2005); Pagani (2007).
[26] Pura (2005); Wu/Wang (2005); Mallat et al. (2009).

The fourth attitudinal variable is a respondent's behavioral *intention to use LBS*. Following suggestions of several researchers[27] it was operationalized by presenting various vignettes, each describing a specific LBS and LBS use context. A sample of the scenarios included in my survey is

> "During a shopping tour you find a dealer advertising a new LCD TV-screen which you consider to buy. Your handheld and your MNO enable you to check which other dealers within a 5 km distance from your current position are selling the same screen model and what selling price they charge for it."

A total of five vignettes were presented. For each scenario, subjects responded to the question "How likely is it that you would use this LBS in the situation just portrayed?" by selecting one out of six answer options. These options were designed as a continuum from "very unlikely" (coded as 1) to "very likely" (coded as 6). The average of the five answers was taken to measure a respondent's intention to use LBS. The *Cronbach* α of 0.78 for this scale indicates that its internal consistency reliability was good.

The fifth attitudinal measure was the *limit rank stated with regard to the 12 stimuli of the conjoint analysis* (i.e., the rank up to which a subject would actually subscribe to the MNS as listed in their order of attractiveness; see chapter II.3.1). This variable captures the overall willingness to use MNS offerings regardless of the pricing approach and collection procedure attribute levels spelt out in the conjoint section of my questionnaire.

For each of the three pricing and collection preference clusters, Table 5 contains mean values and standard deviations of the five attitudinal measures. Further, this table includes ANOVA results testing for the significance of the overall mean differences across the three segments. According to the ANOVA *F*-statistics in Table 5, means of four out of five attitudinal variables differed significantly at a 5% level of statistical significance. The mean differences of the remaining limit rank measure (see variable 5 in Table 5) still achieved a marginal significance of 7.2%.

[27] E.g., Xu/Teo (2004); Heijden et al. (2005); Kwon et al. (2007); Bauer et al. (2008); Sheng et al. (2008).

Table 5: Comparisons of attitudinal measures across the three pricing and collection preference clusters

	Cluster Characteristics[a]							
	Cluster 1 "Flat Pricing Supporters"		**Cluster 2** "Collection-Oriented Customers"		**Cluster 3** "Use Pricing Supporters"		**ANOVA Mean Comparison**	
Attitudinal measure[b]	**M**	**SD**	**M**	**SD**	**M**	**SD**	***F*-Statistic**	**p ≤**
1. Bill surprise concerns	5.04_x [223]	1.03	5.19_x [215]	0.97	4.76_y [78]	1.14	5.04 (df =2,513)	0.007
2. Openness for new mobile services	3.60_x [230]	1.61	3.18_y [228]	1.47	3.59_x [85]	1.64	4.67 (df =2,540)	0.010
3. Perceived frequency of geographic direction needs	2.25_x [242]	0.78	2.05_y [243]	0.67	2.19 [89]	0.71	4.88 (df =2,571)	0.008
4. Intention to use LBS	3.97_x [239]	1.20	3.66_y [234]	1.29	3.90 [90]	1.18	3.89 (df =2,560)	0.021
5. Stated limit rank in pricing/collection attributes CA	5.02_x [246]	3.33	4.32_y [245]	3.35	4.71 [92]	3.71	2.65 (df =2,580)	0.072

a) Figure in squared brackets = Number of respondents with valid answers included in the analysis. Attitudinal mean values with varying subscripts (*x, y*) differ significantly at $p \leq 0.05$ (two-tailed) in a pair wise *t*-test.

b) LBS = Location-based services. MNO = Mobile network operator. CA = Conjoint analysis.

In contrast to flat pricing enthusiasts (cluster 1), members of cluster 2 (collection-oriented customers) were characterized by (1) being generally less open for new mobile services, (2) less frequently requiring on the move geographic direction instructions, (3) a lower intention to use LBS and (4) qualifying a smaller number of stimuli in the conjoint survey as acceptable (i.e., by a higher rigidity with regard to the pricing and collection attribute levels of MNS which were evaluated as acceptable). Overall, subjects of cluster 2 seem to perceive MNS not as very valuable regardless of which pricing scheme an MNO chooses because this type of new services does not appear to fit with their personal mobility patterns and disposition to try out new mobile (data) services, their outfit with 3G enabled devices as well as their mobile communication spending level.

According to Table 5, use pricing supporters (cluster 3) were significantly less (but still seriously) concerned about bill surprises resulting from LBS use than the consumers in the other two clusters. Members of cluster 3 seem to be more convinced that they are able to keep track of their MNS use behavior. With regard to the openness for new mobile services, perceived frequency of geographic direction support, and LBS use intention subjects in cluster 3 were very similar to the benefit segment favoring flat rates for MNS. Use pricing supporters reported a somewhat lower average limit card rank than flat pricing fans.

This might be taken to suggest that cluster 3 members are less flexible with regard to the pricing approach conditions under which they would use an MNS. However, this difference was far from being statistically significant (pair wise *t*-value = 0.76; df = 1,336; $p \leq 0.45$).

II.5 Managerial implications

Quite a few previous studies have shown that price levels of new mobile (data) services such as MNS are significantly negatively related to consumer service adoption. This finding is not particularly striking. It is also not very helpful from a managerial perspective because MNO have to generate revenues from service innovations with the result that they can not give them away for free just to raise the acceptance of the new offerings. Therefore, the present investigation went beyond simply exploring the size of correlations between service price/cost levels and service use intentions by taking a closer empirical look at pricing scheme and collection procedure preferences for navigation service offers of MNO in a sample of 583 German-speaking mobile communications customers.

Based on a conjoint-analytical survey research approach, the results indicated that at the aggregate sample level participants favored MNS which were accompanied by a flat rate schedule and by a settlement of the charges for the service via one's already existing communications bill. Hence, at least in Germany, MNO which intend to promote MNS would be well advised to organize the collection procedure in a way that they incorporate the service charges in the (monthly) communications invoice they send anyway to their postpaid subscribers. In contrast, there appears to exist little justification for extending the "traditional" collection procedure to "progressive" options such as credit card transactions because the average mobile subscriber rejects these kinds of settlement processes for MNS. Rather, probably due to convenience and risk avoidance reasons, they tend to favor collection modes which have a proven quality and with which they are acquainted with.[28]

In terms of appropriate MNS pricing schemes the cluster analysis outcomes suggested that MNO should initially introduce flat rates which seem to be appealing to a large fraction of their subscribers. However, they should supplement these schemes with schedules which charge MNS according to the data transfer volume caused by all service uses or to the frequency of service applications of a

[28] Bauer et al. (2007).

customer during a specified period. This recommendation results from the existence of a unique benefit segment of smaller, but still considerable size (15.9% of the participants) containing mainly male, somewhat older and better educated (as well as probably more affluent) individuals whose decision to opt for an MNS was positively and strongly influenced by offering the service with a pay per data transfer volume or pay per use tariff.

The study also allows insights with managerial implications beyond the design of MNO pricing approaches and collection procedures for MNS. First, they indicate that the average strength of LBS use intentions in the present sample has to be qualified as moderate at best (see variable 4 in Table 5). Thus, MNO should be aware that consumers will probably not "pull" MNS offerings out of their hands. Conversely, operators should be ready to pursue a "push" strategy which convincingly conveys the tangible benefits of MNS installed on a consumer's cellular (smart) phone instead of requiring an additional separate navigation device. Push efforts should be predominantly targeted at subscribers who already frequently apply other mobile data services, who draw on a 3G enabled mobile phone and whose private and professional lifestyles are characterized by a substantial degree of geographic mobility or wanderlust.

Secondly, bill surprise concerns in the context of LBS are currently strong among mobile subscribers, at least in the present sample (see variable 1 in Table 5). Therefore, these concerns could be an important inhibitor of the adoption of MNO LBS offerings in general and MNS innovations in particular. As a result, MNO face the necessity to lower these concerns. This might be achieved by introducing price schedules with maximum monthly charge/cost ceilings, service use test periods or short periods of notice.

Thirdly, my work suggests that conjoint analysis can be a valuable source of information for the design of MNS core and auxiliary services' features as well as of other mobile services which are uncommon to the large majority of an MNO's current subscriber base.[29] Hence, the prevailing reluctance to employ conjoint-analytical research methods among both scholars and practitioners in the domain of mobile services, which was already noted and deplored by Bouwman et al. (2007), should be abandoned.

[29] See also Kleijnen et al. (2004); Köhne et al. (2005).

II.6 Suggestions for further research

Just like any other empirical investigation, the present study is not without limitations; from these, starting points for future work can be derived. Four shortcomings deserve special attention. First, the conjoint-analytical survey section deliberately focused on only two MNS attributes with a total of seven attribute levels. Nevertheless, further research could develop more complex conjoint surveys which combine the pricing and collection procedure attributes with additional MNS features. They might include characteristics of the direction advice given, the type of device/screen available to display navigational information, the design of the customer-service interaction surface, or the type of use situation. For future research, I particularly recommend exploring the external validity of the observed conjoint results for other kinds of LBS or context-aware mobile (data) services.

Secondly, the present sample encompasses merely a small proportion of prepaid customers (see Table 1). Consequently, the average negative part-worth utility detected for the prepaid collection procedure might be caused by not having been able to motivate a higher share of individuals with a prepaid MNO relationship to participate in the study. Hence, further research should strive to better capture MNS pricing and collection preferences in the prepaid customer segment.

Thirdly, my study concentrated on preferences implied by stated answers in a survey. Although there are strong reasons to assume that such *stated* preferences significantly correlate with preferences as *revealed* in actual behavior,[30] it must also be acknowledged that stated preferences or behavioral intentions are not necessarily completely congruent with revealed preferences or actual behaviors (see article V in this book). As a consequence, additional quasi-experimental field studies are desirable which explore the impacts of pricing approach and collection procedure variations on real-world MNS subscription decisions and use intensities of consumers.

Finally, the investigation was carried out in Germany which might imply limited generalizability of the findings to other countries. For instance, it could be surmised that the typical German mobile subscriber is more inclined to avoid uncertainties tied to pricing approaches and collection procedures of MNS than consumers in other countries whose national culture is coined by a weaker ten-

[30] Cf. Hong et al. (2006).

dency to avoid risks.[31] Therefore, it is recommended that future research replicates my findings in other regional contexts which diverge from Germany in terms of their national cultures and the achieved uptake of mobile data services such as MNS or other LBS.

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[31] Cf. Hofstede (2001); Sheng et al. (2008).

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Attribute perceptions as factors explaining mobile Internet acceptance of cellular customers in Germany

– An empirical study comparing actual and potential adopters with distinct categories of access appliances –

Torsten J. Gerpott

Abstract

Although demand for Internet access through cellular networks and portable appliances, i.e. mobile Internet (MI), has recently soared in many countries, the majority of mobile network operator (MNO) customers has still never used MI. Therefore, it is important to gain a better understanding of (1) how MNO customers perceive attributes of MI offers, (2) how these perceptions are related to MI acceptance and (3) the extent to which these judgments and relationships differ as a function of an individual's adoption status (actual compared to potential MI user) and the appliance category employed to access MI (handset compared to laptop). This study analyses these issues by drawing on MI attributes deduced mainly from diffusion of innovation (DOI) and information economic (IE) literature and by using data collected from a survey of 525 effective and 540 potential MI users in Germany. The multivariate results show that the perceived relative functional advantage and communicability of MI offers were significantly positively and their trialability was significantly negatively correlated with MI acceptance in both customer groups. Overall, perceived DOI-based attributes explained MI acceptance better for actual than for potential users. The share of search qualities relative to that of credence qualities which respondents assigned to MI had a small, but significant positive effect on MI acceptance among potential users. The effectively used or preferred appliance category for MI access exerted strong influence on DOI-based MI attribute assessments, especially among actual adopters: MNO customers who (prefer to) use a laptop to obtain MI access perceived MI features more favorable than persons who (prefer to) use a handset as their primary MI access device. These findings provide insights for MNO and appliance vendors on measures which may effectively promote the acceptance of MI.

Keywords: Advanced mobile data services; Attribute perceptions; Diffusion of innovation concepts; Germany; Information economic concepts; IT innovation; IT user survey; Mobile appliance categories; Mobile Internet; Post-adoption; Pre-adoption; Technology acceptance.

III.1 Background and study objective

Market researchers report that demand for Internet access and services through cellular communication networks via various portable appliances, i.e. mobile Internet (MI), has recently started to soar in many countries. Further strong MI subscriber growth is expected in the near future. According to IDATE (2009, p. 1), the number of MI customers in Europe (the U.S.) will expand from about 70 million (35 million) at the end of 2008 to more than 160 million (110 million) at the end of 2012. Particularly for Germany, surveys of large samples which represented the population of residential customers of the four mobile network operators (MNO) in demographic respects revealed that the share of MI adopters in the total of cellular users grew from 3.6% in January 2007 to 9.2% in January 2008 and reached 13.7% in January 2009.[1] Main drivers of the current MI uptake include improvements in performance and price of MI-enabled customer premises equipment, expansions in the geographical availability of broadband mobile data transmission technologies (e.g., EDGE, HSPA) in MNO infrastructures, increases in the quantity and quality of MI services, and substantial decreases of end-customer MI access and use prices.[2]

However, even the most recent German MI adoption figure quoted above, as well as ITU statistics[3] on "mobile broadband subscribers per 100 inhabitants"[4] for other European or North American countries at the end of 2007 – which range from 43.2% in Luxembourg to 1.7% in the Czech Republic – imply that the vast majority of MNO customers has never used MI (yet). Compared to Japan and South Korea for which the MI penetration statistic of the ITU amounted to 56.8% and 48.6%, respectively, at the end of 2007,[5] MI acceptance in many Western developed nations is still way behind the Asian leaders.[6] For instance, a survey of a sample which was representative for residents of Germany and conducted in 2008 indicated that even though 62% of the participants owned a cellular handset with the technical capability to access MI, only 12% of these individuals had effectively used this capacity.[7] In addition, the use intensity of quite

1 tns infratest (2009), p. 6.
2 Kim et al. (2008), p. 109; Verkasalo (2008), p. 40.
3 The ITU sets this indicator as "subscriptions to mobile cellular networks with access to data communications (e.g., the Internet) at broadband speeds (here defined as greater than or equal to 256 kbit/s in one or both directions) … irrespective of the device used to access the Internet" (ITU (2009), p. 79).
4 ITU (2009), p. 79.
5 ITU (2009), pp. 93-94.
6 Minges (2005); Funk (2007).
7 Mohr (2008), p. 12.

a few MI customers is shallow, and a considerable share of customers even completely ceases to use MI after its initial adoption.[8]

Nevertheless, MNO continue to set their hopes on MI as a market arena with high subscriber and revenue growth potentials.[9] Taking into account these growth aspirations and the MI "utilization gaps" illustrated above, a thorough understanding of why MNO voice customers expand their demand to innovative MI offerings or refuse to do so, is evidently of pivotal interest for both MNO managers involved in their firms' MI strategy development and scholars working in the fields of innovation, information technology (IT) management, or consumer psychological foundations of marketing. Thus, it should not come as a real surprise that a substantial number of recent scholarly studies have attempted to empirically identify factors significantly associated with criteria suspected to capture the degree of acceptance of MI in a narrow sense or of other more or less advanced mobile data services (MDS) or devices (see section III.2.1).

From an overall research design angle this previous work may be systematized depending on whether it did not or did deliberately compare MI attribute perceptions and acceptance determinants across mobile customer groups varied with respect to their adoption status. Non-comparative MI acceptance studies, i.e., "single sample investigations", may be further divided subject to whether the work focused on potential users (pre-adoption research), actual users (post-adoption research), or a "mixed" sample including both potential and effective users. Pre-adoption research typically scrutinizes potential customers' behavioral intentions to use MI in general or specific advanced/value-added MDS as dependent criteria. Current examples of this category of investigations are Chen (2008), López-Nicolás et al. (2008), Lu et al. (2008), Chen et al. (2009), Kim and Garrison (2009), and Mallat et al. (2009). Post-adoption analyses tackle with determinants of actual users' intentions to continue with MI or other more or less advanced MDS in the future. Hong et al. (2006), Bouwman et al. (2007), Lee et al. (2007), Hong et al. (2008), Kim et al. (2008), Bouwman et al. (2009), and Kuo et al. (2009) rank among recent instances of this research approach. "Mixed" sample research mainly includes dependent criteria similar to those of pre-adoption studies but occasionally goes beyond them by adding participants' self-assessment or unobtrusive objective measures of use frequencies of MI or other value-added MDS. Examples of the third kind of adoption investigations

[8] Lee et al. (2007), p. 15; Kim et al. (2008), p. 110.
[9] BITKOM (2009).

are Fogelgren-Pedersen (2005), Wu and Wang (2005), Groeppel-Klein and Koenigstorfer (2007), Turel et al. (2007), Bina et al. (2008), Verkasalo (2008), and Kuo and Yen (2009).

The second strand of research on acceptance of MI in general or specific value-added MDS in particular, i.e. the "multi-sample approach", deals with one of the following juxtapositions:

– Users compared to non-users.[10]
– Users in relation to persons who expressed at least a moderate interest to adopt the new mobile service offering in the future (= potential users/ adopters) or to averse individuals who explicitly stated little or no interest in using the service innovation under study in the future.[11]
– Adopters who effectively continued to use MI or reported increases in their use intensity after the first-time adoption compared with users who actually completely stopped to use the focal service or reported negative utilization changes after their first-time recourse to the mobile offer.[12]

The overwhelming majority of earlier work falls within one of the three sub-types of the first thread of research. In contrast, only five comparative multi-sample studies exist which compared MI attribute perceptions of actual users with those of potential adopters, or differences and similarities between both groups with regard to *relationships* between such perceptions, on the one hand, and phase-specific MI acceptance criteria, on the other hand. Unfortunately, these investigations suffer from five limitations. First, three of them do not cover a broad assortment of MI utilization options, but are confined to commercial transactions conducted by means of a cellular network[13] or to the multimedia message service.[14] Second, with the exception of Westlund and Bohlin (2008), multi-group MI or MDS studies either contain no dependent acceptance measures at all[15] or incorporate only use continuance intentions of adopters as "ultimate" dependent criteria.[16] Hence, post-adoption stated use intensity measures have not been considered by the comparative research stream although several single-sample investigations reveal that such frequency self-ratings are suited to

[10] Hsu et al. (2007); Lee/Jun (2007); Westlund/Bohlin (2008); Kim et al. (2009).
[11] Anckar et al. (2003).
[12] Kim et al. (2008); Lee et al. (2008).
[13] Anckar et al. (2003); Lee/Jun (2007).
[14] Hsu et al. (2007).
[15] Anckar et al. (2003).
[16] Hsu et al. (2007); Lee/Jun (2007); Kim et al. (2009).

support the generation of additional insights concerning MI acceptance dynamics following the initial service adoption.[17] This omission is regrettable because for MNO the profitability of their MI offerings is not only affected by the time span during which their customers continue to use MI, but is probably at least shaped to the same extent by the MI access frequency of their customers.[18]

Third, MI and advanced MDS studies have almost invariably relied on the "Technology Acceptance Model" (TAM)[19] or diffusion of innovations (DOI) concepts[20] to identify factors which may explain acceptance differences within samples of actual and/or potential adopters. On the other hand, factors which may be derived from other supplementary theoretical perspectives have been widely ignored. Fourth, previous work implicitly or explicitly assumed that MI is accessed only through "smart" handsets. However, there is evidence suggesting that recent MI subscriber growth has been sparked to a large extent by the advent of hard- and software promoting the application of laptops in order to access MI.[21] Hence, it is important to clarify to what extent earlier findings on MI acceptance and its determinants also hold for customers who use laptops instead of smart handsets as their primary appliance of choice to obtain MI access.

Finally, with the exception of just one mixed single sample study which confined itself to a cellular-based mobile parking reservation and payment service[22] no work on MI or MDS acceptance of customers in Germany has been published, although that Germany is the largest national mobile communications market in terms of subscribers and revenues throughout Europe. This lack of MI studies concentrating on Germany is problematic in that cultural differences between Germans and residents of other countries in which previous MI or MDS surveys took place (mostly Korea, Taiwan, China, Singapore, North America, Finland, Sweden, Netherlands) raise doubts whether extant findings may be generalized without qualification to Germany.[23]

[17] Fogelgren-Pedersen (2005), p. 4; Pedersen (2005), p. 212; Wu/Wang (2005), p. 723; Groeppel-Klein/Koenigstorfer (2007), p. 82; Turel et al. (2007), p. 67; Bina et al. (2008), p. 301; Lee et al. (2008), p. 4; Bouwman et al. (2009), pp. 308-313.

[18] Kollmann (1998), pp. 9-19.

[19] Davis (1989); Davis et al. (1989).

[20] Rogers (2003).

[21] tns infratest (2009), p. 6.

[22] Groeppel-Klein/Koenigstorfer (2007).

[23] Lee et al. (2007).

In light of the paucity of multi-group research on MI or MDS acceptance and of its shortcomings the present study aims at making three contributions to the literature. First, it provides an empirical examination of differences between actual and potential German-speaking MI users concerning their perceptions of MI attributes and the relationships between such perceptions and adoption-phase specific acceptance criteria. Second, it goes beyond TAM- and DOI-based MI or MDS analyses by integrating further supplementary potential determinants of MI acceptance deduced from a theoretical perspective that was neglected in past MI acceptance research. Third, it explores the extent to which MI attribute perceptions and attribute–acceptance criteria relationships vary as a function of the category of appliances (smart handsets compared to laptops) which customers use to access MI.

These contributions are not only important from a scholarly point of view. Rather, they have also considerable ramifications for MNO managers. The contributions may support practitioners in developing differentiated marketing programs effectively addressing either actual MI users or potential MI adopters equipped with distinct appliance categories or in consciously sticking to homogeneous strategies if no group differences were identified.

The remainder of the paper is structured into five sections. The next section reviews earlier studies to specify basic theoretical concepts and to develop my hypotheses and research questions. Section III.3 describes the empirical methods followed by results in section III.4. Section III.5 discusses my findings as well as their practical and theoretical implications. Section III.6 highlights directions for future research arising from the limitations of my work.

III.2 Specification of basic concepts, hypotheses, and research questions

III.2.1 Mobile Internet

MI is a shimmering and fuzzy phenomenon which scholars and practitioners define in a large variety of ways. Some authors[24] 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-

[24] E.g., Yoo/Moon (2006), p. 577; Lee et al. (2007), p. 12; Shin (2007), p. 476; Song et al. (2007), p. 14; Verkasalo (2008), p. 40.

CDMA/UMTS, CDMA-2000). However, the majority of pertinent publications agrees that it is most appropriate to characterize MI in a less extensive sense as follows: MI encompasses the packet-switched and Internet Protocol (IP) based access to a broad assortment of advanced or value-added data services (e.g., web browsing, e-mail, video streaming) through 2.5G or 3G cellular mobile communication networks with high transmission speeds.[25] This definition does not differentiate between MI *services* and mobile *bearer solutions* (e.g., EDGE). Instead, it treats them as a holistic bundle because from an MNO customer perspective MI access and services are components of an offer which may create value for the consumer only if the elements are inextricably intertwined.[26] MI tries to provide the same "look and feel" as wired Internet access solutions at fixed locations (DSL, cable modem, telephone line 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 anytime and anywhere ("ubiquitous communication") even while being on the move.

This study confines itself to MI services accessed by customers of cellular 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. Second, compared to other Internet access platforms, especially from a customer standpoint, MI is unique and novel because 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 cross-sectional enabling hard- and software technologies. They create the foundation for a wide range of communication, information content, entertainment, and commercial transaction services which may be applied both for private or business purposes. MI is *not* identical with but rather a subset of MDS which the literature also occasionally labels as "advanced" or "value-added" mobile non-voice services.[27] MDS do not only cover IP-based delivery of appli-

[25] Minges (2005), p. 114; Groeppel-Klein/Koenigstorfer (2007), p. 73; Kim et al. (2007), p. 113; Lee et al. (2007), p. 12; López-Nicolás et al. (2008), p. 359; Bouwman et al. (2009), p. 302; ITU (2009), p. 79.

[26] Hong/Tam (2006), p. 164.

[27] E.g., López-Nicolás et al. (2008), p. 359; Kuo et al. (2009), p. 887.

cations known from the conventional Internet but additionally the entirety of more or less established variants of text messaging and WAP-based applications delivered by MNO.[28]

III.2.2 Theoretical perspectives on MI attributes as determinants of MI acceptance

Similar to the MI notion, the construct of individual acceptance of innovative goods by customers has also been variably specified in the literature. In line with many authors,[29] I define *customer acceptance* as a broad concept which encompasses three consecutive facets. First, continuously scalable *use intentions* for an innovative offering *before* its first application; second, the first-time, dichotomously-scaled actual use (= adoption); third, post-adoption sustained use intensity behaviors or use continuation intentions which also both are steadily scalable variables. Factors potentially influencing the various acceptance facets may be grouped into personal demo- and psychographic characteristics (e.g., gender, innovativeness), on the one hand, and innovation attributes as perceived by potential or effective users of the novel good, on the other. The present investigation accentuates the second group of potential determinants.

III.2.2.1 Technology Acceptance Model and Diffusion of Innovation concepts

Previous scholarly contributions have typically referred to the TAM or concepts originating from studies on DOI as conceptual frameworks in order to identify MI attributes which may explain MI acceptance variance among residential or business customers of MNO. The TAM was originally developed to improve the understanding of employee IT usage in organizational contexts,[30] but later extended to the acceptance of mobile communication services among consumers. The TAM posits that perceived usefulness (which is similar to the construct of customer value) and ease of use (similar to the construct of usability) of new technology-intensive goods are the two most important attributes of innovative offerings to explain each of the three aforementioned facets of customer acceptance. To date, a very large body of empirical research has found the two explanatory core constructs emphasized in the TAM to be significantly positively

[28] Bina et al. (2008), p. 297; Hong et al. (2008), p. 432; Lee et al. (2008), p. 1; Kuo et al. (2009), p. 887.

[29] E.g., Agarwal/Prasad (1997), p. 566; Kollmann (1998), pp. 67-71; Karahanna et al. (1999), p. 184; Groeppel-Klein/Koenigstorfer (2007), p. 73.

