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Digitalization of High Street Retail

Design, Development, and Evaluation of a Multi-sided Digital Community Platform

Jan H. Betzing

Münster 2019

Inauguraldissertation zur Erlangung des akademischen Grades eines Doktors der Wirtschaftswissenschaften durch die Wirtschaftswissenschaftliche Fakultät der Westfälischen Wilhelms-Universität Münster

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Preface

People settled down where trade roads intersected, and cities and societies came into being. For centuries, high streets and marketplaces have been the centers of social and economic activity. In the "digital age," these activities are shifting increasingly into digital channels: People shop all the time and everywhere. Unfortunately, the small and medium-sized independent retailers that are the backbone of our high streets are struggling to respond to customers' digital demands. A German saying goes "Handel ist Wandel," which denotes that the retail industry is in a constant transformation. However, there is more to high street retail than supplying demand. Owner-operated independent stores are rich in tradition, root in the local community, and cater to the uniqueness and attractiveness of high streets. Shall these businesses surrender to digitalization without a fight?

Jan Betzing takes on this challenge and presents a multi-sided digital community platform that local businesses, customers, and municipal caretakers can leverage to provide service to each other and co-create digital customer experience. In particular, his work includes a novel method to record customers journeys in the high street. This data enables new location-based, personalized service offerings. Although data-driven service can be a privacy threat, Mr. Betzing succeeds in carefully balancing the individual's digital sovereignty and convenience.

The presented thesis addresses several research gaps in our discipline, particularly concerning high streets as socio-technical systems and service ecosystems, and contributes valuable design knowledge at the intersection of marketing, service science, and information systems research. Furthermore, this work is of high relevance to practice. High streets seeking to prevail in the digital age can adopt the platform design to digitally attract customers to shop in the real world.

Münster, November 2019 Prof. Dr. Dr. h.c. Dr. h.c. Jörg Becker

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List of Abbreviations

ADR	Action Design Research
AMCIS	Americas Conference on Information Systems
API	Application Programming Interface
app	Application (in mobile contexts)
AR	Action Research
AVE	Average Variance Extracted
B2C	Business-to-Consumer
BaM	Brick and Mortar
BIE	Building, Intervention, and Evaluation
BLE	Bluetooth Low Energy
BMBF	German Federal Ministry of Education and Research
BMWi	German Federal Ministry for Economic Affairs and Energy
BPMN	Business Process Model and Notation 2.0
BPR	Bayesian Personalized Ranking
CMV	Common Method Variance
CR	Composite Reliability
CRM	Customer Relationship Management
CRUD	Create, Read, Update, and Delete
CSS	Cascading Style Sheets
csv	Comma-separated Values
DBSCAN	Density-based Spatial Clustering of Applications w/ Noise
DOIS	Design-oriented Information Systems Research
DP	Design Principle
DSML	Domain-specific Modeling Language
DSR	Design Science Research
DSRM	Design Science Research Methodology
ECIS	European Conference on Information Systems
ERM	Entity-Relationship Model
ERP	Enterprise Resource Planning
ESQ	Electronic Service Quality
EU	European Union
EV	Electric Vehicle
GAFA	Google, Amazon, Facebook, and Apple
GCP	Google Cloud Platform
GDP	Gross Domestic Product
GDPR	General Data Protection Regulation

GIS	Geographic Information System
GPL	GNU General Public License
GPS	Global Positioning System
GUI	Graphical User Interface
HSJML	High Street Journey Modeling Language
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
IaaS	Infrastructure as a Service
ICIS	International Conference on Information Systems
ICT	Information and Communication Technology
IS	Information System
IT	Information Technology
JSON	JavaScript Object Notation
KPI	Key Performance Indicator
LBA	Location-based Advertising
LBS	Location-based Service
LCSS	Longest Common Sub-sequences
MASQ	Mobile App Service Quality
MEAN	MongoDB, Express.js, Angular, and Node.js
MKWI	Multikonferenz Wirtschaftsinformatik
MSQ	Mobile Service Quality
MVVM	Model–View–ViewModel
NFC	Near-field Communication
NSD	New Service Development
ODM	Object Document Mapper
OS	Operating System
P2P	Peer-to-Peer
PaaS	Platform as a Service
PLS	Partial Least Squares
PoI	Point of Interest
PoS	Point of Sale
PTKA	Project Management Agency Karlsruhe
QCA	Qualitative Content Analysis
QR	Quick Response
RDBMS	Relational Database Management System
REST	Representational State Transfer Protocol
RFID	Radio-frequency Identification
ROI	Return on Investment
RSSI	Received Signal Strength Indicator
SDK	Software Development Kit
S-D Logic	Service-dominant Logic of Marketing
SEM	Structural Equation Modeling
SMAC	Social, Mobile, Analytics, Cloud
SME	Small and Medium-sized Enterprise

SPA	Single-page Application
SQ	Service Quality
TBO	Total Benefits of Ownership
TCO	Total Cost of Ownership
UAT	User Acceptance Test
UGT	Uses and Gratifications Theory
UI	User Interface
US	United States
UUID	Universally Unique Identifier
VC	Virtual Community
VIF	Variance Inflation Factor
WI	Wirtschaftsinformatik
WLAN	Wireless Local Area Network
WOM	Word-of-Mouth
WWS	Warenwirtschaftssystem
WWW	World Wide Web

Part A
Research Overview

1 Exposition

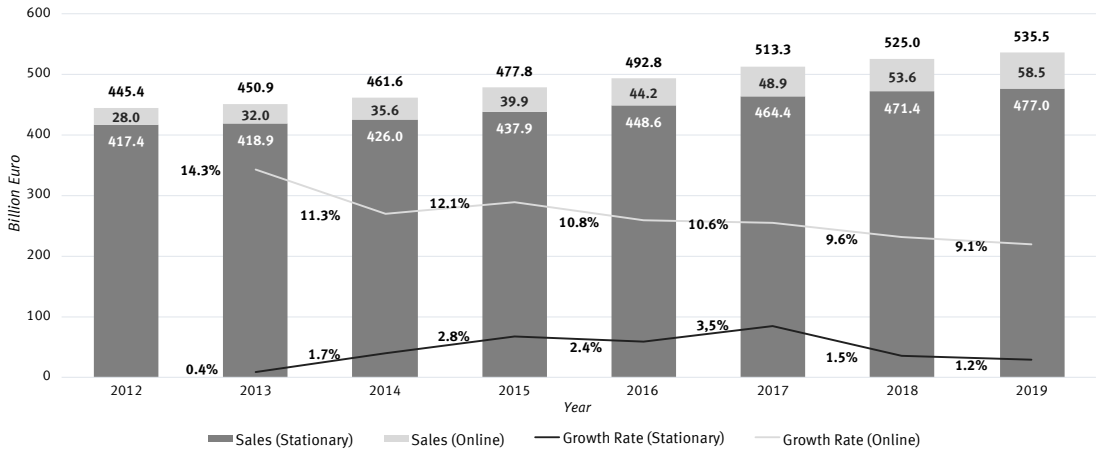
> *"What we need to do is always lean into the future; when the world changes around you and when it changes against you — what used to be a tail wind is now a head wind — you have to lean into that and figure out what to do because complaining isn't a strategy."*
>
> *J. Bezos*

1.1 Introduction and Motivation

For thousands of years, people gathered on marketplaces to trade with merchants and engage in social activities (Tauber, 1972; Niemeier et al., 2013). Over time, the retail landscape became more sophisticated, with specialized stores, department stores, discounters, and shopping malls (Teller, 2008; HDE, 2018b). With the introduction of enterprise resource planning (ERP) software, automated warehouse management, and other information and communication technologies (ICTs) since the 1960s, operational efficiency increased and (inter-) national retail chains became established (Hänninen et al., 2019; Hagberg et al., 2016). However, the current wave of technological innovation and the accompanying transformation in the retail industry (Legner et al., 2017), are challenging the long-standing business model of brick and mortar (BaM) stores, which particularly impacts traditional high street retail[1] structures (Eichholz-Klein et al., 2015).

Fifty-four percent of outlets on German high streets are run by small businesses with fewer than five employees (HDE, 2018a, p. 4). This group of small and medium-sized enterprises (SMEs), which have often been family-owned for multiple generations, acts individually without being part of a retail chain or franchise (Bollweg,

[1] The concept *high street retail* corresponds to the German term "innerstädtischer Einzelhandel" and denotes retailing in a city's central shopping district, inner city, or main street, including markets and pedestrian areas but excluding peripheral industrial areas and shopping malls (Stepper, 2016).



SOURCE: own visualization with data from HDE, 2018b; HDE, 2018c; HDE, 2019

Figure 1.1: Sales Development in the German Retail Sector (2012–2019)

2018; Hänninen et al., 2018). Typically, the owner is in the store daily and runs operations. Regulated opening hours, shelf space, and their catchment areas constrain these stores (Pantano and Priporas, 2016).

BaM stores primarily rely on a steady flow of pedestrians and a loyal customer base (Stepper, 2016). The number of customers in many high streets is decreasing (Küffmann, 2018; HDE, 2019), and shop closings outnumber shop openings (Townsend et al., 2017; HDE, 2018c). Customer loyalty is decreasing, too, as online shopping draws an ever-increasing share of retail sales (see Figure 1.1). Because of high overhead, SME retailers cannot compete with online retailers on price (Pan et al., 2002), and due to a lack of financial resources, time, and knowledge, they have been reluctant to innovate their business model with the help of digital technologies (Bollweg et al., 2019; Bollweg et al., 2016). Although the German economy experienced economic growth in the last decade (Eurostat, 2018), and overall retail sales increased (see Figure 1.1), the percentage of independent retailers across all distribution channels decreased from 31.9 percent in 2000 to 17.1 percent in 2017 (HDE, 2018c, p. 25). This trend also manifested in other Western economies and is projected to gain momentum until 2030 (Eichholz-Klein et al., 2015; Bollweg, 2018; Stepper, 2016). The loss of individual shops that increased the attractiveness and uniqueness of the high

street could trigger a vicious erosion cycle (Coca-Stefaniak et al., 2005), which the US media has called the "retail apocalypse" (Townsend et al., 2017).[2]

Store closings and vacancies decrease the attractiveness of the high street, customer frequencies decline, and more BaM stores become unprofitable. Other venues, such as restaurants and service providers, suffer as well since the attractiveness of the high street depends on and impacts each tenant (Becker et al., 2019).

At the same time, large retail corporations have embraced digitalization — the socio-technical process of "adopting and using [digital] technologies in broader individual, organizational, and societal contexts" (Legner et al., 2017, p. 301) — and have leveraged technology-enabled innovation to expand their business models and value propositions (Matt et al., 2015; Tilson et al., 2010). With the proliferation of social, mobile, analytics, cloud (SMAC) technologies (Legner et al., 2017; Pantano et al., 2018), the boundaries between BaM and e-commerce vanish (Brynjolfsson et al., 2013; Verhoef et al., 2015; Pantano and Viassone, 2015), and new retail business models emerge (V. Kumar et al., 2017; Hagberg et al., 2016; Grewal et al., 2013). Some retail chains pursue omnichannel strategies in which the digital and physical channels converge to provide integrated and seamless service to the customer through multiple channels (von Briel, 2018; Brynjolfsson et al., 2013), such as an online shop, a mobile application, social media, and BaM stores (Herhausen et al., 2015; Verhoef et al., 2015). In-store technologies like self-service areas, and digital service offerings like click-and-collect augment BaM stores and transfer benefits from e-commerce into the physical realm (Inman and Nikolova, 2017; Willems et al., 2017; Beck and Rygl, 2015). At the same time, online pure-players like Amazon and Mister Spex extend their channel portfolios by adding BaM showrooms to serve customers face-to-face (Badrinarayanan and Becerra, 2018; Bell et al., 2017). In short, while large retail organizations use digital means to cater to customers' increasing expectations, most independent high-street retailers are unable to keep up and compete.

Observation 1: *Small and medium-sized businesses on the high streets are laggards with regards to digitalization*.

BaM retailers were once able to justify a price premium by offering expert advice (Brynjolfsson et al., 2013), but now extensive product information is available on

[2] We already see a similar trend in the death of shopping malls in the US (Tokosh, 2018). Ironically, Amazon has begun to buy shuttered mall properties for use as its fulfillment centers when these sites have the right infrastructure (Waters, 2019).

the Internet, and many customers think they are more knowledgeable than the sales associates (Murray, 2016). Customers' expectations of retail are further altered by the proliferation of digital offerings like highly accurate product recommendation systems (Ricci et al., 2015), social shopping communities (Olbrich and Holsing, 2011; Baethge et al., 2016), and product-search and price-comparison tools (Xu and Kim, 2008). This ubiquitous retail environment is characterized by location independence, a high degree of retailer-customer connectivity, instant availability of product information, and low switching costs between retailers (Faulds et al., 2018).

Digitalization in retail profoundly challenges long-standing power relationships (Hänninen et al., 2018; Rippé et al., 2017) and leads to increasingly complex customer journeys along various channels and actors (Lemon and Verhoef, 2016). Phenomena like "research shopping" and "showrooming" (Gensler et al., 2017) reflect changes in customer behavior, where customers inspect products using one channel but purchase it using another channel that does not belong to the same retailer (Rapp et al., 2015). Customers also use multiple channels to interact with the same or different retailers at the same time (e.g., researching products online on a smartphone while shopping in-store).

Observation 2: *Customers' behavior and expectations of brick and mortar retail have changed profoundly through experiences with retail-related service in the digital realm*.

Besides their economic and social value (HDE, 2018c), SME retailers in Germany are deeply rooted in their local communities and are part of the cultural identity (Bollweg et al., 2018). Accordingly, politics and trade associations strive to enhance the attractiveness of high street retail vis-à-vis other channels. For example, the German Federal Ministry for Economic Affairs and Energy (BMWi) funded the workshop series "dialogue platform brick and mortar retail" (BMWi, 2017b), and the German Federal Ministry of Education and Research (BMBF) launched the program "smart service city" (BMBF, 2019) to fund joint research projects that investigate novel digital service offerings, both aiming to "increase the quality of life of citizens and the competitiveness of the urban economy" (BMBF, 2019, *translated from German*). Aside from improvements in accessibility, extended opening hours, joint events, and new use cases for vacant properties, the dialogue platform suggests investments in *customer experience* and the use of *local digital platforms* as an additional channel for the high street (BMWi, 2017a). Given that only 20 percent of high street visits are made to meet basic needs (Kaltenbrunner, 2014, p. 5), it is fair to assume that a focus on

experiential offerings that enhance shopping as a leisure activity can give BaM retail an advantage over e-commerce.

However, unlike physical products that have an inherent value, the value of an experience is perceived individually by each customer and cannot be stocked by the retailer like a product (Becker et al., 2019; Vargo and Lusch, 2017). Instead, retailers can fulfill their customers' needs and co-create experiences through personal and digital service (McColl-Kennedy, Cheung, et al., 2015; Larivière et al., 2016), so retailers share characteristics with service providers (Hänninen et al., 2018). This service-dominant logic challenges retail's goods-based logic of value creation as the exchange of goods against monetary compensation that remained fundamentally unaltered for centuries (Vargo and Lusch, 2004; Niemeier et al., 2013).

Observation 3: *Retailers not only create value through the exchange of goods but also co-create value through service*.

A digital platform like a joint online shop for the high street (BMWi, 2017a; Bärsch et al., 2019), further challenges the mindset of many SME retailers, as platform initiatives have an underlying modus of co-opetition that contrasts with SME retailers' traditional modus of independent coordination of resources and activities (Hänninen et al., 2018). Digital platforms connect multiple user groups, such as businesses and customers, and act as matchmakers between actors in these groups (Täuscher and Laudien, 2017; Yoo et al., 2012). Each actor group makes "platform-specific investments" (Hagiu and Wright, 2015, p. 163) like paying a transaction fee (e.g., retailers on Amazon Marketplace), providing personal information (e.g., users on Facebook), and using own resources (e.g., drivers on Uber) as a precondition for value co-creation with other platform members. The platform itself comprises the technological and organizational foundation on which these actors provide their resources, interact, engage in transactions, and co-create value (de Reuver et al., 2017; Hagiu and Wright, 2015; Breidbach et al., 2014; Smedlund, 2012). Local retailers can join forces on digital platforms to make value propositions that exceed single participants' capabilities (IFH Köln, 2018; Küffmann, 2018).

Observation 4: *Digital platforms provide the foundations for digital service within and across stakeholder groups*.

1.2 Problem Statement and Research Objective

We observe the overarching issue of degrading high streets and city centers and the potential loss of the economic, social, and cultural value a thriving high street gives a society (Becker et al., 2019). Structural change and the replacement of industry branches is a recurring phenomenon in history (Pasinetti, 1981), and a recent survey in Germany reveals that more than half of the customers under age 35 agree that e-commerce can fulfill most, if not all, of their demands (BVDW, 2018). It is fair, then, to argue that high streets are no longer required and may rest in peace, but this work and the German Federal Government (BMWi, 2017a; BMBF, 2019) take the view that high streets and their SMEs are desirable structures that should prevail, even in the digital age (Becker et al., 2019).

For this *wicked problem* of eroding high streets there is no solution with clear fulfillment criteria (Rittel and Webber, 1973). Instead, academia and practice can break up the problem into more manageable subproblems, develop potential solutions, and evaluate their contributions to solving the problem (Baskerville et al., 2018).

From the observations, we derive that *one* subproblem for high streets in general — and SME retailers in particular — is the lack of mechanisms with which to interact and co-create value with customers in the digital realm. The concept of local platforms that provide a central digital interface between high street businesses and local customers resonates with the practice (IFH Köln, 2015), and more than 150 initiatives have been spawned in Germany in recent years (cima, 2018; CCEC, 2019). However, the scope of most of these platforms is limited to digital business directories and the exchange of goods (Küffmann, 2018; Bärsch et al., 2019; Lüke, 2019). In contrast to large e-commerce players, local platforms do little to make personalized service offerings that use the customer's current context and needs (e.g., location, preferences, past shopping behavior) for service delivery (Bärsch et al., 2019, p. 610). Arguably, the full potential of local platforms and SMAC technologies to provide digital service and co-create value in high streets is neither fully understood in theory nor leveraged in practice.

To address this knowledge gap and the identified subproblem, we establish the objectives of a potential solution: First, given SME retailers' limited resources, the solution has to be affordable, feasible for technically inexperienced users, and largely maintenance-free. Second, the solution has to enable the co-creation of value through

personalized service between customers and retailers, which requires eliciting customers' contextual information, such as their past and current shopping behavior in the high street. Third, digitalizing the high street and collecting behavioral data on customers must take place under existing data privacy regulations, and, from an ethical perspective, should prevent abuse like keeping customers under surveillance.[3] Fourth, the solution should strengthen the high street's competitive position against other retail channels, and while it should allow SME retailers to keep their existing customers and attract new ones, the solution should benefit the whole high street. Thus, it should not only make value propositions to local customers and businesses but also support caretakers of the high street, such as municipal urban planners, city managers, local interest groups, and advertising unions (Neirotti et al., 2014).

Against this backdrop, the goal of this doctoral thesis is an information technology (IT) artifact that addresses the stated objectives and contributes to alleviating the identified subproblem.[4] By definition, an IT artifact comprises multiple "technical, social and/or informational components [that] collectively supply one or more functionalities [to fulfill] an (a) information-related or (b) information technology-related purpose" (Drechsler and Hevner, 2018, p. 84).

The IT artifact builds upon the concept and mechanisms of *digital platforms*, so the created solution design knowledge is actionable for practice and adaptable to existing local platforms. Since the high street ecosystem comprises actors who are not retailers and customers, the platform has to be *multi-sided* in nature, enabling value

[3] Related to digital platforms for high streets are "smart city" initiatives. These projects seek to improve the quality of urban life (Nilssen, 2019), and, among other goals, may aim "to provide more efficient services to citizens, to monitor and optimize existing infrastructure, to increase collaboration amongst different economic actors and to encourage innovative business models in both the private and public sectors" (Marsal-Llacuna et al., 2015, p. 628). However, augmenting the physical world with sensors and collecting massive amounts of data often allows individuals to be singled out, which make smart cities prone to becoming Orwellian "surveillance cities" (Chen and Chen, 2018; Giroux, 2015).

[4] The information systems (IS) community has debated the *IT artifact* concept in the last decade (see e.g., Petter et al., 2018; Drechsler and Hevner, 2018; Alter, 2017; Iivari, 2017; Alter, 2015; A. S. Lee et al., 2015; Walsham, 2012; Kuechler and Vaishnavi, 2012; Orlikowski and Iacono, 2001). In Simon's (1996) and March and Smith's (1995) seminal works on design science in IS, IT artifacts are distinguished in concepts, models, methods, and instantiations. Since then, academics have put the IT artifact label on many "things that use IT or are associated with IT in some way" (Alter, 2015, p. 50). This work follows a more narrow understanding of IT artifacts as socio-technical systems (Österle et al., 2011; Markus and Silver, 2008) that have instances in the real world and inherently manifest in hardware and software (Alter, 2015). Other types of artifacts, such as concepts, models, and methods, have a meta-relationship with the actual IT artifact and constitute "nomothetic knowledge about technology" (Drechsler and Hevner, 2018, p. 84) that aids in the development of IT artifacts.

co-creation between various actors (Täuscher and Laudien, 2017), which also includes interactions within the *community* of local customers. The research objective of this work reads as follows:

Research Objective: *The design, instantiation, and evaluation of a multi-sided digital community platform that facilitates personalized service and the co-creation of value on high streets*.

Scholarly knowledge on the co-creation of value through service (e.g., Vargo and Lusch, 2017; Grönroos and Voima, 2013), customer experience, and the customer journey (e.g., Følstad and Kvale, 2018; Lemon and Verhoef, 2016; Verhoef et al., 2009) inform this research. Mature solution design knowledge on digital platforms (e.g., Hagiu and Wright, 2015; de Reuver et al., 2017), and personalized service in e-commerce (e.g., Bauer and Strauss, 2016; Phillips, 2016) is applied to the under-researched high street setting (Bollweg et al., 2018). This thesis applies a design-oriented research methodology and can be positioned as *exaptation* research, that is, an "extension of known design knowledge into a new field" (Gregor and Hevner, 2013, p. 347).