[30] Davis (1989); Davis et al. (1989).

related to various MI or MDS acceptance measures.[31] Nevertheless, the TAM has been criticized as being too parsimonious in regard to the attribute dimensions incorporated and, in some respects, tautological.[32]

Therefore, a smaller number of MI and MDS researchers have solely taken up concepts summarized in the seminal work of Rogers (2003), which stem from studies on relationships between perceived attributes of innovations and the rate as well as speed of their market diffusion.[33] In addition, some other investigators supplemented their TAM-based design by a few MI or MDS attributes derived from the DOI literature.[34] In essence, DOI-rooted work proposes that a set of five attributes of innovations, in general, and of MI or MDI as examples of innovations in the field of telecommunications, in particular, significantly and positively influences the acceptance of such novel offerings. These attributes are:[35]

– *Relative advantage*: This construct deals with the degree to which an innovation is assessed as superior over other already established goods that may fulfill similar functions as the new offering.
– *Compatibility*: This attribute gauges the extent to that individuals believe that a new good complies with their values, previously developed habits and past experiences.
– *Lack of complexity*: This property reflects the degree to which persons are convinced that an innovation can be understood with little effort and therefore can be used without difficulties.
– *Communicability*: This characteristic refers to the degree of simplicity which users of an innovation note when they demonstrate benefits of a new good to their social reference groups and thus make the results of the novelty observable for others.
– *Trialability*: This feature captures the degree to which individuals think that they have the opportunity to experiment with an innovative offering on a

[31] E.g., Cheong/Park (2005); Pedersen (2005); Wu/Wang (2005); Hong/Tam (2006); Hong et al. (2006); Groeppel-Klein/Koenigstorfer (2007); Kim et al. (2007); Lee et al. (2007); Lee/Jun (2007); Shin (2007); Bina et al. (2008); Chen (2008); Hong et al. (2008); Kim et al. (2008); López-Nicolás et al. (2008); Lu et al. (2008); Verkasalo (2008); Kim et al. (2009); Kim/Garrison (2009); Kuo et al. (2009); Kuo/Yen (2009); Mallat et al. (2009).

[32] Lu et al. (2003), p. 207; Pedersen (2005), pp. 206-207; Bouwman et al. (2007), p. 149; López-Nicolás et al. (2008), p. 360. See also article V in this book.

[33] Brown et al. (2003); Hsu et al. (2007); Chen et al. (2009).

[34] Wu/Wang (2005); Chen (2008); Kim et al. (2008); Mallat et al. (2009).

[35] Tornatzky/Klein (1982), pp. 33-39; Agarwal/Prasad (1997), p. 562; Karahanna et al. (1999), p. 188; Rogers (2003), pp. 221-266; Hsu et al. (2007), p. 717; Chen et al. (2009), pp. 242-243.

limited basis before they decide about their commitment to adopt the novelty.

Although the TAM and DOI frameworks have different origins, they show close resemblances with regard to two constructs. First, the relative advantage concept of the DOI framework is largely identical with the usefulness factor in the TAM. Second, the complexity attribute (or the absence of this property) picked up in the DOI literature may be viewed as being congruent with the ease of use idea emphasized in the TAM.[36] Hence, it may be argued "that the constructs employed in TAM are fundamentally a subset of the perceived innovation characteristics"[37] which are discussed in the DOI literature.

Given the more comprehensive nature of the DOI-based attribute set compared with the two TAM core constructs and also in line with the observations which Fogelgren-Pedersen (2005, p. 2) reported in her study on determinants of MI acceptance, the hypotheses and research questions of the present work were mainly geared to the DOI attribute framework. Previous MI and MDS research indicates that individual perceptions concerning the relative advantage, lack of complexity and compatibility of MI or advanced MDS offerings are the most constant explanatory factors associated significantly and positively with stated intentions to use MI or MDS in the future among non-adopters and stated intentions to continue using these novelties in the future among (initial) adopters.[38] Thus, the findings concerning relative advantage and lack of complexity completely agree with the results of MI or MDS researchers who employed the TAM as their conceptual framework. In addition, there also is, albeit less extensive, evidence from which it may be concluded that communicability and trialability are likely to be further significant predictors of MI or MDS use intentions.[39] Thus, the following hypothesis (H) is posited:

H_1: Perceived relative advantage, compatibility, lack of complexity, communicability, and trialability of MI offerings, respectively, have significantly positive effects on MI acceptance.

[36] Agarwal/Prasad (1997), p. 562; Wu/Wang (2005), p. 721; Chen (2008), p. 38; Mallat et al. (2009), p. 191.

[37] Wu/Wang (2005), p. 721.

[38] Brown et al. (2003), p. 390; Wu/Wang (2005), p. 726; Hsu et al. (2007), pp. 720-721; Chen (2008), pp. 44-45; Kim et al. (2008), pp. 119-121; Chen et al. (2009), p. 245; Mallat et al. (2009), p. 194.

[39] Agarwal/Prasad (1997), p. 571; Karahanna et al. (1999), pp. 196-197; Hsu et al. (2007), p. 721; Chen et al. (2009), p. 245.

The DOI framework, but also consumer psychology theories contain the notion that a better understanding of the acceptance of innovative offerings is obtainable by taking into account time-related differences and changes in individual attribute perceptions across various phases in the innovation acceptance process.[40] The implications of this general finding are twofold.

First, this line of dynamic reasoning suggests that actual and potential adopters are likely to differ in their perceptions of MI attributes. In turn, there are three explanations for the first implication. First, MI users may rate MI attributes more favorable because it were just these positive assessments which had caused their decision to make full use of MI as the best course of action available (see H_1). Second, MI users may additionally and unconsciously increase their pre-adoption service evaluations after adoption in order to reduce cognitive dissonances which would be triggered by a misfit between their monetary and non-monetary (MI) selection and utilization costs on the one hand and their MI attribute assessments on the other hand. Finally, a self-selection bias may work because individuals who initially adopted MI but whose service value expectations were not met, discontinue their MI use. Therefore, dissatisfied MI users with strongly negative MI attribute perceptions are underrepresented in research samples which incorporate MI adopters.[41]

Unfortunately, most earlier work emphasizing dynamic aspects of MI acceptance limited itself to the post-adoption phase. In essence, these post-adoption studies have found out that besides perceptions of TAM- or DOI-derived MI or MDS attributes current use intensity is a strong predictor of adopter intentions to continue the use of MI or MDS in the future.[42] To the best of my knowledge, there are just four MI or MDS studies which directly compared service perceptions as a function of the adoption status of an individual.

Anckar et al. (2003) reported findings of a mail survey of Finnish consumers in 2002. They grouped their respondents into effective MI adopters (n = 66), participants with no MI use experience but with an at least moderate stated intention to use MI in the future (= “intended adopters”; n = 164), and MI averse who were defined as non-adopters with no or a very low interest in future MI use (n = 184). MI attribute perceptions of adopters compared to intended adopters were mostly not significantly different, whereas perceptions of MI averse were gener-

[40] Karahanna et al. (1999), pp. 187-189; Hsu et al. (2007), p. 717.
[41] Hong et al. (2006), pp. 1820-1828; Kim et al. (2009), p. 8529.
[42] Hong et al. (2006); Bouwman et al. (2007); Hong et al. (2008); Bouwman et al. (2009).

ally significantly less favorable than in the two other groups. Hsu et al. (2007) conducted an online survey of 207 residents of Taiwan to explain the adoption of multimedia message service (MMS). They detected that MMS adopters "have more positive perceptions of MMS" (p. 722) than individuals who claimed that they do not (yet) use MMS. This observation is in line with findings on differences in DOI-based property perceptions for fixed broadband access between users and non-users of such services[43] and on perception differences between adopters and non-adopters of various IT applications.[44] In a mail survey of 764 Swedes, which took place in 2007, Westlund/Bohlin (2008) found that MI perceptions of participants who reported a "monthly" MI use frequency tended to be less advantageous than those of respondents who had "never" used MI. Finally, the study of Kim et al. (2009) which incorporated 542 Korean students showed that, compared to non-adopters, MI adopters' attribute perceptions for MDS were more favorable with regard to lack of complexity, but less positive in terms of relative advantage.

Indirect evidence on presumable perception differences between MI or advanced MDS users compared to non-adopters may be taken from three studies which longitudinally tracked changes in user perceptions of mobile services. Two investigations[45] revealed that such perceptions became more positive as customers effectively gained MDS use experience, whereas one analysis[46] observed exactly the opposite. Lastly, further indirect evidence may be derived from several investigations which included both actual users and potential adopters of MI or MDS.[47] These studies suggest that MI or MDS attribute assessments significantly affect a subject's behavioral intention to use a mobile service in the future, which in turn has a strong impact on various acceptance measures. In conjunction with the studies' sample composition these indirect attribute effects on MI or MDS acceptance imply that non-adopters perceive MI attributes less beneficial than effective users.

All aspects considered, based on theoretical considerations and the available few relevant empirical findings, the following hypothesis is proposed:

[43] Dwivedi (2008), p. 141.
[44] Karahanna et al. (1999), p. 195.
[45] Junglas (2007); Tsai et al. (2009).
[46] Blechar et al. (2006).
[47] Wu/Wang (2005); Groeppel-Klein/Koenigstorfer (2007); Turel et al. (2007); Bina et al. (2008); Verkasalo (2008); Kuo/Yen (2009).

H_2: Attribute perceptions (relative advantage, compatibility, lack of complexity, communicability, and trialability) of MI offerings are more favorable for actual users than for potential adopters of MI.

The second implication of the introduction of a temporal perspective to the analysis of MI acceptance is that *relationships* between attribute assessments on the one hand, and use interest among potential adopters or use intensity among effective adopters as phase-specific MI acceptance indicators, on the other hand, may differ between the groups of potential and actual MI customers.

Accordingly, various authors assert that "antecedents of continued information technology usage can be quite different from the antecedents of initial adoption"[48]. The explanation for this proposition is that effective users should have very vivid impressions of MI attributes based on their first-hand application experience. In contrast to this, potential MI adopters have to rely on factual information disseminated by the mass media or by their personal social contacts, i.e., they form their MI assessment on the basis of "indirect experience". Karahanna et al. (1999) and Kim et al. (2009) noted that user perceptions formed on the basis of direct use experience are better predictors of actual (post-adoption) use behaviors or continuation intentions than assessments formed on the basis of indirect experience. A first reason for these differential impacts is that information obtained through personal MI use experience enables the customer to evaluate MI more clearly and confidently. A second explanation is that direct experience leads to the formation of an assessment that is more readily accessible in memory, which, in turn, results in stronger relationships between attribute perceptions and acceptance measures.

I located four studies which contain empirical evidence related to the preceding arguments. Hsu et al. (2007) ran two separate regressions explaining intention to use MMS in the future by various DOI- and TAM-based attribute perceptions for MMS users and for potential MMS adopters. A slightly higher share of variance in intent to use was explained for the effective adopter group compared to the potential adopter group. Both groups differed with regard to some of the factors which had emerged as significant predictors in the regression. In a survey of 394 Korean mobile phone users, Lee/Jun (2007) detected that a set of three TAM-based attribute perceptions better explained participants' intention to

[48] Hong et al. (2008), p. 432; for similar views cf. Fogelgren-Pedersen (2005), p. 8; Hong et al. (2006), p. 1820; Constantiou (2009), p. 280; Kim et al. (2009), p. 8529.

engage in commercial transactions over a cellular network for subjects with actual mobile commerce experience than for respondents without such experience. Kim et al. (2009) reported that MDS acceptance was better predicted by TAM-based explanatory constructs for subjects who had adopted MDS than for non-adopters. Lastly, in a sample of 230 PC users in a financial institution, Karahanna et al. (1999) found that attribute perceptions of a new software package were better indirect predictors of intentions to start or to continue the use of the software for individuals who were already working with the program than for respondents who were not (yet) using the package.

Thus, taking into account the conceptual arguments and the previous, albeit scarce, empirical findings, it is expected that the following hypothesis holds in the MI context:

H_3: MI attribute perceptions have significantly stronger effects on MI acceptance criteria for actual MI users than for potential MI adopters.

III.2.2.2 Information economic concepts

Previous scholarly contributions have almost invariably studied individual perceptions and behaviors referring to MDS in general and MI in particular under the lens of the TAM or of DOI concepts. Therefore, taking other theoretical avenues may further enhance the understanding of MI acceptance. One such supplementary approach can be seen in the application of information economic concepts in the context of MI acceptance. In principle, this strand of economic research examines impacts of information availability among buyers and sellers, as well as of information asymmetries between them with regard to quality properties of goods on buyer and seller decision-making processes and resulting customer and supplier behaviors both at the micro (individual) and macro (market) levels. Based on Nelson (1970), and Darby/Karni (1973), information economic (IE) work posits that purchase decisions are significantly affected by the extent to which a category of goods (such as MI access and services) is characterized by the presence of search, experience, and credence attributes or qualities, respectively.

Search qualities relate to attributes of goods which can be evaluated by potential buyers before the effective procurement decision is made. Price, maximum connection speed, or length of contract are three examples of search qualities of MI because it requires relatively little effort to inspect MI offerings of MNO in

terms of these attributes before selecting one of them or none at all.[49] *Experience qualities* are features which can typically be assessed only after a good has been bought by actually using or consuming it over an extended time span. With regard to MI connection stability or average download speed perceived in certain application contexts (e.g., train ride) or the usability of the MI application interface implemented on a mobile device may be taken as examples of experience qualities. *Credence qualities* are attributes of goods which a customer is unable to assess properly (without unduly high information collection and interpretation efforts) both before as well as after a purchase decision. The extent to which an MNO ensures that customer privacy is secured in conjunction with MI use or that customers' MI data transfer volumes are recorded and billed accurately may be classified as instances of credence qualities of MI offerings. A product or service ought not to be categorized only nominally by its predominant quality property because most goods simultaneously always incorporate to some extent search, experience and credence features. Therefore, it is more adequate to profile goods in terms of their IE characteristics by noting the complementary shares of the various classes of quality properties which consumers assign to the category of goods under consideration.

The literature hypothesizes that telecommunication services in general are goods for which the experience qualities share is higher than the shares of search and credence attributes.[50] According to Beckert et al. (2005, p. 2) and Bach (2008, pp. 100-101), the preponderance of experience qualities in relation to search and credence properties should hold in particular for *fixed* broadband access offerings. Bach (2008) tested this conjecture in an online survey of 365 German-speaking university students and employees in 2007. Contrary to his proposition, Bach (2008, pp. 179-183) detected that the mean share of perceived search characteristics of fixed broadband offers amounted to 36.7%, which was significantly higher than the mean experience quality (31.4%) and credence attribute (31.9%) percentages. This unexpected result may be explained by noting that in 2007 fixed broadband was no longer a truly innovative offering in Germany, in general, and for most respondents in the sample. In fact, Bach (2008, pp. 185-186) reported that participants who did not have fixed broadband access at home rated the experience and credence quality shares for this good significantly higher than those subjects who were already subscribers of fixed broadband. Thus, taking into account that in Germany actual MI spread was much lower

[49] Bach (2008), p. 82.
[50] Hellwig et al. (2001), p. 128; Welfens et al. (2005), pp. 79-80.

than fixed broadband dissemination at the time of my data collection and in line with the IE assessment of MDS attributes by Bina/Giaglis (2007, p. 243), I propose the following two hypotheses:

H_4: The perceived share of experience qualities of MI offerings is significantly higher than the assessments of their search and credence property proportions, respectively.

H_5: Potential MI adopters of MI rate the experience and credence quality shares, respectively, significantly higher and the search property share of MI offerings significantly lower than actual users of MI.

Customer perceptions of search, experience and credence quality shares of MI offerings may be interpreted as proxies for the uncertainties consumers feel when they face the decision whether to accept an MI offer or not.[51] Generally, a good is the more likely to be (re-)purchased the more prospective buyers are convinced that they are able to adequately evaluate its functional (= quality) features. Therefore, subjective assessments of the share of the three types of quality properties suggested in the IE literature should be significantly correlated with MI acceptance criteria. More specifically, it is plausible that higher shares of perceived search properties and lower shares of perceived experience and credence qualities, respectively, coincide with higher MI acceptance levels. Notwithstanding this general trend, MI quality assessments of MNO customers who are not yet MI users are likely to be more strongly associated with their intention to adopt MI than the perceptions of actual MI users are linked to their MI use behaviors. This should hold because after the initial adoption, MI-related quality uncertainty assessments ought to be less important for MI use behaviors compared to first-hand application experience and other factors.[52]

Based on the preceding arguments it is expected that the following two hypotheses hold in an MI context:

H_6: The perceived search qualities share of MI offerings has significantly positive, and the assessments of their experience as well as credence attribute shares, respectively, have significantly negative effects on MI acceptance.

[51] Bach (2008), pp. 122, 143-144, 187-188.

[52] E.g., communication need satisfaction, fit between discretionary income, and expenses caused by MI; cf. Karahanna et al. (1999), pp. 188-189.

H_7: MI quality properties perceptions have significantly stronger effects on MI acceptance for potential MI adopters than for actual MI users.

III.2.3 Role of MI customer appliance category

The preceding analysis implicitly posited that the category of appliance which customers use or prefer to obtain cellular-based access to the Internet is of negligible importance in explaining MI acceptance. This procedure perfectly agrees with extant research on MNO customer perceptions and behaviors toward MI or advanced MDS. In contrast, many industry practitioners and consultants strongly emphasize that capabilities and usability of mobile devices have strong impacts on MI acceptance. They assert that a better understanding of the nature and speed of future MI diffusion patterns may be obtained by differentiating between customers who primarily (prefer to) access MI through "smart" handsets/phones or via laptops, the latter being sometimes also labeled as netbooks, mini-notebooks, or pocket PCs.[53] Main laptop variants for MI access are appliances with an embedded data modem or an external USB modem (i.e., a "dongle" or "stick") or solutions which utilize a customer's cellular handset as a modem to connect the portable computer to the MI.

Opinions diverge whether the latest and future growth in MI subscriber numbers was and will be triggered more by advanced handsets, such as *Apple*'s famous *iPhone*, or by small laptop variants.[54] However, there is unanimous agreement that smart handsets and laptops are two MI access device categories which differ substantially. Distinguishing features include weight and physical dimensions, size, resolution and touch sensitivity of the display, keyboard, battery operating and standby time, data storage volume, and computing performance.[55] MI access through laptops offers large screens, easy data key-in, and a "look and feel" similar to what customers are acquainted with from their fixed PC at home or at work. In contrast, smart handsets are easy to carry and well suited for unobtrusive MI access in all kinds of everyday life situations.

To my best knowledge, only four scholarly studies empirically reflected on end-customer cellular device types in the context of MI. Bruner/Kumar (2005) found in an experimental investigation with 212 students that subjects perceived a

[53] Königstorfer (2008), pp. 4-5; Seider et al. (2008), pp. 4-5, 9-10.

[54] See Seider et al. (2008), pp. 9-10; Microsoft (2009), pp. 17, 19 compared to BITKOM (2009), p. 2; tns infratest (2009), p. 6.

[55] Kivi (2007), p. 11; Königstorfer (2008), pp. 4-5, 152-154.

"dumb" cellular phone as being significantly less easy to use than a smart PDA in accessing the Internet. Carlsson et al. (2005) observed in a sample of 383 Finnish consumers that the number of MI services used by cellular customers was correlated with the technical capabilities of their handset. In an experimental study of 214 German students Königstorfer/Gröppel-Klein (2007) detected that MI users equipped with a laptop had more favorable MI attribute perceptions than participants who accessed MI via a smart handset. Finally, Verkasalo (2008) found in a sample of 655 Finnish consumer subscribers that MI adopters who used handsets with more advanced operating systems effectively applied several MI services (e.g., e-mail, streaming multimedia) more frequently than customers with access appliances with older and less powerful operating systems.

Obviously, since only one study directly contrasted MI attribute perceptions of laptop users or potential adopters against assessments of customers using or preferring to use a smart handset to access MI, more such comparative research is desirable. Further, the MI acceptance literature is completely silent on whether *relationships* between MI acceptance criteria and attribute perceptions vary depending on the category of appliances which a customer uses or intends to use for MI access. Hence, the present study addresses the following two research questions (Q):

Q_1: In what way do users and potential adopters of MI, respectively, differ with regard to their MI attribute perceptions as a function of the category of MI access appliance (laptop compared to handset) they use or prefer to use?

Q_2: In what way do relationships between MI attribute perceptions and MI acceptance criteria differ depending on the category of appliances which cellular communication customers mainly use or prefer to use for MI access?

III.3 Empirical methods

III.3.1 Data collection procedure

Data was gathered through an e-mail survey in June 2008 in collaboration with one of the four firms operating GSM/UMTS networks in Germany. To obtain an adequate sample, a market research company was contracted to organize the survey. This company owned a large pool of thousands of e-mail addresses and demographic profiles of residents of Germany who had previously declared that

they were principally willing to fill in questionnaires online. Criteria for randomly selecting an e-mail address of an individual from the pool were gender according to the proportion of females and males in the German population, age between 18 and 49 (primary age target group for MI sales efforts), and a share of persons with fixed broadband access at home (DSL, cable) amounting to 80%. The last criterion was chosen because these addresses have to spend less time to fill in the instrument via the Internet than narrowband dial-up households.

As the cooperating MNO intended to use parts of the survey as a means to better understand its own customers, a 40% share of subjects who were subscribers of the focal MNO was deliberately admitted although its SIM card share in Germany was only around 13% in mid 2008.[56] Supplementary analyses with a smaller subsample of respondents who were distributed across the four German MNO proportionate to the operators' SIM card shares in the total market in mid 2008 revealed that the disproportionally large fraction of customers of the collaborating MNO had no substantial effect on the present study's findings. Therefore, none of the 1,502 individuals who had positively reacted to the market research firm's survey completion request were dropped from the initial sample of the present paper.

Overall, the representativeness of the present sample is probably better than for most Internet surveys recruiting participants through website banners due to the employment of an e-mail address pool which made it possible to target requests for participation exactly at individuals whose characteristics fit with the sample structure requirements. Nevertheless, respondents are still self-selected and, therefore, may be interested in mobile communications or MI issues to a larger extent than the average German MNO customer.

Participants who used the hyperlink contained in the e-mail to enter the online survey system were first informed that the subject of the study was MI. Then, MI was explained as access to services or contents known from the fixed Internet (e.g., browsing, e-mail) through a mobile handset or a laptop with a cellular modem. The survey tool was programmed such that the length of the questionnaire and questions partially varied depending on whether a participant reported that (s)he already was an MI user or not.

[56] Cf. Gerpott (2009), p. 38.

Before conducting the main data collection, this study's questionnaire was pretested in interviews with five experts working in the product management unit of the MNO which supported the study. The initial survey content was modified according to the suggestions of the experts. The revised questionnaire was administered to a pilot group composed of 10 MI adopters and 10 MI non-adopters. These individuals commented on the clarity of the item wording and the length of various parts of the instrument. Lastly, they were invited to give other suggestions on how the questionnaire could be improved. The recommendations of the pilot test were consulted in the development of the final instrument for the large-scale survey.

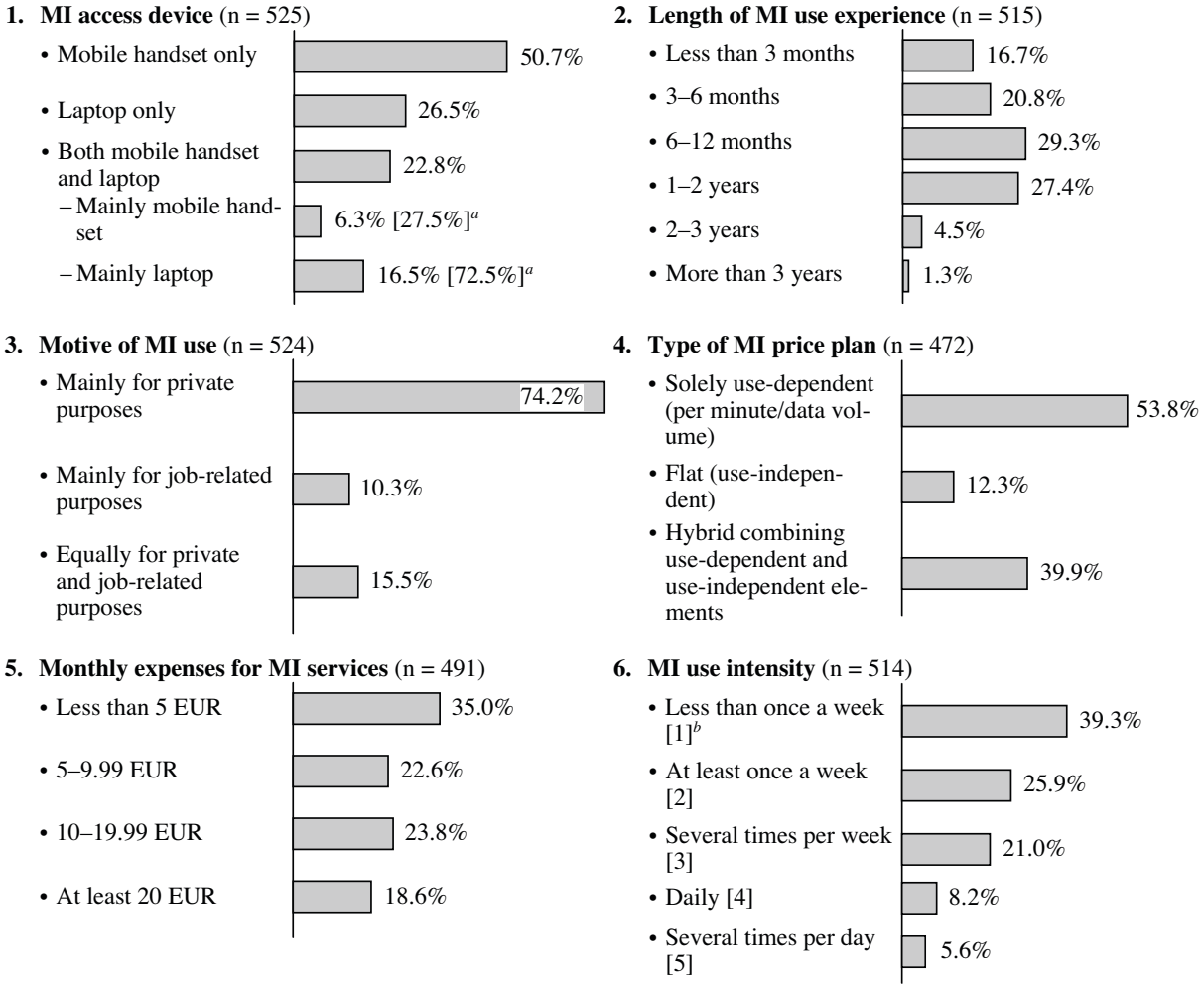
III.3.2 Respondent characteristics

35% of the 1,502 respondents claimed that they already were *MI users*. As shown in Figure 1, 50.7% of the 525 effective MI users only employed their cellular handset to obtain MI access, 26.5% only referred to a laptop and 22.8% used both devices. 64.8% of the actual MI adopters reported an MI use experience of less than one year which reflects the fast MI customer growth observed in Germany since 2007.[57] 74.2% of the adopters said that they mainly used MI access for private purposes. Just 12.3% had a comprehensive flat rate for MI access. 57.6% of the effective users stated that their current average monthly expenses for MI were below the 10 Euro threshold. In conjunction with the rare occurrence of flat rates in the sample this may be taken to indicate that MI use intensity among participants was not very high. This is corroborated by the distribution of the answers to a question, which asked respondents to estimate their current MI use frequency: Just 13.8% used MI at least once a day. MI monthly expense and use frequency responses were significantly correlated (*Pearson r* = 0.62; *Kendall* τ*–b* = 0.56; $p \leq 0.001$; n = 483) which may be taken as an indication of a by and large satisfactory "face validity or accuracy" of the subjects' answers to these two questions (see also section III.3.3. below).

65% of the total number of participants stated that they have not (yet) had access to the Internet through a cellular device/an MNO. Out of this subgroup of 977 individuals, 87.1% indicated that they had already heard about the option to access the Internet via cellular networks. 63.5% of the 851 non-users with knowledge about the MI access possibility rated their general interest to use MI on a continuum from 1 (= "no interest at all") to 10 (= "very strong interest") with a

[57] tns infratest (2009), p. 6.

Figure 1: Characteristics of actual MI users in the study



a) Figure in squared brackets is the fraction for the "mainly mobile handset" or "mainly laptop" respondents in the subsample of participants who use both devices for MI access.
b) Figure in squared brackets indicates coding of answer category for correlation analyses reported in Table 5.

score of at least 5. This subsample of 540 respondents with a stated moderate to high interest in adopting MI in the future is labeled as the group of *potential (MI) users* or adopters in the remainder of this article. Based on the preceding classification of subjects either as actual or as potential MI users, 437 participants remained who had either only weak interest in MI or who stated that the MI notion was not known to them. The third subsample may be characterized as "MI averse". Table 1 profiles the three groups – actual MI users, potential MI users and MI averse – in terms of the variables gender, age, and main Internet access technology at home. Compared to the subsamples of potential MI users and MI averse participants, actual MI users tended to be male and not older than 39 years. The MI averse subsample contained a relatively high share of persons who used a narrowband technology at home to obtain Internet access. Overall,

Table 1: Comparison of demographic characteristics and Internet access technology at home across three MI acceptance subsamples

Variable	MI acceptance subsamples[a]		
	Actual MI users (n = 525)	**Potential MI users** (n = 540)	**MI averse** (n = 437)
1. Gender: Proportion female	$42.7\%_{x}$	$50.6\%_{y}$	$62.2\%_{z}$
2. Age			
• Proportion 18–29 years	$33.3\%_{[x]}$	31.5%	$27.9\%_{[y]}$
• Proportion 30–39 years	$38.7\%_{[x]}$	$33.5\%_{[y]}$	36.2%
• Proportion 40–49 years	$28.0\%_{x}$	$35.0\%_{y}$	$35.9\%_{y}$
3. Main Internet access technology at home			
• Broadband DSL/cable TV modem	$82.1\%_{x}$	$86.3\%_{y}$	$69.1\%_{z}$
• Narrowband analog/ISDN modem	$11.4\%_{x}$	$13.3\%_{x}$	$30.7\%_{y}$
• Other technology (satellite or MI)	$6.5\%_{x}$	$0.4\%_{y}$	$0.2\%_{y}$

a) Percentage values with varying subscripts (x, y, z) without (in squared) brackets differ significantly at $p \leq 0.05$ (0.10) in a pairwise two-tailed χ^2-test.

the profile of German actual MI adopters in Table 1 is similar to findings on demographic characteristics of effective MI users which researchers have reported for other countries such as Finland or South Korea in surveys which were conducted a few years earlier than mine.[58]

Similar to the procedure of Karahanna et al. (1999, p. 192) and Turel et al. (2007, p. 67) the group of MI averse respondents was dropped from the analyses to follow because subjects in this group were not likely to have developed stable perceptions of the MI attributes addressed in the present study. Thus, 525 MI adopters and 540 potential MI users constitute the groups investigated in the remainder of this work.

III.3.3 Variable measurements

The survey instrument was structured into an introductory explanation of MI followed by two major sections. The first section primarily contained factual questions about a participant's gender, age, current MNO, and type of Internet access at home. Further, respondents were invited to indicate whether they at least occasionally use MI in order to distinguish adopters (answer = "yes") from non-adopters (answer = "no"). For MI adopters, the first section also included a question concerning their predominant appliance category (mobile handset compared to laptop) used for MI access. For non-adopters, the first part incorporated

[58] E.g., Fogelgren-Petersen (2005); Wu/Wang (2005); Hong/Tam (2006); Hsu et al. (2007); Westlund/Bohlin (2008); Kim/Garrison (2009).

two questions addressing whether the respondent had already heard about MI (answer categories: "yes" or "no") and the degree to which the subject stated to be interested in using MI in the future on a 10-point *Likert*-type answer format (ranged from "no interest at all" coded as 1 to "very strong interest" coded as 10). These two questions were applied to distinguish potential MI adopters from MI averse participants as explained in section III.3.2. Potential MI users were also prompted whether they preferred a mobile handset to a laptop for MI access or vice versa.

The second main section of the questionnaire encompassed items to measure MI attribute constructs derived from the DOI or IE literature. These items were developed from previously studied and validated measures. They were carefully adjusted to the MI setting of the present investigation. For DOI-based MI attributes the participants expressed their degree of a agreement with nine statements using a 10-point *Likert*-type answer continuum with end points being "strongly disagree" (coded as 1) and "strongly agree" (coded as 10). *Relative advantage*, which closely resembles the TAM-construct of usefulness, was measured through five items which covered key MI facets, namely ubiquitous online connectivity, access reliability and speed, price-performance ratio, data security and privacy protection, as well as transparent cost predictability (see Table 2). These facets were chosen because they were frequently emphasized as important elements of relative advantage or usefulness perceptions in previous MI- or MDS-related attribute operationalizations.[59] Item means and median values are provided in Table 2. At the single item level the results in Table 2 suggest that respondents were most skeptical about the MI price-performance ratio and provided the most positive ratings for the technical quality (reliability, speed) of MI connections. A principal component factor analysis of the five items yielded only one factor with an eigenvalue greater than 1.0 and with high loadings of at least 0.60 for each item. Therefore, the average of the five items was taken to measure perceived relative advantage or usefulness of MI. The *Cronbach* α internal consistency reliability for this scale reached a very satisfactory level of 0.86.

[59] E.g., Cheong/Park (2005), pp. 139-140; Fogelgren-Pedersen (2005), p. 5; Wu/Wang (2005), p. 723; Kim et al. (2007), p. 123; Lee et al. (2007), p. 50; Kim et al. (2008), p. 130; Lee et al. (2008), p. 5; López-Nicolás et al. (2008), p. 363; Kim/Garrison (2009), p. 331; Kuo et al. (2009), p. 891.

Table 2: *Measurement of perceived MI attributes derived from diffusion of innovation literature*

1. **Relative advantage**
   - Scale value = Average of the response values[a] for the following five statements (n = 857)
     - "MI enables me to be online anywhere and anytime" (M = 6.39; S = 2.77; median = 7.00)
     - "Connections to the MI are reliable and fast" (M = 6.55; S = 2.38; median = 7.00)
     - "The MI price-performance-ratio is adequate" (M = 5.72; S = 3.03; median = 5.00)
     - "MI is secure and my data are protected" (M = 5.95; S = 2.71; median = 6.00)
     - "I can easily estimate the monthly costs of the MI service" (M = 6.05; S = 2.98; median = 6.00)
   - Internal consistency reliability *Cronbach* $\alpha = 0.86$
   - Descriptive scale statistics: M = 6.13; S = 2.24; median = 6.00

2. **Compatibility**[b]
   - Scale value[a] = Degree of agreement to the following statement (n = 1,001): "The former Internet access at home can be cancelled"
   - Descriptive scale/item statistics: M = 3.33; S = 2.91; median = 2.00

3. **Lack of complexity**
   - Scale value[a] = Degree of agreement to the following statement (n = 969): "MI handling is easy and comfortable"
   - Descriptive scale/item statistics: M = 6.45; S = 2.49; median = 7.00

4. **Communicability**
   - Scale value[a] = Degree of agreement to the following statement (n = 972): "MI advantages can be easily explained to others"
   - Descriptive scale/item statistics: M = 5.97; S = 2.56; median = 6.00

5. **Trialability**
   - Scale value[a] = Degree of agreement to the following statement (n = 918): "One can easily and comfortably test the MI service"
   - Descriptive scale/item statistics: M = 6.05; S = 2.65; median = 6.00

a) For each statement there were 10 answer categories ranging from "completely wrong" (= 1) to "perfectly right" (= 10). Original item wording was in German and was translated into English for the present article. M = Mean. S = Standard deviation.
b) Based on Tornatzky/Klein (1982), p. 33, this characteristic was interpreted as operational compatibility in the sense of "compatibility with what people do" and *not* as value or norm compatibility.

The remaining four DOI-related MI attributes *compatibility*, *lack of complexity*, *communicability*, and *trialability* were each captured by one item (see Table 2 for the exact wording of the four items). The items were extracted from previous DOI-based work[60] and modified to better suit the MI context. The collaborating MNO insisted on adhering to this single-item measurement approach in order to keep the length of the survey within limits deemed to be reasonable for the people who would receive an invitation to participate in the study. This measurement approach may be rated as a weakness of the present study because it is an established acceptance research practice to capture perceived attributes by several items per construct. However, findings of Bergkvist/Rossiter (2007) suggest

[60] E.g., Agarwal/Prasad (1997), pp. 579-581; Karahanna et al. (1999), pp. 208-209; Hsu et al. (2007), pp. 724-725.

that for constructs that consist of a concrete singular object, such as MI, single-item measures have the same predictive validity as multi-item scales. Further, expert interviews and pilot surveys were conducted to work towards a high face validity of the present study's single-item attribute measures (see section III.3.1.). Therefore, altogether it is tenable to classify each of the four items as imperfect, but usable proxies of the underlying DOI concepts which require further validation in the future. In addition, a principal component factor analysis of the multi-item relative advantage scale and the four measures of the other DOI attributes resulted in a 5-factor-solution with each of the five measures having their highest loading on different factors. This observation suggests that the discriminant validity and the factorial structure of the five DOI-based attribute measures were acceptable.

To capture *perceived IE quality properties* of MI offerings, first an example (organic bread) was introduced which illustrated the notion of search, experience, and credence qualities for the exemplary product. This procedure followed Bach's (2008, p. 232) approach and aimed at familiarizing the participants with the various IE quality categories. Respondents were then instructed to consider the important quality properties of MI and asked: "If you have to assess the MI offering of an MNO with whom you have no prior use experience, how do you spread the total of 100% across the following categories?" (translation from German into English). The question was accompanied by three response fields in which subjects each time entered a percentage for MI quality features which can be assessed "already before the first use" (= *search qualities* measure), "only after the first use" (= *experience qualities* measure) and "not even after repeated service use" *(= credence qualities* measure). The instrument was programmed in such a way that participants were prompted to change percentage entries as long as they did not add to a total of 100%. The overall mean for both actual and potential users (n = 1,065) was 32.91% (S = 21.80) for search, 48.96% (S = 20.85) for experience, and 18.13% (S = 15.77) for credence qualities of MI offerings.

MI acceptance was differently measured for actual compared to potential MI users. Stated *MI use intensity* was chosen to reflect (behavioral) MI acceptance among adopters. Participants who had adopted MI were asked to report their typical frequency of using MI on a 5-point *Likert*-type answer format which ranged from "less than once a week" (scored as 1) to "several times per day"

(scored as 5; see variable 6 in Figure 1). As pointed out by various authors,[61] such self-reported frequency measures are reasonable indicators of relative MI use intensity. In the present adopter group, the mean of this variable amounted to 2.15 (S = 1.19; median = 2.00; n = 514).

Claimed *interest in using MI* was selected to serve as an (attitudinal) MI acceptance criterion among non-adopters. Respondents who had stated not (yet) to be an MI user were invited to react to the following question: "How would you rate your general interest to use MI?" using a 10-point *Likert*-type answer format with the end poles being "no interest at all" (coded as 1) and "very strong interest" (coded as 10). Similar measures are common in MI of MDS pre-adoption research to assess subjects' intention to use a focal service in the future.[62] The mean of this variable was 7.33 (S = 1.66; median = 7.00; n = 540) for the subjects who were classified as potential adopters according to the procedure described in section III.3.2.

III.4 Empirical results concerning the research hypotheses and questions

The results of bivariate correlation and multivariate OLS regression analyses[63] conducted to address hypotheses H_1, H_3, H_6, and H_7, as well as research question Q_2, are reported in Table 3. For actual users, the bivariate associations between the five DOI-based attribute perceptions and the MI use intensity criterion were all statistically significant at $p \leq 0.001$, as suggested by H_1. For potential users, bivariate correlations between three DOI-based MI attribute perceptions (relative advantage, lack of complexity, communicability) were significant at $p \leq 0.01$ or better, whereas bivariate associations between compatibility and trial-

[61] E.g., Agarwal/Prasad (1997), p. 567; Wu/Wang (2005), p. 723; Turel et al. (2007), p. 67; Bina et al. (2008), p. 301; Lee et al. (2008), p. 4. For a critical assessment of this standpoint see article V in this book.

[62] As recent illustrations see Chen et al. (2009); Kuo et al. (2009); Mallat et al. (2009).

[63] Covariance- or variance-centric structural equation modeling (LISREL, AMOS, PLS) was deliberately not selected as a statistical technique to analyze the present data. This deviation from the mainstream procedures in acceptance research was chosen because unidirectional cause–effect paths between various partially overlapping potential (MI) acceptance determinants posited in many structural equation papers are arbitrary due to the reciprocal, non-recursive nature of the relationships between the constructs considered as potential MI determinants (e.g., perceived MI usefulness compared to MI attitude). Hence, similar to Hsu et al. (2007), bivariate correlation and multivariate OLS regression procedures were chosen as simpler but at the same time sufficient statistical techniques.

Table 3: Associations between MI acceptance indicators and MI attribute perceptions in the actual and potential users subsamples

Variables[c]	MI use intensity (actual users)[a]			MI use interest (potential users)[b]		
	Bivariate correlation		Multivariate β-weight[d]	Bivariate correlation		Multivariate β-weight[e]
	Kendall's τ–*b*	*Pearson*'s *r*		*Kendall*'s τ–*b*	*Pearson*'s *r*	
1. Relative advantage	0.29*** (468)	0.37***	0.22***	0.16*** (381)	0.23***	0.33***
2. Compatibility	0.27*** (501)	0.32***	0.04	0.03 (489)	0.05	–0.23*
3. Lack of complexity	0.27*** (504)	0.33***	0.07	0.12*** (455)	0.14**	0.02
4. Communicability	0.25*** (498)	0.29***	0.11*	0.16*** (464)	0.18**	0.13*
5. Trialability	0.15*** (497)	0.17***	–0.13*	0.04 (411)	0.05	–0.21**
6. Search qualities share	0.02 (514)	0.01	–0.01 [–0.01]	0.04 (540)	0.08+	0.16* [0.04]
7. Experience qualities share	–0.01 (514)	0.01	0.00 [–]	–0.00 (540)	–0.03	–0.04 [–]
8. Credence qualities share	0.01 (514)	–0.03	– [–0.00]	–0.06+ (540)	–0.07+	– [–0.09]
9. Actual/preferred main MI device[f]	0.27*** (514)	0.29***	–0.01	–0.03 (540)	–0.04	–0.18*
10. Cross-product 2 x 9	–	–	0.27**	–	–	0.27*

a) Measurement of MI use intensity is explained in Figure 1, variable 6.

b) Response to the question "How would you rate your general interest to use MI?" The item was accompanied by 10 answer categories ranging from "no interest at all" (= 1) to "very strong interest" (= 10). Only respondents who scored at least 5 were assigned to the "potential users" subsample. Figure in round brackets shows the number of cases for each bivariate coefficient.

c) Details on the measurement of variables 1–8 are reported in Tables 2 and 5.

d) Based on OLS regression calculation with n = 442 (listwise deletion of cases with at least one missing value). Overall regression $R^2 = 0.225$ ($p \leq 0.001$). Figure in squared brackets is the β-weight with the experience qualities share as the quality type reference category.

e) Based on OLS regression calculation with n = 333 (listwise deletion of cases with at least one missing value). Overall regression $R^2 = 0.103$ ($p \leq 0.001$). Figure in squared brackets is the β-weight with the experience qualities share as the quality type reference category.

f) Variable 9 is coded as 1 (0) for actual users who only or mainly use a laptop (mobile handset) as their MI access device. Further, it is coded as 1 (0) for potential users who stated to prefer a laptop (mobile handset) over a mobile handset (laptop) as their most likely future MI access device.

+ $p \leq 0.10$ * $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$ (two-tailed test).

ability failed to achieve statistical significance. Thus, from a bivariate perspective H_1 was partially but not completely confirmed in the potential adopter group.

The bivariate correlations between the three IE quality property measures and MI use intensity were close to zero in the actual user group which runs counter to H_6. For potential adopters, the *Pearson*-correlations between MI use interest

and search qualities (0.08) as well as credence qualities (–0.07) were absolutely small, but still reached a marginal 10% level of statistical significance. Thus, the overall support for H_6 derived from the bivariate analysis is limited.

In light of Q_2, correlations between MI attribute perceptions and MI use intensity were compared between laptop and handset customers in the adopter group. A similar comparison was conducted for the potential users' group. The comparisons revealed that associations between attribute perceptions and MI acceptance criteria did not significantly differ depending on the MI appliance category of the subjects. The only exception was the compatibility measure. It had a significantly positive association of 0.38 ($p \leq 0.001$; $n = 218$) for laptop users, which was significantly higher ($z = 2.43$; $p \leq 0.05$) than the correlation of 0.17 ($p \leq 0.01$; $n = 283$) in the handset user group. For potential adopters with a laptop preference, the correlation between compatibility perceptions and MI use interest was 0.12 ($p \leq 0.05$; $n = 333$) which differed significantly ($z = 2.47$; $p \leq 0.05$) from the association of –0.12 ($p > 0.10$; $n = 156$) in the group of potential adopters with a handset preference. Hence for subjects who (prefer to) use a laptop to access MI the opinion that MI adoption enables them to cancel the fixed Internet access at home strongly increases MI acceptance, whereas this effect is weaker or non-existent among respondents who (prefer to) apply smart handsets as the primary mobile appliance category to access the Internet. To sum, the results indicate that the device category mostly does not moderate relations between perceived MI attributes and acceptance criteria with the exception of MI compatibility assessments in the sense of MI's perceived potential to substitute one's fixed Internet access at home.

Based on the preceding findings concerning the moderating role of an MI customer's appliance category, only one cross-product term (device category times compatibility) had to be introduced in multivariate regressions of the two acceptance criteria on MI attributes to test whether the simple correlation differences described above would still hold after partialling the effects of the other MI attribute perception measures. The regression results[64] in Table 3 show that relative advantage and communicability had significant unique effects on MI ac-

[64] There results were not detrimentally affected by predictor multicollinearity because variance inflation factors of the explaining variables 1–8 in Table 3 did not exceed 2.2, which is considerably lower than the threshold value of 5–10 recommended in the literature (e.g., Chatterjee/Price (1991), p. 191) as indicators of the problem of multicollinearity. Furthermore, robustness of the OLS regression results was checked by running ordinal regressions. The latter materially yielded the same findings. Therefore, this article only presents the OLS regression coefficients.

ceptance both for adopters and non-adopters. In the effective adopter group the compatibility measure was significantly positively associated with use intensity for laptop users but not for handset customers. This corroborates the corresponding bivariate correlation difference reported above. In the potential adopter group the perception that MI may serve as a substitute of one's fixed Internet access was significantly negatively related to MI use interest for subjects who intended to apply a handset to obtain MI access, whereas this association was close to zero for respondents who preferred a laptop as their primary MI access appliance. Again, this multivariate pattern of results is similar to the finding of the bivariate analysis reported earlier.

Trialability emerged as a significant predictor of MI acceptance in both regressions but the signs of the β-weights were negative which is contrary to what was posited in H_1.

The search qualities share achieved a significant β-weight in the regression for potential adopters in which the credence qualities were treated as the IE reference category. This means that MI use interest increased with a higher proportion of perceived MI search qualities and decreased with a higher share of perceived credence properties. This provides partial multivariate support for H_6.

All in all, the results in Table 3 clearly confirm H_1 with regard to relative advantage and communicability, but not with respect to lack of complexity (no unique multivariate effect), trialability (negative multivariate effect), and compatibility (no general positive effect, but only for laptop users). Further, H_6 receives some moderate multivariate support for the search and credence property shares, but not for the experience qualities category in the potential adopter group. For actual adopters, the findings run counter to H_6.

Together, the eight MI attribute perception measures and the two predictors required to account for the moderation of the compatibility–acceptance path by end-user MI appliance category explained 22.5% of the variance in use intensity for actual adopters and 10.3% of the variance in use interest for potential users. The corresponding R^2 values in case of excluding variables 9 and 10 from the regressions in Table 3 were 0.208 and 0.091, respectively. The correlation and β-weight patterns in Table 3 reveal that the difference in the criterion variance explained between adopters and potential users was mainly due to the stronger relationships between DOI-based MI attribute perceptions and the acceptance indicators in the adopter group as compared to the potential user group. There-

fore, the results in Table 3 are overall broadly consistent with H_3, but suggest that H_7 should be rejected.

Hypothesis H_2 and research question Q_1 referred to potential differences in perceptions of DOI-based MI attributes as a function of a customer's adopter status or preferred appliance category to obtain MI access. According to Table 4, actual MI users perceived MI offerings significantly more favorable in terms of relative advantage and trialability. This is consistent with H_2. However, contrary to H_2, effective MI adopters had significantly worse MI perceptions with regard to the easiness of MI use than potential adopters. Both groups did not differ in judged compatibility and communicability, which is counter to H_2, too. With regard to Q_1, the results in Table 4 suggest that actual (potential) users accessing MI through a laptop assessed four (three) of the five DOI-based MI attributes significantly better than actual (potential) handset proponents. Supplementary analysis of variance in which both adoption status and access device category were simultaneously considered as factors revealed that adoption status had significant unique effects on relative advantage ($F = 10.88$; $p \leq 0.001$) and trialability ($F = 9.09$; $p \leq 0.003$). The customer's used or preferred appliance cate-

Table 4: Comparison of diffusion theory derived MI attribute perceptions across MI adoption status and actual/preferred main MI access device subsamples

	Adoption status[a]				Adoption status and access device							
					Actual users[a]				Potential users[a]			
	Actual users		Potential users		Laptop		Handset		Laptop		Handset	
MI attribute	M	S	M	S	M	S	M	S	M	S	M	S
1. Relative advantage	6.33** (476)[b]	2.17	5.89** (381)	2.30	6.82*** (208)	1.97	5.94*** (268)	2.23	5.93 (255)	2.30	5.80 (126)	2.33
2. Compatibility	3.30 (512)	2.97	3.35 (489)	2.84	4.05*** (220)	3.14	2.74*** (292)	2.71	3.77*** (333)	2.91	2.47*** (156)	2.47
3. Lack of complexity	6.30* (514)	2.55	6.62* (455)	2.41	6.95*** (220)	2.27	5.81*** (294)	2.64	6.85** (310)	2.33	6.12** (145)	2.52
4. Communicability	5.95 (508)	2.63	5.98 (464)	2.47	6.61*** (220)	2.60	5.45*** (288)	2.56	6.11+ (322)	2.49	5.69+ (142)	2.42
5. Trialability	6.31*** (507)	2.58	5.73*** (411)	2.69	6.48 (221)	2.61	6.17 (286)	2.55	5.66 (281)	2.68	5.90 (130)	2.73

a) Superscripts indicate significant mean differences between the two compared subsamples based on *t*-tests which were calculated with independent variance estimates if *Levene*'s test indicated that variances differed significantly at $p \leq 0.05$.

b) Figure in brackets shows the number of respondents with valid answers.

+ $p \leq 0.10$ * $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$ (two-tailed test).

gory had highly significant ($p \leq 0.001$) unique impacts on each of the five DOI-based attribute measures with the exception of trialability. Further, two significant interactions emerged: Appliance category had significantly stronger effects on judged relative advantage ($F = 5.64$; $p \leq 0.02$) and perceived communicability ($F = 4.69$; $p \leq 0.03$) for actual MI users than for potential adopters.

In summary, the findings suggest to accept H_1 for relative advantage, and communicability perceptions and to reject it for judged compatibility, lack of complexity, and trialability. Overall, compared to customers' adoption status, their appliance category was more relevant in explaining DOI-based MI attribute assessments, particularly among MNO customers who were effective MI users.