1.3 Research Methodology and Design

A research methodology comprises the general "process, methods, and tools" (Nunamaker et al., 1990, p. 91) to use when conducting research in a field, whereas the research design is the individual orchestration and combination of methods and activities to reach a given research objective (Recker, 2012; Nunamaker et al., 1990). This thesis is set in the IS field, whose central vision, according to Walsham (2012, p. 91), is to contribute to "a better world" through the study and design of ICTs. Two research paradigms prevail in the IS discipline: The Anglo-American IS community focuses primarily on positivist, behavioral research (Benbasat and Zmud, 1999; Gregor, 2006) that yields explanatory and descriptive knowledge to "enhance our understanding of the world and the phenomena our technology harness (or cause)" (Drechsler and Hevner, 2018, p. 82), whereas the Scandinavian IS community and the German *Wirtschaftsinformatik* understand IS as an engineering science (Bichler et al., 2016; Österle et al., 2011) and focus more on design-oriented research that yields prescriptive knowledge "about technological innovations that are or can

be useful for individuals, organizations, or society" (Drechsler and Hevner, 2018, p. 82). These two research paradigms complement each other, as the design of innovative solutions draws on prior knowledge and creates new phenomena to assess in evaluations that themselves yield both prescriptive and propositional knowledge (Gregor and Hevner, 2013).

The goal of this thesis is to develop an IT artifact that facilitates digital service in high streets. Consequently, a design-oriented research methodology is applied (Nunamaker et al., 1990; Goldkuhl, 2012), which supports the creation of IT artifacts as "potential solutions to real-world problems" (Drechsler, 2019, p. 1). As Peffers et al. (2018) pointed out, the IS community has proposed multiple (complementary) "genres" of design-oriented research. This thesis focuses on the construction of an applicable IT artifact and so draws from the design science research methodology (DSRM) (Peffers et al., 2007; Hevner et al., 2004), and design-oriented information systems research (DOIS)[5] (Österle et al., 2011; Winter, 2008).

The DSRM suggests a multi-stage process with which to design applicable IT artifacts (Peffers et al., 2007; Hevner et al., 2004). The process starts with identifying a real-world societal or economic problem, which in this case is the decline of high streets. We then established the research objective of designing and instantiating a multi-sided digital community platform for high streets and formalized the characteristics that the solution must fulfill (among others, enabling value co-creation through digital service). The design and development stage, which represents the major part of this thesis, is focused on the solution's design (March and Smith, 1995; Hevner et al., 2004). Design requirements are identified from the literature and empirical assessments (Meth et al., 2015), knowledge about how to realize the IT artifact is derived from studies (Drechsler and Hevner, 2018), and the IT artifact is conceptualized. In the demonstration stage, the platform and the conceptualized services are implemented in a laboratory setting to show its general viability and technical utility in solving the problem (Venable et al., 2016). Then, in a large-scale field study in the city center of Paderborn, Germany, the IT artifact's performance and suitability for the intended purpose are evaluated vis-à-vis the proposed objectives (Peffers et al., 2012; Venable et al., 2016). Additional evaluation methods, such as informed arguments, survey research, and expert interviews, are performed

[5] DOIS corresponds to the German "gestaltungsorientierte Wirtschaftsinformatik," which 111 full professors of the German IS community have endorsed as a research methodology in a memorandum (Österle et al., 2011).

to yield complementary findings (Dinter and Krawatzeck, 2015), and the resulting IT artifact is evaluated against the DOIS methodology's criteria "abstraction, originality, justification, and benefit" (Österle et al., 2011; Peffers et al., 2018). Since the DSRM allows the researcher to return to previous process stages, design, build, and evaluation activities take place iteratively and are executed in multiple cycles (Sein et al., 2011). Finally, the communication stage comprises all activities to formalize the knowledge gained and communicate it to academia and practice. In addition to this thesis, the included journal and conference publications, as well as teaching activities and public talks given by the author, serve as means of dissemination.

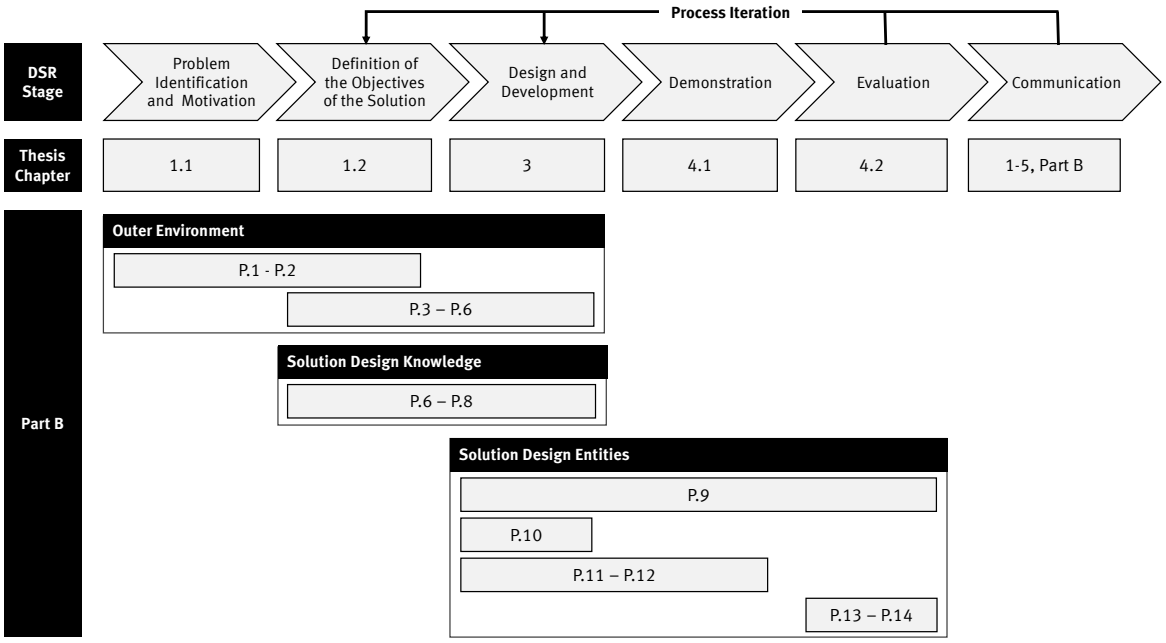
The research design follows a mixed-methods approach to conceive the various parts of the overall solution (Venkatesh et al., 2013; Chen and Hirschheim, 2004). The methods applied comprise structured literature reviews (Webster and Watson, 2002; vom Brocke et al., 2009), conceptual modeling (Becker et al., 2014; Frank, 2013), qualitative content analysis (Mayring, 2014), surveys (Goldkuhl, 2019; Benbasat and Zmud, 1999), expert interviews (Recker, 2012), and laboratory and field experiments (Venable et al., 2016; Gregor and Jones, 2007).

While the applied DSRM and DOIS provide the means through which to achieve rigorous academic outcomes, the IS community faces a (perceived) gap between rigorous academic outcomes and practitioners' needs for applicable solutions (Becker et al., 2015; Kuechler and Vaishnavi, 2011; Winter, 2008). In response, IS researchers have proposed consortium research (Österle and Otto, 2010) as a form of design-oriented research, where partners from academia and practice work together (Iivari, 2015). The IT artifact presented in this thesis is developed in the context of a consortium research project — smartmarket² — in which IS and service researchers have partnered with a network equipment supplier and a market research company to build innovative service offerings for high streets.[6] *smartmarket²* serves the role of a "knowledge engine" (Drechsler and Hevner, 2018, p. 93), and the project setting allows the project partners to elicit the IT artifact's requirements from multiple perspectives, ensures its relevance to practice, and enables an assessment of its utility in its supposed real-world environment.

[6] The research project smartmarket² (`www.smartmarketsquare.de`) is funded by the German Federal Ministry of Education and Research from March 2017 to February 2020 under promotion sign 02K15A074 within the aforementioned program "smart service city" and managed by the Project Management Agency Karlsruhe. The author is part of the project team.

1.4 Structure of the Dissertation

This cumulative thesis is structured into two parts (Figure 1.2). Part A is structured along the stages of the DSRM process (Peffers et al., 2007) and lays out the overall theme and objectives of this work, describes the research background, summarizes and discusses the results, and highlights contributions to theory and practice.



SOURCE: adapted from Peffers et al., 2007, p. 54

Figure 1.2: Structure of the Dissertation

Part B comprises fourteen published academic publications that paved the way for the thesis. All manuscripts have been subjected to double-blind peer-reviewing processes. The research has been published in the *Electronic Markets* journal, the *Journal of Retailing and Consumer Services*, and *HMD - Praxis der Wirtschaftsinformatik*. Results have been presented also at recent installments of the *International Conference on Information Systems (ICIS)*, *European Conference on Information Systems (ECIS)* and *Americas Conference on Information Systems (AMCIS)* as well as the *International Conference on Wirtschaftsinformatik (WI)* and the *Multikonferenz Wirtschaftsinformatik (MKWI)*. The publications in Part B are not sorted chronologically but are arranged to follow the stages of the DSRM.

Figure 1.2 structures the publications with regard to their theoretical contributions on three levels. First, the thesis yields knowledge on the digitalization of the high

street ecosystem, which marks the outer environment or application domain of the IT artifact (Simon, 1996). Second, it provides solution design knowledge that is independent of a particular artifact instance and can be applied to similar problems and related classes of artifacts (Kuechler and Vaishnavi, 2012; Baskerville et al., 2018). Third, it contributes solution design entities in which knowledge is "embedded in the design" (Peffers et al., 2007, p. 55) of an IT artifact. However, publications that present solution design entities always contribute abstract design knowledge as well (Drechsler and Hevner, 2018).

Table 1.1 provides bibliographic information on the included publications, which are referenced by their IDs. *P.1* introduces the issue of degrading high streets and motivates the benefits of digital interaction in the high street ecosystem. *P.2* provides methodological guidance for creating innovative service offerings in joint research projects like *smartmarket*[2]. *P.3–P.6* explore the digitalization in high street retail through multiple lenses: *P.3* assesses mobile shopping companions through the lens of service quality (SQ) by deriving customer preferences for these IS from about 1,500 online reviews; *P.4* provides a structured literature review to identify the capabilities that in-store technologies hold to augment the physical retail environment with digital touchpoints; *P.5* applies survey research to assess customers' perceptions of digital service in BaM stores by presenting service instances that have been adapted from e-commerce to the BaM retail environment; and *P.6* sheds light on digital technologies' influences on the existing customer experience construct.

Knowledge about designing the IT artifact is given in *P.6–P.8*: *P.6* names design principles for IT artifacts that foster the co-creation of *digital* customer experience; *P.7* defines the fundamental concepts of high street customer journeys and proposes a new domain-specific modeling language (DSML) to understand and visualize these journeys; and in *P.8*, an online experiment is executed to learn how users' decision-making regarding the provision of personal information in mobile contexts is affected by transparent information on the underlying data-processing practices. *P.8* provides six design principles for privacy-transparent mobile applications that comply with the EU General Data Protection Regulation (GDPR).

P.9–P.14 describe the individual solution design entities: *P.9* presents the platform design, core service offerings, stakeholder groups, and a preliminary evaluation; *P.10* conceptualizes a framework for location-based services (LBS) in the high street, which are enabled by recording individual customers' journeys; *P.11* defines the

underlying algorithm to track these journeys; *P.12* provides additional information about building digital platforms; *P.13* reports on real-world evaluation activities and paves the way for a geo-spatial recommendation system in high streets; and, finally, *P.14* evaluates the merits of extending the platform with means for user-generated content and customer-to-customer interaction.

The publications in Part B have not been altered regarding content, but have been adapted to the layout of this thesis. Modifications include correction of minor spelling mistakes, and the standardization of labels, tables, footnotes, and abbreviations. Because of these alterations, the size and positions of figures and tables may differ slightly from their original publications.

Table 1.1: List of Publications in Part B

ID	Publication	Outlet
P.1	**J. H. Betzing**, D. Beverungen, J. Becker, M. Matzner, G. Schmitz, C. Bartelheimer, C. I. Berendes, M. Braun, A. Gadeib, M. von Hoffen, and C. Schallenberg (2017). "Interaktive, digitale Einkaufserlebnisse in Innenstädten." In: *HMD Praxis der Wirtschaftsinformatik* 54.5, pp. 659–671	*JNL*
P.2	M. Matzner, F. Plenter, F. Chasin, **J. H. Betzing**, and M. von Hoffen (2018). "New Service Development Through Action Design Research in Joint Research Projects." In: *26th European Conference on Information Systems*. ECIS '18. Portsmouth, UK	*CNF*
P.3	T. Wulfert, **J. H. Betzing**, and J. Becker (2019). "Eliciting Customer Preferences for Shopping Companion Apps: A Service Quality Approach." In: *14th International Conference on Wirtschaftsinformatik*. WI '19. Siegen, Germany	*CNF*
P.4	**J. H. Betzing**, A.-Q. M. Hoang, and J. Becker (2018). "In-store Technologies in the Retail Servicescape." In: *Multikonferenz Wirtschaftsinformatik*. MKWI '18. Lüneburg, Germany, pp. 1671–1682	*CNF*
P.5	**J. H. Betzing**, M. Niemann, B. Barann, B. Hoffmeister, and J. Becker (2019). "Mirroring E-service for Brick and Mortar Retail: An Assessment and Survey." In: *14th International Conference on Wirtschaftsinformatik*. WI '19. Siegen, Germany	*CNF*
P.6	**J. H. Betzing**, D. Beverungen, and J. Becker (2018). "Design Principles for Co-Creating Digital Customer Experience in High Street Retail." In: *Multikonferenz Wirtschaftsinformatik*. MKWI '18. Lüneburg, Germany, pp. 2083–2094	*CNF*
P.7	C. I. Berendes, C. Bartelheimer, **J. H. Betzing**, and D. Beverungen (2018). "Data-driven Customer Journey Mapping in Local High Streets: A Domain-specific Modeling Language." In: *39th International Conference on Information Systems*. ICIS '18. San Francisco, CA, US	*CNF*
P.8	**J. H. Betzing**, M. Tietz, J. vom Brocke, and J. Becker (2019). "The Impact of Transparency on Mobile Privacy Decision Making." In: *Electronic Markets*. forthcoming. DOI: 10.1007/s12525-019-00332-3	*JNL*

continued ...

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PID	Publication	Outlet
P.9	C. Bartelheimer, **J. H. Betzing**, C. I. Berendes, and D. Beverungen (2018). "Designing Multi-sided Community Platforms for Local High Street Retail." In: *26th European Conference on Information Systems*. ECIS '18. Portsmouth, UK	*CNF*
P.10	**J. H. Betzing** (2018). "Beacon-based Customer Tracking across the High Street: Perspectives for Location-based Smart Services in Retail." In: *24th Americas Conference on Information Systems*. AMCIS '18. New Orleans, LA, US	*CNF*
P.11	**J. H. Betzing**, M. Niemann, and C. I. Berendes (2019). "Privacy-friendly User Location Tracking with Smart Devices: The BeaT Prototype." In: *14th International Conference on Wirtschaftsinformatik*. WI '19. Siegen, Germany **Winner of the Best Demo Award**	*CNF*
P.12	**J. H. Betzing**, M. von Hoffen, F. Plenter, F. Chasin, M. Matzner, and J. Becker (2017). "One Plug at a Time — Designing a Peer-to-Peer Sharing Service for Charging Electric Vehicles." In: *13th International Conference on Wirtschaftsinformatik*. WI '17. St. Gallen, Switzerland, pp. 1275–1278 **Winner of the Best Prototype Award**	*CNF*
P.13	**J. H. Betzing**, C. Bartelheimer, M. Niemann, C. I. Berendes, and D. Beverungen (2019). "Quantifying the Impact of Geospatial Recommendations: A Field Experiment in High Street Retail." In: *27th European Conference on Information Systems*. ECIS '19. Stockholm-Uppsala, Sweden	*CNF*
P.14	**J. H. Betzing**, M. Kurtz, and J. Becker (2020). "Customer Participation in Virtual Communities for Local High Streets." In: *Journal of Retailing and Consumer Services* 54 (102025)	*JNL*

2 Research Background

"When in doubt, go to the library."

J. K. Rowling

This chapter holds the research background and kernel theories that are relevant to the overall theme of this thesis. We view the high street through the lens of service science, which gives us the ecosystem in which actors co-create value. Then, customer experience as a central value construct in retail is introduced. Customer journey theory provides the concepts that structure and potentially interfere with customer behavior. Next, digital platforms for multi-sided markets form the foundation on which to connect different actors and their resources through ICTs and mediate digital and physical service. Since the individual studies in this thesis draw from additional streams of research, the reader is referred to the respective publications in Part B.

2.1 Co-Creation of Value in the High Street Ecosystem

Goods-based industries have traditionally focused on the distribution and monetized exchange of goods, where the value is embedded in the good (value-in-exchange) (Vargo and Lusch, 2004; Saarikko, 2015). However, in recent years, services have become the focal source of economic value creation.[7] The term "servitization" describes the economic paradigm shift in many industries from a goods-based focus towards service-centered offerings (Ostrom et al., 2015; Fließ and Kleinaltenkamp, 2004). Following the Service-dominant Logic of Marketing (S-D Logic), a central theory in service science, value is co-created through the exchange of service

[7] For example, the service sector accounted for 68 percent of Germany's gross domestic product (GDP) in 2018 (DESTATIS, 2018).

(Vargo and Lusch, 2016).[8] Vargo and Lusch (2008, p. 26) defined service as "the application of specialized competencies [...] through deeds, processes, and performances for the benefit of another entity or the entity itself." Two or more goal-oriented actors come together in a service encounter to co-create value through the integration and the exchange of their resources (Vargo and Lusch, 2011).[9] The co-created value "is always uniquely and phenomenologically determined by the beneficiary" (Vargo and Lusch, 2017, p. 47), which makes the service encounter and the underlying utility function dependent on the individual actor's context (*P.6*).

The following example of consultation makes the lens of value co-creation tangible. A customer expresses his[10] needs to a store associate, who uses his knowledge to select a product that meets the customer's needs and explains how to use the product. The customer's perceived value depends on how well the consultation and the product fulfill his needs.

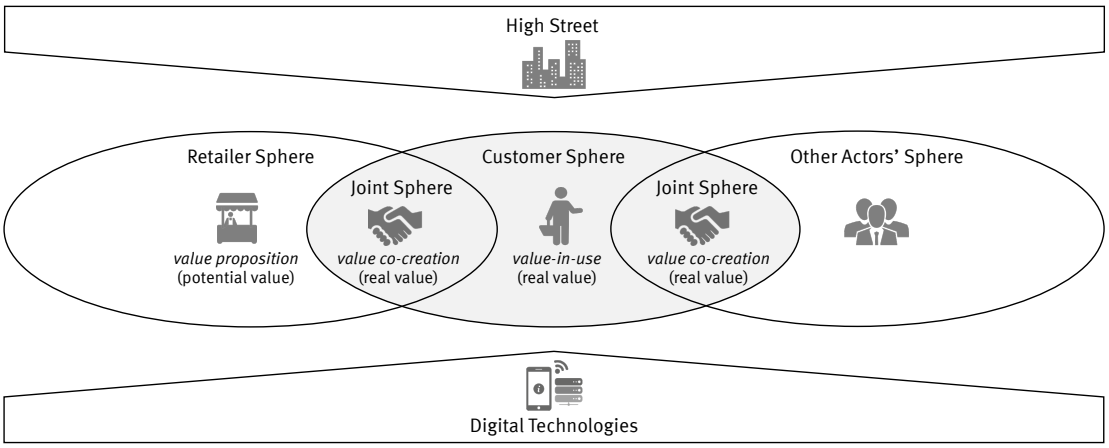
This understanding of value creation poses a paradigm shift for retailers from being providers of goods to being active co-creators of customer value (Niemeier et al., 2013). Figure 2.1 shows value creation "spheres" in a high street ecosystem. Retailers propose a potential value to customers through, for example, the range of products and services offered and the store's presentation (Frow et al., 2014). In the joint sphere, service encounters take place to translate business potential into real economic value through service. The customer creates additional value beyond the retailer's reach: On the one hand, a value-in-use accrues over time from using a product or service (Vargo and Lusch, 2016). On the other hand, value co-creation in the high street takes place with additional actors such as other customers in the store who, for example, offer advice (Grönroos and Voima, 2013).

We study the high street as a dynamic service ecosystem of networked actors like customers, retailers, service providers, municipal authorities, and their resources (Spohrer et al., 2009; Chandler and Lusch, 2015). Individual actors can join or leave,

[8] In terms of the S-D Logic, the singular term "service" is used to describe the act of value creation, whereas the plural form "services" denotes the process outcome (Vargo and Lusch, 2008; Vargo and Lusch, 2017).

[9] The S-D Logic distinguishes resources in operant and operand resources. The former denotes intangible competencies, knowledge, and skills, whereas the latter denotes monetary and physical resources like materials and products. As part of service, operant resources can be applied to operand resources (Vargo and Lusch, 2017). For example, factory workers apply their knowledge (operant) onto machines (operand) to fulfill steps in the manufacturing process.

[10] To improve legibility, the simultaneous use of female and male forms is omitted in favor of the generic masculine. All personal designations apply equally to both sexes.



SOURCE: own visualization, based on *P.1* and Grönroos and Voima, 2013

Figure 2.1: High Street Ecosystem with Value Creation Spheres

exchange their resources, and engage in service in various roles that may change over time (Vargo and Lusch, 2016). As loosely-coupled systems that are guided by shared institutional arrangements, service ecosystems continually evolve (Vargo and Lusch, 2016). For example, the physical high street ecosystem follows basic rules of economic exchange and enables (e.g., links demand and supply) and constrains (e.g., location, opening hours) resource exchange and value co-creation (Lusch et al., 2016). Further, actors associate themselves with the ecosystem and share a belief system (e.g., a positive attitude about shopping) (Thornton and Ocasio, 2008).

Actors require interfaces to join the service ecosystem and establish contact with each other in joint spheres (cf. Figure 2.1) (Barann, 2018; Grönroos and Voima, 2013), so the retailers' value propositions have to include interfaces and engagement opportunities for customers. However, retailers walk a thin line between proposing engagement opportunities that are sufficiently generic to appeal to a wide range of potential customers and also are specific enough to solve the individual customers' problems, which are unknown prior to the first contact (Saarikko, 2015).

In addition to person-to-person interaction, where retailers get to know customers' needs so they can provide personalized service (Glushko, 2016), interconnected smart devices and products provide new interfaces to the service ecosystem (Bradlow et al., 2017; Faulds et al., 2018). ICTs sense their environment, perform computations, and hold digital information on the customer's context. This data as an indispensable resource in value creation practices can be used to tailor service to the individual customer's needs (Glushko, 2016). Since smart devices have material

agency (Barann, 2018), they are actors themselves (Becker et al., 2019; Hagberg et al., 2016). IT-infused products and services led to the notion of *smart* services (Beverungen et al., 2019), where ICTs even allow retailers to reach into the customer sphere (cf. Figure 2.1) by, for example, providing post-purchase digital service that contributes to the value-in-use.

Service science brought forth the notion of engagement platforms as structural mechanisms to draw people into the service ecosystem and foster interactions between the various actors (Storbacka et al., 2016; Frow et al., 2015; Breidbach et al., 2014). Engagement platforms, which formalize the digital and physical interfaces to the service ecosystem and support matchmaking between actors (Lusch et al., 2016), enable actors to exchange resources but do not engage in the interaction themselves (Storbacka et al., 2016; Blaschke et al., 2019).

Against this background, the IT artifact proposed in this thesis will be a means to encourage people to visit the high street and widen the joint spheres between the customer and other actors. Thus, it will embody an engagement platform for the high street (*P.1*, *P.9*).

2.2 Customer Experience and the Customer Journey

The construct of *value* in S-D Logic is a function of the beneficiary's subjective perception and can comprise "economic, financial or social value or some combination of these" (Chandler and Lusch, 2015, p. 6). The construct is related to the customer-perceived value in marketing, which is the result of customers' cost-benefit calculus (Zeithaml, 1988). Zomerdijk and Voss (2010) calculated the total value of a service offering as the sum of its attributes or features, the price, and the perceived experience of consuming the service. All concepts share a qualitative, experiential component, which reflects in the corresponding value construct in retail — customer experience[11] — that is, the formation of "cognitive, emotional, behavioral, sensorial and social responses" (Lemon and Verhoef, 2016, p. 74) to interactions that take place along the customer journey (*P.6*, *P.7*, *P.9*). Customer experience forms from those sensations,

[11] There are various related concepts such as service experience, which focuses on the core service encounter (e.g., Voorhees et al., 2017; Jüttner et al., 2013), and shopping experience, which focuses on the experience of shopping in a BaM store (e.g., Rippé et al., 2017; Fiore and Kim, 2007). Since customer experience entails both concepts, we view them as synonymous in this thesis.

which customers continuously evaluate vis-à-vis previous and co-occurring experiences (Homburg et al., 2017). The literature has provided insights into the attributes and moderators that affect customer experience (Lemon and Verhoef, 2016; Verhoef et al., 2009) and further has identified the hedonic, symbolic, and functional components that these customer experiences can have (*P.1*; Tynan et al., 2014).

The customer journey spans the customer's decision and buying process (Becker et al., 2011) — a time-logical sequence of the discrete and continuous interactions a customer has with one or more service providers and other actors during the pre-purchase, purchase, and post-purchase stages to achieve a specific goal (*P.7*; Halvorsrud et al., 2016; Voorhees et al., 2017; McLean et al., 2018; Lemon and Verhoef, 2016). Payne et al. (2008) distinguished three types of interaction that co-create value during the customer journey. First, there is the *service encounter* from S-D Logic, which manifests in personal interactions between the customer and the retailer (face-to-face or digitally mediated). Second, *communication encounters* subsume customers' interactions with the physical and digital information issued by the retailer. Third, the creation of value-in-use takes place in episodes of product or service use (*usage encounters*) (Payne et al., 2008, p. 90). Individual interactions can be abstracted to generic interfaces, called touchpoints (*P.7*; Heuchert et al., 2018) that take place through channels, media of contact like the store, e-mail, phone, online shops, mobile applications (apps) and social media (Neslin et al., 2006; Straker et al., 2015).

Retail marketing has traditionally viewed the customer journey to be catered to the customer by a focal retailer trough all stages of the process (Howard and Seth, 1969; Lavidge and Steiner, 1961). Recent scholarly perceptions have assumed a "continuous, dynamic decision-making process" (Becker et al., 2019, p. 295) that is not limited to a single retailer. In effect, customer journeys can be characterized by media multiplexity (Haythornthwaite, 2005) and the use of complementary channels (Dutta-Bergman, 2004); customers continually reevaluate their decisions and switch dynamically between channels and service providers (Faulds et al., 2018).

To make the customer journey visible, consider the simplified example depicted in Figure 2.2, which spans the journey from receiving an e-mail from an online service with product recommendations to buying one of the products in a store. The figure shows touchpoints between the customer and other actors and takes the view of a BaM retailer that the customer has decided to visit. In this example, the customer

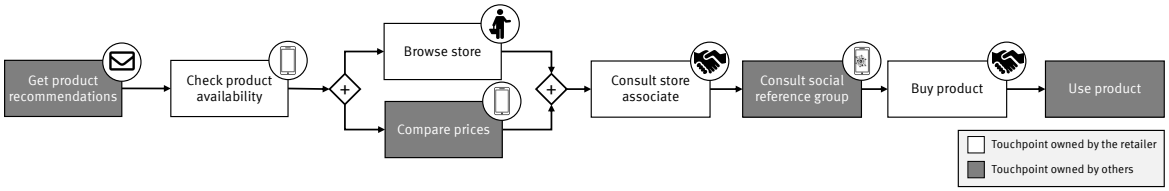


Figure 2.2: Simplified Customer Journey Including Digital/Physical Touchpoints with Multiple Actors

seamlessly switches between digital and physical channels. He has touchpoints that are in control of the retailer, while other interactions take place with different service providers that are out of the retailer's reach. In the store, the customer uses multiple channels in parallel. Figure 2.2 exemplifies how customer journeys have evolved into sequences of mixed online and offline interactions (Halvorsrud et al., 2016; Faulds et al., 2018). As customer experience is co-created at all touchpoints, it also evolves at the same time into a digital and physical construct whose overall evaluation depends on the individual episodes of interaction (*P.6*; Lemon and Verhoef, 2016).

The marketing and service literature have focused primarily on the dyadic relationship between retailer and customer (e.g., Shostack, 1987; Bitner et al., 2008; Heuchert, 2019; Rosenbaum et al., 2017; Teixeira et al., 2012; Patrício et al., 2011). Marketing and IS scholars have only just begun to investigate the evolution of customer journeys into complex multi-actor, online-offline scenarios that span the boundaries of single retailers (Faulds et al., 2018; Hosseini et al., 2017; Nüesch et al., 2015). In light of the research objective, this thesis zooms out of the dyadic relationship to focus on the co-creation of digital and physical customer experience during journeys on the high street level.

2.3 Multi-sided Digital Platforms

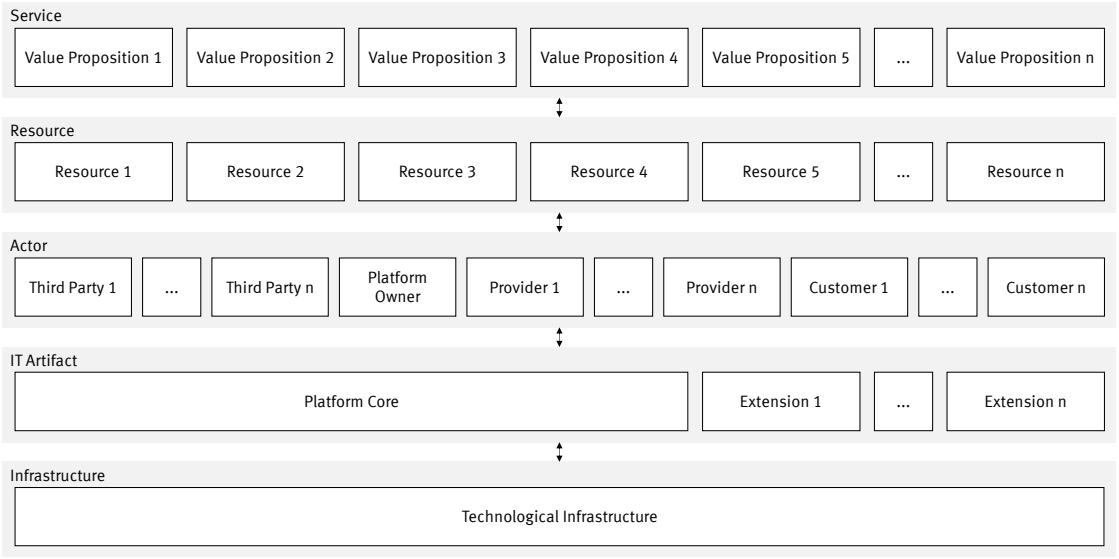
During the last decade, platform-facilitated digital service has matured to be the central value proposition of highly-valued organizations like Google, Amazon, Facebook, and Apple (GAFA) (Evans and Gawer, 2016; Williams et al., 2008). Digital platforms are ubiquitous in our daily lives (de Reuver et al., 2017), ranging from social networking sites (e.g., Facebook, Reddit), operating systems and cloud technology platforms (e.g., Google Android, Amazon Web Services), to marketplaces

(e.g., eBay, Alibaba), payment platforms (e.g., PayPal, Square), and sharing economy platforms (e.g., Airbnb, Uber) (Chasin et al., 2018). According to Constantinides et al. (2018, p. 381), a digital platform is "a set of digital resources — including services and content — that enable value-creating interactions between external producers and consumers."[12]

The platform's raison d'être is matching actors from different sides that are all affiliated with the platform and allowing these actors to interact with each other directly (Hagiu and Wright, 2015; Kazan et al., 2018). Evans (2003) found that platforms emerge as a market structure when actors from different sides require coordination for reasons related to supply and demand, and an intermediary can facilitate this matchmaking more efficiently than direct communication between the parties can. In effect, platforms can decrease the cost of information acquisition for users (Hagiu, 2014; Rochet and Tirole, 2003). When a substantial number of associated users are acquired on each side, indirect network effects emerge (McIntyre and Srinivasan, 2017). Besides matchmaking, platform owners can become actors themselves, when they integrate their members' resources with theirs to co-create value (Blaschke et al., 2019). For example, Airbnb's core activity is matchmaking between lodging providers and customers (von Hoffen et al., 2018), where the provision of accommodations takes place in direct interaction between the host and the guest. Airbnb makes supplementary value propositions to their lodging providers, such as professional real estate photography and insurance (Hein et al., 2018).

Figure 2.3 takes an architectural view of digital platforms based on Blaschke et al.'s (2019) dimensions, which were updated to follow the terminology of S-D Logic. Digital platforms build on existing technological infrastructures like the Internet and smart devices that serve as channels for service delivery (Saarikko, 2015). These infrastructures make digital platforms time- and location-independent and have the potential to create global market reach (Constantinides et al., 2018). Notably, digital platforms are seldom isolated systems but create innovation by recombining existing digital service offerings (Beverungen et al., 2018; Yoo et al., 2012) and integrating other platform ecosystems into their value chains (Tiwana, 2015). For example, the

[12] As de Reuver et al. (2017) noted, views and definitions of the term digital platform (a.k.a. IT platform) vary. Computer science views digital platforms as "extensible codebase[s] to which complementary third-party modules can be added" (de Reuver et al., 2017, p. 127), whereas management and economics apply a market view on how digital platforms affect organizations' value chains and ecosystems. While all perspectives are valid and beneficial for academia, this thesis subscribes to the previously stated socio-technical view.



SOURCE: own visualization, based on Blaschke et al., 2019, p. 578

Figure 2.3: Dimensions of Digital Platforms

streaming provider Netflix uses the Google Android and Apple iOS platforms to deliver its mobile service, and also procures computational resources from cloud platform provider Amazon Web Services (Adhikari et al., 2015). In effect, digital platforms can be built entirely on the physical infrastructure resources of others, and also leverage other platforms' digital service offerings for their service delivery (Constantinides et al., 2018).

As an IT artifact, the platform comprises "a set of stable core components" (McIntyre and Srinivasan, 2017, p. 150) with interfaces to implement extensions in a modular fashion (Hevner and Malgonde, 2019; Saarikko, 2015). Depending on their value-creation strategies, platform owners can either provide open access to the platform's interfaces (e.g., via application programming interfaces (APIs)) to enable third parties to develop complementing extensions (Karhu et al., 2018), or keep their value networks closed (Kazan et al., 2018). The duality of a stable core and variable extensions enables generativity (Wareham et al., 2014; Yoo et al., 2012) and the ability to adapt to changes in customers' demands and the competitive environment (Gawer, 2014). The core platform implements the underlying processes, governance mechanisms, roles, and permissions that regulate how actors interact (Smedlund and Faghankhani, 2015).

The actor and resource dimensions acknowledge the integrative function of the digital platform to link a service ecosystem of several stakeholder groups and their resources (F. T. C. Tan et al., 2016; Vargo and Lusch, 2017). Actors appear in varying provider and customers roles, supply their (operand and operant) resources, and engage in service. Third-party providers can make their capabilities available to support value creation (Parker et al., 2017). Depending on the number of actor groups (sides), the literature speaks of two-sided or multi-sided platforms (Eisenmann et al., 2006; Armstrong, 2006; Hagiu and Wright, 2015). For example, the high street constitutes a multi-sided service ecosystem, in which additional stakeholder groups (e.g., municipal authorities) complement providers (e.g., retailers) and customers (Evans, 2003).

The service dimension comprises both the value propositions that the platform itself renders to its members and those the actor groups make to one another. Once an IT artifact enables a value-creating interaction between at least two user groups, it meets the definition of a digital platform. Therefore, a digital platform does not necessarily have to cover financial transactions or the exchange of goods (Constantinides et al., 2018).

Besides bilateral matchmaking between user groups, some digital platforms (e.g., social networking sites) also foster multilateral social interactions between actors in and across user groups, building online communities of like-minded peers that "interact around a shared interest" (C. E. Porter, 2006). The literature has described *virtual communities* (VCs) as location-independent, geographically dispersed accumulations of individuals and organizations with "strong social relationships [...], community-specific organizational structure, a shared history, community rituals, [and] continuity of communication" (Stanoevska-Slabeva, 2002, p. 71). Exchange among these actors is supported by a digital platform as the underlying infrastructure (Dholakia et al., 2004; Martínez-López et al., 2016). In the retail domain, users form VCs on existing platforms (e.g., groups on social networking sites and messaging services) (Baethge et al., 2016; Zaglia, 2013). Other digital platforms are built with the goal of establishing virtual communities (e.g., brand, social shopping, deal communities) (Muniz and O'Guinn, 2001; Cheung et al., 2015; Bergmeier et al., 2016). In effect, VCs add a social dimension to the value co-creation on digital platforms.

By taking part in a digital platform ecosystem, organizational innovation is externalized to some extent (Parker et al., 2017; Hevner and Malgonde, 2019). For example,

a digital platform for high streets can provide innovative touchpoints between retailers and customers, a task that has traditionally been the retailer's responsibility. While platforms can empower organizations to make value propositions beyond their internal capabilities (Blaschke et al., 2019), they are usually also open for competitors to leverage the same benefits, hence diluting the competitive advantage of the individual organization when competitors join the same digital platform (Hänninen et al., 2019). Similar to high streets and shopping malls that attract large numbers of customers because of the retail agglomeration (Teller, 2008), digital platforms yield indirect network effects. The size of the individual organization's net benefit depends to a degree on the number of (potentially rival) organizations that join (Katz and Shapiro, 1985; Parker and van Alstyne, 2005). In effect, then, digital platforms can result in co-opetition (Ritala et al., 2014). In this mode, organizations follow a shared goal like strengthening the high street, and so collaborate on some activities like digital marketing. At the same time, they compete in other activities such as managing their product portfolio and delivering in-store service (Möller and Rajala, 2007; Kazan et al., 2018).

The literature provides guidance regarding platform governance (Tura et al., 2017; Schreieck et al., 2016), launch strategies (de Reuver et al., 2018; Hagiu, 2014), user base scaling (S. Liu et al., 2019), sustainable operations and survival (Blaschke et al., 2018), inter-platform competition (Rochet and Tirole, 2003; Eisenmann et al., 2006), and users' multi-homing behavior (Armstrong, 2006; B. C. Kim et al., 2017). However, as de Reuver et al. (2017, p. 130) noted in their recent research agenda, design-oriented research that provides design knowledge on digital platforms is scarce. This thesis responds to de Reuver et al.'s call by designing, instantiating, and evaluating a digital platform for high streets.

3 Design of a Multi-sided Community Platform for High Streets

> *"Without research efforts directed toward developing new solutions and systems, there would be little opportunity for evaluative research."*
>
> *Nunamaker et al. (1990), p. 90*

In line with the DSRM process (Peffers et al., 2007) and Gregor and Hevner's (2013) and Drechsler and Hevner's (2018) types of knowledge contribution, this chapter provides the design of the multi-sided community platform for high streets.

First, we examine the solution's outer environment (Simon, 1996) by briefly exploring the digitalization of interfaces and interactions between BaM retailers and customers, and updating our view of the creation of digital customer experience in the high street. Then, we revisit the objectives of the solution that we identified in Section 1.2 and derive the requirements that will guide the design of the proposed IT artifact (Gregor and Hevner, 2013; Meth et al., 2015). In particular, the SME retailers' needs, and the conflict between personalized, contextualized service and customers' desire for data privacy are investigated. Next, we describe the conceptualized IT artifact and prescriptive design knowledge (Gregor and Hevner, 2013). Structured by the dimensions of digital platforms that were presented in Section 2.3, the actors, resources, and core service offerings are presented.

3.1 Descriptive Design Knowledge

3.1.1 Digitalization of the Retailer-Customer Interface

Customers' frequent use of smartphones while they shop in BaM stores (Chopdar et al., 2018; Faulds et al., 2018) suggests that they want to leverage the benefits from both e-commerce (e.g., detailed product information and comparison, ratings and reviews) and physical retail stores (e.g., instant availability, inspectable merchandise) (Blázquez, 2014; Bell et al., 2017).[13]

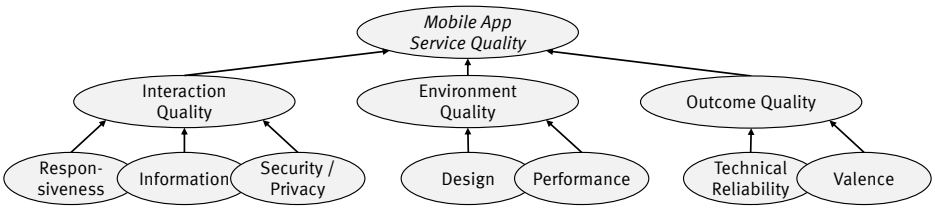
Large BaM retail corporations have responded to this behavior by introducing *shopping companion apps*, which are "retailer-provided [information systems], executed on the customer's smartphone that complement [...] the personal and [digital] service of a BaM retailer by an additional mobile channel that manifests as a digital support to the shopping process inside and outside the store" (*P.3*, p. 135). These apps allow customers to co-create value with the retailer that they otherwise might have created with third-party providers. Shopping companion apps support information retrieval with features like product search, comparison, and availability checking, but also have personalized, context-aware features like suggestions, loyalty programs, and in-store navigation (Chopdar et al., 2018).

By combining a structured literature review with a qualitative content analysis (QCA) of about 1,500 customer reviews of three major shopping companion apps (*P.3*), we identified an adapted scale with which to measure Mobile App Service Quality (MASQ) and twenty-three customer preferences for shopping companion apps (see Table 8.4, p. 143). SQ measures the quality of a service encounter by comparing the customer's expectations with their perceptions of the service received (Parasuraman et al., 1994; Zeithaml et al., 2000); a high SQ is achieved when perceptions meet or exceed expectations (Grönroos, 1984).[14] Formative SQ models are often hierarchically structured, and detailed primary dimensions and items explain a set of secondary dimensions (Stiakakis and Petridis, 2014; Vlachos et al., 2011).

[13] Some customers prefer the high street as a retreat from e-commerce precisely because of the absence of digital technologies. However, since these customers already support the high street, they are not the target group of a digital platform for high streets.

[14] The customer experience construct forms similarly from customers' perceptions but takes a broader perspective across all types of encounters along the customer journey, and also includes the perceived value-in-use (Lemon and Verhoef, 2016). SQ always entails a comparison between an envisioned to-be state and a received as-is state.

MASQ emerges from the customer's interactions with the service provider (service quality), the context in which service delivery takes place (environment quality), and the customer's perception of the process outcome (Fullerton, 2005; Y. Lu et al., 2009). Figure 3.1 shows the multidimensional model that can be further specified by individual items for each dimension (see Table 8.2, p. 140).

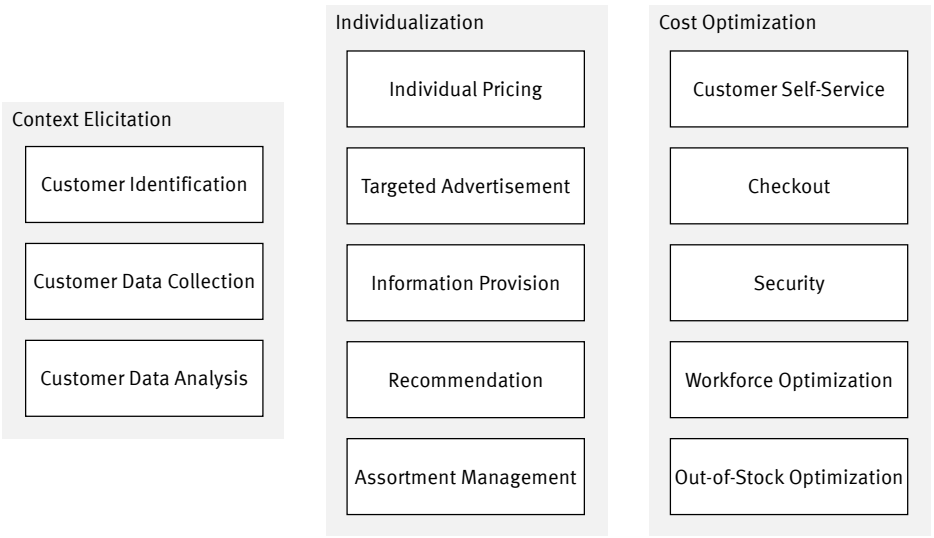


SOURCE: adapted from *P.3* and Stiakakis and Petridis, 2014, p. 945

Figure 3.1: Multidimensional Hierarchical Model of MASQ

This study confirms the assumption of customers' demand for digital service in BaM retail. Moreover, customers have high expectations for these apps and frequently voice their opinion in the form of reviews if the perceived MASQ does not live up to their expectations. This study shows that customers are particularly sensitive to issues regarding the design and technical reliability of such apps. Retailers have to manage the mobile service they provide carefully and take customers' expectations into account to prevent negative experiences. Although MASQ assessments take place only after an app is launched (*P.2*), this thesis' design activities can be informed by customers' preferences and the identified MASQ items to prevent pitfalls or address them early.