Hypotheses H_4 and H_5, as well as research question Q_1, concerned assessments of MI quality properties derived from IE concepts. In the combined sample of actual and potential MI users the mean MI experience qualities share of 48.96% was significantly ($t = 13.20$; df = 10.64; $p \leq 0.001$) higher than the MI search qualities mean, which amounted to 32.91%. The latter significantly ($t = 15.17$; df = 1064; $p \leq 0.001$) exceeded in turn the 18.13% mean of the MI credence qualities share. Thus, H_4 received clear support in the present samples of effective orpotential MI adopters. According to Table 5, the means of the assessments of MI search and credence qualities shares did not diverge significantly between actual and potential MI users. The difference between these two groups in terms of the mean share of perceived MI experience qualities reached a marginal 7.7% level of statistical significance ($t = 1.77$; df = 1063). Additional analysis of variance indicated that this already weak adoption status effect on assessments of the experience qualities share became insignificant ($p > 0.15$) if appliance category was simultaneously introduced as a potential determinant of MI perceptions with regard to its IE quality properties. Therefore, H_5 has to be rejected.

In view of Q_1, Table 5 also contains statistics for IE qualities measures both within the adopter and within the potential user group as a function of MNO customers' effective or preferred appliance category. The data in Table 5, as well as supplementary analysis of variance with adoption status and device category as explaining factors, suggested that assessments of MI offerings did not significantly diverge in terms of their mean search, experience and credence qualities shares depending on the MI appliance category used or preferred by a study participant.

Table 5: Comparison of quality property perceptions for MI offers across MI adoption status and actual/preferred main MI access device subsamples

Percentage of MI quality properties which can be assessed …	Adoption status[a]				Adoption status and access device							
					Actual users[a]				Potential users[a]			
	Actual users (n = 525)		Potential users (n = 540)		Laptop (n = 226)		Handset (n = 299)		Laptop (n = 375)		Handset (n = 165)	
	M	S	M	S	M	S	M	S	M	S	M	S
1. already before first service use (***search qualities***)	33.51 [27.62][b]	22.49	32.34 [24.81]	21.12	33.64 [28.76]	21.71	33.41 [26.76]	23.09	31.66 [22.93]	20.39	33.89 [29.09]	22.67
2. only after first service use (***experience qualities***)	47.81+ [56.38]	20.73	50.07+ [59.63]	20.93	48.29 [55.31]	20.77	47.45 [57.19]	20.73	50.69 [62.40+]	20.12	48.67 [53.33+]	22.65
3. never, i.e., no valid assessment possible even after repeated service use (***credence qualities***)	18.67 [9.71]	16.00	17.59 [7.59]	15.54	18.07 [9.29]	15.71	19.14 [10.03]	16.23	17.65 [6.40]	14.95	17.44 [10.30]	16.84

a) Superscripts indicate significant mean differences between actual users and potential users based on *t*-tests which were calculated with independent variance estimates if *Levene*'s test indicated that variances differed significantly at $p \leq 0.05$.

b) Number in squared brackets is the share of respondents in the particular subsample who assigned the highest value to search, experience or credence qualities, respectively. Percentage values in a column do not add up to 100% because of participants who assigned equal numbers to at least two quality categories. Significance of subsample differences for each of the three shares was examined with χ^2-tests.

+ $p \leq 0.10$ * $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$ (two-tailed test).

III.5 Discussion and implications

This study attempted to compare perceptions of various MI attributes deduced from literature in the fields of DOI and IE, as well as effects of perceived attributes on MI acceptance measures between two groups of MNO customers, namely MI users and potential adopters, on the basis of a survey of 1,065 German-speaking cellular service users. In addition, the present research explored the extent to which MI attribute assessments and relationships between perceived attributes and MI acceptance criteria varied depending on the appliance category (handset compared to laptop) a customer primarily applied or preferred to obtain MI access.

Overall, the findings indicate that DOI-based attribute perceptions of MI offers tend to have stronger impacts on MI use intensity among effective adopters than on MI use interest among potential adopters. These results support prior authors who expected that perceptions of attributes of innovative goods based on direct experience are more related to use behaviors than perceptions which are formed

based on information from the media or social contacts are linked to future use intentions.[65] Both actual MI adopters' use intensity and potential adopters' use interest were significantly positively influenced by judged relative advantage or functional usefulness of MI offers and communicability or demonstrability of MI benefits to others. The findings for relative advantage and functional usefulness are consistent with previous TAM- or DOI-based research which also had concluded that the construct of functional usefulness or relative advantage is particularly powerful in explaining the acceptance of innovative offers. For MNO practitioners in charge of designing MI offerings, the preceding results imply that strategies which increase the perceived functionalities of MI in terms of ubiquitous availability, transmission speed, data security, and especially price–service performance adequacy (see Table 1, 3rd item of the relative advantage measure) are likely to be effective in promoting MI use intensity and interest *both* among actual and potential MI users. Somewhat weaker, but still important acceptance outcomes may be achieved by convincing actual and potential MI adopters that evident MI benefits such as receiving or sending e-mails from anywhere can easily be demonstrated to their close social contacts. Such demonstrations should promote more positive evaluations of MI by one's social environment. This affirmative social influence could again amplify MI acceptance of actual and potential MI users.[66]

The negative β-weights for trialability in the regressions of the MI acceptance measures on MI attribute assessments both for the actual and potential MI user groups are the opposite to what was hypothesized. Two earlier studies likewise detected that trialability was negatively correlated with the acceptance of MMS[67] and a new PC software package[68] after controlling for other DOI-based attributes of the focal innovation. The present and prior observations imply that MNO measures aiming at high trialability of MI offerings may be a double-edged sword. One the one hand, they lower use barriers but on the other hand, they may foster the impression among potential MI adopters that MI trials can be postponed in the future due to the ease with which MI offers are testable. Similarly, MI adopters may refrain from using MI more frequently because they are convinced that it is simple to test benefits and disadvantages of increased MI use frequencies in the future. In any case, the unexpected multivariate results for

[65] E.g., Karahanna et al. (1999); Kim et al. (2009).
[66] Cf. Pedersen (2005), p. 216; Hong/Tam (2006), p. 174; López-Nicolás et al. (2008), p. 362.
[67] Hsu et al. (2007), p. 721.
[68] Karahanna et al. (1999), pp. 196-197.

trialability suggest that future MI research should explore the trialability construct and its interplay with other MI properties in greater depth.

This study also reveals that the appliance category which actual or potential MI adopters employ or intend to employ had significant influences on MI attribute perceptions, particularly for actual MI users. All in all, effective and potential MI adopters who (intend to) use a laptop for MI access perceive DOI-based MI attributes more positively than the respective adopter groups equipped with a cellular handset. This difference may be explained by a comparative MI evaluation in which MNO customers refer to their wireline fixed Internet access experience at home as a reference point in order to contrast their actual or expected MI functionality impressions against this reference point.[69] MI access through a laptop is more similar to the wireline Internet access customers are acquainted with at home than MI utilization via a handset. Hence, assessments of DOI-based MI attributes are better for (potential) laptop choosers than for (potential) handset customers. As shown in Table 4, actual MI users with handsets perceived DOI-based MI features mostly similar to or even worse than potential MI adopters with a handset preference, whereas actual MI laptop users judged DOI-based MI attributes considerably more favorable than potential MI adopters with a laptop preference. Thus, it appears that MI functionality expectations before adoption are more likely to be met by actual MI use experiences after adoption if customers employ a laptop rather than a handset for MI access. The observation that the relationship between compatibility perceptions, in the sense of viewing MI as an offer which allows a smooth transition away from one's previous wireline Internet access, and MI acceptance criteria was significantly positive only for actual or potential laptop users but not for the respective handset groups suggests the following: MNO customers accessing or intending to access MI through a handset believe that MI does *not* reach the functionalities and thus is *not* a serious substitute of their current wireline Internet access.

The pattern of results sketched before has several interesting management and research implications. In practice, it indicates – in the first place – that MNO are well advised to position MI access as a full-fledged substitute of wired Internet access technologies only in conjunction with the message that such a replacement requires the usage of a laptop for MI access. The effectiveness of this message may be enhanced by offering MI services bundled with subsidized laptops. This bundling strategy should be economically tenable because MI adopters

[69] Cf. Ishii (2004), pp. 56-57; Constantiou (2009), pp. 273-274.

with a laptop effectively access MI more frequently than MI users with handsets (see Table 3). Therefore, laptop adopters are more likely to continue to use MI and to generate higher MI utilization revenues in the future than handset adopters. Accordingly, it is highly probable that MI customers with a laptop are more valuable for MNO than those users who access MI through smart handsets. Thus, this investigation provides indirect support to the commercial viability of recent efforts of German MNO to emphasize the advantages of MI access via laptops compared to handsets.[70]

Second, it suggests that manufacturers should further strive for improvements in the usefulness and demonstrability of handset appliances which they sell as tools to obtain MI access whose functionality is similar to what customers are accustomed to in case of wired Internet access technologies and devices. Third, it implies that MNO may be well-advised to provide potential MI adopters who prefer access MI through handsets with realistic previews not only of the unique advantages of MI access via this appliance category, but also of its limitations compared to laptops. From a research perspective, the strong effects of appliance category on DOI-based MI attribute perceptions and on MI use intensity in the adopter group reveal that future conceptual and empirical academic investigations should explicitly incorporate the peculiarities of various MI device categories and the evolution of appliance capabilities across different equipment generations in exploring determinant structures of MI acceptance.

The present analysis shows that MNO customers tend to be convinced that almost 50% of the qualities of MI offerings are assessable only after the initial phase of effective service use. Put differently, according to my observations, MI is predominantly viewed as an “experience good”. This holds independent of the MI adoption status of and the MI appliance category used or preferred by cellular customers. For potential users, the perceived search qualities share of MI offerings relative to their credence qualities share had a weak positive, albeit significant impact on MI adoption interest. Hence, MNO should consider strategies that help customers to assess personally relevant benefits and drawbacks of various MI offers before their initial use decision without confusing consumers with too much irrelevant technical or commercial MI information and choice options. This should lower the level of uncertainty among potential adopters with regard to the specific value of MI offerings for them.

[70] Schüler (2009).

III.6 Limitations

Just as other scholarly work using standardized customer surveys as the sole data collection method, this study bears several weaknesses which are typically associated with this research design. They imply that the own findings need to be interpreted with caution for several reasons. First, although the present study's sample was quite large and deviated positively from many previous investigations which had covered mainly or exclusively college students,[71] it only drew from the German mobile market. However, as pointed out by several authors,[72] customers' MI attribute perceptions and acceptance may vary as a function of national cultural background and of the development state of the wired and wireless communications markets in a country. Therefore, future research is required to test the generalizability of the own results. Second, this study examined only potential MI acceptance determinants deduced from DOI and IE literature. Four out of five DOI attributes had to be measured by single items. Perceived shares of IE qualities of MI offerings were likewise captured by single, abstract questions. It is easily conceivable that more MI attributes (e.g., enjoyment, task service fit) or individual characteristics (e.g., personal innovativeness, demographics) suggested by other theoretical frameworks may influence MI acceptance. Consequently, future work is valuable which employs refined measures of DOI- and IE-based MI attributes and adds further constructs to better understand MI use interest and intensity.

Third, for adopters, MI acceptance was gauged by self-reported MI use frequency. Although such use frequency measures are widely applied in research on the acceptance of MI or MDS offers[73] or other innovative IT services[74], one may question the accuracy of such self-reports.[75] Therefore, more work is desirable which relies on objective MI use statistics obtained from mobile network monitoring and reporting systems.[76] Finally, this study was based on a cross-sectional survey of respondents which differed in terms of their MI adoption status and MI appliance category used or preferred. However, in order to truly

[71] E.g., Kim et al. (2007); Lee/Jun (2007); Turel et al. (2007); Kim et al. (2009); Kim/Garrison (2009); Kuo et al. (2009).

[72] E.g., Ishii (2004), p. 57; Lee et al. (2007), pp. 41-42; Shin (2007), p. 481; Kim et al. (2008), p. 126.

[73] E.g., Fogelgren-Pedersen (2005), p. 4; Wu/Wang (2005), p. 723; Groeppel-Klein/Koenigstorfer (2007), p. 82; Turel et al. (2007), p. 67; Bina et al. (2008), p. 301; Lee et al. (2008), p. 4.

[74] E.g., Agarwal/Prasad (1997), p. 567.

[75] Cf. Kim et al. (2008), p. 124.

[76] Cf. Kivi (2007); Verkasalo (2008). See also article V in this book.

assess impacts of pre- and post-adoption MI attribute perceptions on the initial adoption decision and subsequent use intensities, one may argue for a longitudinal investigation tracking (changes in) MI attribute judgments, as well as MI adoption and use behaviors of a single customer group. Such a research design is undoubtedly precious from an academic standpoint. Nevertheless, it faces substantial implementation barriers in empirical work unwilling to confine itself to student surveys, but aiming at incorporating a broader set of MNO customers.

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Impacts of mobile Internet use intensity on the demand for SMS and voice services of mobile network operators

– An empirical multi-method study of German mobile Internet customers –

Torsten J. Gerpott

Abstract

Scholarly and business publications alike convey the message that past and future strong growth in mobile Internet (MI) access and service demand has solely positive commercial implications for mobile network operators (MNO). This position neglects the possibility that increasing MI use intensity may lead to demand decreases for the highly profitable short message service (SMS) and mobile voice telephony. The extant literature provides few insights on relations between MI use intensity, on the one hand, and SMS as well as mobile voice call use intensities, on the other. This study developed hypotheses concerning the presence or absence of impacts of MI use intensity and circumstances of MI use (e.g., device type, tariff scheme) on the demand of SMS and mobile voice telephony at the individual customer level. The hypotheses were tested by analyzing actual use behaviors of 304 MI adopters in Germany, for whom objective use intensity data were extracted from the billing system of an MNO. These non-reactive measures were combined with responses collected from the adopters through a telephone survey. Multivariate regression results suggest that though MI use intensity significantly negatively affected both number of SMS sent and received, these effects were so small that their practical relevance is highly doubtful. Further, customers who used MI more intensively did *not* generate lower volumes of outgoing or incoming mobile voice connection minutes. Conclusions are drawn for MNO, telecommunications sector regulators and scholarly researchers seeking to explain the acceptance of mobile communications services.

Keywords: Adoption; Customer behaviors; Demand interrelationships; Germany; Mobile communications services; Mobile Internet; Service substitution; Short Message Service (SMS); Use intensity.

IV.1 Research background and questions

Market analysts agree that demand for Internet access through nationwide cellular wireless networks via various portable devices, i.e. *mobile Internet* (*MI*), has started to boom in the past few years. Further hefty MI subscriber and traffic growth is expected in the near future. IDATE (2009) forecasts that the number of MI customers in Europe will increase from about 70 million at the end of 2008 to more than 160 million at the end of 2012. With regard to the US, the IDATE prediction for this timeframe is that the MI subscriber number will move from 35 million to 110 million. Similarly, Cisco (2009) expects that the average monthly global MI traffic will increase from 0.033 million terabyte in 2008 at a compound annual growth rate of 139% to 1.076 million terabyte in 2012.

At a first glance, the bright MI market development projections appear to have solely positive business implications for mobile network operators (MNO), since they promise increasing revenues and profits from MI access and services. However, a closer look reveals that MI diffusion and use increases may also have negative commercial ramifications for MNO. MI could substitute the established short message service (SMS) and (circuit-switched) mobile voice calls sold at high prices by Internet Protocol-(IP-)based packet-switched traffic which generates lower prices per service unit and consequently reduces MNOs' profit contribution margins. Demand for SMS or mobile voice calls simply could decrease because customers have a limited time and monetary budget for telecommunication activities and spend more time and money on MI access and applications.

Looking merely at *SMS*, it is important to recognize that many customers use laptops instead of handsets to obtain MI access. Portable computers have fully fledged keyboards which make it more convenient to send written (short) person-to-person news via the Internet to the e-mail or instant messaging (IM) account of a recipient rather than conveying them by SMS to the mobile access number of the addressee. On the other hand, compared to SMS, customers could perceive MI-based e-mail or IM services as not being functionally equivalent or, in media use theory parlance, as not providing the same "gratifications". A first justification for this imperfect equivalence is that, at least in the residential end-customer market, many mobile users are not reachable without major delays because the share of MI users among all MNO customers with access to mobile (push) e-mail or IM clients is still low in most countries. This in turn decreases the likelihood that *any* mobile user can be contacted almost in a real-time man-

ner by MI-based e-mail or IM services.[1] Second, interoperable and easy-to-use e-mail or IM clients are currently not embedded in every MI-ready device. This increases the SMS substitution barriers for customers with limited technology skills or learning motivation.[2]

The relationship between *mobile voice call* volumes and the use intensity of MI services raises complex demand- and supply-side issues. From a *customer* standpoint it is obvious that mobile calls serve bidirectional/interactive and synchronous/real-time communication needs occurring in work-related, social and emergency situations. Compared with this, most MI services such as IM or e-mailing fulfill diverging needs for unidirectional and asynchronous information exchange or collection triggered by other work-related and social situations.[3] The proposition that mobile voice calls and mobile access to data services satisfy distinct communication needs is also reflected in the regulatory framework of the European Commission for service markets within the electronic communications sector. More specifically, the Commission Recommendation (2007/879/EC) on the definition of telecommunication service markets susceptible to *ex ante* regulation for ensuring effective competition implies that mobile data and voice offers address different markets and thus should not be treated as mutually interchangeable.[4]

However, from a *supply*-side perspective MI access and use may decrease the number and length of "old-fashioned" circuit-switched mobile telephony connections. Technically, voice is just one kind of data with specific performance requirements in terms of maximum tolerable periods of transport delay and variance of such delays. Therefore, it is possible to "produce" a mobile telephony service by carrying voice data over IP networks (= mobile voice over IP/VoIP).[5] Put differently, established circuit-switched mobile voice supply is exchanged for packet-switched mobile VoIP traffic. However, up to now, MNO and manufacturers of mobile communication devices have typically reverted to technical measures which ensure that VoIP clients downloaded to various types of end-customer appliances do not work on cellular mobile networks.[6] Thus, at least until today the potential of MI access to cannibalize the circuit-switched pro-

1 Buvat et al. (2007), p. 10.
2 Haas (2006), p. 225.
3 Wei (2008).
4 Commission of the European Communities (2007); see also ECC (2004), p. 14.
5 Heikkinen/Luukkainen (2008), pp. 3-8; Verkasalo (2009), p. 73.
6 Heikkinen/Luukkainen (2008), p. 7.

duction of mobile telephony by routing voice traffic over (wireline) Internet infrastructures which are not completely under MNO control is volitionally restricted by MNO.

This limited supply-side substitution potential is unlikely to change quickly even if mobile voice service providers cease the technical blockage of mobile VoIP. Mobile data network transport speed and capacities will remain too limited for several years to allow for large mobile VoIP traffic volumes without severe degradation of the quality of voice calls and other data applications. In addition, a considerable share of residential mobile customers could lack the skills and/or the motivation to install VoIP clients on their mobile appliances.

In summary, in most national mobile communication markets the supply strategies of MNO currently prevent that their customers who adopted MI access have the possibility of substituting circuit-switched telephony by mobile VoIP. Nevertheless, it remains an open question to what extent diverse MI access-based applications other than mobile VoIP provide MNO customers with functionalities or gratifications which have impacts on consumers' use intensity of mobile voice calls.

The scholarly literature is almost silent with regard to interdependencies between individual MI use intensities, on the one hand, and individual SMS or mobile voice call activity levels, on the other. This is surprising because these relationships are not only interesting from an academic consumer behavior point of view in order to better explain mobile communication service use patterns in a multi-service environment. Rather, an enhanced understanding of cross-demand elasticities between MI use and SMS/mobile voice call activity levels is also important for practitioners. First, this knowledge is helpful in making better informed MNO marketing strategy decisions concerning, among others, the degree of aggressiveness in promoting MI offerings in a market which in the past was dominated by mobile voice and SMS revenues, or the integration of MI access, SMS, or mobile voice service in "bundled" offerings. Second, this understanding is beneficial for telecommunications sector regulatory authorities in improving their decisions on the delimitation of mobile voice, SMS, and MI access as well as services markets. It is exactly this demarcation analysis which constitutes a pivotal element in appropriately assessing the competitive intensity and the resulting need for regulatory remedies in various telecommunication markets.

Considering the paucity of empirical research on demand interdependencies for MI services, SMS and mobile voice calls and the scholarly and practical importance of this subject, the purpose of the present paper is to shed empirical light on these relationships. More specifically, it is guided by two research questions (Q):

Q_1: To what extent does MI use intensity affect the SMS demand of (residential) MNO customers at the individual level of analysis?

Q_2: To what extent does MI use intensity affect the mobile voice call demand of (residential) MNO customers at the individual level of analysis?

I report the results of an empirical study that addresses these research questions. This study extends previous research not only by providing data on relationships between mobile communications use variables which have hardly ever previously been explored by scholars. Moreover, it also contributes to the literature by unobtrusively capturing real use behaviors from the internal billing system of a German MNO while most earlier work on the initial adoption and continued use of mobile communication services merely measured use intentions or claimed use behaviors.

The remainder of the paper is organized as follows. Section IV.2 clarifies basic concepts related to the research questions and develops the current study's hypotheses. Section IV.3 presents the empirical methods and descriptive statistics for the major study measures. It is followed by the results of the variable association analysis in section IV.4. The article concludes in section IV.5 with a discussion of the findings and their implications for practitioners and researchers working in the fields of telecommunications management and regulation.

IV.2 Clarification of basic concepts and development of hypotheses

IV.2.1 Basic concepts

IV.2.1.1 Mobile Internet

MI is a shimmering and fuzzy phenomenon which scholars and practitioners define in a large variety of ways. Some authors[7] 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-

[7] E.g., Yoo/Moon (2006); Lee et al. (2007a); Shin (2007); Song et al. (2007); Verkasalo (2008a).

CDMA/UMTS, CDMA-2000). However, the majority of pertinent publications agrees that it is most appropriate to characterize MI in a less extensive sense as follows: MI encompasses the packet-switched and IP-based access to a broad assortment of advanced or value-added data services (e.g., web browsing, e-mail, IM) through 2.5G or 3G cellular mobile communication networks with high transmission speeds.[8] 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 an offer which may create value for the consumer only if the elements are inextricably intertwined.[9] MI tries to provide the same "look and feel" as wired Internet access solutions at fixed locations (DSL, cable modem, telephone line 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 anytime and anywhere ("ubiquitous communication") even while being on the move.

This study confines itself to MI services accessed by customers of cellular 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. Second, compared to other Internet access platforms, especially from a customer standpoint, MI is unique and novel because 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 cross-sectional enabling hard- and software technologies. They create the foundation for a wide range of communication, information content, entertainment, and commercial transaction services which may be applied both 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.[10] MDS do not only cover IP-based delivery of applications known from the conventional Internet but ad-

[8] Minges (2005); Groeppel-Klein/Koenigstorfer (2007); Kim et al. (2007); Lee et al. (2007a); López-Nicolás et al. (2008); Bouwman et al. (2009); ITU (2009).

[9] Hong/Tam (2006).

[10] E.g., López-Nicolás et al. (2008); Kuo et al. (2009).

ditionally the entirety of more or less established variants of text messaging (SMS, MMS) and WAP-based applications delivered by MNO.[11]

IV.2.1.2 Use intensity of mobile communication services

Earlier research describing and explaining variance in the use intensity of diverse mobile communication services attaches different connotations to the use intensity construct. Most studies interpret it as the strength of the *behavioral intention* to utilize a specific service type such as SMS, MI in general or particular MI-based services (e.g., m-banking) in the future. The use intention notion may refer to a service which a customer has not yet utilized, i.e. it focuses on the first-time or initial adoption of a new offering.[12] In addition, it alternatively may concern a service which a customer has already utilized in the past, i.e. it concentrates on continued acceptance of an offering for which a customer claims to possess real life use experience.[13]

Fewer investigations construe use intensity as the *self-reported frequency and/or duration of* certain categories of *behaviors*, such as initiating or receiving a mobile voice call or SMS or downloading/playing a game on a mobile device.[14]

To the best of my knowledge, aside from Verkasalo (2007) and Grzybowski/ Pereira (2008), there is no scholarly work on use intensities of mobile communication services which captured *real life behavior classes* at the level of the individual customer.[15] An explanation for this omission is that such objective traffic data cannot be obtained by plain surveys. In fact, if researchers do not want to install a measurement software on the device of each study subject[16] such data require access to the billing or customer administration systems of MNO.[17] Operators in turn tend to treat internal traffic information as confidential and accordingly are rarely willing to share it with external researchers.

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[11] Bina et al. (2008); Hong et al. (2008); Lee et al. (2008); Kuo et al. (2009).

[12] E.g., Cheong/Park (2005); Hong/Tam (2006); Hsu et al. (2007); Kim et al. (2007); Lee et al. (2007b); Kim/Garrison (2009); Kuo/Yen (2009).

[13] E.g., Hong et al. (2006); Yan et al. (2006); Lee/Jun (2007); Lee et al. (2007a); Shin (2007); Chen (2008); Hong et al. (2008); Koivumäki et al. (2008); Lu et al. (2008); Bouwman et al. (2009); Kim et al. (2009); Kuo et al. (2009); Mallat et al. (2009).

[14] E.g., Fogelgren-Pedersen (2005); Turel et al. (2007); Bina et al. (2008); Economides/ Grousopoulou (2008); Lee et al. (2008); Oh et al. (2008); Wei (2008); Westlund/Bohlin (2008).

[15] E.g., minutes of outgoing voice calls per time period; cf. Smura et al. (2009), p. 61.

[16] Cf. Verkasalo (2008a), p. 45.

[17] Church et al. (2007), p. 9.

Unfortunately, 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[18] and for communication services in particular.[19] Thus, most extant use intention work in the field of mobile communications services has presumably not captured and explained variance in the true use of these services but variance in attitudes towards the offerings.

In addition, the validity of studies which drew on self-report measures of use frequency and duration of mobile service classes is also uncertain at least because they applied crude overall assessments instead of relying on more expensive but also more accurate methods such as collecting detailed diary accounts on the use of specific communication services from participants. Recently, this methodological shortcoming was nicely illustrated in an investigation of almost 3,600 Korean MDS customers.[20] By comparing objective traffic data and survey-based claimed use measures the researchers found "that more than one-third of all respondents failed to report their past [MDS] usage accurately"[21]. Hence, global self-reports of mobile communication behaviors can hardly be classified as strongly convincing measures of the use intensity of diverse classes of mobile services.

As a result, the present work gauged use intensity by objective metrics of traffic caused by the focal three services, namely SMS, mobile voice and mobile access to all kinds of Internet-based service offerings.

IV.2.2 Development of hypotheses

As explained above, specific MI applications such as IM or e-mail could fulfill similar communication functions and provide similar gratifications as SMS. Overall, most authors take positions which imply significantly negative cross-demand elasticities between *SMS* and MI use. For instance, Verkasalo (2008b, p. 54) proposes that "SMS usage intensity could be decreasing as more and more instant messaging mobile clients are making it to the mobile market". Similarly, Buvat et al. (2007, p. 3) claim "that mobile instant messaging, as an alternative text-based communication service, could cannibalize … high-margin SMS revenues" and anticipate "an SMS substitution rate of around 10–15%"[22] by MI-

[18] Chandon et al. (2005); Seiders et al. (2005).
[19] Verkasalo (2007). See also article V in this book.
[20] Kim et al. (2008).
[21] Kim et al. (2008), p. 124.
[22] Buvat et al. (2007), p. 10.

based IM in Europe until 2012. Funk states that one of the major reasons for the delayed uptake of MI subscriptions in Europe relative to Japan was that European MNO refrained from aggressively promoting MI services, in general, and IM as well as e-mail push services over the mobile Internet in particular in order "to avoid cannibalizing their SMS revenues"[23] and "to maintain high prices for SMS"[24]. On the other hand, Informa (2009, p. 10) concludes from an analysis of 37 MNO offerings of mobile IM services over the Internet that this application "helps increase revenues from the other services (typically voice and SMS)"[25].

Unfortunately, most authors do not back their conjectures on SMS–MI use relations with empirical investigations containing factual service use behavior data. An exception is Verkasalo (2007), who analyzed such data at the individual level for 659 Finnish consumer subscribers in 2005 and 2006. His results imply that the number of SMS generated by mobile customers is not clearly related to the use intensity of MI multimedia services. A secondary analysis of mobile use statistics collected at the aggregate global or national market level of analysis also supports the view that MI access is not a strong substitute for SMS: From 2005 to 2008 the world SMS market did not change much from 44 SMS per SIM-card and month in 2005 to 45 SMS per SIM-card and month in 2008.[26] At the same time the global number of MI subscriptions tripled from 1.0 subscriptions per 100 inhabitants by the end of 2005 to 3.0 by the end of 2007.[27] Specifically in Germany, the average number of SMS per SIM-card grew from 22 per month in 2006 to 24 per month in 2008,[28] whereas the share of mobile customers accessing the Internet via UMTS-enabled devices in Germany increased from 2.3% at the end of 2006 to 9.2% at year-end 2008.[29] However, this aggregate analysis may mask diverging individual level change patterns in different customer segments: It leaves room for the possibility that decreases in SMS traffic generated by individuals with MI access are more than offset by increases in SMS use intensities among customers who have not (yet) accepted MI offerings of MNO.

[23] Funk (2007b), p. 343.
[24] Funk (2007a), p. 17; see also Verkasalo (2009), pp. 72-73, 80.
[25] For a similar opinion see Blackwell (2006).
[26] Cf. Poulbere (2005), p. 41; EITO (2007), p. 247.
[27] ITU (2009), p. 6.
[28] Cf. Bundesnetzagentur (2009), pp. 78-81.
[29] tns infratest (2009), p. 6.

To sum, the persuasiveness of the preceding market level average use intensity calculations is limited. In addition, most authors provide strong conceptual arguments for a negative correlation between SMS and MI use intensities at the individual level. Accordingly, I propose the following hypothesis (H):

H_1: The quantity of SMS sent and the quantity of SMS received by a customer are significantly negatively related to the overall volume of MI traffic generated by this person.

With regard to the relationship between MI use intensity and *mobile voice call* activity level, the differences between these two communication media in terms of their (a)synchronicity, interactivity and channel richness imply that the correlation between use indicators for these two services should not be significantly negative but close to zero. Wei (2008, p. 39) even proposes a "supplement or activation effect" in the context of mobile communication services consumption. It entails the notion that the extent of an individual's MI use is significantly positively associated with the frequency and length of this person's mobile voice calls. He supports this suggestion with a telephone survey of 208 MNO customers in the USA conducted in 2003. The survey revealed that the "number of mobile phone calls made and received during a day"[30] was significantly higher for subjects who reported that "they had used their mobile phones to … surf the Internet"[31]. The validity of this finding is questionable though because the study did not collect actual MI and mobile telephony use data. Rather, it relied exclusively on claimed use measures generated from a telephone survey. This monomethod design is likely to cause inflated correlations between study variables (see section IV.2.1.2). In contrast to Wei (2008), the Verkasalo (2007) investigation of Finnish mobile consumers revealed no clear association between factual indicators of MI use intensity and the frequency as well as the length of mobile voice calls.

Aggregate market-level analysis also suggests that the uptake of MI and mobile voice use intensity are not closely intertwined. For instance, in Germany, the average monthly volume of outgoing (incoming) voice minutes per SIM-card amounted to 58 (53) minutes in 2006 and expanded to 69 (54) minutes in 2008[32] in spite of the tremendous growth of MI usage in Germany described above. Hence, at least in Germany, mobile voice use intensity appears to be shaped primarily by other factors, such as mobile relative to fixed line call prices or

[30] Wei (2008), p. 41.
[31] Wei (2008), p. 40.
[32] Bundesnetzagentur (2009), pp. 78-79.

quality of the wireline telephony network, than by increasing demand for MI access and services.

Taken together, the conceptual considerations and the empirical evidence, albeit sparse, favor the hypothesis:

> H_2: The quantity of mobile call minutes initiated and the quantity of call minutes received by a customer are not significantly correlated with the overall volume of MI traffic generated by this person.

Previous customer acceptance and innovation management research implies that the initial adoption and subsequent use intensity of SMS, mobile voice service and MI access as well as the demand interrelationships between these offerings depend on customer perceptions of the functional, monetary, social, and hedonic performance or "value" of the services both in absolute terms and relative to each other.[33] The experienced performance or value dimensions of MI relative to SMS and mobile voice calls are partially but not exhaustively reflected in a customer's service use intensities as addressed in the first two hypotheses. Important supplementary facets of MI use which may have implications for demand interrelationships between this study's three focal mobile services may be captured by taking *circumstances* of MI use into account. Unfortunately, empirical or conceptual work is scarce from which researchers can derive answers with regard to the question which specific use circumstances ought to be incorporated in an empirical study. Based on a review of popular frameworks in the fields of technology/innovation acceptance and diffusion research, the present investigation picked up a limited set of such MI use circumstances in propositions which are intended to supplement its two "core hypotheses" developed above.

First, the appliance type which a customer employs to obtain MI access appears to be an important driver of the functional value/usefulness and usability/ease of use of MI communication services (IM, e-mail) compared to SMS and mobile voice service.[34] From a high level perspective, there presently are two device categories which customers may use for MI access, namely (1) "smart" handsets/phones and (2) laptops, the latter being sometimes also labeled as netbooks,

[33] Hong/Tam (2006), pp. 164-169; Yan et al. (2006), pp. 18-20, 27; Bouwman et al. (2007), pp. 147-151; Hsu et al. (2007), p. 717; Kim et al. (2007), pp. 113-114; Lee et al. (2007b), pp. 2067-2069; Turel et al. (2007), pp. 64-65; Kim et al. (2008), p. 114; Lee et al. (2008), pp. 2-3; Verkasalo (2008a), pp. 50-51; Chen et al. (2009), pp. 242-243; Kim et al. (2009), p. 8530; Kuo et al. (2009), pp. 888-889; Kuo/Yen (2009), pp. 104-106.

[34] Andersson et al. (2006), pp. 141-158.

mini-notebooks or pocket/tablet PCs.[35] Laptops outperform handsets in terms of convenience of text entry and display size. These advantages make it easier to write outgoing and read incoming text messages via one's e-mail account, or to use Internet-based IM services instead of SMS.[36] In contrast, MI access through a laptop does not entail recourse to a service with functionalities similar to those provided by mobile voice telephony. Accordingly, I propose:

H_3: Customers who access MI through laptops only generate significantly lower quantities of outgoing and incoming SMS than customers who exclusively or partially rely on handsets to obtain MI access.

H_4: Customers who access MI only through laptops do not differ significantly in the quantity of mobile voice minutes initiated and in the quantity of incoming mobile voice minutes from customers who exclusively or partially rely on handsets to obtain MI access.

A second circumstance which could have effects on the monetary value/performance of MI access and services relative to SMS and mobile voice calls is the type of MI tariff scheme selected by the customers.[37] MNO offer strictly use-dependent price plans which directly (and mostly in a linear way) link MI charges to the volume of up- and downloaded IP-data. These plans entail constant marginal and average MI use costs. Second, they sell MI flat rates which result in a fixed charge regardless of the actual use intensity of a customer. In case of a flat price, a customer's marginal MI use costs are zero and the average costs per Kilobyte (KB)/Megabyte (MB) fall with increasing IP traffic. Finally, there are "mixed", "block", or "three-part" price plans which combine features of use-dependent and flat tariffs. Previous MI and MDS studies unanimously suggest that increasing customer costs of MI coincide with decreasing MI and MDS use intentions.[38] Compared to flat or block tariffs, use-dependent MI price schemes entail a smaller incentive to substitute SMS or mobile voice calls because of constant marginal and average MI costs incurred for a customer which result in increasing total charges in case that customers extend their MI use intensity. Consequently, I hypothesize:

[35] Königstorfer (2008), pp. 4-5; Horrigan (2009), pp. 37-38; Smura et al. (2009), pp. 57-58.

[36] Blackwell (2006).

[37] Cf. Verkasalo (2007), pp. 16 and (2009), p. 76.

[38] Cheong/Park (2005), p. 137; Hong/Tam (2006), p. 174; Kim et al. (2007), p. 120; Turel et al. (2007), p. 68; Bina et al. (2008), p. 304; Hong et al. (2008), p. 440; Kim et al. (2009), p. 8534; Kuo/Yen (2009), p. 108.

H_5: Compared to customers with flat or block MI price schemes, customers with a strictly use-dependent MI tariff generate significantly higher volumes of outgoing and incoming SMS as well as larger quantities of outgoing and incoming mobile voice minutes.

As explained above, e-mail and IM are specific MI applications which are functionally similar to SMS but not to mobile voice calls. Therefore, I suggest:

H_6: Customers who report e-mailing or IM to be their most frequently used MI application generate significantly lower volumes of outgoing and incoming SMS than customers who report other MI applications as their most frequently used service class; both groups do not differ with regard to their quantities of outgoing and incoming mobile voice minutes.

A fourth circumstance with potential impacts on an individual's use intensity of various mobile communication services is whether customers draw on such services for private, at least partially hedonic reasons, or for job-related and mainly utilitarian/rational purposes. Business-related service use is characterized by a lower degree of voluntariness or discretion than service demand for personal reasons.[39] Further, job-related mobile communication is likely to relate to more complex tasks than mobile communication for private purposes. More complex tasks require the availability of "rich" mobile channels capable of coping with ambiguous situations and of carrying large quantities of partly subtle information. The "richness" of SMS is lower than that of voice calls and e-mails.[40] SMS is an "informal" communication channel which better fits with private communication needs whereas voice telephony is a service which is particularly important to fulfill job requirements. Assuming that mobile customers who access MI mainly for business purposes use mobile voice calls and SMS also to a large fraction for such reasons, I hypothesize:

H_7: Customers who access MI mainly for job-related reasons send and receive lower quantities of SMS than customers who obtain MI access not mainly for job-related purposes.

H_8: Customers who access MI mainly for job-related reasons initiate more outgoing and receive more incoming mobile voice minutes than customers who obtain MI access not mainly for job-related purposes.

[39] Agarwal/Prasad (1997), p. 564; López-Nicolás et al. (2008), p. 360; Kim/Garrison (2009), p. 325.

[40] Lee et al. (2007b).

The literature unanimously emphasizes that buyers assess the value or performance of a seller's offer not only in *absolute* terms but also *relative* to other goods of the same or other suppliers which may accomplish similar functions.[41] Thus, SMS and mobile voice calls should be the more substituted by MI applications the better customers assess the functional and monetary value or performance of these services. Stated more formally, I propose:

H_9: Customers' assessments of the value of MI offerings are significantly negatively related to the quantities of SMS which they send and receive, as well as to the volumes of mobile voice minutes which they initiate and which come in for them.

IV.3 Empirical methodology

IV.3.1 Data generation procedures and sample

The data collection was organized in collaboration with a leading MNO, which served an 8-digit-number of customers in Germany in 2008. The firm permitted to draw a random sample of about 400 subjects out of their postpaid residential customer stock who had subscribed to an MI tariff and for whom the billing system of the MNO indicated that they had generated mobile IP traffic during the first quarter of 2008. This procedure led to a selection of 403 MI adopters. Out of this initial sample 67 cases were deleted because these persons had opted for a "pure" laptop data card tariff which made it impossible to use the MNO's SMS and mobile voice service. For the remaining 336 active MI users, standardized telephone interviews were conducted by trained agents of an established market research firm during an 8-day-period in April 2008. The telephone survey dealt with customer perceptions of reasons for signing an MI contract with their MNO, MI use experiences and MI use behaviors. A total of 304 customers completed the interviews without response denials for the present study's focal variables.

These 304 persons constitute the basis for the subsequent statistical analysis. Table 1 profiles my sample with regard to three demographic variables and three measures capturing MI-related background characteristics of the participants. 84.2% of the respondents were male, 62.5% fell in the age range from 18 to 30 years. In terms of occupation, 60.4% of the sample indicated to be employed by

[41] E.g., Tornatzky/Klein (1982), p. 34; Bouwman et al. (2007), p. 149; Hsu et al. (2007), p. 717; Chen et al. (2009), p. 242.

Table 1: Profile of study sample

Characteristics[a]	n	%	Characteristics[a]	n	%
1. Gender (n = 304)			**4. Length of MI use experience** (n = 303)		
– Male	256	84.2%	– Less than 6 months	231	76.2%
– Female	48	15.8%	– 6–11 months	40	13.2%
			– 12–23 months	23	7.6%
2. Age (n = 304)			– At least 24 months	9	3.0%
– 18–20 years	22	7.2%	**5. MI subscription motive** (n = 304)		
– 21–30 years	168	55.3%	– Mainly private purposes	204	67.1%
– 31–40 years	69	22.7%	– Mainly job-related purposes	24	7.9%
– 41–50 years	32	10.5%	– Both private and job-related purposes	76	25.0%
– 51–80 years	13	4.3%			
3. Occupation (n = 285)			**6. MI access appliance** (n = 304)		
– Student/apprentice/pupil	68	23.9%	– Handset only	125	41.1%
– Employee	172	60.4%	– Laptop only	136	44.7%
– Self-employed person	35	12.3%	– Both handset and laptop	43	14.1%
– Other	10	3.5%			

a) Data for characteristics 1 and 2 were extracted from the collaborating MNO's customer administration system. The measurement of the remaining four characteristics was based on customer self-reports gathered in standardized telephone interviews. 19 subjects refused to state their current occupation. One participant felt unable to respond to the question "Since when do you use mobile Internet services?" MI = Mobile Internet.

a private corporation or a public institution. 76.2% of the participants reported that they had started to use MI not longer than 6 months ago, 67.1% claimed that they had adopted an MI offering of their MNO mainly for private purposes, 7.9% stated that their MI subscription motive was primarily job-related and the remainder reported both private and job-related reasons as their motive to use MI. 41.1% (44.7%) of the participants indicated that they obtained MI access through a handset (laptop[42]) only, 14.1% said that they relied both on a handset and a laptop as appliances to get MI access. Overall, the gender and age structure of the present study's sample resembles the profile of early MI or advanced MDS adopters observed in previous investigations of this customer segment in countries other than Germany.[43]

[42] The MNO's technical and contractual arrangements for the laptop users were such that this customer group could also send/receive SMS and make/accept mobile voice calls (e.g., by providing them with an integrated set of two SIM-cards for their mobile computer and handset or with a handset which serves as a modem to connect their laptop with the operator's mobile data network).

[43] E.g., Fogelgren-Pedersen (2005), p. 3; Verkasalo (2007), p. 9; Kim et al. (2008), p. 119, Koivumäki et al. (2008), p. 67, Oh et al. (2008), pp. 224-225; Westlund/Bohlin (2008), p. 7.

IV.3.2 Operationalization of variables

Measures for the variables addressed in the research questions and hypotheses were generated from different sources to avoid common-method variance problems which plague most previous research on the use of mobile communication services.

IV.3.2.1 Use intensities of mobile communication services

Non-reactive, objective *use intensity* measures were extracted from the collaborating MNO's billing system. Earlier MI use research implies that the monthly volume of up- or download IP-switched data traffic via the MNO's network is an adequate metric to capture the *MI use intensity* at the individual customer level.[44] Therefore, I obtained this measure from the MNO's billing system by averaging the three monthly IP traffic quantities registered for a customer during the second quarter of 2008. Variable values ranged from 1.00 KB to 952.46 MB. The mean MI use intensity in the sample was 103.89 MB per month (SD = 195.91; see variable 12 in Table 2). The median MI use intensity amounted to 14.39 MB. The considerable difference between the mean and median reveals that there were few "heavy users" with IP traffic volumes far above the sample median and many customers who caused only a moderate IP traffic quantity.

Verkasalo (2008b, p. 62) detected a similarly skewed MI use intensity distribution in his study of Finnish smartphone customers arranged in 2005 and 2006. However, the average monthly MI use intensity of his subjects amounted only to 1.9 MB in 2005 and to 6.7 MB in 2006.[45] The larger IP traffic volume per MI user observed in the present study is in line with reports of recent phenomenal mobile IP traffic growth[46] fueled by advances in mobile appliance and radio network performance as well as by MI retail price decreases and a movement towards flat tariff schemes for MI access. However, compared to broadband Internet access via fixed networks, the MI use intensity observed in the sample during the first quarter of 2008 is still low. In Germany, the average monthly IP traffic volume per fixed broadband line (DSL, cable modem) added up to 9.65 GB in 2008.[47] Thus, the average customer in my sample reached just 1.1% of the IP data volume generated by a typical fixed network broadband user in Germany in 2008.

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[44] Church et al. (2007), p. 9; Verkasalo (2007), pp. 16-17; Smura et al. (2009), pp. 62-64; Verkasalo (2009), p. 75.

[45] Verkasalo (2009), p. 76.

[46] Cisco (2009).

[47] Cf. Bundesnetzagentur (2009), pp. 71, 73, 85.

Table 2: Descriptive statistics and bivariate correlations of study variables (n = 304)

Variables[c]	Data source[d]	Descriptive statistics[a] M	SD	Correlations[b] 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Outgoing SMS traffic (number per month)	BS	66.75 [34.50]	116.13	–	51***	23***	26***	–16**	–02	01	02	03	02	–03	–10+
2. Incoming SMS traffic (number per month)	BS	28.02 [13.00]	44.56	65***	–	28***	43***	–12*	–01	–02	–09+	–01	–08	05	–08
3. Outgoing voice traffic (minutes per month)	BS	325.76 [139.00]	442.84	30***	27***	–	39***	–18**	13*	03	–04	04	00	–07	–04
4. Incoming voice traffic (minutes per month)	BS	96.62 [53.22]	135.42	32***	37***	46***	–	–09	05	03	00	–06	–01	–09	01
5. Age (years)	CAS	30.77 [28.00]	10.25	–18***	–08**	–10*	–01	–	08	05	00	–07	12*	03	00
6. MI access appliance = Laptop only[e]	SRI	0.45	0.50	00	–01	11*	07	03	–	16**	10+	01	11+	00	–17**
7. MI tariff = Strictly use-dependent[e]	BS	0.20	0.40	–02	–07	07	07	04	16**	–	06	–08	–09	02	–13*
8. Email = Most frequently used MI service[e]	SRI	0.60	0.49	05	–01	–01	00	03	10+	06	–	–28***	04	14**	–06
9. IM = Most frequently used MI service[e]	SRI	0.05	0.22	–07	–05	–01	–06	–07	01	–08	–28***	–	05	–03	17**
10. MI subscription motive = Mainly job-related[e]	SRI	0.08	0.27	–04	–06	07	02	08+	11+	–09	04	05	–	–09	–00
11. MI value assessment[f]	SRI	5.47 [5.67]	1.56	–05	–00	–07+	–06	06	01	01	11*	–03	–07	–	–05
12. MI use intensity (IP traffic in MB per month)	BS	103.89 [14.39]	195.91	–05	–02	02	02	–04	16***	–31***	–07	12**	01	–05+	–

a) M = Mean. SD = Standard deviation. Figure in squared brackets below each mean is the variable's median. Median values are not calculated for nominally-scaled variables 6 to 10.

b) Leading decimals are omitted for association coefficients (e.g., –16 = – 0.16). Figures above the main diagonal are *Pearson* product-moment correlations (*r*). Coefficients below the main diagonal are *Kendall* rank-order correlations (τ–*b*).

c) MI = Mobile Internet. IM = Instant messaging. IP = Internet protocol. KB = Kilobyte.

d) BS = Billing system. CAS = Customer administration system. SRI = Self-report/-assessment of customer in standardized telephone interview.

e) Binary variable with 1 = true and 0 = otherwise.

f) Average of assessments of six MI characteristics (reliable, fast, attractive price, secure/low data security risk, easy and comfortable to handle, predictable with regard to access and use costs) on a 10-point *Likert*-type answer format ranging from "not at all applicable" (= 1) to "fully applicable" (= 10). *Cronbach*'s $\alpha = 0.70$.

+ $p \leq 0.10$ * $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$ (two-tailed tests).

In accordance with suggestions of Smura et al. (2009, p. 61) and the empirical procedures of earlier SMS acceptance studies[48] *SMS use intensity* was operationalized by collecting the numbers of SMS (1) sent and (2) received as recorded in the MNO's billing system for the first quarter of 2008. These figures were divided by 3 to calculate measures of the average monthly outgoing and incoming SMS traffic per customer. The ranges of the monthly SMS use intensities varied from 0 to 1,103 SMS sent and between 0 and 373 SMS received. The average respondent sent (received) 66.75 (28.02) SMS per month (see variables 1 and 2 in Table 2). Again, mean outgoing and incoming SMS values considerably exceeded the sample's median figures for these two variables. Put differently, and in line with findings of Verkasalo (2008b, p. 62), a small proportion of study participants caused a large share of the outgoing and incoming SMS traffic. The sample mean of the monthly number of outgoing SMS is similar to the average volume of outbound SMS per month observed by Verkasalo (2007, p. 13) among early MI adopters in Finland in 2006. However, it is substantially higher than the average monthly number of 23.75 SMS sent per MNO customer in Germany in 2008.[49] This difference suggests that, compared to a typical MNO customer in Germany, the early MI adopters in the sample were, on average, also more extensive SMS users. Outgoing and incoming SMS were significantly positively correlated (see Table 2), but the strength of this association was somewhat lower than the *Pearson r* of 0.79 observed by Höflich/Rössler (2001) in a sample of 204 German teenagers in a survey study organized in July 2000.

As proposed by Verkasalo (2007, p. 13) and Smura et al. (2009, p. 61), *mobile voice use intensity* was measured by extracting the monthly average number of outgoing voice minutes and the monthly average quantity of incoming voice minutes during the first three months of the year 2008 for each study participant from the MNO's billing system. Compared to operationalizations of voice use intensity of past research,[50] which were based merely on the number of calls, this measure is advantageous because it reflects both the number and the duration of mobile voice calls. Variable values of monthly outgoing voice traffic ranged from 0 to 3,194 minutes; incoming voice traffic varied between a minimum of 0 minutes and a maximum of 1,452 minutes per month. The average participant generated 325.76 (96.62) minutes of outgoing (incoming) voice traffic during the first quarter of 2008 (see variables 3 and 4 in Table 2). Sample

[48] E.g., Yan et al. (2006), p. 21; Turel et al. (2007), p. 67; Verkasalo (2007), pp. 12-13.
[49] Cf. Bundesnetzagentur (2009), pp. 78, 81.
[50] E.g., Höflich/Rössler (2001); Grzybowski/Pereira (2008); Wei (2008).

median values of outgoing and incoming voice call minutes were lower than the sample means of these two use intensity indicators. This indicates that the distribution of voice traffic was also positively skewed by a small number of customers who each caused a far above average volume of mobile voice traffic. The sample mean number of outgoing mobile voice minutes per month was about 15% lower than the mean mobile voice usage intensity detected by Verkasalo (2007, p. 13) in his study of early smartphone adopters in Finland. In contrast to this, the present sample's mean values of monthly outgoing and incoming mobile call minutes were much higher than the corresponding averages of 69 outgoing and 54 inbound mobile voice minutes per month which were generated by a typical MNO customer in Germany in 2008.[51] Again, this difference highlights that the early MI adopters in my sample were also more active mobile voice service users than the "normal" MNO customer in Germany.

Outgoing and incoming mobile voice minutes were significantly positively correlated ($r = 0.39$, $\tau\text{–}b = 0.46$, $p \leq 0.001$; see Table 2), which is line with findings of Verkasalo (2007) and Wei (2008). As can be seen from the correlations between the use intensity variables in Table 2, individuals who were heavy mobile voice service users also tended to show high levels of SMS use intensities. These associations support earlier empirical work[52], which also suggested that mobile voice and SMS are not competing modes of electronically mediated interpersonal communication but rather complementary mobile services.

To sum, a total of 5 objective mobile communication use intensity indicators was extracted from the collaborating MNO's internal billing system. The sample variance of each of these measures was high. This implies that a statistical prerequisite for the existence of correlations between the demand for SMS and mobile voice services on the one side and MI use intensities on the other side was met in this study's sample.