Shopping companion apps exemplify how BaM retailers can extend the joint sphere with their customers by offering digital touchpoints in the physical servicescape, that is, the "environment within which service encounters occur" (Chandler and Lusch, 2015, p. 12). Industry and academia have generated an ever-increasing basket of customer-facing in-store technologies from which retailers can choose (for an overview see *P.4*), which poses a particular burden for SME retailers, who must select the appropriate ICTs to provide digital service to their customers. In light of the speed of technological innovation, we now abstract instances of technology to the capabilities they provide. From a managerial point of view, the introduction of ICTs can contribute to two organizational goals: individualization and cost optimization, where the former refers to efforts to cater to individual customers' needs, decrease customers' efforts, and increase convenience, whereas the latter refers to efforts to increase operational effectiveness and efficiency (M. E. Porter, 1998).



SOURCE: adopted from *P.4*

Figure 3.2: Digital Capabilities Provided by In-Store Technologies

Figure 3.2 shows thirteen capabilities provided by digital in-store technologies that were derived from a structured literature review of ninety-five publications (*P.4*). In addition to five capabilities identified for each of the two organizational goals, three additional context-eliciting capabilities enable the other ones. Dey and Abowd (1999, p. 5) defined context as "any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves." In-store technologies can have capabilities that identify the customer and his context, collect situational and behavioral data and yield new information from analyzing raw data.

The customer's context is an operant resource that enables ICTs and store associates to adapt their behavior to that individual customer's situation. Automatic customer identification during the service encounter increases customers' convenience, while analysis of the customer's past behavior allows the retailer to provide information that is relevant to that customer, which decreases his efforts related to information search. On the other hand, aggregated analysis of customer behavior allows store operations to be optimized with regard to staffing and stock management.

Zooming out to the high street level makes evident that the platform requires capabilities that can elicit customers' context across retailers, thus yielding wider information than retailer-specific tools like shopping companion apps. However, given

SME BaM retailers' fragmentary ICT landscape, the IT artifact cannot be integrated as tightly into retailers' service delivery as retailer-specific ICTs can, so which digital service offerings high street customers are interested in and whether the IT artifact can facilitate them remains an open question.

Since e-commerce has matured over the last decade and has been widely adopted by customers, one can assume that this channel has converged to a dominant design, that is, a set of commonly offered and accepted digital service offerings (Suárez and Utterback, 1995). Since these e-commerce touchpoints have resonated well with customers, they can be assessed in terms of their potential for adoption in high street retail (*P.5*). A qualitative content analysis of leading German e-commerce retailers revealed dominant touchpoints that have been adopted for application in BaM retail, yielding twenty "mirrored" digital touchpoints (see Figure 10.1, p. 172). In a thought experiment (Maxwell, 2013), 250 customers were surveyed regarding the likelihood of using these complementary digital service offerings in BaM retail stores. Besides an overall positive response to digital service in BaM stores, the best-rated touchpoints support customers in managing their journeys: planning the journey, facilitating the purchase, and accessing past purchases (Figure 10.2, p. 179). Customers generally prefer touchpoints that make new information available and provide smart service to increase the effectiveness (e.g., ease product search) and efficiency (e.g., make the checkout faster). The literature has identified mobile apps and in-store terminals as central channels for digital service in BaM stores (Pantano and Viassone, 2014), so customers were surveyed regarding their use of applicable touchpoints (e.g., the need to access product reviews) through either channel with the results showing that customers strongly prefer mobile apps over stationary terminals. Consequently, the digital platform should be accessible from customers' smart devices.

The studies on shopping companion apps (*P.3*), capabilities of in-store technologies (*P.4*), and digital service offerings in BaM (*P.5*) are contributions to knowledge that support the platform's design and development.

3.1.2 Digital Customer Experience in High Streets

The number of channels and digital touchpoints for personalized service delivery in retail is growing (*P.3*–*P.5*), but existing models of customer experience do not

account sufficiently for the effect of using digital touchpoints (Lemon and Verhoef, 2016). Therefore, we describe how customers' smart devices and retailers' technologies support *digital* customer experience creation in the physical servicescape, by giving an updated overview of the attributes of customer experience management from Verhoef et al.'s (2009) seminal model (*P.6*). Table 3.1 introduces the model's elements and describes the potential of digital technology — and particularly mobile technology — to provide digital service that co-creates customer experience.

Table 3.1: Potentials of Digital Technologies for Customer Experience Creation

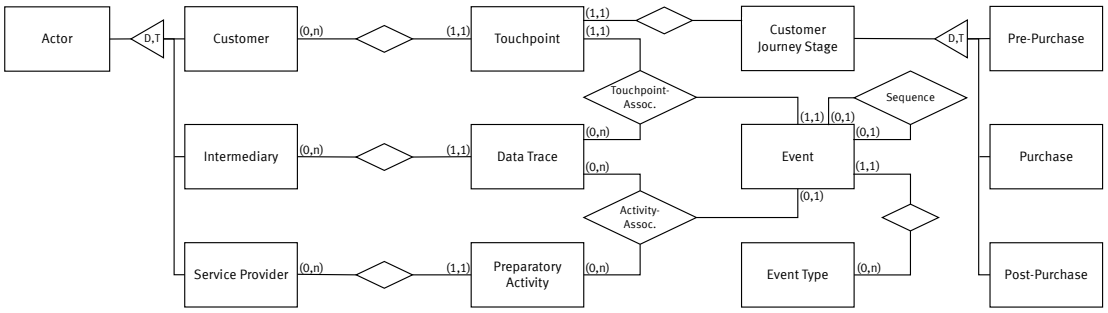
SOURCE: adapted from *P.6* and Verhoef et al., 2009, p. 32

Element	Description	Potentials of Digital Technologies
Social environment	Other actors in the customer's immediate vicinity (e.g., friends, other shoppers).	• Access to the wider social reference group and strangers (who do not need to be physically present in the store) • Instant access to recommendations and feedback through messaging and online communities
Service interface	The channel, touchpoint and type of encounter between retailer and customer.	• Integration of customers' devices in the encounter • Elicitation of the customer's context to personalize encounters across channels (omnichannel service) • Extension of touchpoints beyond the store perimeter
Retail atmosphere	The physical characteristics of the store that trigger the customer's senses (e.g., store design, music).	• Augmentation of the physical servicescape with virtual environments • Personalized provision of audio-visual cues
Assortment	The depth and breadth of the retailer's portfolio.	• Provision of hybrid offline-online assortments (e.g., provide a wider range of products online) • Access to digital product catalogues and product availability information • Aggregation of product assortments in local marketplaces
Price	The retailer's price politics including promotions and loyalty programs.	• Implementation of digital loyalty programs and personalized promotions • Differentiation of prices on an individual level of detail
Experiences in other channels	The customer's experiences with the retailer in other channels.	• Identification of customers across touchpoints and devices • Integration of customer data from different channels
Retail brand	The customer's perception and emotions towards the brand.	• Development of brand attributes (e.g., modern, innovative) • Creation of immersive encounters on customers' devices
Previous customer experience	The customer's experiences with the retailer in previous encounters.	• (Automated) collection of customer information and analysis of online reviews for continuous improvement • Response to and compensation for bad experiences

To design a platform that leverages digital technologies that foster the co-creation of customer experience beyond the realm of single retailers, we must understand the customer journeys in the high street. The service design literature has suggested using models that provide "common ground from which critical points of customer

contact, physical evidence, and other key functional and emotional experience clues can be orchestrated" (Bitner et al., 2008, p. 70). However, existing notations for customer journeys cannot express journeys on the high street level when these journeys comprise digital and physical touchpoint events and multiple actors (Haugstveit et al., 2016; Bitner et al., 2008; Rosenbaum et al., 2017).

In light of this thesis' research objective, a DSML was designed as a meta-artifact that covers these customer journeys (*P.7*). DSMLs comprise a set of concepts and their relationships to model matters of interest using domain-specific terminology and semantics (Frank, 2013; Becker et al., 2014). The DSML — called High Street Journey Modeling Language (HSJML) — combines proven visual elements from modeling notions like service blueprinting (Bitner et al., 2008) and BPMN 2.0 (OMG, 2011) with a procedural, data-driven view of the customer journey as a sequence of touchpoint events. Figure 3.3 depicts HSJML's abstract syntax as meta entity-relationship model (ERM) (Becker et al., 2007), using the concepts presented in Section 2.2.



SOURCE: adapted from *P.7*

Figure 3.3: Meta Model of the High Street Journey Modeling Language

HSJML assumes a central intermediary like a digital platform in the back-stage that links the actors and holds data traces on the customer's interactions with service providers on the high street. Similar to the reconstruction of business processes from log data (van der Aalst, 2016), customer journeys are reconstructed from a sequence of events, where each event is associated with a touchpoint and optional data traces. The underlying semantics of the encounter are given by associating the event with an event type (e.g., "receive offer"). Since models in HSJML are built retrospectively from data, the service provider can be associated with an event through the preparatory activities (e.g., "send offer") he had to execute to enable the event and the associated touchpoint. Touchpoints can be grouped by the stages

of the customer journey (Lemon and Verhoef, 2016). Table 12.2 on p. 209 shows the visual components (concrete syntax) for HSJML. HSJML provides a pre-defined set of event types that the modeler can extend at his own discretion. HSJML's utility in supporting the design of platform-facilitated interactions between customers and high street actors is demonstrated in Section 3.2.2.3 and Figure 3.13 therein.

3.2 Prescriptive Design Knowledge

3.2.1 Requirements for the Digital Platform

Against the background of economic challenges in high streets and the ongoing digitalization of interactions between retailers and customers, building a central IS in the form of a platform that enables the group of SME BaM retailers to provide digital service jointly seems a viable organizational and technological structure. The descriptive knowledge base (Section 3.1) already indicates design parameters and central functionalities, but the specific high street setting (many independent SME retailers, personalized digital service, and data flows across organizational boundaries) calls for further investigation before an IT artifact can be conceived.

SME Service Provider's Perspective To build an IT artifact that resonates with practice and fulfills retailers' needs (*P.2*), expert interviews with owners of nineteen high street businesses in Paderborn, Germany, were conducted in 2018.[15] The interviews revealed that digitalizing only retailers is insufficient, as customers visit the high street not only for shopping but also to meet with friends, eat out, and use service offerings (Stepper, 2016). Consequently, the IT artifact is designed for the group of high street tenants as a whole, and mentions of *retailers* hereinafter include all customer-facing businesses located there.

The business owners confirmed decreasing customer frequencies, especially on side streets. About 80 percent of respondents named gaining customers' attention and drawing them into their stores as the primary goal that a digital platform should

[15] The sample comprises twelve businesses that do retail, four that primarily provide service (e.g., banking), and three are food service companies. All but two businesses are independently organized SMEs that are not part of a corporation or franchise. The businesses have an average of nine employees.

support. Once the customer visits the store, platform-mediated interaction was seen as less important than personal service. Other goals were encouraging purchases, providing a digital contact channel, strengthening customer loyalty, creating a positive brand perception, and increasing customer satisfaction. As one retailer noted, positive customer experience yields word-of-mouth (WOM), and a platform could serve as an outlet for user-generated content.

Our case high street does not have a local digital platform, but 84 percent of the interviewed businesses have a presence on Facebook. In terms of digital marketing, respondents valued the lower cost compared to print and radio advertising, the ability to define target groups, access to "digital natives," and statistics on demographics, usage, and advertisements. Two contrarian interviewees referred to digital marketing's imprecise targeting and too-broad reach, as people who are outside their potential catchment area are also shown the advertisements. About half of the business owners were critical of the possible dependence on a global player like Facebook.

Sixty-nine percent of the respondents voiced positive sentiments about *local* platforms. Five business owners suggested local platforms may allow them to address their potential customers more precisely than global ones can. Local platforms may also be more relevant to customers, since these platforms feature only nearby businesses and may include location-specific value propositions. Two businesses expected that instead of competition from nationwide providers local platforms will provide opportunities for local stores to co-operate (e.g., with joint offers and events). Eighty-four percent of business owners said they already co-operate with other local businesses or plan to do so, and most said they were organized in local advertising associations that support the high street. One respondent suggested that a local platform should be provided by a local entity, such as an advertising association, who could also serve as a direct contact for support.

Twelve of the businesses reported that they still advertise in newspapers and six reported using mail advertising via post. Compared to digital ads, these forms of advertising remain visible for longer periods and yield measurable returns (For example, some businesses measured return rates for cut out coupons). Four businesses had discontinued their digital marketing campaigns via e-mail and messaging services and reverted to offline advertising because of concerns about EU GDPR compliance.

Although the business owners appreciated the reporting features of digital advertising tools, they had little knowledge about their walk-in customers. Five respondents collected no information about their clientele, while another twelve relied on their gut feeling and observations. Some stores used sales reports or measured visitor frequency via light barriers at the door. The interviewees showed a general interest in learning about their customer groups and expected to get behavioral customer data like visitor frequencies and demographics from the digital platform.

Some respondents expressed concerns about complex digital solutions because they did not have the time to learn how to use them and keep their information on the platform current. Finally, two business owners reminded us that the platform must make value propositions to *all* actor groups to establish itself in the long run.

Table 3.2 gives six service provider requirements for the digital platform, which are based on the interviewees' expectations and remarks and are "generic requirements that any artifact instantiated from this design should meet" (Meth et al., 2015, p. 807). Although the retailers explicitly voiced it, compliance with data privacy regulations like the EU GDPR is a mandatory requirement that holds equally for *all* user groups, so it will be investigated subsequently from a general perspective.

Table 3.2: Service Provider Requirements for the Digital Platform

ID	Description
SP.1	The platform should enable service providers to attract potential customers to their stores.
SP.2	The platform should enable service providers to address customers and customer segments individually.
SP.3	The platform should provide service providers with reports about customers' behavior and interactions with their businesses.
SP.4	The platform should enable customers to contact and interact with service providers digitally.
SP.5	The platform should enable customers to exchange their opinion.
SP.6	The platform should be easy to use and largely maintenance-free for service providers.

Context Elicitation Addressing customers individually and providing service providers with behavioral information requires eliciting the customers' context, which comprises identification, data collection, and data analysis (*P.4*). Some service providers can identify their regular customers through loyalty cards and lookups in the

ERP system, which may suggest the need to integrate data from existing ERP systems into the platform (Hänninen et al., 2018). However, doing so puts businesses at a disadvantage that are already digital laggards and do not use back-stage ICTs, and retailer-specific data silos reveal only a fractured picture of the customer. Therefore, the platform should not integrate particular businesses' existing data sources, thus creating exclusive rights, but should collect contextual information across the high street itself to create equal conditions for all service providers (*P.10*).

Customers in the online realm are frequently tracked and analyzed (Phillips, 2016), creating information that can be transferred to the high street setting through an analogy: Imagine the World Wide Web (WWW) as a high street. When a customer enters WWW street, drones appear and record every step he makes. In the back-stage, behavioral customer analysis tools conclude demographic characteristics and the customer's needs. Based on this information, the businesses' storefronts automatically adjust themselves to display relevant products and offerings. Any action, such as picking up a product or making a purchase, is stored, and business owners get detailed reports on their customers' behavior. While drone surveillance and self-adjusting storefronts may appear far-fetched, the literature shows examples of recording the customer journey across physical stores (e.g., Ghose, Li, et al., 2019; Oosterlinck et al., 2017), similar to tracking cookies that follow online shoppers (Mayer and Mitchell, 2012).

In general, digital platforms are location-independent (Constantinides et al., 2018), but LBS can reintroduce the geographic dimension. This class of service offerings uses real-world geographical information like the user's position, the location of businesses in the high street, and customers' footfalls as operant resources in service delivery (*P.10*). Exemplary LBS are locating nearby points of interest (PoIs), location-based advertising (LBA), geo-tagging, and navigation (Junglas and Watson, 2008). Given the focus on the high street as a perimeter for service delivery, the local platform should provide LBS, and so, as a precondition, facilitate the automated collection of the customers' physical movements in the high street (i.e., trajectories of spatio-temporal information). Recording customers' trajectories has to be possible at indoor and outdoor locations because high street customers' journeys take place both in public spaces like sidewalks and in stores. Moreover, the platform should link recorded trajectories to the respective customer and augment this contextual information with personal data like his demographics and interests, to personalize service offerings on the individual level and allow for fine-grained reports (*P.9*). Table 3.2 summarizes the context elicitation requirements for the digital platform.

Table 3.3: Context Elicitation Requirements for the Digital Platform

ID	Description
CON.1	The platform should automatically collect spatio-temporal data on customers.
CON.2	The platform should facilitate data collection within stores and at outdoor community spaces.
CON.3	The platform should link collected data with the respective customers it belongs.
CON.4	The platform should gather additional contextual information on customers.

Data Protection and Privacy Eliciting context decreases users' level of anonymity and allows individuals to be singled out (Zuiderveen Borgesius, 2016), which is governed by data protection laws, particularly by the EU GDPR (Regulation (EU) 2016/679) that came into effect on May 25th, 2018 (European Union, 2016).

The regulation is based on the principles of lawfulness, fairness, and transparency (Art. 5, No. 1a, EU GDPR). For any processing of personal data to be lawful, either it is done to fulfill legal or contractual obligations, or the data subject (e.g., the person whose data are processed) has consented to the specific purpose (Art. 6, No. 1, EU GDPR).[16] In the second case, the privacy-by-default principle holds (Gimpel et al., 2018; Schaar, 2010). Service providers are not allowed to collect personal data before the user has given consent, which is defined as follows (Art. 4, No. 11, EU GDPR):

> *"Consent of the data subject means any freely given, specific, informed and unambiguous indication of the data subject's wishes by which he or she, by a statement or by clear affirmative action, signifies agreement to the processing of personal data relating to him or her."*

The definition rules out opt-out mechanisms, where consent is assumed by default (Carolan, 2016). Instead, users must be able to make an *informed* decision to give consent and actively declare it, which requires that service providers transparently inform their users about the reasons and terms of data processing before requesting consent. Article 13 EU GDPR lists the information to be specified as including the types of data, the time of collection, the identity of the collector, the purpose of the collection, the third-parties with which data is shared, and the storage period (*P.8*).

[16] Personal data (and the synonym personal information) comprise any information that can be used to identify a natural person directly or indirectly (Art. 4, No. 1, EU GDPR). Data processing includes all operations within the data lifecycle such as recording, transfer, storage, analysis, sharing, and deletion (Art. 4, No. 2, EU GDPR).

Since users will interface with the platform through a mobile app on their smart devices, the platform should ask for consent through this channel. However, the limited screen size complicates the presentation of privacy-related information. Furthermore, the literature has found that users have difficulty understanding privacy policies and mobile permission systems (McDonald and Cranor, 2008; Schaub et al., 2015; Keith et al., 2016) and often give consent without being aware of the consequences (Almuhimedi et al., 2015; Lin et al., 2012), thereby unintentionally disclosing personal data to third parties.

In light of the newness of the regulation and known issues with privacy-related decision making in mobile environments, we designed two EU GDPR-compliant mechanisms for informing users and asking for consent (*P.8*). The first design features a long dialogue box with a textual description and two buttons to give or reject consent (see Figure 13.2b, p. 229). The second design, called the onboarding process, features multiple swipe-through screens that explain the data-processing practices using images and text, with buttons to indicate or withhold consent in the end (see Figure 13.3, p. 232). The designs were evaluated against a default mobile permission request that is frequently used in practice (see Figure 13.2a, p. 229) to test whether the designs affect users' consent decision and their comprehension of the consequences thereof. An online experiment with 307 participants (see *P.8*) revealed no significant differences in users' decisions but showed significantly higher degrees of comprehension with the onboarding design compared to the default request. To comply with the EU GDPR, the app should use a multi-modal presentation of privacy-related information, before requesting consent.

The regulation also grants users far-reaching rights for withdrawing consent, as well as for inspecting, correcting, and deleting personal data (Art. 13 – Art. 17, EU GDPR). The mobile app may provide a self-service feature through which users can control data processing and exercise their rights (*P.8*), to relieve the provider from manual work and to optimize costs (cf. Subsection 3.1.1).

Although a user's consent to track his trajectories in the high street allows for continuous recording, the service provider should follow the fairness principle and give users control over the time and scope of trajectory recording. The system should also implement technical safeguards to confine tracking to the high street to limit the potential for abuse, such as recording users in private situations (*P.11*). Table 3.4 summarizes the data privacy requirements for the digital platform, which are derived from the EU GDPR and our own studies (*P.8*, *P.11*).

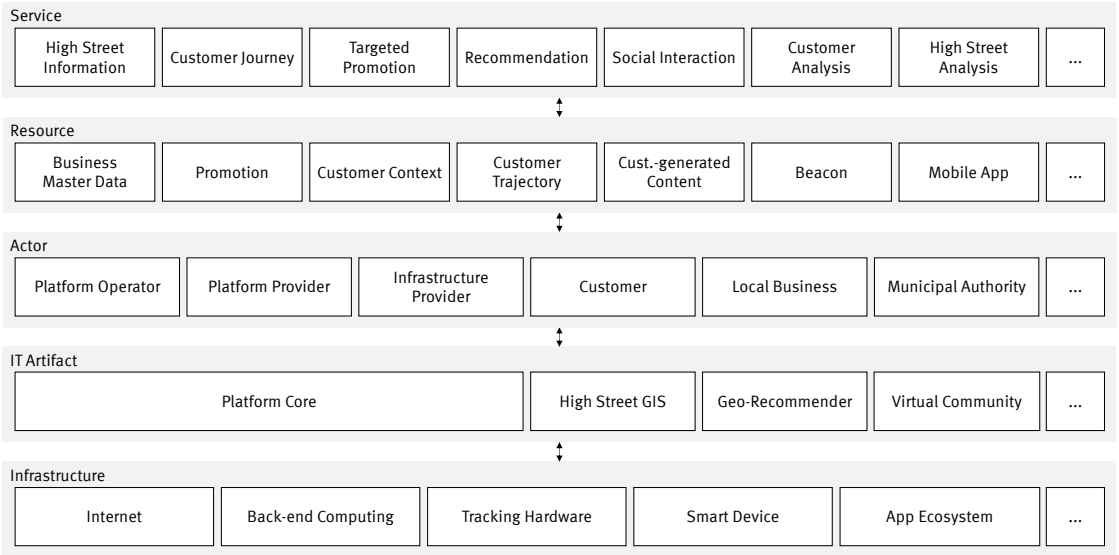
Table 3.4: Data Privacy Requirements for the Digital Platform

ID	Description
PRV.1	The platform must inform customers about personal data-processing practices upfront.
PRV.2	The platform must get the consent of the informed customers before collecting and using any personal data (privacy-by-default).
PRV.3	The platform must enable customers to exercise their rights given by the EU GDPR.
PRV.4	The platform must enable customers to have full control over the time and scope of spatio-temporal data collection.
PRV.5	The platform must ensure to track information on the high street perimeter only.

3.2.2 Solution Design Entities

The platform is designed as an "amalgamation platform" (Blaschke et al., 2019, p. 581) that provides service offerings to the high street actors instead of relying on third-parties to implement value propositions. The platform should make a core set of offerings as a foundation to stimulate the emergence of a digital high street ecosystem before third-parties can add complementary extensions.

Figure 3.4 shows the dimensions of the designed digital platform but also indicates that design is a search process (Hevner et al., 2004) and that the dimensions are not final but evolving and may be extended over time.



SOURCE: own visualization, based on Figure 2.3 and Blaschke et al., 2019, p. 578

Figure 3.4: Dimensions of the Designed Digital Platform

The next paragraphs detail the actors' roles, the resources, and the service offerings, whereas Section 4.1 sheds light on the infrastructure and IT artifact dimensions, which are contingent on how the instantiation is situated.

3.2.2.1 Actors' Roles

At the front-stage, the platform provides engagement opportunities between the groups of local businesses and customers, and within the group of customers (*P.9*). In the back-stage, the local businesses access reports on customers' digital interactions, municipal authorities investigate the status of the high street, and the platform continually analyzes collected data to adjust its behavior.

- The *Platform Operator* is an organization or person who runs the platform for a local high street and has obligations toward the various user groups through contractual agreements. The platform owner is responsible for attracting users to the platform, onboarding them, and retaining them. He (or it) acts as a digital caretaker of the high street, a content creator, and the central point of contact for support. In this function, he also equips local businesses and the high street with the (tracking) hardware needed to interact with customers digitally. The platform owner either implements and maintains the platform himself, or procures a solution from an external platform provider and customizes his instance to fit the particularities of the local high street.
- *Platform Providers* are organizations that implement local platforms as infrastructures or white label blueprints with multi-client capabilities that are individually licensed and instantiated for platform operators in high streets. The platform core comprises elements like user interfaces, user and role management, and master data management. The platform provider can make additional features, such as geospatial analyses and reporting, available to individual instances in a modular fashion. A platform provider is not required if the operator takes on this task himself. Platform providers can also operate platforms themselves.
- *Infrastructure Providers* are external entities that supply the platform providers and operators with the required operand resources (hardware and software). In particular, access to the respective app ecosystems is required because customers interface with the platform through smart devices. The user interfaces

connect to the platform's core components, which run on back-end computing architectures, via the Internet.

- *Customers* are individuals who visit the high street and engage with local businesses and other customers through the platform.[17] Customers record their journeys in the high street and make their contextual information available on a voluntary base. They use the platform to browse local businesses in their vicinity, to receive personalized promotions, and to contact the businesses. Customers create content and share their experiences by rating and reviewing businesses and creating, voting for, and discussing deals.
- *Local Businesses* on the high street use the platform to promote their businesses and engage with customers digitally. These organizations create store profiles by making general information like opening hours, location, description, pictures, and contact channels available to the platform. By adding targeted promotions, they create engagement opportunities with customers, whereas the analysis of customers' interactions with their stores helps them improve their service delivery.
- *Municipal Authorities* are external entities like urban planners, chambers of commerce, and local marketing and tourism organizations that act for the common good of the city and high street. The platform can support them in their planning and management activities, as aggregated customer behavior can yield insights on the status and "health" of the high street.

Users are not limited to a single actor role but may adjust their roles to fit the individual encounter (Vargo and Lusch, 2011). For example, a municipal employee who is responsible for urban planning may also use the platform as a customer, and the platform operator may also run a store on the high street (*P.9*).

3.2.2.2 Resources

The platform's ability to make value propositions is contingent on user-provided operant resources like customers' trajectories and businesses' master data and promotions. Figure 3.5 provides a simplified overview of the platform's core data structures as an ERM using Chen's (1976) notation.

[17] More precisely, these individuals are *shoppers*, while customers generally refers to the users of products and services (Shankar et al., 2011). For example, a mother (the shopper) buys a toy in a store that she gives her child (the customer). Shoppers can also be customers. For simplification, we use the term "customer" throughout this thesis.

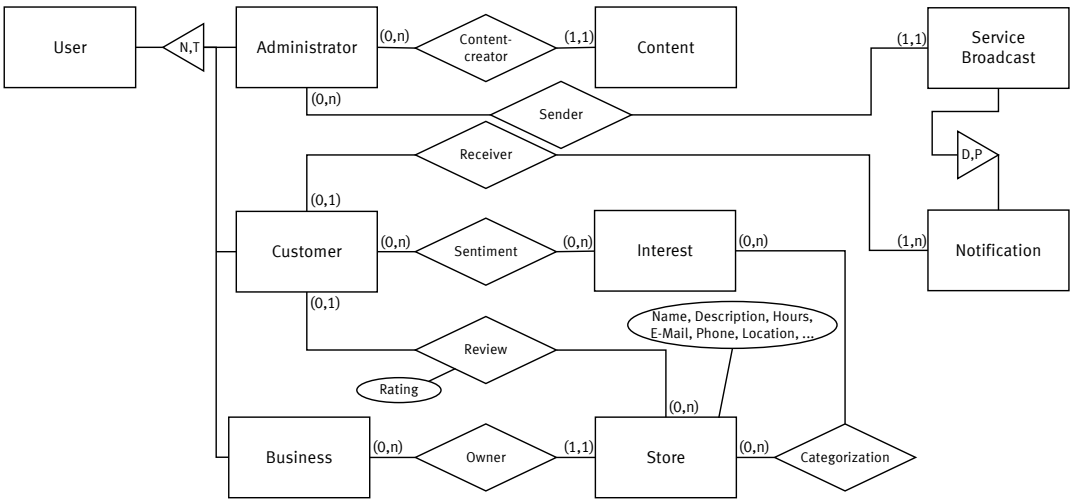


Figure 3.5: Core Data Structures

Resources come from *administrators* (platform operator), *customers*, and *businesses* (*P.9*). Administrators create informative content like lists of events that are taking place on the high street or news on shopping opportunities and broadcast service notifications to all or selected customers. Business owners create store profiles that include the venue's name, pictures of the store, a description of the offerings, opening hours, and its location. Making contact channels like e-mail, landline, mobile phone, and social media profiles available allows customers to contact the businesses digitally (SP.4). Since businesses can have multiple locations, business owners set up individual profiles for each store, and categorize them by selecting items from a set of interests (e.g., home and garden, fashion, or music). In a similar vein, customers select interests from a list for which they prefer to receive content and for which they do not want to receive any. Customers may rate and review each store only once to prevent rating manipulation, abuse, and spam, but they can update their opinion at a later point (SP.5).

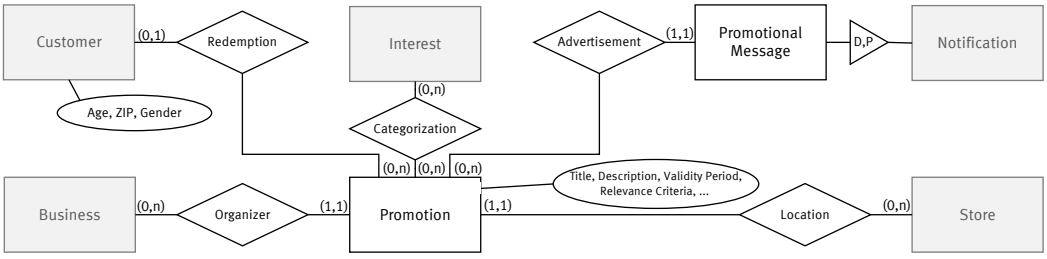


Figure 3.6: Data Structures for Promotions (gray entity types correspond to the previously introduced ones)

Businesses can create promotions to attract customers (SP.1). Figure 3.6 enhances the core data structures by adding promotions. A business owner creates a promotion that comprises a title, description, pictures, a validity period, and the previously introduced interests and links it to a particular store.[18] Customers can voluntarily disclose demographic information like age, gender, and zip code (CON.4), which business owners can use as relevance criteria for customer segmentation (SP.2). In return, customers receive personalized promotions and can redeem them.

Customers' demographic information provides input for reports for business owners (SP.3). Although it was omitted in the ERMs for reasons of legibility, if the customer has consented, any interaction he has with an entity (e.g., view a store profile) is logged as behavioral information. However, the system still needs a means to track journeys in the high street. While tracking customers in online environments is well-established (Phillips, 2016; Underhill, 2008), it creates issues in the physical world. In particular, existing technologies like Wireless Local Area Network (WLAN) fingerprinting (e.g., Bai et al., 2014) and video-based analysis (e.g., Hwangbo et al., 2017), which automatically record customers *without* consent, are in conflict with the EU GDPR. On the other hand, having customers manually "check-in" to the visited locations is inconvenient and yields incomplete journeys.

Oosterlinck et al. (2017) reviewed the literature on automated human trajectory tracking and found that most current approaches do not track humans but use proxies like smartphones and shopping carts (with radio-frequency identification (RFID) tags) to follow humans' movements. Using a shopping cart is not feasible in a high street scenario that crosses the borders of businesses, but tracking smartphones is. For example, trajectories can be recorded using Global Positioning System (GPS) sensors in customers' smartphones (CON.1), although only after customers have granted the client app access to that sensor (PRV.2). The client then can link recorded journeys to the respective customer (CON.3) and send them to the platform. However, GPS-based tracking violates requirements CON.2 and PRV.5, since GPS is imprecise in indoor locations (Mainetti et al., 2014) and, because of its *global* design, cannot limit tracking to the *local* high street perimeter securely.

Instead, we use Bluetooth-based tracking with beacons (see *P.10*, *P.11*). Beacons are Bluetooth Low Energy (BLE) devices that, similar to a lighthouse, broadcast

[18] The interviews with business owners revealed that promotions should be seen not only as discount offerings but also as means to highlight a store's assortment and exclusive in-store events.

data to the surrounding area in a fixed interval, such as 500 ms. The configurable advertising packet consists of a 16-byte alphanumeric Universally Unique Identifier (UUID), and 2-byte major and minor values (Statler, 2016). In contrast to WLAN access points, beacons send one-way messages and cannot receive data from nearby devices (Faragher and Harle, 2015). Beacon hardware transmitters are inexpensive, fit on a one-square-centimeter circuit board, and are usually powered by batteries that can last multiple years.

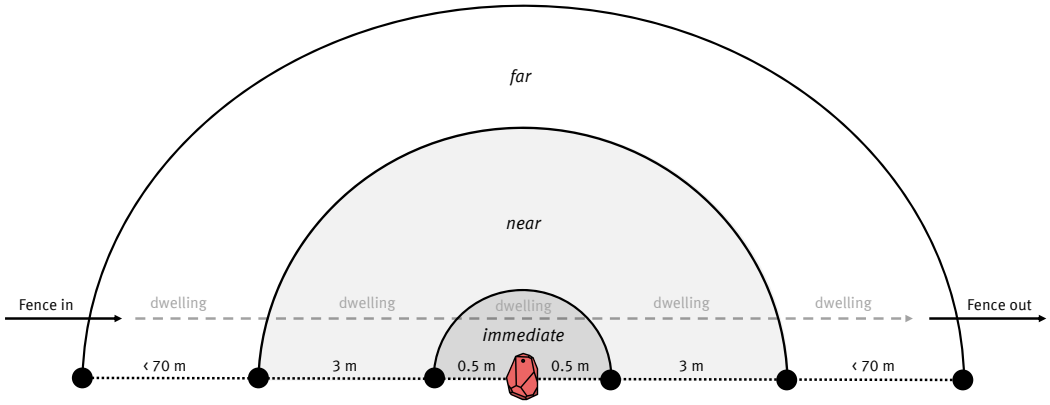
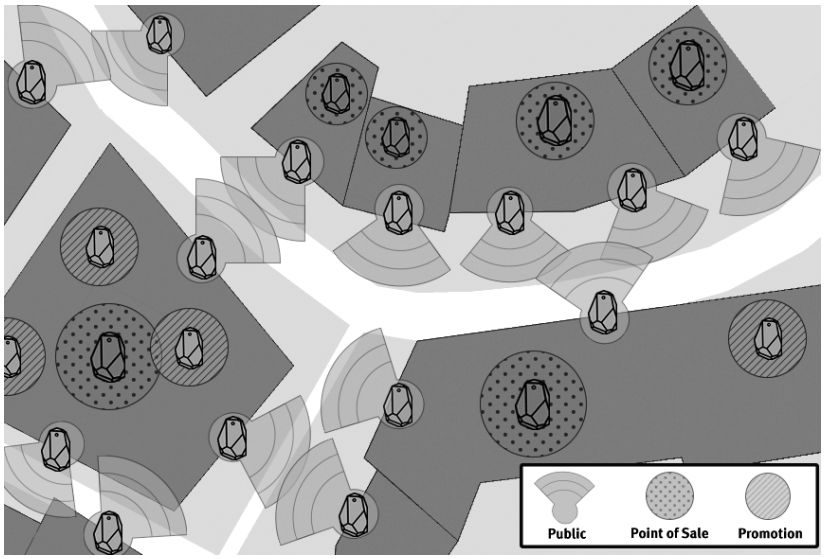


Figure 3.7: BLE Beacon Geofence with Distance Categories

Figure 3.7 depicts the signal area of the beacon, the so-called "geofence". Smartphones with Bluetooth 4.0 capability that enter the geofence can receive the beacon payload and estimate their distance to it using the received signal strength indicator (RSSI) (Bai et al., 2014). However, distance estimates with beacons are inaccurate, as spatial conditions and other radio-frequency signals lead to interference and effects like signal strength attenuation (Bai et al., 2014; Faragher and Harle, 2015). In response, the underlying *iBeacon* protocol relies on coarse distance categories (far, near, immediate), which are sufficient in the given scenario (Gast, 2014). In contrast to GPS, beacons allow for both indoor and outdoor tracking (CON.2) and confine the tracking parameter physically since the platform operator and businesses must deploy them in the high street manually (PRV.5). Therefore, the high street is equipped with beacons first, and then customers can record their journeys from beacon sightings using their smartphones (CON.1).

P.10 shows the beacon payload can be leveraged to infer contextual information (CON.4). All beacons that belong to a platform instance use the same UUID to distinguish them from other beacons that may be deployed in the high street. The major value is used to assign the beacon to a particular location, such as a store, and



SOURCE: adopted from *P.10*

Figure 3.8: Digitalized High Street with BLE Beacons

the minor value classifies the type of beacon. Figure 3.8 exemplifies a beacon deployment in a high street that uses three types of beacons: *Public* beacons broadcast their payloads with high signal strength into the public space outside a store, which allows for digital interaction with passersby. *Promotion* beacons are attached to PoI such as an advertising space inside a store to trigger promotional notifications. *Point of sale (PoS)* beacons are attached to the checkout counter to distinguish buyers from browsers. Both promotion beacons and PoS beacons use low signal strengths to cover the immediate vicinity only.

Tracking the customer journey takes place through a mobile app that periodically (e.g., once per second) receives a set of visible beacons belonging to the platform, with their major, minor, and relative distance values. Over time, a substantial amount of data accumulates, which may lead to potentially undesirable resource utilization in terms of mobile storage and network use. In response, a *BEA*con *T*racking algorithm called `BeaT` was designed to extract the customer journey from the raw data stream (see *P.11* and Algorithm 1).

The customer journey cj holds a sequence of entries $cj.je$ that correspond to individual locations. In the beginning, the set of journey entries is empty. The `BeaT` algorithm uses the beacon sightings — machine-to-machine touchpoints between the customer and the business (Glushko, 2016) — to create journey entries and add

Input: (cj, JE, tp)

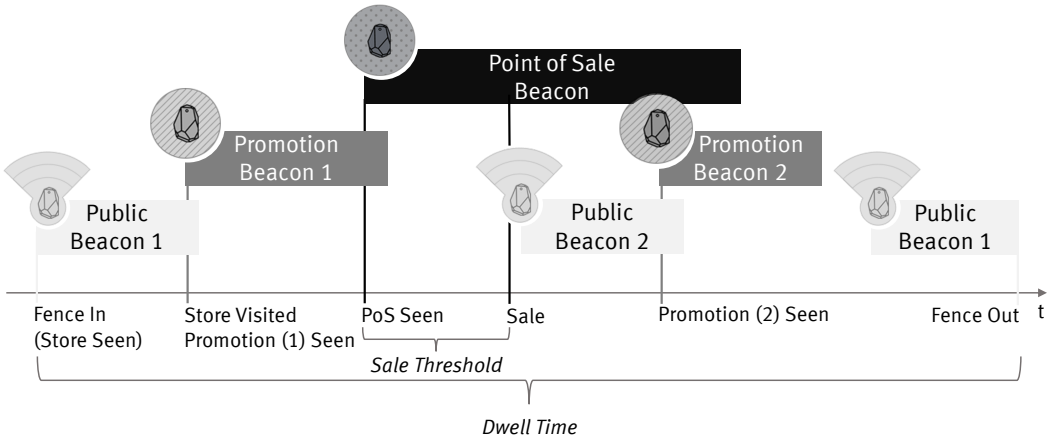
1: **procedure** BEAT
2: $je \leftarrow$ GETACTIVEJOURNEYENTRYBYMAJOR(JE, $tp.major$)
3: **if** je == none **or** DIFF($je.end$, $tp.time$) $>$ 10 min **then**
4: $je \leftarrow$ CREATEJOURNEYENTRY(tp) ▷ Create new journey entry te based on tp
5: $JE \leftarrow JE \cup je$ ▷ Add je to active journey entries JE
6: $cj.je \leftarrow cj.je \cup je$ ▷ Add je to current journey cj
7: SEND(tp) ▷ Send new location sighting tp to back-end
8: ENDEXPIREDJOURNEYENTRIES(JE) ▷ End expired je and remove them from JE
9: BEAT(cj, JE, tp) ▷ Execute BEAT again, having an active je
10: **else**
11: $cj.end \leftarrow tp.time$
12: $je.end \leftarrow tp.time$
13: **switch** $tp.type$ **do**
14: **case** "Public"
15: **if** $je.tp_first$ == none **then** $je.tp_first \leftarrow tp$
16: $je.tp_last \leftarrow tp$ ▷ Save tp as potential last sighting
17: **case** "Promotion"
18: **if** tp.dist != "far" **then**
19: je.visited $\leftarrow$ true ▷ Mark je as visited
20: **if** tp $\notin je.promos$ **then** SEND(tp) ▷ Send promotion sighting tp to back-end
21: $je.promos \leftarrow je.promos \cup tp$ ▷ Add tp to the set $je.promo$ of seen promotions
22: **case** "Point of Sale"
23: **if** tp.dist != "far" **then** je.visited $\leftarrow$ true ▷ Mark je as visited
24: **if** tp.dist == "immediate" **then**
25: **if** $je.pos_first$ == none **then** $je.pos_first \leftarrow tp$
26: $je.pos_last \leftarrow tp$ ▷ Save tp as potential last sighting
27: **if** DIFF($je.pos_first$, $je.pos_last$) $>$ 30 sec **then** $je.sale \leftarrow$ true

Algorithm 1: Beacon Tracking Algorithm `BeaT`, adapted from *P.11*

contextual information to them. Given a set of beacon sightings (called touchpoint set TP hereafter) the algorithm executes for each item $tp \in TP$ in the set.

The algorithm takes an active customer journey cj, a set of active journey entries JE, and a single touchpoint tp as inputs. A journey entry is active when the user was last seen in the particular location (identified by the beacons' major value) within the *keepalive threshold* (ten minutes by default). We test for an active journey entry $je \in JE$ that matches the major value of touchpoint tp. If none is found, a new journey entry je is created and added to both the customer journey $cj.je$ and the set of active journey entries JE. In other words, a new journey entry is created when the user enters the geofence of a location where he has not been in the current journey, or where the last visit has been longer ago than the keepalive threshold. If a new journey entry is created, the `BeaT` algorithm removes expired journey entries from JE, and the beacon sighting causing je is sent to the back-end as a potential trigger for notifications. With je created, `BeaT` is executed recursively.

If an active journal entry je exists, we update the end times of the customer journey and the entry, which later allow the overall duration of the customer journey and the dwell times at the individual locations to be calculated. The dwell time is defined as the period in which the customer is within a location's geofence (Figure 3.7). Depending on the type of beacon that causes tp and the user's distance, additional information is extracted. If the beacon is a public beacon, we store the first and the last beacon sighting. If a promotion beacon or a PoS beacon comes into near or immediate range, we infer that the user has entered the store. Therefore, the corresponding journey entry (i.e., the underlying location) is marked as *visited* to distinguish visitors from passersby. Further, when a customer traverses a new promotion beacon, the promotion is defined as seen, and the tp is added to the set of promotion beacon sightings $je.promos$. In addition, the touchpoint tp is sent to the service back-end to allow the promotion service to issue a notification. For PoS beacons, we also store the first and the last sighting. The checkout process takes a certain amount of time, defined as the *sale threshold*, within which the PoS beacon must be in immediate proximity (e.g., 30 seconds) to distinguish a purchase from passing by the checkout counter while browsing the store. When the sale threshold is reached, we set the *sale* flag on the journey entry.