IV.3.2.2 Circumstances of mobile Internet use

The *type of appliance* which a customer primarily used to obtain MI access (see H_3 und H_4) was measured in the telephone survey by asking participants to report the device which they currently apply to access MI. They were provided with three response options (see variable 6 in Table 1). The answers were transformed into a binary variable which was coded as 1 for respondents who

[51] Cf. Bundesnetzagentur (2009), pp.78-79.
[52] Höflich/Rössler (2001); Verkasalo (2007).

claimed to use laptops only as their MI appliance (44.7% of the sample) and 0 otherwise. Information on a participant's type of *MI tariff* (see H_5) was taken from the MNO's billing system. Subjects who had subscribed to a use-dependent MI price plan received a value of 1 (20.1% of the sample); a value of 0 was assigned to the remaining participants with a block scheme or a flat rate (see variable 7 in Table 2).

The measurement of whether *e-mail* or *IM* was the *MI service most frequently used* by a participant (see H_6) was based on subjective self-assessments collected in the telephone interviews. The MI adopters were requested to indicate the MI service they presently use most frequently out of a list of 17 diverse services (e.g., search machines, audio streaming, social networks, general news). The answers were transformed into two binary scales, one to capture whether e-mail (1 = yes, 0 = otherwise) and one to reflect whether IM (1 = yes, 0 = otherwise) was selected as the most frequently used MI service. 60.2% of the participants claimed that e-mail is their most frequently used MI service. 4.9% reported that IM is the MI service, which occupied the top position in terms of use frequency (see variables 8 and 9 in Table 2).

MI subscription motive (see H_7 and H_8) was gauged by a single question in the telephone survey. Interviewers queried why an individual had chosen to subscribe to an MI offering of their MNO. The question was accompanied by 3 answer categories (see variable 5 in Table 1). The responses were dichotomized. Subjects received scale value of 1 if they stated that they became MI users primarily due to job-related reasons; otherwise they were assigned a value of 0. 7.9% of the sample reported that they had adopted MI mainly for job-related purposes.

The *assessment of MI value* (see H9) followed previous work which dealt with similar perceived benefits/utilities and costs/sacrifices of MI access under diverse conceptual labels such as "value"[53], "usefulness"[54], "system quality"[55], "service quality"[56], "relative advantage"[57], "utility"[58], or "performance expec-

[53] Kim et al. (2007), p. 114; Lee/Jun (2007), p. 344; Turel et al. (2007), p. 64; Kuo et al. (2009), p. 891.

[54] Cheng (2008), p. 51; Kim et al. (2008), p. 130; López-Nicolás et al. (2008), p. 364; Kim et al. (2009), p. 8531; Mallat et al. (2009), p. 195.

[55] Shin (2007), p. 482; Lee et al. (2008), p. 3.

[56] Kuo et al. (2009), p. 891.

[57] Hsu et al. (2007), p. 717; Chen et al. (2009), p. 242.

[58] Verkasalo (2008a), p. 51.

tancy"[59]. Participants were asked to rate the extent to which they agreed that – according to their own MI use experience – MI is (1) "reliable", (2) "fast", (3) "secure", (4) "easy and comfortable to handle" and (5) "predictable with regard to access and use costs". For each characteristic, subjects expressed their degree of agreement on a 10-point *Likert*-type answer continuum for which 1 represents "not at all applicable" and 10 equals "fully applicable". A principal component factor analysis of the five items yielded only one factor with an eigenvalue > 1.00. Therefore, the average of the five items was taken to measure a customer's MI value assessment (see variable 11 in Table 2). The *Cronbach* α internal consistency reliability of this scale reached a satisfactory level of 0.70.

Two further individual background characteristics (occupation, length of MI use experience; see Table 1) were obtained in the telephone survey by asking direct questions accompanied by default response options. Finally, information on age and gender (see Tables 1 and 2) was taken from the MNO's customer administration system.[60]

IV.4 Empirical analyses addressing the research questions and hypotheses

Correlations and multivariate regressions were calculated in order to address the research questions and the hypotheses (see Table 3). The regressions contained the MI use intensity metric (see H_1 and H_2) and the MI use circumstances (see H_3–H_9) as independent variables and the four SMS and voice traffic measures as dependent criteria. Further, they included the age of a customer as a control variable which captured both generation-related and budget constraint impacts on the use intensity of SMS and mobile voice services. Finally, the outgoing/ incoming amount of traffic for the corresponding other "traditional" mobile communication service was also entered as a control variable. Multicollinearity was not a problem in the regressions because the variance inflation factors of the predictors did not exceed 1.50 which is far below the threshold values of 5–10 recommended in the literature.[61] However, *Cook's D* statistic revealed that the

[59] Koivumäki et al. (2008), p. 72.

[60] There were no incidents of deviation between gender recorded by the telephone interviewers and the gender code contained in the files of the MNO's customer administration system.

[61] E.g., Chatterjee/Price (1991), p. 191; Cohen et al. (2003), pp. 423-425.

Table 3: Regression results for SMS and voice traffic

	Dependent variables[a]							
	SMS traffic				Voice traffic			
	out (n = 281)		in (n = 282)		out (n = 272)		in (n = 257)	
Independent variables[b]	β	p ≤	β	p ≤	β	p ≤	β	p ≤
1a. Outgoing SMS traffic [1]	–		–		**14** [15]	060 [028]	–	
1b. Incoming SMS traffic [2]	–		–		–		**29** [28]	001 [001]
1c. Outgoing voice traffic [3]	**37** [40]	001 [001]	–		–		–	
1d. Incoming voice traffic [4]	–		**36** [36]	001 [001]	–		–	
2. Age [5]	**–15** [–22]	006 [001]	–07 [–11]	205 [080]	–09 [–09]	132 [148]	–06 [–05]	324 [408]
3. MI access only through laptop [6]	01 [02]	866 [764]	06 [02]	313 [756]	07 [05]	296 [402]	09 [10]	173 [112]
4. Strictly use-dependent MI tariff [7]	–04 [–01]	439 [946]	**–20** [–13]	001 [032]	–02 [–01]	788 [918]	**10** [10]	097 [100]
5. Email most frequently used MI service [8]	06 [06]	331 [294]	01 [02]	931 [722]	–03 [–00]	694 [974]	02 [03]	787 [678]
6. Instant messaging most frequently used MI service [9]	**–11** [–12]	056 [042]	–03 [–07]	566 [248]	–07 [–04]	259 [518]	00 [–01]	995 [868]
7. Mainly job-related MI subscription [10]	–08 [–08]	148 [184]	**–11** [–08]	062 [180]	08 [08]	211 [166]	**16** [14]	011 [026]
8. MI value assessment [11]	**–09** [–10]	099 [088]	–00 [–03]	936 [660]	–06 [–08]	361 [188]	–00 [01]	984 [884]
9. MI use intensity [12]	**–14** [–16]	014 [010]	**–13** [–10]	025 [092]	–01 [–02]	831 [782]	–08 [–11]	191 [074]
Multiple R^2	0.234		0.187		0.045		0.134	
Regression F-Value	9.211		6.934		1.377		4.249	
Degrees of freedom	9, 271		9, 272		9, 262		9, 247	
p ≤	0.001		0.001		0.199		0.001	

a) Respondents whose predicted criterion values deviated at least 3 standard deviations from the predicted sample mean value of a criterion were excluded to ensure that results were not distorted by influential outliers. For the remaining cases *Cook*'s *D* values did not exceed 0.42 indicating that no influential outliers remained present in the reduced samples. Figures in squared brackets below each standardized regression weight (β) are *Pearson* zero-order correlations (r). All leading decimals are omitted for β- and r-values. β-values achieving statistical significance at p ≤ 0.10 (two-tailed) are set in bold.

b) Figure in squared brackets in this column refers to the number assigned to a variable in Table 2.

regression estimates were distorted by influential outliers.[62] Therefore, Table 3 reports only the regressions which excluded the outlying cases.[63]

Research questions 1 and 2 as well as H_1 and H_2 dealt with interrelationships between MI use intensity (see variable 12 in Table 2 and variable 9 in Table 3) and the demand for SMS and voice calls (see variables 1-4 in Table 2). The pertinent bivariate *Pearson* and *Kendall* correlations in Table 2 did not reach the 5% level of statistical significance. However, in the multivariate analysis MI use intensity exhibited a significantly negative regression weight for both outgoing and incoming SMS volumes. This supports H_1. Although the effects of MI use on the two SMS demand criteria were statistically significant at the 1.4% and 2.5% levels, the absolute sizes of the effects were quite small. For instance, the regression equation for SMS sent indicated that a monthly IP traffic increase of 34.76 MB would result in one outgoing SMS less per month. In the regression MI use intensity accounted only for a unique share of 1.8% (1.5%) of the variance of the outgoing (incoming) SMS quantities. In accordance with H_2, for both voice traffic measures no significant relationships were found with the MI use intensity indicator in the bivariate and multivariate analysis.

Counter to H_3, customers who accessed MI only via laptops did not differ in their SMS traffic from MI adopters who exclusively or at least partially relied on handsets to use MI (see variable 6 in Table 2 and variable 3 in Table 3). Laptop-based MI customers generated and received similar quantities of mobile voice call minutes. This supports H_4.

Contrary to H_5, a subscription to a use-dependent MI tariff showed no relationship to outgoing SMS traffic and a significantly positive association with incoming SMS quantities in the regressions (see variable 7 in Table 2 and variable 4 in Table 3). With regard to mobile voice traffic, the multivariate results in Table 3 suggest that customers with a use-dependent MI tariff attracted a slightly larger volume of incoming call minutes than adopters with a block or flat MI price plan. Thus, all in all, H_5 was not supported.

[62] Cf. Cook/Weisberg (1982), p. 118.

[63] For outgoing (incoming) SMS, 23 (22) customers were discarded, each of whom sent (received) more than 150 (80) SMS per month. For outgoing (incoming) voice traffic 32 (57) persons were excluded, each of whom initiated (received) more than 860 (190) call minutes per month. In the four regressions for the reduced samples *Cook's D* values for all cases were far below the 1.0 threshold suggested by Cook/Weisberg (1982, p. 118).

H_6 was confirmed only for outgoing SMS quantities with regard to IM as the most frequently used MI service (see variable 9 in Table 2 and variable 6 in Table 3). The statistics in Table 3 indicate that MI adopters who report IM to be their favorite MI application generated a significantly lower number outgoing SMS.

Perceived job-relatedness of MI use (see variable 10 in Table 2 and variable 7 in Table 3) only had a marginally significant effect on the number of incoming SMS in the regression. Thus, the analysis provides very limited support for H_7. According to the regression results, customers who subscribed to MI primarily for job-related purposes received a significantly larger volume of mobile voice traffic than their counterparts whose MI use was not mainly triggered by business reasons. Hence, H_8 was confirmed for one of the two mobile voice use intensity criteria.

H_9, which posited a significantly negative impact of MI value perceptions (see variable 11 in Table 2 and variable 8 in Table 3) on the demand for SMS and mobile voice services, received almost no support in the sample: None of the pertinent bivariate and multivariate associations achieved the 5% level of statistical significance. For outgoing SMS quantities, the regression analysis revealed just a marginally significant ($p < 0.099$) negative effect of MI value perceptions on the criterion values.

IV.5 Discussion

The fast growth of MI subscriptions raises the question whether the demand for entrenched mobile communication services is detrimentally affected by the diffusion of this new type of ubiquitous access to the Internet and the universe of Internet-based services. The present research attempted to figure out relationships between MI use intensity, on the one hand, and the use intensities of SMS and mobile voice telephony as mainstreams services, on the other hand, at the level of the individual customer. Deviating from most earlier research, the investigation did not revert to questionnaire-based assertions concerning the extent to which a customer had used specific classes of mobile communication services. In fact, it extracted non-reactive, objective use intensity measures for MI, SMS, and mobile voice telephony from the billing system of a large MNO. These metrics were collected for a random sample of 304 German-speaking MI adopters and combined with survey responses obtained from each of them.

The key insight for practitioners from the empirical analysis is that there were significantly negative relationships between the intensity of MI use (average monthly amount of mobile IP traffic during the second quarter 2008) and the monthly quantities of SMS sent or received by a customer. However, the absolute magnitudes of these relationships were so small that their practical relevance for MNO is more than doubtful. Further, no associations were observed between MI use intensity and outgoing or incoming mobile call minute quantities. Taken together, the results lead to the conclusion that MI access satisfied mobile communication needs or delivered "gratifications" which were not congruent with the needs or gratifications which drive demand for two established service offerings, namely SMS and mobile voice calls.

These findings have important practical implications for MNO supply strategies and telecommunication market demarcation decisions of regulators. They indicate that MNO should not hesitate to aggressively push their MI offerings, for instance, through competitive prices and appealing devices, because demand for MI access and services is *unlikely* to cannibalize a large proportion of their high margin SMS and voice traffic. MI acceptance may even be enhanced by tying SMS or voice minute quantities together with mobile IP traffic allowances in single "packaged" offers. This may attract those customers who are strong general communicators across various mobile service categories. For telecommunication sector regulators, the absence of strong negative relationships between MI and voice telephony use intensities suggests that the up to now prevailing practice to classify MI and mobile voice services as distinct markets is tenable from a demand-side perspective. However, the small correlation between MI and SMS use intensities also implies that from a customer point of view, regulators are well-advised not to lump these two service types together in an "umbrella" rubric entitled MI services or MDS in case of delineating markets susceptible to state interventions.

The results also give rise to some considerable scholarly qualifications concerning the validity of past research on factors influencing the acceptance of innovative MI services or MDS. This strand of work has typically reported that a large share of behavioral intentions to initially use or to continue the use of MI services/MDS was explained by various facets of the perceived value of the offerings and by personal characteristics (e.g., openness for innovations). In contrast, the present investigation detected that the correlation between actual MI use intensity and MI value assessment was close to zero (see variables 11 and 12 in Table 2). This observation lends support to critics of common MI and MDS

studies who argue that insights which can be gained from pure survey (i.e. single-source) studies with regard to determinants of real MI use behaviors are quite narrow.[64] According to the present research, objective measures of MI, SMS and voice telephony intensities share very little variance with a survey-based scale of MI value perceptions. These intensities appear to be shaped by other factors such as contextual communication requirements.

In interpreting the results of the current research, one should consider its shortcomings from which avenues for future scholarly efforts can be derived. A first limitation relates to the broad operationalization of a customer's MI use intensity. Measuring use intensity on the basis of monthly IP data transmission volume takes account neither of the classes of applications "behind" the MI traffic nor of the personal arousal or involvement caused by the data exchanged over cellular networks. The lack of differentiation of various MI service types is particularly unfortunate because several studies[65] have highlighted the advantages of researching MI or MDS use at the level of the individual service category instead of MI/MDS use in general. Thus, additional research is needed to develop more fine-grained non-reactive measures of use intensities of distinct MI service types which are extractable from MNOs' billing and customer administration systems. This work may also look at the extent and drivers of convergence between unobtrusive and survey-based measurements of MI use intensity.

A second limitation results from the present study's focus on persons who possessed MI experience already during the first quarter of 2008 or even before this period. This implies that I looked only at customers who were early adopters of MI offerings. However, according to diffusion of innovation theory, communication behaviors as well as determinants of such behaviors may differ between pioneer and later adopters.[66] Hence, future research should examine the extent to which the present study's focal variable interrelationships remain constant as MI markets evolve by comparing different adopter categories over time.

A third limitation concerns the sample. It consisted of residential MI users of one MNO in Germany only. The extent to which this has effects on the generalizability of the findings to consumers or business customers outside of the German market is unclear. This is yet another important issue to be explored in future work which could fine-tune our current understanding of the implications

[64] Cf. Bouwman et al. (2007), p. 149; Lee et al. (2007b), p. 2075.
[65] E.g., Bouwman et al. (2007); Hong et al. (2008); Bouwman et al. (2009).
[66] Rogers (2003), chapter 7.

of the accelerating MI uptake by MNO customers for the demand of SMS and mobile voice telephony.

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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 –

Torsten J. Gerpott

Abstract

Most research on the first adoption and subsequent use (= acceptance) of Internet access through cellular networks and portable 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.

Keywords: Acceptance; Adoption; Advanced mobile data services; Common method biases; Factual use case features; IS user survey; Mobile communications; Mobile Internet; Perceptual constructs; Use intensity measurement.

V.1 Introduction

Mobile Internet (MI) is a topical subject which scholars and practitioners define in a variety of ways. Some authors[1] 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, e-mail) *through 2.5G or 3G cellular mobile communication networks with high transmission speeds*.[2] 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.[3] 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 cre-

[1] E.g., Yoo/Moon (2006); Lee et al. (2007a); Shin (2007); Song et al. (2007); Verkasalo (2008a).

[2] Minges (2005); Groeppel-Klein/Koenigstorfer (2007); Kim et al. (2007); Lee et al. (2007a); López-Nicolás et al. (2008); Bouwman et al. (2009); ITU (2009).

[3] Hong/Tam (2006).

ate 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.[4] 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.[5]

Worldwide MNO set strong hopes on MI as a market with phenomenal subscriber and revenue growth.[6] 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.[7] 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.[8] In addition, a considerable share of MI subscribers fails to use it intensively or even completely ceases to apply MI after the initial adoption.[9]

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 et al. (2007), Lee et al. (2007b), Chen (2008), López-Nicolás et al. (2008), Lu et al. (2008), Chen et al. (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 et al. (2006), Bouwman et al. (2007), Lee et al. (2007a), Hong et al. (2008), Kim et al. (2008), Koivumäki et al. (2008), Bouwman et al. (2009), Kim et al. (2009), Kuo et al. (2009) and Mallat et al. (2009) rank among recent instances of research which emphasizes the explanation of *post-adoption* customer use behaviors.

[4] E.g., López-Nicolás et al. (2008); Kuo et al. (2009).
[5] Bina et al. (2008); Hong et al. (2008); Lee et al. (2008); Kuo et al. (2009).
[6] BITKOM (2009); IDATE (2009).
[7] Minges (2005); Funk (2007); ITU (2009).
[8] Economides/Grousopoulou (2008); Koivumäki et al. (2008); Mohr (2008).
[9] Lee et al. (2007a); Kim et al. (2008); Lee et al. (2008); Verkasalo (2008b).

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[10], as well as for telecommunication and IS services in particular.[11] 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.[12]

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.[13] 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 et al. found "that more than one-third of all respondents failed to report their past [MDS] usage accurately"[14]. To date, MI/MDS accep-

[10] Chandon et al. (2005); Seiders et al. (2005); Trommsdorff (2009), pp. 152-154.

[11] Szajna (1996), p. 89; Kim/Malhotra (2005), p. 187; Verkasalo (2008a), pp. 47, 52.

[12] Bouwman et al. (2007), p. 149; Sharma et al. (2009), pp. 483-484.

[13] E.g., Fogelgren-Pedersen (2005); Sugai (2007); Turel et al. (2007); Bina et al. (2008); Economides/Grousopoulou (2008); Koivumäki et al. (2008); Lee et al. (2008); Oh et al. (2008); Wei (2008); Westlund/Bohlin (2008); Bouwman et al. (2009).

[14] Kim et al. (2008), p. 124.

tance 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.[15] If anything, it typically relies on quite general participants' self-ratings of their use behaviors on ambiguous response formats[16]. Based on the preceding discussion, one may conclude that these global self-reports can hardly be classified as strongly convincing measures of the actual use of distinct classes of mobile services.[17]

The strong evidence that stated behavioral MI/MDS use intentions and unspecific self-ratings of MI/MDS use behaviors are far from being congruent with actual MI/MDS use gives rise to the question why past research has mostly explained large proportions of variance of MI/MDS acceptance by perceptual measures of popular theoretical constructs such as, for instance, usefulness, value, relative advantage, utility, service quality, system quality, or performance expectancy of MI/MDS offerings. A key reason for this pattern of results may be that relationships between independent variables and MI acceptance criteria are exaggerated because of "systematic error variance shared among variables measured with and introduced as a function of the same method and/or source".[18] Therefore, a comparison of relationships between potential determinants of MI or MDS acceptance and distinct use intensity criteria based on diverging measurement approaches is beneficial in improving our understanding of the extent to which estimates of the impacts of various independent perceptual constructs suggested by earlier work may be inflated due to common method biases.[19] The detection of variable associations distorted by common method variance has considerable scientific and practical value because it helps to reduce misleading conclusions drawn from single-method studies.

To my best knowledge, there are only three publications containing measures of customers' *actual MI use behaviors*.[20] An explanation for this paucity of work capturing *real behavior classes* at the level of the individual customer (e.g., duration of a mobile user's visit of a search website) is that such non-reactive data cannot be obtained by plain surveys. In fact, if researchers do not want to install

[15] E.g., phrasing of questions, design of response options, recourse to customer diaries to register user actions at several occasions; cf., Kim/Malhotra (2005); Thulin/Vilhelmson (2007).

[16] Normally "agree – disagree" scales; cf., Sharma et al. (2009), pp. 478-479.

[17] Straub/Burton-Jones (2007), p. 225.

[18] Richardson et al. (2009), p. 2.

[19] Straub/Burton-Jones (2007); Sharma et al. (2009).

[20] Church et al. (2007); Kim et al. (2008); Verkasalo (2008a and 2008b).

a measurement software on the device of each study subject[21], such measures require access to the billing or customer administration systems of MNO. Therefore – and in line with Sharma et al. (2009, p. 479) – they are denoted as "system-captured" use criteria in the remainder of this paper. Operators tend to treat internal traffic information as confidential and accordingly are rarely willing to share it with external researchers. Thus, it should not come as a surprise that I am not aware of a single scholarly study which has collected objective MI use measures at the individual customer level *and* compared the explanatory power of potential antecedents of MI acceptance for both self-report and measures of actual use intensity. The purpose of this paper is to contribute toward closing this research gap.

The rest of this article proceeds in six sections. Section V.2 develops hypotheses concerning differences in the magnitude of relationships between potential determinants of MI use intensity on the one hand and self-report as well as system-captured operationalizations of the dependent construct on the other. The empirical methods used to obtain measures of the study variables are then presented. Section V.4 describes the results of the statistical analysis in order to test the hypotheses. Section V.5 and V.6 discuss the study's empirical findings as well as its research and practical implications. The final section elaborates the paper's core conclusions.

V.2 Development of hypotheses

Most investigations of factors influencing MI acceptance do not explicitly mention the issue of a distortion of their results by common method variance.[22] In general, they confine themselves to providing statistical evidence concerning the discriminant validity of their measures by putting a study's items into a confirmatory or exploratory factor analysis. Then, the researchers show that various hypothesized factors have emerged from the analysis. From this finding they appear to implicitly conclude that common method variance does not pose a serious problem to the validity of the investigation's focal variable associations. However, the emergence of multiple factors "is not evidence that the measures are free of common method variance"[23]. Both confirmatory and explorative factor analysis techniques are especially characterized by an "insufficient sensi-

[21] Cf., Verkasalo (2008a), p. 45.
[22] For an exception see Hong/Tam (2006), p. 171.
[23] Podsakoff et al. (2003), p. 889.

tivity to detect small or moderate levels of common method variance effects"[24]. Even worse, some researchers incorporate only their independent indicators but not their acceptance items in the factor analysis.[25] Due to this omission, the results of their factor analysis are inappropriate to assess the extent to which the associations observed between independent constructs and self-report MI use intensity measures are attributable to the common method. Finally, previous MI acceptance studies did not resort to any of the more advanced statistical diagnostics and remedies discussed in the literature on common method bias.[26] Thus, it is reasonable to conclude that previous survey research on determinants of MI acceptance provides only very weak evidence that the studies' findings were not severely affected by common method distortions. Hence, it appears seminal to discuss in greater depth impacts of common method bias on results of various types of MI acceptance investigations.

As explained above, self-report measures of both pre- and post-adoption MI acceptance differ depending on whether they concentrate on abstract behavioral intentions or on more specific descriptions of one's own past MI use behaviors. The majority of past MI acceptance research has focused on explaining ratings of *general behavioral intentions to use MI in the future* by independent variables which refer to *complex perception-based constructs* and which are therefore not directly observable. Among such constructs are (I) customer *evaluations* of the outcomes of MI offerings for the user (e.g., relative advantage/usefulness, usability/ease of use, enjoyment, satisfaction, quality, value/benefits-sacrifice ratio), (II) customer *beliefs* concerning the endorsement of MI use by their close social contacts or in the mass media (social norms/influence), and (III) personal *traits* of customers (e.g., propensity to try out new offerings in general and innovative mobile communications services in particular, self-efficacy). These factors of influence are difficult to gauge without omission of relevant and inclusion of irrelevant construct facets. In addition, it is very hard to translate conceptually distinct constructs emphasized in admired nomological networks (e.g., technology acceptance model [TAM], diffusion of innovation [DOI] theory) into concise and unambiguous questionnaire items whose content is not partially

[24] Malhotra et al. (2006), p. 1867.

[25] E.g., Cheong/Park (2005), pp. 134-135; Hsu et al. (2007), p. 720; Kim et al. (2007), p. 124; Bina et al. (2008), p. 303; Kim et al. (2008), p. 132.

[26] See Podsakoff et al. (2003), pp. 889-897; Richardson et al. (2009), pp. 6-9; Temme et al. (2009), pp. 130-136.

overlapping or even tautological with subjective behavioral MI use intention measures.[27]

It is just this architecture of a typical MI/MDS study which is especially prone to common-method distortions of predictor-criterion associations. The high probability of artifactual covariance in this research setting results "from the fact that the predictor and criterion variables are obtained from the same … rater"[28] and from "the manner in which items are presented to respondents"[29]. Main reasons for method effects produced by a common source of independent and dependent variables are participants' desire to appear consistent and rational in their responses, implicit theories held by persons with regard to the co-occurrence of rated items/constructs, respondents' tendencies to give socially desirable answers and people's general propensity to agree or disagree with survey items independent of their content.[30] Furthermore, MI or MDS questionnaire studies overwhelmingly relied on similar *Likert*-type item formats and on identical answer anchors as well as the same number of response levels in measuring abstract antecedents of MI acceptance and the criterion itself.[31] This practice "makes it easier for the respondents to complete the questionnaire", but it "may also increase the possibility that some of the covariation observed among the constructs may be the result of the consistency in the scale properties rather than the content of the items"[32].