SOURCE: adopted from *P.10*

Figure 3.9: Journey Entry with Information Derived from BLE Beacon Sightings

Figure 3.9 depicts the information that `BeaT` extracts for individual journey entries. In short, when a customer enters a public beacon's geofence, a journey entry is created and the corresponding location is defined as seen. From promotion and PoS beacons, we infer whether a customer has visited the store and bought something. The dwell time spans the public beacon's first to last sightings.

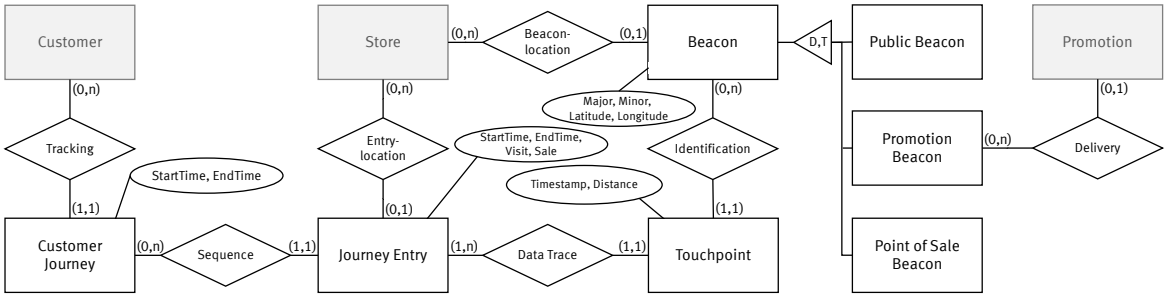


Figure 3.10: Data Structures for Customer Journey Tracking

Figure 3.10 extends the data structures to account for tracking. Every customer journey belongs to a particular customer (CON.3), and the customer journey holds multiple journey entries whose sequence is derived from sorting the entries by their start times. Touchpoints take place at specific times and have an approximated distance to the beacon. Data traces, such as the first and the last sighting of a public beacon, link touchpoints to journey entries. The digital representation of a beacon contains the major and minor values and its geographic coordinates. Beacons and journey entries can be assigned to a particular store, but may also be used to track customers' footfalls in public spaces independently of a store. For example, public beacons can be used to measure the number of customers who enter the high street at particular locations.

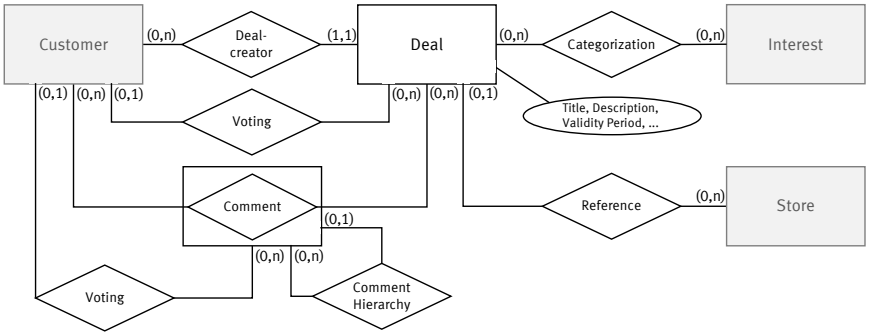


Figure 3.11: Data Structures for a Virtual Community

SP.5 mandates that the digital platform provides engagement opportunities within the group of customers. So far, customers can rate and review stores. Figure 3.11 provides the data structures to extend the digital platform with an optional local VC for sharing deals. Similar to online deal communities (Bergmeier et al., 2016), customers can post the offers and sales events they spot to the community (*P.14*). A voting mechanism allows customers to distinguish highlights from irrelevant content. They can also comment on deals, upvote and downvote them, and reply to

each other's comments. Deals may refer to stores and can use the interest categories. Like promotions, deals have a title, a description, pictures, and a period during which they are valid.

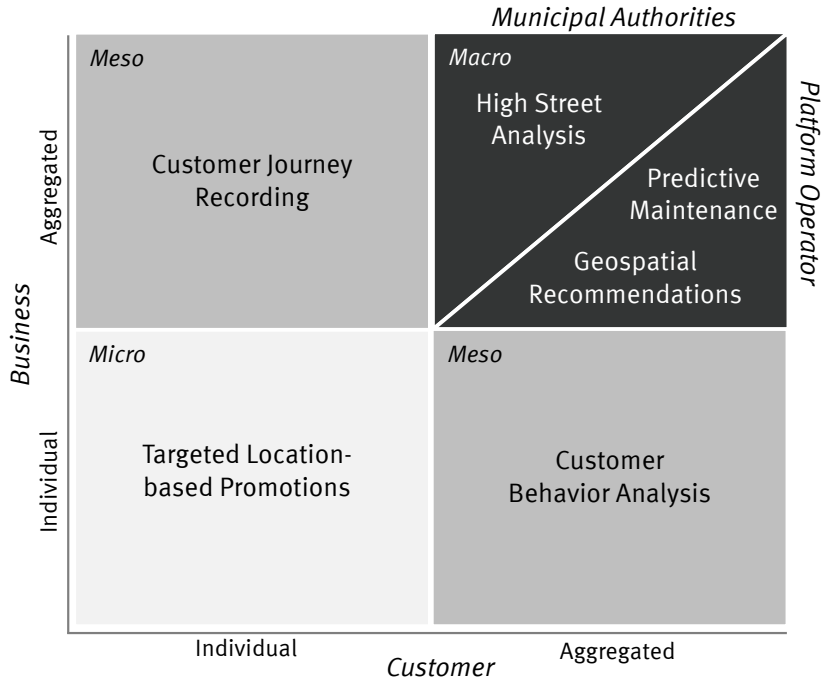
3.2.2.3 Service Offerings

By using the underlying operant (data) and operand (beacons, smartphone apps) resources, the platform makes various service offerings to the actor groups that allow for the co-creation of value in joint spheres (see Figure 3.4).

High Street Information Service Customers can engage with local businesses in communication encounters (Payne et al., 2008) even before visiting the high street by using the smartphone app to learn about ongoing events, the high street businesses, and current promotions, which allows them to plan their journeys. Platform operators can extend the information service with additional data categories (e.g., landmarks, parking, public amenities), and customers can engage with local businesses in service encounters (Payne et al., 2008) by contacting them through e-mail, phone, and social media (SP.4). The client app should directly integrate with the phone's communication apps to ensure a seamless experience. The information service is a routine design (Gregor and Hevner, 2013), since it corresponds to what local platforms in practice are already offering (cima, 2018; CCEC, 2019), but subsequently designed offerings need this essential service.

Customer Journey Service This service comprises recording and viewing journeys preceding a legal introduction (PRV.1) and the request for consent (PRV.2). Customers must actively start and stop journeys, which allows them to retain control regarding tracking (PRV.4). Only after customers have consented and a journey is started, the device can listen for beacon signals and run `BeaT`. Customers can view their journeys to learn about their surroundings. By examining past shopping trips, customers reflect on their high street visits and extend their journeys to the post-purchase stage.

Collected data on customer journeys facilitates additional service offerings (*P.10*). Figure 3.12 structures these offerings by the levels of analysis and the actors who benefit. We already addressed the individual customer's interactions with multiple businesses (customer journey recording; second quadrant in Figure 3.12) and now focus on the remaining types of service offerings.

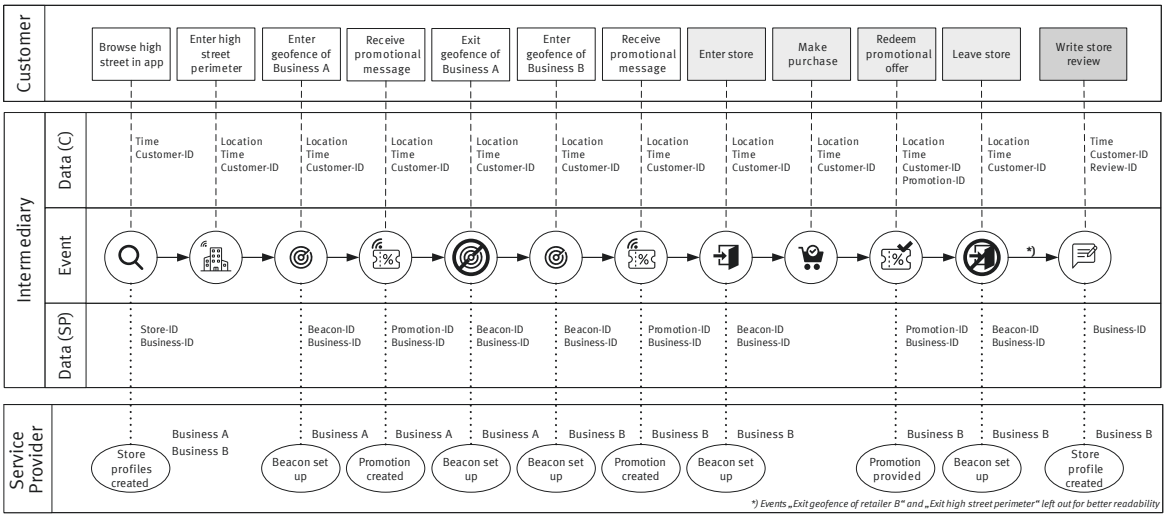


SOURCE: adapted from *P.10*

Figure 3.12: Tracking-enabled Service Offerings by Level of Analysis and Beneficiary

Targeted Location-based Promotions Taking a micro-level perspective, we focus on interactions between single customers and single businesses. Businesses use advertising to attract new customers and retain existing ones. Bauer and Strauss's (2016) review on location-based mobile advertising found that customers face an advertisement overload. Their likelihood that they will respond to offers depends on the advertiser's careful selection of ads that fit the customers' situation. Customer-provided information, such as their demographics, interests, and journeys, yield the context with which businesses can target particular customers and customer groups with exclusive promotions (SP.2). Businesses can segment customers demographically by age group, gender, or zip code, so customers become eligible to receive a higher number of promotions when they disclose their data. However, the platform makes a customer-friendly trade-off between detailed targeting and privacy by requesting the customer's year of birth and the zip code instead of asking for more detailed information, such as an address. Then, by linking the promotion to a promotion beacon, it becomes location-dependent, and notifications about the promotion can be delivered more precisely. Businesses can also target their promotions in relation to customers' recorded behavior (e.g., their history with the store).

Pull- and push-based ad-delivery modes are feasible in mobile contexts. With pull-based ads, customers request a list of available promotions from the service provider, while with push-based ads, the service provider issues a notification to which customers can react. Xu et al. (2011) found that customers value push notifications that fit their contexts but also have privacy concerns about third parties eliciting their contexts. The platform design alleviates such privacy concerns to some extent (*P.8*) by making tracking transparent and giving users control over it. Customers' needs for privacy and unobtrusiveness must be weighted more heavily than businesses' needs for targeted advertising. Informed by the literature and our own studies (*P.8*; Xu et al., 2011; Bauer and Strauss, 2016; Watson et al., 2013; C.-H. Wu et al., 2012), we defined five preconditions for issuing promotional push notifications: (1) The customer must be in the target group of the promotion (targeting); (2) the customer must be inside the geofence of the respective business (location relevance); (3) the promotion must have at least one interest category that the user has chosen (content relevance); (4) the promotion must not be categorized by an interest that the user has actively deselected (inverse content relevance); and (5) the customer must not have disabled push notifications. The targeted location-based promotion service creates engagement opportunities for customers to co-create value with businesses, which culminates in the customers redeeming promotions.



SOURCE: adapted from *P.7*

Figure 3.13: Exemplary Customer Journey with Promotional Messages (in HSJML)

We have presented various communication and service encounters between customers and service providers along the high street customer journey. A logging

service in the back-stage collects data traces on the user's touchpoints. Figure 3.13 is based on these event logs and the HSJML to depict an example of a platform-enhanced customer journey on the high street.

Customer Behavior Analysis The interviews with the local SMEs revealed that most rely on their "gut feelings" and experience in their planning and continuous-improvement processes. The platform provides businesses with a customer behavior analysis service that aggregates individual customer data on the store level. In doing so, it gives business owners digital evidence about their interactions with customers, and what constitutes their customer groups. Businesses can combine multiple dimensions such as age group, gender, interests, store visits, beacon sightings, interactions with promotions, and time to create reports. The analysis service allows them to see the platform's impact on the store and customers' responses to their promotions. Beacon reports yield insights on customers' footfalls at a particular location inside and outside the store over time. The data may reveal hot and cold spots in the store, as well as aggregated information about periods of high and low traffic. Depending on how business owners use the reporting service, the platform can aid them in optimizing their stores' layouts, opening hours, and workforce schedule. Time-series analyses allow them to compare customers' behavior before and after an intervention (such as rearranging the shop windows) and see the spillover effects of local events, such as a Christmas market, on the store. Business owners get feedback on their promotions' performance with regard to traditional key performance indicators (KPIs), such as engagement and capture rates, the number of interactions over time, and the demographics of the customers who respond (Bendle et al., 2016). Stores can also compare the intended target group with the group that was reached and adjust their promotions accordingly.

High Street Analysis Data on both customers and service providers are aggregated on the macro level to provide a holistic view of the high street (Figure 3.12). A high street analysis service extends the core platform with reporting dashboards and interfaces for municipal authorities.[19] The dashboard reveals the high street's

[19] Another thesis, which will be written in the context of the *smartmarket*^{2} joint research project, will focus on geographic information systems (GIS) for high street analysis and develop new tools with which municipal authorities can analyze the high street, its KPIs, and infer customers' goals for making a shopping trip from the collected trajectories (see zur Heiden et al., 2020; Berendes, 2019). Therefore, these service offerings and the associated extensions to the core IT platform are not specified further in the present dissertation.

real-time status with pedestrian flows and crowd densities and provides the means to compare them with historical information. Geospatial analyses visualize how customers enter and exit the high street, where hot and cold spots form, and how specific areas and stores perform with regard to customer patronage. Municipal authorities can quantify the impact of marketing campaigns by comparing the number of visitors, the duration of the customer journey, and the number of stores visited during those journeys. The ratio of new to recurring visitors, combined with an analysis of the catchment area, yields data on the high street's attractiveness. In short, the platform can be an additional data provider and a tool for municipal authorities' planning activities.

Geospatial Recommendations Analytical service offerings benefit the high street customers only indirectly by supporting service providers in improving their (customer-facing) offerings. However, aggregated customer journey data can also yield value for customers. As an optional addition to the core IT platform, *P.13* presents the design of a geospatial recommendation service (geo-recommender hereafter) to influence customers' decision processes and their high street journeys. Recommender systems can generate suggestions based on items' properties and other users' behavior (Adomavicius and Tuzhilin, 2015). In this case, high street customer journeys are analyzed to suggest stores to customers during their journeys that may be relevant to their contexts. The geo-recommender design is based on Ghose, Li, et al.'s (2019) work on trajectory-based clustering. At build time, historical customer journeys are grouped by their similarities into clusters that are regenerated periodically to account for changing customer behavior and new stores that join the platform. At run time, the geo-recommender identifies the cluster that is most similar to the ongoing journey. Collaborative filtering is applied between the current journey and those in the cluster to derive a set of candidate recommendations (V. W. Zheng et al., 2010; Balabanović and Shoham, 1997). Closed and recently visited stores are purged from the list, yielding a final set of recommendations for the customer. Similar to location-based promotions, users request a list of recommendations from the platform and receive push notifications when they are physically near the suggested businesses. This service facilitates matchmaking, creates another touchpoint that can trigger interactions between businesses and customers, and may extend the high street customer journey.

Predictive Beacon Maintenance Most BLE beacons transmit their battery levels in the advertising package, so customer journey tracking yields information on the hardware status as a byproduct. The platform operator can leverage this data to replace near-empty batteries in beacons proactively — making a convenient value proposition for the local businesses.

Social Interaction Service The joint sphere of social interaction between high street customers is addressed through user-generated content. As known from e-commerce, customers use a five-point rating and textual review mechanism to give feedback to individual businesses. The VC service extends the business-generated promotions with user-generated deals and the organizational frame to share information, engage in social interaction, and support fellow shoppers. *P.14* conceives a design for a VC service in the platform. In this context, deals comprise user-generated suggestions about products, events, and services in the high street that can go beyond what the businesses themselves are advertising (Bergmeier et al., 2016). In effect, customers share with the local community positive experiences and recommend offerings they have spotted in the high street, generating WOM for business owners (Nisar et al., 2019). Customers access the VC on the high street by browsing for deals nearby and locate them on a map. Each deal can be upvoted (+1) and downvoted (-1) and displays the resulting number of votes. This voting mechanism serves as the central means to distinguish hot deals from irrelevant content. Customers can have a community profile that displays their username, a picture, a description, and statistics on their community activities. The deal detail page shows information on the deal, the store that it offers, and the user that created the deal. Customers can comment on the deal and respond to comments, thus directly interacting with each other, as well as voting on comments and navigating to the business. The graphical user interface (GUI) can use digital nudging (Weinmann et al., 2016) to encourage users to post their deals and engage in social interaction.

Privacy Self-Service In light of the comprehensive data privacy requirements, privacy itself can become a service offering. Results from *P.8* suggest including a privacy self-service in the client app that allows customers to read the privacy policy, learn about data-processing practices, and exert their rights given by the EU GDPR (PRV.3): Customers can give and revoke consent to every type of personal data processing, inspect the personal information that has been collected (e.g., their profiles,

their selected interests, their recorded customer journeys, and created content), edit or remove content (which requires back-stage processing to delete or anonymize the information (PRV.4)), view raw logging information like clickstreams and export it, and send inquiries on data-processing practices to the platform operator through the app. This privacy self-service facilitates transparency, responds to users' privacy concerns, and automates the platform operator's compulsory duties.

4 Demonstration and Evaluation

> *"If an artifact is novel and useful, then it necessarily contributes to design knowledge."*
>
> *Baskerville et al. (2018), p. 359*

Design-oriented IS research aims to generate solutions that alleviate or solve real-world problems while adding to the academic knowledge base (Drechsler, 2019; Peffers et al., 2007). The previous chapter provides the solution design knowledge with which to build a multi-sided digital community platform that takes the form of meta-artifacts like constructs, requirements, models, methods, algorithms, and design principles (March and Smith, 1995; Baskerville et al., 2018).

Following the DSRM process, this chapter translates these principles of form and function into an expository instantiation (Gregor and Hevner, 2013) that manifests the design in a bundle of hardware and software (Orlikowski and Iacono, 2001). The prototypical *smartmarket²* platform implementation[20] demonstrates its technical feasibility (Hevner et al., 2004), and its evaluation in a real-world setting "enable[s] researchers to learn about the real world, how the artifact affects it, and how users appropriate the design artifact" (Baskerville et al., 2018, p. 362).

Given the complex nature of the socio-technical system (Österle et al., 2011), we use multiple evaluation methods. A naturalistic field study reveals the core IT artifact's utility in its target environment (Venable et al., 2016), whereas a criteria-based evaluation assesses the fulfillment of the objectives of the solution vis-à-vis the elicited requirements (Becker, 2010; Peffers et al., 2007). The practical usefulness of a VC as an extension of multi-sided digital platforms in high streets is evaluated through an online survey (Peffers et al., 2018). In addition to the evaluation methods from design science, responses to public presentations at trade fairs and academic conferences, and the "review process prior to scientific publications [are also] part of the evaluation" (Österle et al., 2011, p. 9).

[20] For reasons of readability and brevity and to distinguish the instantiation from the previously presented IT artifact design, the term *smartmarket² platform* is used to denote the prototype.

4.1 Expository Instantiation

Over two and a half years, the multi-sided digital community platform was implemented as a prototype.[21] The *smartmarket*^{2} platform comprises a back-end system that links the database and third-party services and provides an API to be consumed by front-end applications. Customers access *smartmarket*^{2} through apps for Apple iOS and Google Android (Huy and Thanh, 2012). Due to reliance on the Bluetooth sensor to receive beacon signals, both apps are implemented in their respective native languages *Swift* and *Java* instead of using a cross-platform app-development framework like *ionic*.[22] Local businesses and the platform operator use a web-based management portal.[23]

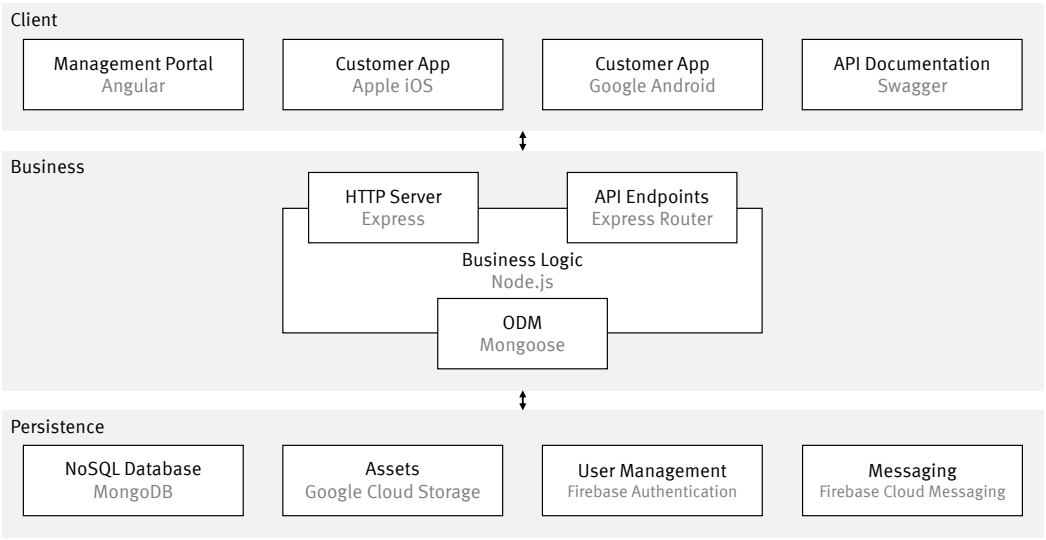


Figure 4.1: Three-Tier Platform Architecture with Components (black text) and Selected Technologies (gray text)

Figure 4.1 depicts the platform's core infrastructure dimension (cf. Figure 3.4) in the form of a high-level architecture. Additional technological infrastructures that are

[21] An academic demonstrator is used to test new concepts and is understood as a pre-market proof-of-concept that can inform the implementation of a market solution. Accordingly, the prototype does not meet the same non-functional requirements as enterprise-grade software. For example, given the limited development resources, most automated software testing that is crucial for enterprise software was skipped in favor of extending the functional scope.