One avenue to decreasing common method variance problems of past prototypical MI acceptance studies lies in a revised conceptualization of the dependent MI acceptance criterion. Here, a shift away from probing for general behavioral intentions[33] may reduce common method biases. Instead of this criterion type, questions requiring descriptions of specific verifiable behaviors appear to be

[27] Cf., Bouwman et al. (2007), p. 149; Straub/Burton-Jones (2007), p. 225; López-Nicolás et al. (2008), p. 360.

[28] Podsakoff et al. (2003), p. 881.

[29] Podsakoff et al. (2003), p. 883.

[30] Podsakoff et al. (2003), pp. 881-883.

[31] E.g., Hong/Tam (2006), pp. 177-178; Hsu et al. (2007), pp. 724-725; Kim et al. (2007), pp. 123-124; Lee et al. (2007a), p. 50; Shin (2007), p. 482; Chen (2008), pp. 51-52; Hong et al. (2008), p. 443; Kim et al. (2008), p. 130; Koivumäki et al. (2008), p. 70; Lee et al. (2007b), p. 2072; Lee et al. (2008), pp. 4-5; López-Nicolás et al. (2008), pp. 363-364; Lu et al. (2008), pp. 62-63; Bouwman et al. (2009), p. 308; Kim et al. (2009), pp. 8535-8536; Kim/Garrison (2009), pp. 331-332; Kuo et al. (2009), p. 891; Kuo/Yen (2009), p. 106; Mallat et al. (2009), p. 195.

[32] Podsakoff et al. (2003), p. 884.

[33] E.g., "I intend to continue using MDS in the future"; cf., Hong et al. (2008), p. 443; Lu et al. (2008), p. 62; Kim et al. (2009), p. 8536.

promising.[34] Responses to this type of queries may be collected on continuous scales without predetermined answer options or with a closed set of quantitatively anchored answer categories.[35]

In the literature on IS acceptance, such criterion variables focusing on how frequently an IS system is used and on the duration per use are referred to as *use intensity*. Explaining variance in (stated) IS use intensity has been a key topic in IS research for years.[36] In contrast, relatively little attention has been paid to the narrower subject of clarifying differences in (stated) *MI* use intensity. In MI acceptance research, a shift away from broad use intention measures towards (stated) use intensity criteria is not only prudent to reduce common method bias problems, but it also entails a significant advantage from a practical point of view: For MNO the commercial success of their MI offering is more directly shaped by MI access frequencies and durations of their customers rather than by customer intentions to just adopt or merely continue to use MI.

Nevertheless, even a focus on self-reported MI use intensity as the dependent acceptance variable is unlikely to completely eliminate common method bias problems. Still objective, non-reactive measures of MI use intensity obtained from another source than the person whose questionnaire responses form the basis of capturing independent constructs are less affected by method distortions caused by a common rater or by item characteristics.[37] Therefore, their correlations with predictors should be less inflated than the associations between self-reports of MI use intensity and the same set of survey-based predictors. Thus, I propose the following hypothesis (H):

> H_1: Correlations between potential determinants of MI use intensity measured by survey responses and self-reports of MI use intensity are higher than associations between these independent variables and system-captured MI use records.

A second avenue to improving past prototypical MI acceptance studies consists of an extension of the kinds of considered predictors. The emphasis on a limited set of perception-based abstract customer beliefs about MI/MDS offerings has

[34] E.g., "In the course of the past 4 weeks, how many e-mails have you sent via your MI access on a typical day?"; cf., Kim/Malhotra (2005), pp. 195-196; Economides/Grousopoulou (2008), pp. 739-744.

[35] Sharma et al. (2009), p. 479.

[36] Benbasat/Barki (2007), p. 213.

[37] Podsakoff et al. (2003), p. 897; Straub/Burton-Jones (2007), p. 226; Sharma et al. (2009), p. 479.

led researchers to neglect *factual attributes of MI offerings*.[38] Examples of this class of independent variables include access speed, the type of tariff scheme upon which a customer's MI invoice is based, or the appliance category used by the customer to obtain MI access. Further, most investigations left out *objectively verifiable personal living circumstances* as potential predictors of MI acceptance. Illustrative instances for this category of predictors are whether customers are frequently on the move or whether they live in a household with a landline broadband Internet access. Past research on acceptance of residential fixed broadband Internet access and on mobile telephony lines has shown that such factual attributes and living circumstances are significant predictors both of the initial adoption of fixed Internet access or mobile telephony offerings and of their subsequent use intensity.[39]

Whereas common method bias is likely to lead to strong correlations between complex evaluations of one's MI experiences or expectations and (diffuse) behavioral use intentions, this kind of independent variables should be less associated with acceptance criteria which focus on (stated or actual) tangible MI use intensities.[40] Therefore, if researchers seize upon such behavioral criteria, then variables which *describe* factual MI use features or clearly detectible personal living circumstances of MI usage should predict the dependent measures better than the perceptual constructs prevailing in past MI acceptance research. This differential predictive capability should not just hold in case of a research architecture that comprises dependent actual behavioral data obtained from another source than the independent variables and, therefore, does not suffer from common method problems. Rather, it should also be maintainable in a research setting with self-rated MI use intensity measures. Although common method bias is to be expected in this setting (see H_1), one may argue that the distortion *equally* affects the relationship between *any* of the independent variables and the MI use intensity self-rating.[41] This in turn leaves the *relative* standing of each of the predictor's impacts on the subjective criterion measure unchanged. Formally, I hypothesize:

H_2: Variables which describe factual attributes or easy-to-verify personal living circumstances of MI usage better predict both self-reports and system-captured records of MI use intensity

[38] Cf., Benbasat/Barki (2007), pp. 212-213.

[39] Rodini et al. (2003), p. 471; Gerpott (2007), pp. 803-804; Bouwman et al. (2007), p. 149; Dwivedi (2008), pp. 139-163; Rappoport et al. (2009), pp. 194-196.

[40] Sharma et al. (2009), p. 479.

[41] Cf., Richardson et al. (2009), pp. 4-5.

than variables which gauge perceptual constructs related to customers' assessments of various benefits and sacrifices adjunct to MI use.

V.3 Empirical methods

V.3.1 Data collection procedures and sample

This study's data base was generated in collaboration with the German subsidiary of the mobile division of a large international telecommunications network operator. This MNO had permitted to draw a random sample of 350 individuals out of their postpaid residential customer base who had subscribed to an MI tariff and for whom the billing system of the MNO indicated that they had generated mobile IP traffic during the first quarter of 2008. These active MI adopters were contacted on their mobile inviting them to participate in a standardized telephone survey. The inquiries and interviews were conducted by trained agents of a major market research firm in the name of the cooperating MNO during an 8-day period in April 2008. The telephone survey dealt with customer perceptions of personal reasons for signing an MI contract with their MNO, MI use experiences, and MI use behaviors. A total of 300 customers completed the interviews without any response denials for the items pertaining to stated MI use intensity (see below). They constitute the sample analyzed in the remainder of this work.

Table 1 presents three demographic features and three variables capturing MI-related background characteristics of the respondents. 82.7% of the participants were male. 60.3% fell in the age range from 19 to 30 years. In terms of occupation, 77.4% of the sample indicated to be employed by a private corporation or a public institution. 69.0% of the participants reported that they had started to use MI not longer than six months ago; 67.0% claimed that they had adopted an MI offering of their MNO mainly for private purposes; 8.7% stated that their MI subscription motive was primarily job-related, and the remainder reported both private and job-related reasons as their motive to use MI. 34.0% (54.3%) of the participants indicated that they had obtained MI access through a handset (lap-

Table 1: Profile of study sample

Characteristic[a]	n	%	Characteristic[a]	n	%
1. Gender (n = 300)			**4. Length of MI use experience** (n = 300)		
– male	248	82.7%	– less than 6 months	207	69.0%
– female	52	17.3%	– 6–11 months	60	20.0%
			– 12–23 months	22	7.3%
2. Age (n = 247)			– at least 24 months	11	3.7%
– 19–20 years	17	6.9%	**5. MI subscription motive** (n = 300)		
– 21–30 years	132	53.4%			
– 31–40 years	56	22.7%	– mainly private purposes	201	67.0%
– 41–50 years	33	13.4%	– mainly job-related purposes	26	8.7%
– 51–80 years	9	3.6%	– both private and job-related purposes	73	24.3%
3. Occupation (n = 284)			**6. MI access appliance** (n = 300)		
– Student/apprentice/pupil	54	19.0%			
– Employee	185	65.1%	– handset only	102	34.0%
– Self-employed person	35	12.3%	– laptop only	163	54.3%
– Other	10	3.5%	– both handset and laptop	35	11.7%

a) Data for characteristics 1 and 2 were extracted from the collaborating MNO's customer administration system. The measurement of the remaining four characteristics was based on customer self-reports gathered in standardized telephone interviews. 16 subjects refused to state their current occupation.

top[42]) only; 11.7% said that they had relied on both a handset and a laptop as appliances to get MI access. Overall, the gender and age structure of the present study's sample resembles the profile of early MI or advanced MDS adopters observed in previous investigations of this customer segment in countries other than Germany.[43]

V.3.2 Variable measurements

Information to objectively measure one of the two criteria addressed in the hypotheses was acquired from a different source than the one that had provided the data basis for remaining study variables. Put more precisely, a multi-method, mono-trait approach was chosen for MI use intensity as the dependent variable, whereas a mono-method, multi-trait design had been used to cover both evalua-

[42] The MNO's technical and contractual arrangements for the 163 laptop users were such that 111 of the customers in this group were also able to send/receive SMS and make/accept mobile voice calls (e.g., by providing them with an integrated set of two SIM-cards for their mobile computer and handset or with a handset which serves as a modem to connect their laptop with the operator's mobile data network). 52 persons within the laptop user subsample had opted for a "pure" (flat) laptop data tariff which made it impossible to use their mobile access for voice calls or SMS.

[43] E.g., Fogelgren-Pedersen (2005); Kim et al. (2007); Kim et al. (2008); Koivumäki et al. (2008); Oh et al. (2008); Verkasalo (2008a); Westlund/Bohlin (2008).

tive constructs frequently explored in past run-of-the-mill MI/MDS acceptance research and supplementary factual variables describing the MI use case and environment.

Before conducting the telephone survey, this study's questionnaire was pretested in interviews with five experts working in the product management unit of the MNO that supported the study. The initial survey content was modified according to the experts' suggestions. The revised questionnaire was administered to a pilot group of ten MI adopters. These individuals commented on the clarity of the item wording. Lastly, they were invited to give other suggestions on how the questionnaire could be improved. The recommendations of the pilot test were consulted in the development of the final instrument for the main survey.

V.3.2.1 Measurement of MI use intensity

The *self-report scale of MI use intensity* was constructed from responses to three questions adopted from previous MI, MDS and IS research.[44] First, it was asked "How often do you currently use MI services?".[45] The question was accompanied by five *Likert*-type response options which started with "less than once a week" (coded as 1) and ended with "several times per day" (coded as 5). Secondly, participants responded to the question "How long are you online during an average MI session?" using a five-point answer format ranging from "up to 5 minutes" (coded as 1) to "more than 60 minutes" (coded as 5). Thirdly, respondents reacted to the query "What average total amount of time per month do you spend on accessing MI services?" by choosing from a 5-point *Likert*-format answer continuum with end points being "up to 20 minutes" (coded as 1) and "at least 16 hours" (coded as 6). A principal component factor analysis of the three stimuli yielded one factor with an eigenvalue greater than 1.0 and with high loadings of at least 0.70 for each item. Therefore, the average of the three items was taken to measure a customer's self-reported MI use intensity (see variable 1 in Table 2). The *Cronbach* α internal consistency reliability of this scale was 0.76 which is above the threshold value of 0.70 generally required for construct measures composed of several reflective indicators. The scale mean of 3.58 was close to its median of 3.67. The scale's standard deviation of 1.06 suggested that the variance in the self-ratings of MI use intensity was sufficient to open up the

[44] E.g., Tung (2004); Kim/Malhotra (2005); Turel et al. (2007); Bina et al. (2008); Economides/Grousopoulou (2008); Koivumäki et al. (2008); Oh et al. (2008); Lee et al. (2008); Wei (2008); Kuo/Yen (2009).

[45] The original wording of all survey measures was in German and then translated into English for the present paper.

possibility of detecting significant correlations between this criterion measure and the independent variables.

The *system-captured, objective MI use intensity* measure was extracted from the collaborating MNO's billing engine. Earlier MI use research implies that the monthly volume of up- and downloaded IP-switched data traffic via an MNO's network is an adequate metric to capture *MI use intensity* at the individual customer level.[46] This operationalization approach has the benefit that other MDS such as SMS, MMS, or WAP-based applications which are distinct from MI access and services (see section 1), are eliminated, i.e., this metric precisely confines itself to MI as one sub-area of MDS. Further, a customer's IP traffic volume reflects both the frequency and the duration of MI use cases. Compared to mobile customers' monthly bills for their IP traffic which Sugai (2007) employed to gauge MI use intensity, the traffic figure has two advantages: First, it is applicable across various MNO with different price schemes. Secondly, the metric is not distorted by customers' (in)ability to exactly select the MI tariff which best fits their typical use behaviors in the sense that it minimizes their monthly amount paid for MI and is therefore insensitive to customers' potential biases against or in favor of specific types of pricing schedules.[47]

Therefore, I chose to obtain the average monthly IP traffic quantities (in kilo-/megabyte [KB/MB]) recorded for a customer by the MNO's billing system during the second quarter of 2008. Variable values ranged from 2.00 KB to 952.46 MB. The mean MI use intensity in the sample was 130.17 MB per month (SD = 218.06; see variable 2 in Table 2). The median MI use intensity amounted to 30.32 MB. The large difference between mean and median shows that there existed a small number of "very heavy users" with IP traffic volumes well above the sample median and many customers who caused only a moderate IP traffic quantity.

Verkasalo (2008b, p. 62) detected a similarly skewed MI use intensity distribution in his study of Finnish smartphone customers arranged in 2005 and 2006. However, the average monthly MI use intensity of this author's subjects amounted only to 1.9 MB in 2005 and to 6.7 MB in 2006.[48] The larger IP traffic volume per MI user observed in the present study is in line with reports of recent phenomenal mobile IP traffic growth (Cisco, 2009) fueled by advances in mo-

[46] Church et al. (2007); Smura et al. (2009); Verkasalo (2009).
[47] Cf., Verkasalo (2008b), pp. 63-64.
[48] Verkasalo (2009), p. 76.

bile appliance and radio network performance as well as by MI retail price decreases and a movement towards flat tariff schemes for MI access.

The statistically significant *Pearson* (*Kendall*) correlation between the self-report and system-captured MI use intensity measures was 0.40 (0.39). Hence, the joint variance share of the two criteria amounted to 16%. This proportion falls within the value range of correlations between self-report and objective measures of IS use intensity observed in earlier work.[49] Nevertheless in absolute terms this value is relatively low and therefore provides only very modest support for the convergent validity of the self-reported amount of MI use with the actual MI use intensity.

V.3.2.2 Measurement of potential determinants of MI use intensity

MI appliance class, tariff type, and primary subscription motive were selected as three factual MI use case features which may affect customers' MI use intensity.

With regard to *MI appliance class* previous research suggests that mobile end-user devices' capabilities and usability of the human–machine interface have considerable impacts on the acceptance of diverse MI offerings.[50] From a broad perspective, two classes of appliances for MI access are currently distinguishable.[51] First, MNO customers use *laptops* which are also labeled as netbooks, mini-notebooks or pocket/tablet PCs. Main laptop versions for MI access are appliances with an embedded data modem or an external USB modem (i.e., a "dongle" or "stick") or solutions which utilize a customer's cellular handset as a modem to connect the portable computer to the MI. MI access through laptops offers large screens, easy data key-in, and a "look and feel" similar to what customers are acquainted with from their fixed PC at home or at work. The second class of MI access devices encompasses *smartphones* or PDA. Compared to "ordinary" mobile phones, unique features of smart handsets incorporate an advanced PC-like operating system which makes Internet browsing possible as well as user surfaces which enable quite convenient entry of texts longer than those based on SMS. Smart handsets are easy to carry and well suited for unobtrusive MI access in all kinds of everyday life situations. Compared to smart handsets, laptops appear to better fit with MI applications which entail large data transfer volumes and require customer attentiveness for longer periods. Hence,

[49] Szajna (1996), pp. 88-90; Kim/Malhotra (2005), p. 191.
[50] Carlsson et al. (2005); Sugai (2007); Verkasalo (2008a).
[51] Smura et al. (2009).

on average, customers who access MI only through a laptop should display higher MI use intensity criterion values than their counterparts who do not rely exclusively on this appliance category in order to obtain MI access.

The *appliance class* which a customer primarily used to obtain MI access was measured in the telephone survey by asking participants to report the device which they currently apply to access MI. They were provided with three response options (see variable 6 in Table 1). The answers were transformed into two binary variables (see variables 3 and 4 in Table 2). The first was coded as 1 for respondents who had claimed to use laptops as their *only* MI appliance (54.3% of the sample) and 0 otherwise. The second was scored 1 for customers who had reported to access MI *only* via a handset (34.0% of the sample) and 0 otherwise. This variable construction implies that 11.7% of the respondents fell in the reference category of customers who had relied on both laptops and handsets as MI access devices.

A second factual MI attribute which may affect the (monetary) value of MI access and services is the *type of tariff scheme* selected by the customers.[52] MNO offer strictly use-dependent price plans which directly (and mostly in a linear way) link MI charges to the volume of up- and downloaded IP-data. Secondly, they market MI flat rates which result in a fixed charge regardless of the actual use intensity of a customer. Finally, there are "mixed", "block", or "three-part" price plans which combine features of use-dependent and flat tariffs. Previous MI and MDS studies unanimously suggest that (perceived) increases in customer costs of MI coincide with decreasing MI and MDS use intentions.[53] Compared to completely or partially use-dependent price schemes, flat tariffs entail a stronger incentive to extensively use MI because they imply marginal costs of zero and decreasing average IP traffic costs per MB for customers extending their MI data transfer quantities. Thus, subscription to a flat rate should be significantly positively related to MI use intensity.

Information on a customer's *type of MI tariff* was solicited by a question asking participants to indicate the kind of price scheme they had elected during the first quarter of 2008. There were three response options: strictly use-dependent tariff, block price scheme, and flat rate. Each response category was illustrated with a numeric example and names of prototypical price plans which the MNO had of-

[52] Cf., Cardona et al. (2009); Verkasalo (2009).

[53] Cheong/Park (2005); Hong/Tam (2006); Kim et al. (2007); Turel et al. (2007); Bina et al. (2008); Hong et al. (2008); Kim et al. (2009); Kuo/Yen (2009).

fered during the first quarter of 2008. 50.7% of the participants stated that they had had a flat rate; 32.3% claimed that they had chosen a block price scheme, and 17.0% indicated that their MI price plan was strictly use-dependent. The answers were transformed into a binary variable. Subjects who had subscribed to an MI flat rate received a value of 1, a value of 0 was assigned to the remaining participants with a block or a use-dependent scheme (see variable 5 in Table 2).

A third factual MI attribute with potential impacts on an individual's MI use intensity is the person's main motive for subscribing to an MI offering. *Subscription motive* refers to whether customers draw on MI primarily for private, often partially hedonistic reasons, or job-related and mainly utilitarian, rational purposes.[54] The work of Kim/Garrison (2009) contains evidence suggesting user acceptance of advanced MDS is higher among customers who had opted for such services predominantly for business reasons than for individuals who use MI overwhelmingly for personal purposes – even if customers pay MI bills completely on their own.

MI subscription motive was gauged by a single question in the telephone survey. Interviewers queried why an individual had chosen to subscribe to an MI offering of their MNO. The question was accompanied by three answer categories (see variable 5 in Table 1). Responses were dichotomized. Subjects received a scale value of 1 if they had stated that they had become MI users primarily due to private reasons; otherwise they were assigned a value of 0 (see variable 6 in Table 2).

Three evaluative constructs were chosen for inclusion in this study because of their significant relationships with MI or MDS acceptance repeatedly demonstrated in past research. The items for the perceptual construct scales were developed from previously studied and validated measures. They were carefully adjusted to the MI setting of the present investigation.

The first perceptual construct pertains to the balance of benefits and sacrifices/costs which customers experience on the basis of their MI use. This balance is most often subsumed under the heading of customers' (subjective) *value assessment* of MI or other MDS.[55] Perceived MI value closely resembles several

[54] Cf., Hong et al. (2008); Westlund/Bohlin (2008).

[55] Anckar/D'Incau (2002); Tung (2004); Kim et al. (2007); Turel et al. (2007); Kuo et al. (2009).

Table 2: Descriptive statistics and bivariate correlations of study variables

Variables[c]	Data source[c]	Descriptive statistics[a] M	SD	n	Correlations[b] 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. MI use intensity – self-reported	SRI	3.58 [3.67]	1.06	300	(76)	40***	40***	–46***	55***	–18**	–03	16**	04	–36***	–02
2. MI use intensity – system-captured (monthly IP traffic in MB)	BS	130.17 [30.32]	218.06	300	39***	–	22***	–31***	44***	–10+	–09	–01	–01	–31***	–02
3. MI access appliance = Laptop only[d]	SRI	0.54	0.50	300	34***	25***	–	–78***	47***	–10+	04	07	07	–25***	–04
4. MI access appliance = Handset only[d]	SRI	0.34	0.48	300	–38**	–31***	–78***	–	–47***	16**	–04	02	–10+	38***	08
5. MI tariff = Flat rate[d]	SRI	0.51	0.50	300	47***	50***	47***	–47***	–	–17**	01	11+	06	–30***	–02
6. MI subscription motive = Mainly private[d]	SRI	0.67	0.47	300	–14**	–09+	–10+	16**	–17**	–	07	–03	–05	–15*	02
7. MI value assessment	SRI	5.58 [5.67]	1.60	278	–04	–04	03	–02	02	07	(70)	13*	33***	–02	–06
8. Social endorsement of MI use	SRI	3.08 [2.50]	2.12	275	11*	00	05	04	08	–02	10*	(73)	07	07	03
9. Satisfaction with MI offering of one's MNO	SRI	5.56 [6.00]	2.82	297	02	05	07	–09+	07	–03	24***	03	–	03	–04
10. Fixed broadband Internet access at home[d]	SRI	0.56	0.50	300	–31***	–27***	–25***	38***	–30***	–15*	–02	06	02	–	–18**
11. Fixed dial-up Internet access at home[d]	SRI	0.02	0.15	300	–02	–01	–04	08	–02	02	–04	04	–04	–18**	–

a) M = Mean. SD = Standard deviation. n = number of cases. Figure in squared brackets below each mean is the variable's median. Median values are not calculated for nominally-scaled variables 3 to 6, 10 and 11.

b) Leading decimals are omitted for association coefficients (e.g., –46 = – 0.46). Figures above the main diagonal are *Pearson* product-moment correlations (r). Coefficients below the main diagonal are *Kendall* rank-order correlations (τ–b). Coefficients in round brackets on the main diagonal are internal consistency reliabilities (*Cronbach*'s α) for multi-indicator scales. Due to missing answers, n varies between 255 and 300.

c) BS = Billing system. MI = Mobile Internet. MNO = Mobile network operator. SRI = Self-report/-assessment of customer in standardized telephone interview.

d) Binary variable with 1 = true and 0 = otherwise.

+ $p \leq 0.10$ * $p \leq 0.05$ ** $p \leq 0.01$ *** $p \leq 0.001$ (two-tailed tests).

other cognitive constructs frequently discussed in previous MI/MDS acceptance studies as "usefulness"[56], "system quality"[57], "service quality"[58], "relative advantage"[59], "utility"[60], or "performance expectancy"[61]. Extant work unanimously leads to the conclusion that MI value assessment should be significantly positively correlated with MI use intensity.

In accordance with past MI/MDS research[62] *customers' assessments of MI value* were captured by asking participants to rate the extent to which they agreed that five attributes correctly reflected their own MI use experience. The MI attributes were (1) "reliable", (2) "fast", (3) "secure", (4) "easy and comfortable to handle", and (5) "predictable with regard to access and use costs". For each characteristic, subjects expressed their degree of agreement on a 10-point *Likert*-type answer continuum for which 1 represents "not at all applicable" and 10 equals "fully applicable". A principal component factor analysis of the five items yielded only one factor with an eigenvalue > 1.00. Therefore, the average of the five items was taken to measure a customer's MI value assessment (see variable 7 in Table 2). The *Cronbach* α internal consistency reliability of this scale reached a satisfactory level of 0.70. The scale mean of 5.58 (SD = 1.60) and the median of 5.67 revealed that in the present sample typical MI value assessments were not overly enthusiastic.

The second perceptual construct dealt with the extent to which customers were of the opinion that their MI use was positively evaluated by close social contacts. The literature which takes up this construct under slightly varying labels such as *social influence*/norms/pressure/push or normative beliefs argues that the initial adoption and subsequent use of new MI/MDS offerings is influenced by the endorsement of the innovation by people who are important to the customers.[63] The rationale for this effect is that mobile communication services, such as MI, are at least partially used in a public context and serve as a means to maintain or improve one's social standing/prestige through interactions with a

[56] Chen (2008); Kim et al. (2008); López-Nicolás et al. (2008); Kim et al. (2009); Mallat et al. (2009).
[57] Shin (2007); Lee et al. (2008).
[58] Kuo et al. (2009).
[59] Hsu et al. (2007); Chen et al. (2009).
[60] Verkasalo (2008a).
[61] Koivumäki et al. (2008).
[62] Cheong/Park (2005); Kim et al. (2007); Shin (2007); Kim et al. (2008); Lee et al. (2008); Kuo et al. (2009).
[63] Hong/Tam (2006); Schepers/Wetzels (2007); Shin (2007); Hong et al. (2008); Kim et al. (2008); López-Nicolás et al. (2008); Lu et al. (2008); Verkasalo (2008b).

small circle of significant other persons. Thus, perceived endorsement of MI use by one's close contacts is expected to positively affect MI acceptance.