[22] `https://ionicframework.com`

[23] The author is the technical lead in the underlying joint research project and is responsible for the back-end systems and the iOS app, whereas another project partner developed the Android app with the same scope of functions. Therefore, we focus on the iOS implementation, and mentions of the app always refer to the iOS instance.

used include the Internet, web-hosting services, beacons, the end-users' devices to interface with the platform, and the app ecosystems by Apple and Google.

The *smartmarket*^{2} platform implements a traditional three-tier architecture that separates data management, back-stage business logic, and client interfaces (Eckerson, 1995). The *MongoDB*[24], *Express.js*[25], *Angular*[26], and *Node.js*[27] (MEAN) stack was selected as the technological basis for multiple reasons. First, all components are released as free software under the GNU General Public License (GPL) or MIT license. Second, all components use the same programming language — *JavaScript* — which eases development for inexperienced programmers and allows code to be reused in the front-end and back-end. Third, to avoid mistakes made in a related academic platform-development project, where a *Java*-based architecture had performance issues with concurrent API requests (*P.12* and Chasin, 2017), the *smartmarket*^{2} platform uses a stack designed to cope with large numbers of concurrent connections.[28] The *Node.js* and *MongoDB* engines also allow for load balancing and horizontal scaling across machines. Finally, the stack has a large and active user base, a comprehensive ecosystem of third-party extensions and knowledge bases, and is compatible with most platform as a service (PaaS) runtime environments (IBM, 2019).

The *Node.js* back-end defines the business logic and handles data management by employing the *Mongoose* object document mapper (ODM) module, which translates business objects into database records (Mozaffari and Tanaka, 1989). *MongoDB* is a document-oriented NoSQL database that stores *JSON*-formatted (JavaScript Object Notation) records in collections (Stonebraker, 2010). In contrast to relational database management systems (RDBMS), *MongoDB* does not use a relational schema and two-dimensional structures that consist of columns (attributes) and rows (records) (Codd, 1970). Instead, records are structured in sets of key-value pairs, where values themselves can contain sets of key-value pairs (Stonebraker, 2010). This structure, which is comparable to associative arrays, allows for multi-

[24] `https://mongodb.com`
[25] `https://expressjs.com`
[26] `https://angularjs.org`
[27] `https://nodejs.org`
[28] The *CrowdStrom* project (`https://www.crowdstrom.de`), which was funded by the BMBF from 2013 to 2017, developed a peer-to-peer sharing and collaborative consumption service that allows individuals to share their electric vehicle charging stations with others to increase the number of available charging stations and to support the diffusion of electric mobility. The platform handles information, bookings, and payment services for peer-providers and peer-customers, and directly connects to charging stations to control charging sessions (reservation, authentication, (un-)locking, meter reading). The author was part of the project team.

dimensional hierarchical data structures.[29] Because of the lack of a relational schema to enforce business logic (e.g., a store must have a title), *Mongoose* is used to enforce typecasting, validation, and schemata during create, read, update, and delete (CRUD) operations. The *Express.js* module for *Node.js* establishes an Hypertext Transfer Protocol (HTTP) server and the central API. The API provides a service layer that exposes the set of operations available for front-end clients and coordinates the bi-directional communication (Fowler, 2002). Communications over the API are based on *REST* (representational state transfer protocol) using *JSON*-formatted messages. *Swagger JSDoc*[30] is used to generate an *OpenAPI*-compatible documentation from commented code and to expose an interactive API documentation as a web application.

The management front-end is realized as an single-page application (SPA) using the *Angular* web framework (Mikowski and Powell, 2013). The front-end employs the Model–View–ViewModel (MVVM) pattern (Fowler, 2002). GUIs are defined as views in Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS), using the *Bootstrap 4*[31] framework to leverage responsive, state-of-the-art interfaces and designs. While (domain) models define the object structure, the viewmodel (a.k.a. the presentation model) synchronizes the model state with the view in both directions. For example, object manipulations through the GUI are reflected in the model, and model updates are reflected in the view. *Angular* includes an HTTP client to communicate with the back-end through CRUD operations over the REST API. Map interfaces and geo-coding services, the conversion of addresses into geographic coordinates, use the *Google Maps API*. Charts are drawn by the *ngx-charts*[32] module for *Angular*. The mobile apps are realized with their ecosystems' software development kits (SDKs) and use the same back-end API for communication.

The *smartmarket*^{2} platform leverages third-party services to minimize the effort required to implement for common functionality and IT operations (hosting, deploy-

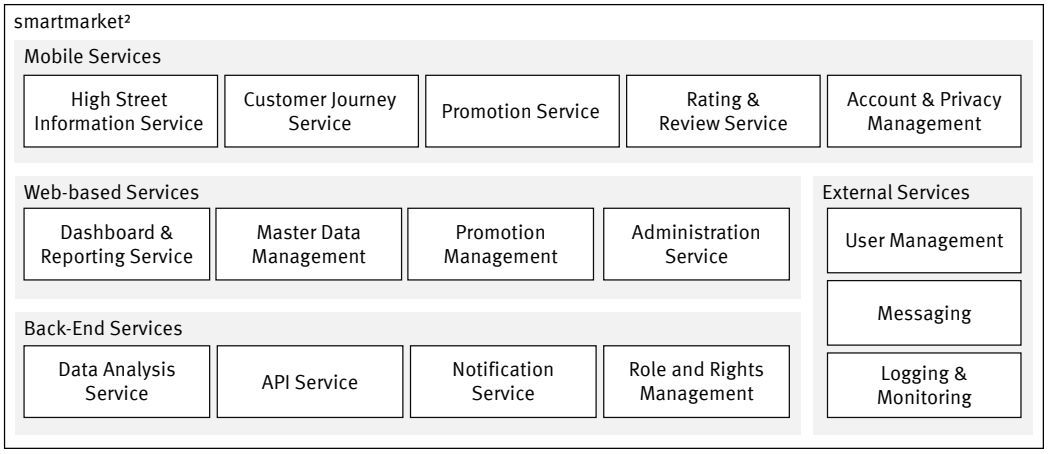
[29] This hierarchical structure solves the object-relational impedance mismatch (Russell, 2008) since the database representation resembles how the business logic structures objects and their collections. In hindsight, opting for a hierarchical data model was the wrong choice, since it complicated the queries required for the analysis services, which span multiple levels and object types. A high-performance open-source RDBMS with a two-dimensional schema and normalized relationships would have fit the existing workload better, but resource constraints permitted exchanging the database layer at the point of realization.

[30] `https://npmjs.com/package/swagger-jsdoc`

[31] `https://getbootstrap.com`

[32] `https://github.com/swimlane/ngx-charts`

ment, scaling, and performance optimization). The Google Cloud Platform (GCP)[33] hosts the back-end. *MongoDB* runs as a containerized application in a virtual machine (*Google Compute Engine*), whereas the PaaS *Google App Engine* executes the business logic. The PaaS allows application instances to scale up and down automatically in response to the current workload and provides administrative tools like versioning, logging, and reporting. A continuous integration pipeline using *Google Cloud Build* was set up to build and deploy new software versions automatically from the underlying version control system to the GCP. Static assets like images are hosted on the infrastructure as a service (IaaS) *Google Cloud Storage*. The mobile application development platform *Firebase*[34], which integrates with the GCP, provides further services such as authentication and user management (*Firebase Authentication*) across all components, crash reporting (*Crashlytics*) and performance analysis (*Performance*) for mobile apps, and messaging services (*Firebase Cloud Messaging*) for issuing push notifications to the mobile clients.



SOURCE: adapted from *P.9*

Figure 4.2: Services Provided by the Platform Core

Figure 4.2 summarizes the platform's fifth and concluding dimension, the IT artifact itself, which has implemented the service offerings belonging to the platform core as services.[35] The subsequent Section 4.2 presents screenshots and demonstrates the IT artifact's features. The prototype excludes peripheral extensions that are not operationally feasible in the given pre-market setting.

[33] `https://cloud.google.com`
[34] `https://firebase.google.com`
[35] In this case, the notion of "services" refers to the software design, where loosely coupled units with clearly defined interfaces bundle features. In terms of the S-D Logic, these features constitute operand resources that the platform operator uses to make service offerings (cf. Section 2.1).

4.2 IT Artifact Evaluation

Representatives of all design science genres have stressed the need for rigorous evaluation (Peffers et al., 2018; Nunamaker et al., 1990; March and Smith, 1995; Hevner et al., 2004; Peffers et al., 2007). The literature has suggested a variety of methods, depending on the type of artifact and the goal of the evaluation (Peffers et al., 2012; Dinter and Krawatzeck, 2015; Drechsler, 2019). Building and instantiating a digital platform that is embedded in a broader ecosystem requires a multi-stage evaluation that first establishes the system's quality before a socio-technical evaluation measures the IT artifact's impact on its supposed real-world environment. This course of action corresponds to Venable et al.'s (2016) "Human Risk & Effectiveness" evaluation strategy, which suggests multiple assessments of increasing complexity throughout the research, beginning with narrowly-scoped technical tests of individual parts before the full IT artifact is evaluated in a naturalistic setting.

Technical Tests The prototype was developed in an iterative fashion that alternated among design, building, and testing activities, and the individual features and the interplay among the various components of the stack were continuously improved until the release confirmed with the design specifications and was deemed stable.[36] An artificial laboratory setting was set up as a testbed for beacon-based tracking to test the interplay between the physical and computational infrastructures (*P.10*; von Hoffen et al., 2017). An office building mimicked a high street. The location was equipped with BLE beacons by the manufacturer *Kontakt.io*[37], and the researchers acted as customers who traverse the high street while tracking their journey through the *smartmarket*[2] app on their smartphones. During testing, multiple shortcomings of the Beacon technology emerged. First, the accuracy of distance measurements to these beacons differed between smartphone models, which prevented pinpointing the customer reliably to a particular store when the geofences of neighboring stores overlapped, such as when a customer stood in the middle

[36] "Stability" in this context refers to the structural quality, which is continuously monitored by the employed cloud tools. In particular, all front-end and back-end issues identified by *Firebase Crashlytics* and *Stackdriver Logging* that threw errors or resulted in crashes were resolved. Further, the back-end was optimized for efficiency using *Firebase Performance* to provide sub-second response times to all API requests. In short, best practices for establishing software quality in agile software development projects were followed where applicable but are outside the thesis' focus and are not discussed further.

[37] `https://store.kontakt.io/our-products/30-smart-beacon-sb16-2.html`

of the high street facing stores to his left and right. Second, beacon detection rates varied between smartphone models, mobile operating systems, and app states. As long as the user was not yet in a geofence, smartphones monitored for BLE signals only every few seconds (Statler, 2016), so in some cases fast-paced users traversed a geofence without the smartphone's noticing. Third, when a geofence was identified, smartphones detected nearby beacons as frequently as once per second. This mode, called *ranging*, is used to create customer journeys. While Android does not restrict developers from accessing the Bluetooth sensor, iOS suspends beacon ranging after about ten minutes when the app is in the background to prevent battery drain.

Because of its privacy benefits, the selected technology was retained. The first shortcoming was mitigated by allowing the `BeaT` algorithm to hold parallel customer journey entries, which prevents "ping-ponging" between stores in the case of overlapping geofences. The second shortcoming is not severe, as it only results in missing journey entries for stores the user traverses but does not enter, since entering a store takes enough time for the smartphone to catch the Beacons' signals. The third shortcoming affects only the subset of platform users who have an iOS device. As a workaround, the iOS app can request access to the device's accelerometer and its activity-monitoring capability.[38] Now, when the user moves from a stationary position while the app is in a suspended state, beacon ranging reactivates for a few seconds, with the exact duration of the reactivation depending on the goodwill of the iOS energy management. Nevertheless, the quality of tracking depends on the users to checking the *smartmarket*^{2} app frequently during their journeys to automatically reactivate ranging. Despite these technical restrictions, the test results confirm the utility of the `BeaT` algorithm to create customer journeys from beacon signals.

High Street Field Study An extensive field study was carried out from November 1st to December 31st, 2018 in Paderborn, Germany (*P.13*).[39] The researchers took the role of the platform operator who cooperates with the city's local marketing manager to attract participants. Fifty-nine local business owners, including those interviewed ex-ante to elicit requirements (Section 3.2.1), with sixty-six stores took part and

[38] `https://developer.apple.com/documentation/coremotion`

[39] Paderborn is a representative example of about forty other German cities that have 100,000–200,000 residents. Historically grown, distinctive high streets that blend SME retailers with chain stores characterize these cities, that stand as regional hubs for the surrounding towns and rural areas. However, these cities face the issues sketched in Section 1.1 to varying extents, as they often lack the potentials to foster customer experience that metropolises like Berlin and Munich have.

allowed us to equip their venues with beacons. Thirteen locations were stalls at the local Christmas market, which took place during the test period. Beacons were also attached to public structures like lamp posts to collect more detailed journeys. Figure 4.3 displays the beacon distribution in the city. More than 400 undergraduate freshmen of Paderborn University performed as test customers and received bonus points for a class for participating.

Figure 4.3: Beacon Distribution in the City Center of Paderborn (red markers are stores, whereas yellow markers are public locations)

4.2.1 Demonstrated Functionality

The participating local businesses and customers could use the core IT artifact's functionality. The next paragraphs introduce the range of provided functions along the service delivery lifecycle before evaluation results are presented.[40]

Local businesses registered on the web portal using their e-mails, passwords, and their names.[41] After consenting to a cooperation agreement and the privacy policy, they used the portal to create store profiles.[42] Figure A.1 (Appendix, p. 89) shows

[40] Depicted interfaces have been translated for this thesis, as the prototype is built in German.
[41] The prototype is available (in German) at `https://portal.smartmarketsquare.de`
[42] The privacy policy is based on the elicited privacy requirements and the insights gained in *P.8*.

the profile-creation screen.[43] High streets have not only stationary stores but also temporary booths whose locations may change, so business owners could use either a fixed address or indicate their geographical location by setting a pin on a map.

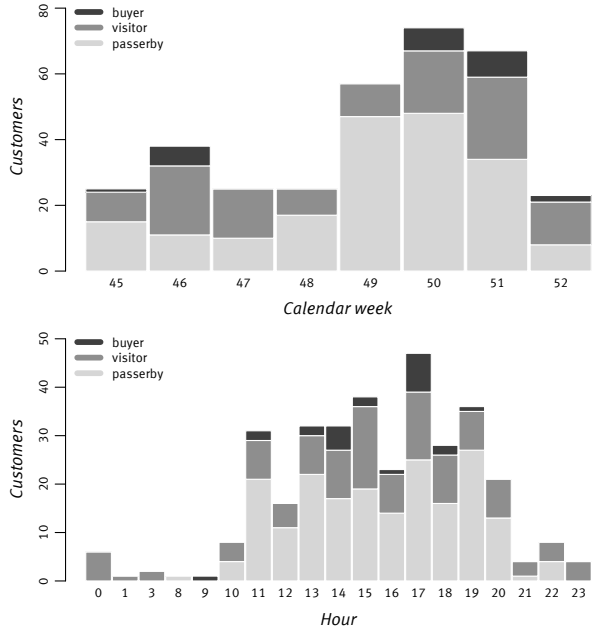
On behalf of the business owners, the platform operator created beacon entities in the management portal, assigned them to a store profile, configured the physical beacon's major and minor values according to values suggested by the back-end, and delivered the pre-configured beacons to the store. Similar to the envisioned service delivery, the researchers who were mimicking the platform operator aided the businesses in physically installing the beacons in the stores to ensure appropriate placements, and to onboard the business owners personally to the *smartmarket*^{2} platform. The business owners saw their beacons in the portal and specified a description and the beacon's exact location in the store, using the same location-picker component from the profile-creation screen.

At the beginning of the field study, the businesses were asked to create at least one promotion, so that the platform had an initial set of promotions to show to the customers. Figure A.2 (Appendix, p. 90) shows an excerpt of the promotion-creation screen. Besides providing general information about the promotion, the business owners configured the mode of redemption, since, if they wanted to receive statistical information, the redemption transaction had to take place through the IT artifact. In this case, a four-digit code was used (master code for the store or individual code per promotion), which a store representative entered into the *smartmarket*^{2} app on the customer's phone at the time of redemption. Business owners applied targeting through their selection of interests and by the inclusion of customer groups with particular behavior.[44] The *customer interaction* attribute separated first visitors, repeat visitors, buyers, and customers who redeemed offers in the past so the business owners could, for example, target potential customers differently than loyal ones. Based on the number of journeys a customer had made (*high street activity*), businesses could chose to target only infrequent high street visitors or frequent shoppers (e.g., customers who visit the high street every week). Finally, promotions could be associated with a promotion beacon to limit them to store visitors since customers were eligible for the promotion only after their phones sensed that beacon.

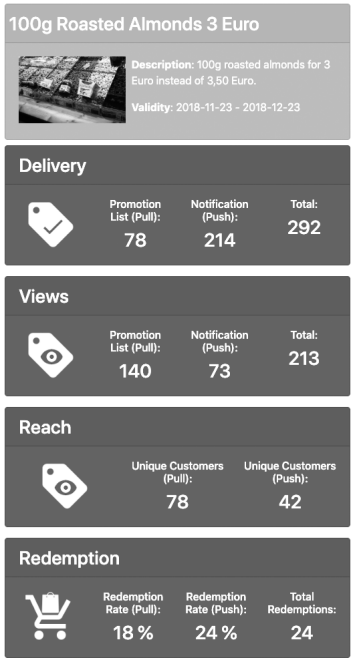
[43] Instead of providing the end-users with extensive manuals that become outdated quickly and may confuse them, the *smartmarket*^{2} platform features comprehensive on-screen help and textual descriptions next to the particular interface components.

[44] Demographic targeting by age and zip code was hidden in the field study because of the homogeneity of test customers.

A dashboard gave business owners a quick service overview by showing the current day's KPIs for customer interactions with their stores and their promotions. Based on collected customer journey entries, the overview showed the total number of contacts, the number of unique customers, and the subsets of browsing customers and buying customers. Promotion KPIs comprised the number of notifications delivered, the number of promotions viewed, and the number of promotions redeemed.



(a) Customer Frequency Diagram



(b) Promotion KPIs

Figure 4.4: Reports for Business Owners in the Management Portal (excerpt)

The dashboard marked an entry point for detailed reports on the store, promotion, and beacon levels. Business owners could analyze customer frequencies by calendar week and time of day (Figure 4.4a), and viewed reports on their promotions (Figure 4.4b). Promotion reports distinguished the modes of delivery; once a promotion appeared in the customer's list of promotions in the app, a pull-based delivery was recorded, whereas every time the promotion was delivered through an advertisement notification, a push-based delivery was recorded. Customers could receive the same promotion as a push notification multiple times if they passed by the store in multiple customer journeys. The report also showed business owners the number of times users clicked the promotion in the list or clicked on the push notification, how many unique customers were addressed via push and pull delivery, and the proportion of customers who redeemed the promotion.

Local businesses learned about their customers' opinion by reading the reviews in the management portal. However, user-generated content like reviews can suffer from abusive language and spam (Nobata et al., 2016). In these instances, local businesses could use the portal's reporting feature to request a manual check and potential deletion by the platform operator. Of course, this issue was not a concern in our study with student customers.

Business owners could use multiple channels to contact the platform operator to receive support, while the platform operator could provide hands-on support by logging in as any local business. This "masquerade" feature displayed the management portal in the same state that the business owner would see it, which alleviated to some extent the need for separate administration GUIs, although a few additional GUIs, used to manage beacons, events, notifications, and users were accessible only by the platform operator.

Customers downloaded the *smartmarket*^{2} app on their smartphones and registered themselves by inputting a pseudonym, a password and their gender, year of birth, and zip code. Then an onboarding process introduced the central benefits of the platform and asked users for their preferences (Figure 4.5).