To measure *social endorsement of MI use* participants were requested to express their degree of agreement to the following two statements which had been successfully validated in earlier MDS acceptance work:[64] (1) "Use of MI improves my status/prestige among my friends, acquaintances, and business partners". (2) "People around me think that I should use MI". The items were accompanied by a 10-point *Likert*-type answer continuum which ranged from "is completely wrong" (coded as 1) to "is completely right" (coded as 10). The average of the two items was calculated to capture customers' perceived social endorsement of MI use (see variable 8 in Table 2). The internal consistency reliability of the scale was acceptable (*Cronbach*'s $\alpha = 0.73$). The scale mean of 3.08 and median 2.50 indicated that, overall, MI use was not felt as being strongly positively reinforced by persons in the immediate social environment of a sample member.

The third evaluative variable with potential ramifications for customers' MI use intensity levels incorporated in the own investigation was *customer satisfaction with the MI access and services of one's current MNO*. Previous analyses suggest that customer satisfaction with MI or MDS remains a significant positive predictor of use continuance intentions for the service under study even after controlling for effects of MI value assessments or other congeneric constructs (usefulness, quality etc.; cf., above).[65]

The satisfaction of MI adopters with the MI access and services of their current MNO was measured by the degree of agreement which a participant expressed to the item "I am completely satisfied with the MI offerings of *<name of cooperating MNO>*" on a 10-point *Likert*-style response format with the extremities "is completely wrong" (coded as 1) and "is completely right" (coded as 10). Unfortunately, the collaborating MNO insisted on adhering to this single-item measurement approach in order to keep the length of the survey within limits deemed to be reasonable for the people invited to participate in it. This operationalization may be rated as a weakness of the present study. However, findings of Bergkvist/Rossiter (2007) suggest that for constructs that consist of a specific object, such as MI, single-item measures have the same predictive validity as multi-item scales. Therefore, altogether it appears tenable to acquiesce a single-

[64] E.g., Hong/Tam (2006); Shin (2007); Lu et al. (2008).

[65] Tung (2004); Fogelgren-Pedersen (2005); Hong et al. (2006); Lee et al. (2007a); Kuo et al. (2009).

item customer satisfaction measure (see variable 9 in Table 2), but to acknowledge that it is a prime candidate for additional validation efforts. In the present sample the mean of the customer satisfaction variable amounted to 5.56, its median was 6.00. Again, this observation suggests that customers generally were not extraordinarily impressed by their MI performance experiences.

The correlations between the three evaluative constructs were low (see Table 2). A principal component factor analysis of the eight items designed to gauge the three constructs resulted in three factors carrying eigenvalues > 1 with the items pertaining to a specific variable having their highest loadings on the same factor. Hence, one may conclude the discriminant validity and the factorial structure of the three perceptual construct measures were reasonable.

The final independent variable focused on a factual aspect of MI use, namely *the presence and, if applicable, the type of landline Internet access that an MI adopter had at home*. This variable mirrors an element of mobile customers' living circumstances whose MI use intensity impact is intuitively plausible: Customers who are unable to access the Internet at home through a fixed broadband (DSL, cable) or narrowband (dial-up) line are expected to use their MI access more extensively than their counterparts who have a landline home access to the Internet. In contrast, consumers who have the option of choosing between fixed and mobile Internet access at home are more likely to rely on the landline access while being at home because, until now, the latter outperforms MI offerings in terms of functional (connection speed and stability, in-house coverage) and cost attributes.[66] On the other hand, mobile-only customers by definition have no other choice than to access the Internet via a device connected to the radio infrastructure of their current MNO even if they stay at home.

A *customer's Internet access situation at home* was captured by asking participants to report whether they have landline Internet access at home, and if so, to indicate its type by choosing from two answer options (broadband versus dial-up). The answers were converted into two binary variables, one capturing the presence of a landline broadband access at home (1 = yes, 0 = otherwise) and one to depict the availability of a narrowband dial-up home access (1 = yes, 0 = otherwise). 56.3% (2.3%) of the MI adopters stated that their home was equipped with a fixed line broadband (dial-up) Internet access (see variables 10

[66] Cardona et al. (2009); Rappoport et al. (2009).

and 11 in Table 2). This implies that 41.4% of the sample fell into the reference category of customers who had no fixed home Internet access.

V.4 Empirical results concerning the hypotheses

To test the hypotheses bivariate correlation and multivariate regression analyses were calculated with the help of *SPSS 16.0*. H_1 posited that, compared to a system-captured MI use intensity criterion, a self-report measure of MI use intensity would be more strongly associated with a set of survey-based factual and perceptual potential antecedents of MI acceptance. As can be seen from Table 2, the absolute values of seven out of nine bivariate antecedent–criterion correlations were larger for the self-reported MI use intensity than for the system-captured use measure. The equality of the nine pairs of predictor–criterion correlations was tested according to the procedure suggested by Steiger (1980, p. 247, eq. 14). The tests revealed that the difference of the correlations between the binary appliance variable which separated laptop MI adopters from the rest of the sample (see variable 3 in Table 2) and the subjective and objective use intensity measures was highly significant ($z = 2.759$, $p \leq 0.006$, two-tailed). A similar result was observed for the social endorsement of MI use scale (see variable 8 in Table 2), whose correlations with the two criteria differed significantly at $p \leq 0.007$ ($z = 2.726$). The correlations between the binary device variable distinguishing handset MI adopters from users with laptops or with both handsets and laptops (see variable 4 in Table 2) and the two use measures were significantly different at $p \leq 0.047$ ($z = 1.984$). Furthermore, correlations of the two predictors MI use motive (see variable 6 in Table 2) and MI tariff type (see variable 5 in Table 2) were found to differ at a marginal level of statistical significance as a function of the approach to measure MI use intensity (MI use motive: $z = 1.879$, $p \leq 0.060$; MI tariff type: $z = 1.667$, $p \leq 0.096$). Correlations between the remaining four predictors (see variables 7, 9–11 in Table 2) and self-reported MI use intensity did not deviate significantly ($p > 0.215$) from these variables' association with the system-captured actual use measure.

To supplement the bivariate analysis multiple regressions were run for each MI use intensity criterion in which the nine factual and perceptual indicators mirroring seven independent factors were simultaneously entered as predictors (see

Table 3).[67] The listwise deletion of customers for whom a response for *any* of the predictors in the regression had been missing resulted in a reduction of the number of valid cases from 300 to 252. Taking into account that the complete-case deletion technique not only results in a substantial attrition of sample size and statistical power, but may also lead to biased regression estimates,[68] I chose to estimate (impute) missing values for three survey scales without complete responses (see variables 7–9 in Table 2) with the "expectation maximization" (EM) algorithm implemented in *SPSS 16.0* for variables which may be treated as interval-scaled. Therefore, Table 3 reports two regressions for each criterion, one without and one with imputation of missing response values.

The equations containing self-rated MI use intensity as the dependent variable accounted for 44.8% of the variance of this criterion if cases with missing responses were deleted listwise, and for 40.6% if values missing for the three perception-based constructs were substituted by EM estimates. Compared to these benchmarks the amount of variance in actual MI use intensity explained by the same set of predictors (29.4%/25.0% without/with missing value imputation) was notably lower. In particular, two survey variables (stated MI subscription motive, beliefs concerning social endorsement of MI use) had significant β-weights in the regression of self-reported use intensity, but not in the equations explaining variance in the system-captured use measure. In summary, results in Tables 2 and 3 are more in accordance with than counter to H_1. Therefore it appears justifiable to conclude that H_1 was confirmed in the present sample.

H_2 posited that variables describing the MI use case and the personal living context in which MI use is embedded are excellent predictors of self-rated as well as system-captured MI use intensity. In contrast, although complex constructs that aim at reflecting various use experiences or evaluations of MI adopters and require respondents to engage in more cognitive processing materially overlap with use intentions/beliefs, these constructs were expected to be worse predictors of claimed or actual MI use intensity than the factual variables. Table 2 reveals that ten out of twelve associations between the factual variables and

[67] Multicollinearity was not a problem in the regression analysis because the maximum variance inflation factor of the nine predictors amounted to 3.14. This is well below the thresholds of 5 to 10 recommended in the statistical literature (e.g., Cohen et al. (2003), pp. 423-425). Moreover, the regressions were not distorted by influential outliers as the outlier diagnostic *Cook*'s *D* did not exceed 0.11 in the sample which is again clearly below the 1.0 cutoff value suggested by Cook/Weisberg (1982, p. 118).

[68] Schafer/Graham (2002).

Table 3: Regression results for self-reported and system-captured mobile Internet use intensity criteria

Independent variables[b]	1. Self-reported MI use intensity				2. System-captured MI use intensity			
	MV Imputation[a]				MV Imputation[a]			
	No (n = 252)		Yes (n = 300)		No (n = 252)		Yes (n = 300)	
	β	p ≤	β	p ≤	β	p ≤	β	p ≤
3. MI access appliance laptop only[c] (1 = true)	041 [428][d]	611 [001]	–002 [397]	976 [001]	–155 [253]	088 [001]	–132 [221]	120 [001]
4. MI access appliance handset only[c] (1 = true)	–125 [–473]	141 [001]	**–199** [–461]	013 [001]	**–198** [–353]	039 [001]	–171 [–313]	057 [001]
5. MI flat rate[e] (1 = true)	**366** [575]	001 [001]	**351** [545]	001 [001]	**415** [483]	001 [001]	**354** [440]	001 [001]
6. MI subscription motive mainly private[f] (1 = true)	**–125** [–194]	014 [002]	**–112** [–181]	020 [001]	006 [–066]	915 [294]	–053 [–104]	327 [074]
7. MI value assessment	–053 [–026]	302 [686]	–046 [–026]	353 [656]	–062 [–062]	287 [324]	–069 [–077]	213 [186]
8. Social endorsement of MI use	**148** [170]	003 [006]	**147** [159]	002 [006]	–025 [–017]	654 [790]	012 [009]	819 [876]
9. Satisfaction with MI offerings of one's MNO	–035 [023]	500 [722]	000 [036]	996 [534]	–048 [–017]	412 [784]	–018 [–016]	740 [784]
10. Fixed broadband Internet access at home[g] (1 = true)	**–267** [–411]	001 [001]	**–216** [–363]	001 [001]	**–170** [–334]	009 [001]	**–188** [–311]	002 [001]
11. Fixed dial-up Internet access at home[g] (1 = true)	–053 [–015]	285 [812]	–034 [–016]	462 [786]	–041 [–021]	472 [734]	–037 [–017]	481 [766]
Multiple R^2	0.448		0.406		0.294		0.250	
Regression F-value	21.793		21.999		11.197		10.763	
Degrees of freedom	9, 242		9, 290		9, 242		9, 290	
p ≤	0.001		0.001		0.001		0.001	

a) MV = Missing value. The expectation maximization algorithm implemented in *SPSS 16.0* was used to estimate missing data for variables 7 to 9.

b) Variable numbers in this table and in Table 2 refer to the same measure.

c) After inclusion of variables 3 and 4 in the regression respondents who use both a laptop and a handset as MI access appliances are the reference category.

d) Figures in squared brackets below each standardized regression weight (β) are *Pearson* zero-order correlations (r) for the reduced sample (n = 252) without missing value imputation or for the full sample (n = 300) after imputing missing values. β-weights achieving statistical significance at p ≤ 0.05 (two-tailed test) are set in bold. Leading decimals are omitted for β-weights, simple r's, and significance levels (e.g., – 155 = – 0.155).

e) After inclusion of variable 5 in the regression respondents who indicated to have no flat rate, but a completely or partially use-dependent tariff are the reference category.

f) After inclusion of variable 6 in the regression respondents who stated that they do not use MI mainly for private, but overwhelmingly for job-related or equally for job-related and private purposes are the reference category.

g) After inclusion of variables 10 and 11 in the regression respondents who reported to have no fixed Internet access at home are the reference category.

the two MI use intensity measures were highly significant (p ≤ 0.001). As expected, MI access only via a laptop and choosing an MI flat rate had considerable positive effects on MI use intensity. As likewise anticipated, MI access just

through a handset, subscribing to MI mainly for private reasons and living in a residence equipped with a fixed broadband Internet access coincided with far lower MI use intensity.

Out of the six simple correlations between the three perceptual constructs and the two MI use criteria only the association between social endorsement and self-rated MI use intensity was statistically significant ($r = 0.16$, $p \leq 0.01$; τ-$b = 0.11$, $p \leq 0.05$; see Table 2). In the multivariate analysis selection of an MI flat rate and installation of a broadband Internet access at home emerged as predictors with significant β-weights in each of the four equations. The regressions also revealed that MI use intensity did not significantly differ between customers who access MI only through a laptop and "hybrid" consumers who revert to a laptop on some occasions and employ a handset to obtain MI access on other occasions (see variable 3 in Table 3). The multivariate results concerning the binary indicator separating handset only cases from the remainder of the sample are somewhat more unequivocal (see variable 4 in Table 3). Taken as a whole, they point in the direction that MI use intensity of customers who solely or partially use a laptop to access MI exceeded that of consumers who exclusively rely on a handset as their MI appliance of choice. Social endorsement of MI use was the only one of the three perceptual constructs reaching statistical significance in the regressions of self-reported use intensity. None of the three perceptual constructs under study achieved a significant β-weight in the regressions of the system-captured use criteria.

The subset of the six factual predictors accounted for an additional significant ($p \leq 0.001$) share of 42.4% of the variance in self-rated MI use intensity after controlling for the three perceptual variables in the equation without missing value imputation. In total, the three perceptual constructs explained a variance share of 2.4% in self-rated MI use intensity after incorporating the six factual predictors as controls. This increment was statistically significant at $p \leq 0.017$ but in absolute terms almost 20 times lower than the explanatory contribution of the subset of factual variables under study. In the regression of the system-captured use criterion the corresponding percentage of the six factual indicators was 28.5% ($p \leq 0.001$), whereas the comparable figure for the three perceptual predictors

amounted to 0.9% ($p \leq 0.370$).[69] Thus, overall the results were clearly consistent with what was posited in H_2.

V.5 Discussion

Past research on MI use has typically resorted to mono-method designs in which claimed use (intention) was predominantly explained by various beliefs about MI as for instance its "usefulness" or "ease of use". This study set out to empirically analyze the extent to which the ability of specific variables to explain variance in MI use intensity varies as a function of the measurement method chosen for the use criterion. Further, it tried to contribute to the literature by incorporating four straightforward and verifiable factors as predictors of MI use intensity. The common feature of these independent variables is that they were neglected in past work based on TAM or DOI theory as popular conceptual frameworks within the broad research domain of IS/MDS acceptance. Finally, it compared the predictive power of these supplementary factors against that of three perceptual constructs which were part of countless investigations on determinants of IS, MDS, and MI acceptance. The analysis was based on system-captured actual MI use data and survey responses obtained for a sample of 300 German-speaking customers of one MNO who had effectively accessed MI during the first quarter of 2008.

Taken as a whole, the results suggest that observed predictor–use intensity correlations were substantially inflated if the measurements of dependent and independent variables were obtained from a single respondent reacting to questions asked in the very same survey. Compared to a system-captured measure of actual MI use, self-rated MI use intensity correlated obviously more with predictors capturing factual attributes of MI use cases/environments, as well as variables reflecting evaluative constructs related to MI use. Under the assumption that the system-captured criterion is free of measurement error, comparisons of the R^2 statistics obtained for self-rated and objectively recorded MI use intensity (see Table 3) may be taken to generate rough clues concerning the severity of common method biases in the present study. These comparisons yield that for

[69] Similar evidence was detected in the regressions with imputed missing values. Further regressions in which the logarithm of the system-captured dependent criterion was employed and in which demographic characteristics (gender, age, occupation; see variables 1–3 in Table 1) and length of MI use experience (see variable 4 in Table 1) had been entered as controls uniformly yielded results which were materially very close to those displayed in Table 3. Therefore, I refrain from explicitly presenting these findings in ancillary tables.

the total set of nine predictors (which reflected seven determinants) the upper boundary of the proportion of variance explained in self-rated use which can be attributed to common method effects amounted to 34.4% (= (0.448 – 0.294) / 0.448) in the analysis which deleted cases with missing values on any of the study variables and 38.4% (= (0.406 – 0.250) / 0.406) if missing values were imputed for three predictors.

This extent to which common method distortion may influence findings in MI acceptance research falls within the ranges of quantifications of the bias mentioned in earlier reviews of the literature in various social science disciplines, such as business, psychology, sociology, and education.[70] It may be argued that, compared to the present investigation, many MI/MDS acceptance studies are even more severely affected by spurious covariance shared among variables due to common methods. They employed ambiguous "intention to (continue to) use" self-ratings as their criteria instead of the more concrete behaviorally anchored use intensity self-reports applied here. Further, they reverted to the same equivocal closed response options across independent and dependent variables. Thus, although quite a number of MI/MDS studies accounted for more than 50% of the variance in their self-report acceptance criteria with a limited set of two to six perceptual predictors[71], this pattern of results should not be mistaken. It does not signal the outstanding quality of the studies' nomological construct networks and the needlessness of exploring factual variables as antecedents of MI acceptance. Rather, due to severe methodological shortcomings, it is very likely that variable relationships posited by previous MI/MDS acceptance research have little to do with the true covariance underlying the focal constructs. In summary, the present analysis and broader studies on method effects on relationships between IS use and its antecedents indicate that common method bias poses a serious validity threat to earlier mono-method evidence concerning factors influencing customer acceptance of MI and MDS.[72]

In particular, none of the *perceptual* constructs significantly contributed to the explanation of variance in *actual* MI use. This corroborates other authors who had likewise concluded that the power of concepts such as "usefulness" or "val-

[70] Podsakoff et al. (2003), p. 880; Straub/Burton-Jones (2007), p. 225; Sharma et al. (2009), p. 475; Temme et al. (2009), pp. 129-130.

[71] Cheong/Park (2005), p. 137; Hong/Tam (2006), p. 174; Hong et al. (2006), pp. 1827-1828; Hsu et al. (2007), p. 721; Lee et al. (2007b), p. 2073; Hong et al. (2008), p. 440; Lu et al. (2008), p. 60; Kim/Garrison (2009), p. 330; Kuo et al. (2009), p. 894; Mallat et al. (2009), p. 193.

[72] Straub/Burton-Jones (2007); Sharma et al. (2009).

ue" in explaining MI or IS acceptance vaporizes once measures of these constructs and IS acceptance criteria are no longer provided by the same person and system-captured behavior records come into play to gauge the level of acceptance.[73] Interestingly, even some of the seemingly simple to verify factual drivers of MI acceptance were correlated more strongly with self-rated use intensity than with actual use. For instance, MI subscription motive (see variable 6 in Table 3) or presence of a landline broadband Internet access at homes (see variable 10 in Table 3) obtained larger β-weights if self-rated use intensity instead of actual MI use was regressed on the predictors. Hence, the introduction of factual predictors and dependent use measures referring to specific actions accompanied by a closed set of behaviorally anchored answer options or by continuous, open-ended answer formats recommended by various authors to IS acceptance researchers[74] may have limited curing impacts on the magnitude of common method problems and surely is not a panacea to completely eliminating them. Thus, the most desirable investigation design unalteredly remains the one which implies the gathering of actual use data from sources that are independent from customer self-reports employed to capture other variables.[75]

The significant correlations between MI access appliance class, MI tariff type, and availability of fixed broadband Internet access at home as indicators of factual circumstances and the MI use criteria suggest that future research is well-advised to widen the set of acceptance determinants accentuated in the TAM and DOI literatures. Additional work on MI use intensity would benefit from analyzing the peculiarities of various classes of MI appliances, tariff types and fixed home Internet access alternatives in more detail than it was possible in this study.

The present results also have managerial implications for MNO. In practice, they imply that MNO should emphasize factual MI use circumstances more than complex customer perceptions related to their MI experiences if MNO attempt predicting or influencing traffic volumes generated by their MI adopters. According to this study's findings which are in accordance with observations by Verkasalo (2009, p.76) and Cardona et al. (2009, pp. 83, 91), MI tariff type appears to be a particularly strong driver of MI use intensity. On average, the monthly MI traffic volume of an MI subscriber with a flat rate surpasses that of

[73] Straub/Burton-Jones (2007); Verkasalo (2008a); Sharma et al. (2009).

[74] E.g., Kim/Malhotra (2005), p. 193; Malhotra et al. (2006), p. 1866; Sharma et al. (2009), p. 485.

[75] Podsakoff et al. (2003), p. 897; Straub/Burton-Jones (2007), p. 226.

customers with a use-dependent or block price scheme by 191.81 MB (F = 73.27; df = 1, 298; $p \leq 0.001$). In addition, the MI access appliance class exerts considerable influence on a customer's IP traffic quantities. The highest MI use intensity was observed for "hybrid" customers who rely on their laptops as well as on their handsets to obtain MI access (M = 201.34 MB). It even exceeded the use intensity of "laptop-only" subscribers (M = 174.27 MB). In contrast, a significantly lower average IP traffic volume was detected for "handset-only" adopters (M = 35.27 MB; F = 16.39; df = 2, 297; $p \leq 0.001$). Hence, MNO may promote higher MI use intensity by providing "bundled offerings" which encompass a flat rate, a smartphone and a laptop at a packet price lower than the sum of the prices of the single elements contained in the bundle for consumers who sign an MI contract with a specific minimum duration. However, pursuance of such a strategy implies that the MNO's IP transport capacity is large enough to cope with the elevated MI use intensity without substantial bottlenecks. Furthermore, MNO may closely monitor the extent to which advances in smartphone capabilities, as exemplified by *Apple*'s famous *iPhone*, contribute towards closing the MI use intensity discrepancies between "handset-only" adopters on the one hand and "hybrid" or "laptop-only" customers on the other which were found in the present investigation.

Finally, MNO should reflect on the result that the landline Internet home access platform of their customers is an important determinant of MI use intensity. According to my data, residential customers living in a home without a *broadband* landline to the Internet generate significantly *more* mobile IP traffic than MI adopters who have a fixed broadband Internet home access, too. Consumers without a fixed broadband line may use the Internet connectivity provided by their MNO to access the Internet even while they are at home. Put differently and in line with results of Cardona et al. (2009, pp. 74, 91), there appears to exist a customer segment whose members use their MI access rather as a *substitute* than as a *complement* to fixed broadband access. When the data collection took place, 43.7% of the participants belonged to this segment, i.e., at least in early 2008 it was quite sizable. Although the fixed broadband penetration has increased since then, it still appears reasonable that MNO develop targeted activities which aim at discouraging those customers who do not already own a fixed broadband access at home from the acquisition of such an installation in the future. One potential measure would be to position MI access and services as a fully-fledged alternative to fixed broadband lines in terms of functional performance characteristics and price levels. MNO should strive for this positioning only if they are able and motivated to provide the considerable financial and or-

ganizational resources required to build and to run a cellular infrastructure capable of substituting fixed broadband lines without disappointing customer expectations.

V.6 Limitations

In interpreting findings of this study, one should consider its shortcomings from which further avenues for scholarly efforts can be derived. A first limitation relates to the system-captured operationalization of a customer's MI use intensity. Measuring use intensity on the basis of monthly IP traffic takes account neither of the classes of applications "behind" the MI traffic nor of the personal arousal or involvement caused by the data exchanged over cellular networks.[76] For instance, IP traffic may be caused by down- or uploading software, music or games, by exchanging instant messages or e-mails or by WWW-browsing.[77] The lack of differentiation of various MI application types is particularly unfortunate because several studies[78] have demonstrated the advantages of researching MI or MDS use at the level of the individual application category instead of MI/MDS use in general. Thus, additional research is needed to develop more fine-grained non-reactive measures of use intensities of distinct MI application types which are extractable from MNOs' billing and customer administration systems. This work may also take a closer look at the boundary conditions that affect the extent of convergence between system-captured and survey-based measurements of MI use intensity.

Secondly, due to constraints imposed by the collaborating MNO this research had to confine itself to three cognitive constructs as potential predictors of MI acceptance. Consequently, it is impossible to preclude that other perceptual constructs, such as ease of use, usefulness, relative advantage, or confirmation of performance expectations, may be able to better predict MI use intensity than the ones integrated here. Therefore, more work is desirable which compares the power of various perceptual variables directly derived from TAM, DOI theory, expectation–disconfirmation theory, or other common conceptual frameworks in predicting *actual* MI use intensity.

A third limitation results from the present study's focus on persons who possessed MI experience already during the first quarter of 2008 or even before this

[76] Benbasat/Barki (2007), p. 215.
[77] Verkasalo (2009), p. 77.
[78] E.g., Bouwman et al. (2007); Hong et al. (2008); Bouwman et al. (2009).

time period. This implies that I have only looked at customers who had been early adopters of MI offerings. However, according to DOI theory, MI use behaviors as well as determinants of such behaviors may differ between pioneers and later adopters.[79] Hence, future research should examine the extent to which the present study's findings remain unchanged as MI markets evolve by comparing different adopter categories over time.

A final limitation concerns the sample. It consisted of residential MI users of one MNO in Germany only. The extent to which this has effects on the generalizability of the findings to consumers or business customers outside of the German market is unclear. This is yet another important issue to be explored in future work which could fine-tune our current understanding of the effects of perceptual constructs and verifiable application conditions on self-rated and system-captured use measures for MI, but also for other emerging offerings of MNO in particular and IS firms in general.

V.7 Conclusion

This paper suggests that within the research domains of IS acceptance in general and MI/MDS use in particular it is time to move beyond pure survey studies which correlate measures of general intentions to use innovative MI/MDS or IS offerings with fuzzy beliefs based on a survey with identical ambiguous response options across all study items. Investigators should undertake strenuous efforts to gather both system-captured or other non-reactive data to measure *revealed* instead of *claimed* MI, MDS, and IS use intensity. If scholars are unable to employ a multi-method design they should by all means take – and document – deliberate steps to reduce and diagnose the common method variance-based validity threat to their findings. In doing so, researchers should refrain from creating the impression that common method bias is not a severe problem in their mono-method designs only because confirmative or explorative factor analysis of the study items yielded dimensions which were in line with the theoretically espoused independent and dependent constructs. Finally, the present results reveal that verifiable variables describing MNO customers' tariff type, appliance class, and Internet access situation at home play an important role in shaping MI use intensity of residential MNO customers. This insight may be seminal for researchers exploring new variables eligible to enhance the understanding of MI

[79] Rogers (2003), chapter 7.

acceptance differences at the individual user level, but also for practitioners seeking to influence the MI use intensity of their customers.

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Index