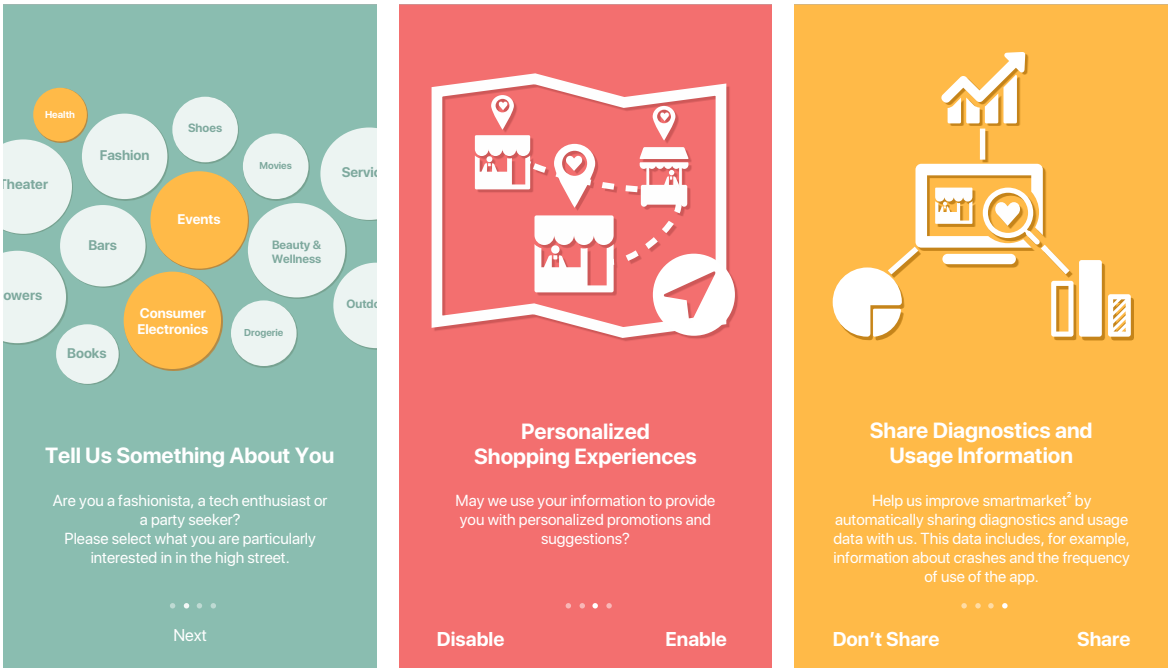
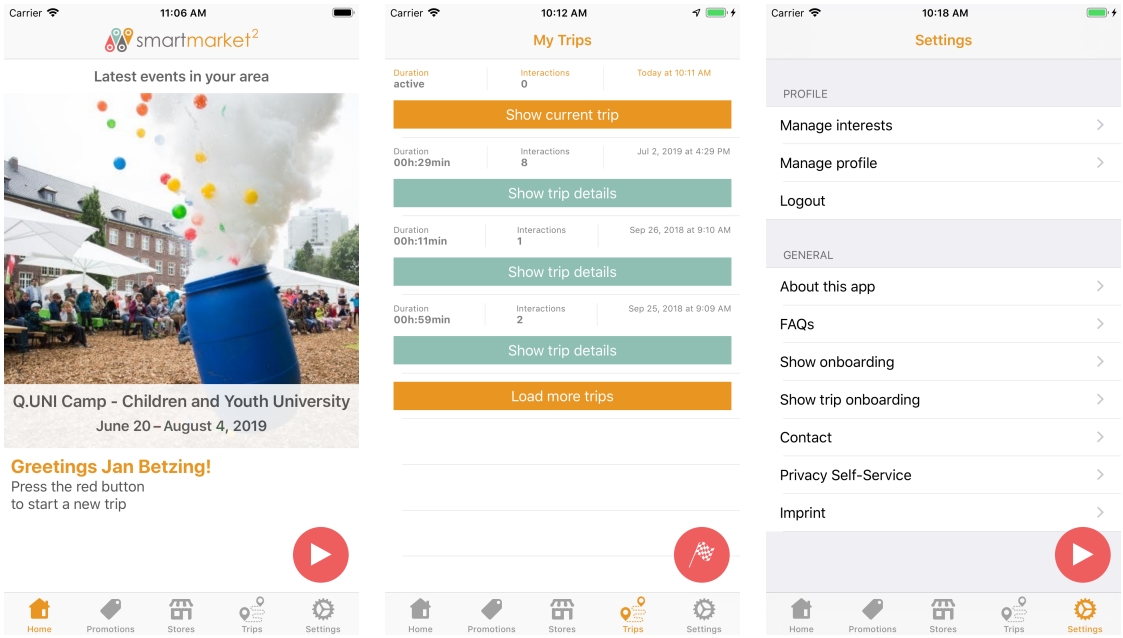


Figure 4.5: Introductory Swipe-through Screens to Onboard New Users (excerpt)

Users selected the interests by tapping on animated bubbles and then were given a choice to make their behavioral information available for personalization or not. Next, the app requested consent to the collection of diagnostics and usage information. Performance monitoring and crash reports are, arguably, necessary for service delivery, so the EU GDPR allows them to be collected without consent (Art. 6, No. 1a, EU GDPR). However, by making this consent explicit, the app aimed to appeal to privacy-conscious users.

A tab bar structured the *smartmarket*^{2} app in five primary interfaces: the *home*, *promotions*, *stores*, *trips*, and *settings* views. The *home* view (Figure 4.6a) showed events in a slideshow and suggested customers to start a journey (henceforth *trip*).[45]

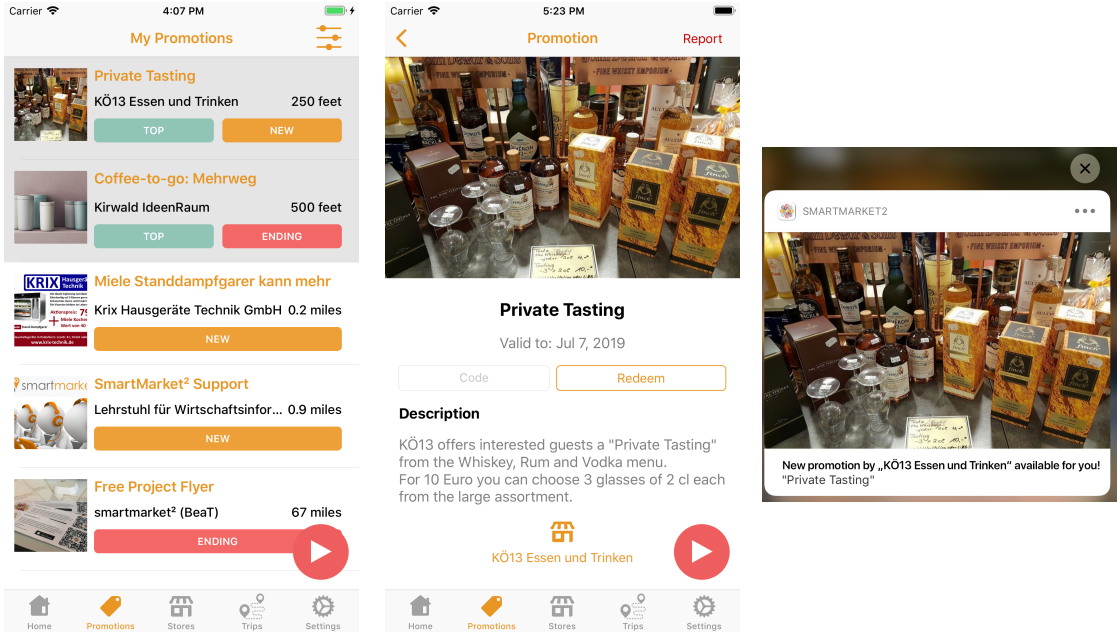


(a) Home Screen **(b)** Trips List View **(c)** Settings View

Figure 4.6: Primary Interfaces of the *smartmarket*^{2} App (the primary interfaces for *promotions* and *stores* are shown in Figures 4.7 and 4.8)

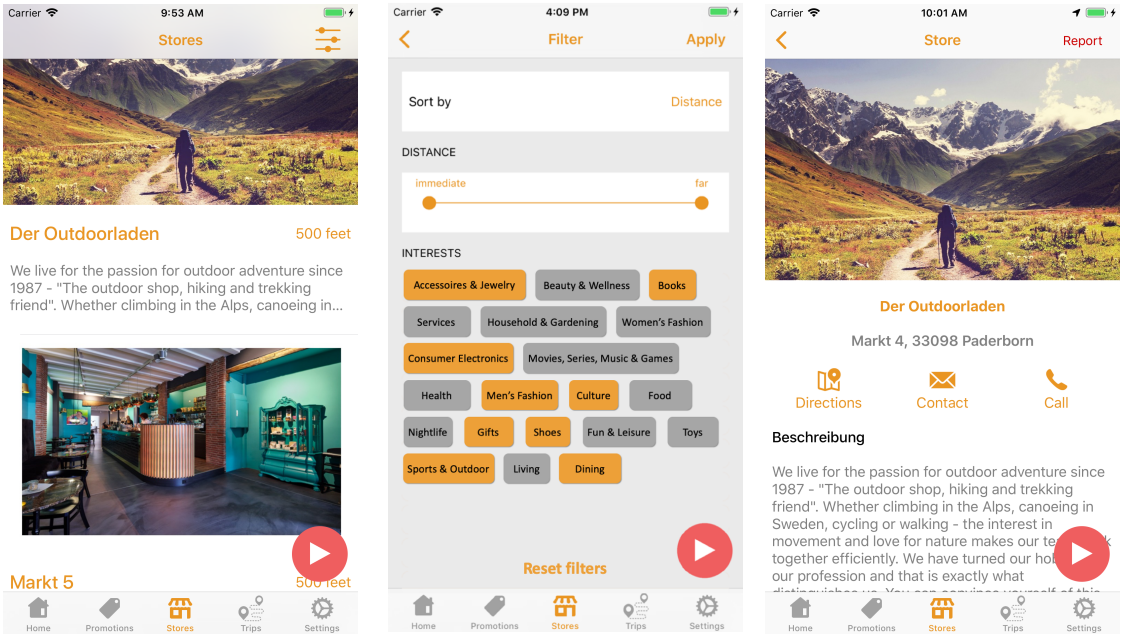
Customers examined available promotions in the *promotions* list (Figure 4.7a). By default, this list started with gray highlighted promotions with a green *top* badge that matched the user's interests, before the remaining ones were listed. The *new* badge marked promotions the user had not viewed yet, whereas the *ending* badge reminded customers that the promotion would end within the next 48 hours. Tapping a promotion led to its detail view (Figure 4.7b), where its conditions were shown, and the business owner entered the four-digit redemption code.

[45] For simplification, customer-facing views use the term "trip" to denote customer journeys.



(a) List of Promotions **(b)** Promotion Detail View **(c)** Push Notification

Figure 4.7: Promotion Feature

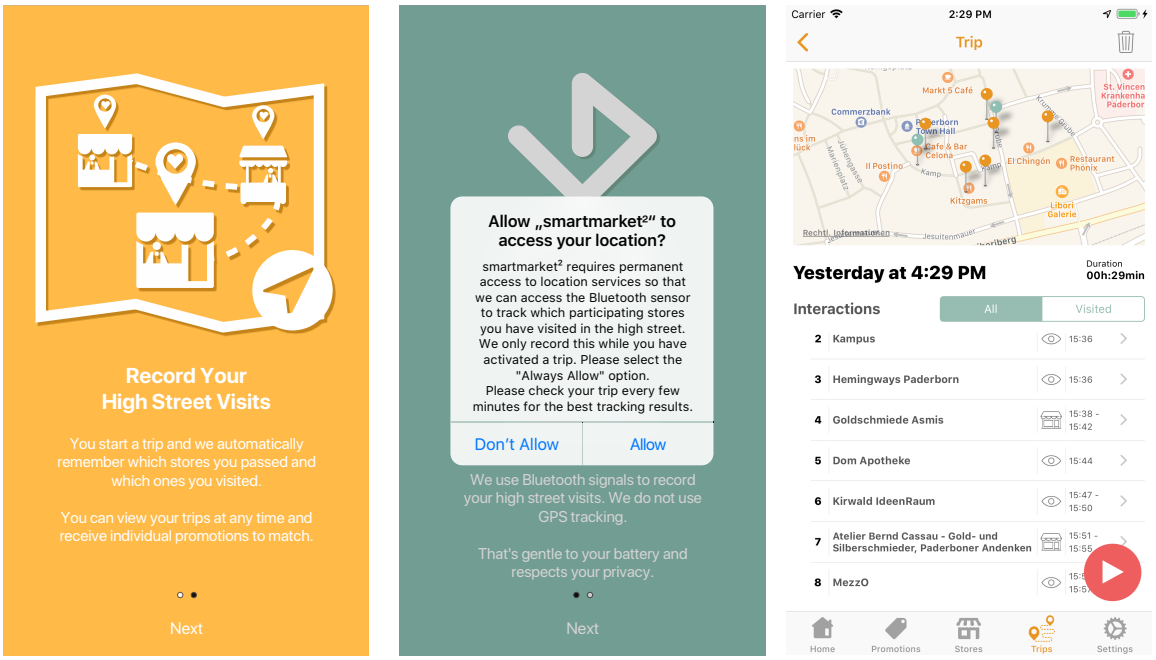


(a) List of Stores **(b)** Filter Interface for Stores and Promotions **(c)** Store Detail View

Figure 4.8: Store Information Feature

The interfaces were linked to each other. For example, users reached the store profile from the promotion detail view and from the *store* interface that provided the list of stores (Figure 4.8a). Text search, sorting (by distance or alphabetically) and filtering (by distance or interests) mechanisms aided customers in finding the businesses that were most relevant to them (Figure 4.8b). Similar filters could be applied to the list of promotions. Besides reading owner-provided information and contacting the store (Figure 4.8c), customers rated and reviewed it and read others' opinions.

A red *play* button that overlapped all views (cf. e.g., Figure 4.8) started a new trip. On the first start of a trip, the app introduced customer journey recording to the user through another onboarding process that ultimately requested the necessary consents and permissions to access the Bluetooth and motion sensors (Figure 4.9a). The *trips* interface provided additional explanations on how to start a trip. After the user had recorded trips, the trips were listed chronologically in the trips interface. Customers used the trip detail view to examine a trip as it commenced and to review past trips (Figure 4.9b). The view comprised a chronological list of visited and passed businesses, along with the time they spent in each one and direct access to the businesses' profiles. A map visualized the customer's trajectory.



(a) Trip Onboarding (excerpt) **(b)** Trip Detail View

Figure 4.9: Trip Feature

During their trips, customers received push notifications for promotions (Figure 4.7c) that directly linked to their details. Customers stopped trips manually by pressing the play button again. The trip information persisted en bloc to the back-end to minimize use of network resources. The app implemented two measures to guard against forgotten trips: customers were reminded of active trips by push notifications, and the app ended trips automatically in the background after six hours.

4.2.2 Evaluation Results

Customers actively engaged in communication and service encounters with businesses through the *smartmarket*[2] app. During the two-month field study period, participants had on average twenty-four sessions in the app, which comprised periods of constant interaction that may be interrupted only by pauses up to ten minutes long. One session lasted an average of 3 minutes and 26 seconds and a median of 51 seconds. In total, more than 2,000 trips were started by 275 unique users. Because of users' unfamiliarity with the service and some initial issues that were quickly patched, the data contained a substantial number of test recordings. After filtering outliers that took less than five minutes or more than six hours, 1,104 trips remained. Some recordings were not made in the high street or near beacons, so 78 trips did not include beacon sightings, leaving 1,026 trips with journey entries. On average, trips to the high street lasted about an hour (median 47 minutes), and participants had machine-to-machine interactions with 9.86 venues (median 9.00). Android users averaged two more journey entries per trip than iOS users, confirming both the general utility of `BeaT` but also the limitations of iOS background processing.

The businesses published 127 promotions, and an average of 38 promotions were available for redemption at any given time during the field study. Customers received 2,290 push notifications, which had an average click rate of 72.14 percent. Since push notifications are a way to draw passersby to a store, customers' physical response to the notifications were examined. Users visited the location 241 times (10.5 %) after receiving a notification, which can be divided into 125 visits to stalls at the Christmas market and 116 visits to stationary retailers. However, the disproportion between the low number of stalls and the high number of visits does not allow direct conclusions to be drawn about the promotions' effectiveness, as outdoor locations are less prone to signal interference than indoor locations are and have better

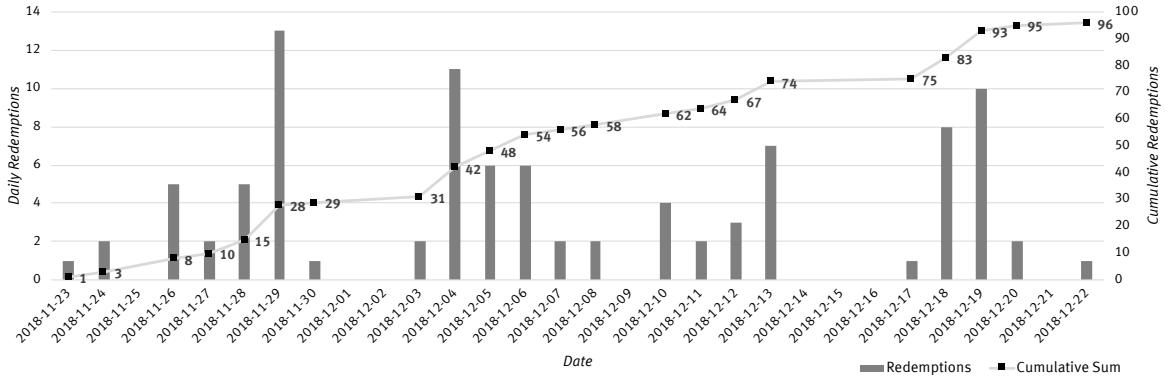


Figure 4.10: Redemption of Promotions During the Field Study

beacon detection rates, so they may trigger push notifications more often. In addition, the proximity of the stalls to one another sometimes led to false positives when stalls were recognized as visited although the user stood at a neighboring one.

Customers' redemption behavior yielded further insights. Participants opened promotions 3,013 times, and 96 redemption transactions were recorded. Figure 4.10 shows their distribution over time. Notably, three promotions accounted for 90.63 percent of the redemptions, and all but one redemption were for promotions issued by stall operators. Consequently, the period in which most redemptions took place corresponded to the dates of the Christmas market. The distribution can be explained by two observations: First, students, who made up the sample of test customers, tend to be more susceptible to low-cost, spontaneous deals like a "buy-one-get-one-free mulled wine" promotion than to more expensive buys, such as clothing. They may have planned to visit the Christmas market to get food and drinks when they started the trip, and the promotion influenced only their choice of stalls. Second, local businesses usually added to the platform their general promotions, which they also advertised through their shop windows and other marketing channels, rather than unique promotions designed specifically for the platform. In contrast, the stall operators used promotions that were exclusively available through *smartmarket*[2]. Reportedly, they also were more conscientious in entering the redemption codes and, thus, actually recording the transactions. An analysis of store profile views in the app confirmed the popularity of market stalls, as their profiles were viewed an average of 28 times. Restaurants were the second most popular category, with an average of 23 views, whereas fashion stores were the least popular venues, averaging only 8 profile views.[46] Quantitative results hint that the least digitalized businesses had the most customer interactions.

[46] The overall low numbers of profile visits can be attributed to the field setting, where the student test customers were asked to use the customer journey feature.

To understand the influence of platform use on high street patronage and spending, participants were surveyed about their shopping trips. The participants were required to complete a survey for each trip, which was shown after a user ended a recording in the app.[47] Test customers were extrinsically, not intrinsically, motivated to visit the high street and record their journeys, so every tenth respondent viewed the app as a burden or distraction from the actual shopping trip. On the other hand, use of the app contributed positively to the high street visit from an economic point of view, as 37 percent of respondents (n = 1,036) stated that they had spent more time on the high street than planned, which about a quarter of them attributed to using the app. Respondents also reported spending money on the high street in three out of four trips (n = 1,058). Forty percent of buyers reported higher spending than initially planned, which almost half of them said was influenced through the use of the *smartmarket*^{2} app (n = 319).

Table 4.1: Findings from Test Customers' Comments on App Use

ID	Finding
CU.1	A digital companion to the high street was perceived as an attractive, modern, and useful information service that yielded functional value and supported users in learning about their surroundings (17). The platform provided hedonic entertainment value (7), which may be extended by gamification elements such as location-based competitions (1).
CU.2	Promotions provided a strong incentive for app use, and users were willing to engage in value co-creation by making some of their information available in return for benefits. However, users expected a greater variety of participating stores (such as chain stores and local farmers' markets) and available promotions (13), as well as more target-group-specific and exclusive promotions (3). Promotions that only appear while visiting the store were viewed critically because some users already wanted to view them at home to plan their high street visits (3).
CU.3	The chosen data protection strategy was effective, as customers privacy calculus was in favor of tracking their customer journeys. Only two users took a critical view of the recording of behavioral information.
CU.4	Users had a low tolerance for technical issues, even with knowledge of the prototypical state of the IT artifact (35), but also acknowledged improvements on stability and functionality through updates (6).
CU.5	More intuitive user interfaces and feedback mechanisms could extend customer journey tracking (5). For example, the main view could adapt to the context of the current trip to make nearby promotions and other interaction opportunities with the identified businesses easier to access. Feedback regarding sensed beacons could counteract feelings of a "black box" and showing the reasons for receiving a particular promotion further establishes transparency.

[47] The survey, which was administered by a project partner, focused on the customer-perceived value-in-use of location-based high street service offerings made by ICTs like the *smartmarket*^{2} platform. Another Ph.D. thesis will be written to address this topic in detail, so insights are reported only briefly here.

Users who voluntarily answered an open question on their perceptions regarding app use (n = 60) in an online follow-up survey provided differentiated insights and suggestions for improving the IT artifact from the customers' point of view. Table 4.1 summarizes the findings.

Local Businesses adopted the *smartmarket*^{2} platform and the functions made available through the management portal to varying degrees. The portal logged their behavior. To group similar users by their behavior, k-means clustering with three groups was applied to the number and average length of sessions, the number of page views per session, and the number of promotions created (Hartigan and Wong, 1979). Further, to triangulate the data and gain detailed insights into the local businesses' perceptions of the *smartmarket*^{2} platform, all but one of the nineteen previously interviewed business owners answered questions after the field study. Users fell into three categories regarding their intensity of use:

1. *Heavy users* (14 %) logged into the management portal every other day to check on their promotions and on customers' interactions with their stores. Sessions averaged 2:26 minutes and comprised 8.28 page views. Heavy users accessed the reports frequently and created an average of seven promotions.
2. *Regular users* (58 %) concentrated their maintenance, reporting, and promotion activities in one or two sessions per week that comprised an average of 12.20 page views. The majority of regular users created at least one promotion (∅ 1.6) and accessed reports occasionally.
3. *Infrequent users* (28 %) used the portal at the beginning of the field study to explore its features (∅ 25.35 page views), but without instant gratification and measurable returns, appeared to lose interest over time. These users seldom created promotions (∅ 0.38) or viewed reports, and the researchers themselves had to create some of their store profiles. A few of these businesses allowed beacons to be installed but did not want to become more involved in the study.

Responses from the ex-post interviews with the business owners were transcribed and then coded using an exploratory QCA. The positive response from Paderborn's high street businesses, which was reflected both in the time the owners invested and in their feedback, confirmed the relevance of multi-sided platforms like *smartmarket*^{2} and, at least in this city, the local businesses' willingness to cooperate and employ new ICTs. Table 4.2 summarizes the main findings from the interviews.

Table 4.2: Findings from Ex-post Interviews with Business Owners

ID	Finding
BO.1	The GUI and range of functions provided by the management portal were predominantly judged positively. The portal had a high perceived ease of use (8), could intuitively be used by non-technical users (3), and only two users experienced technical issues and called the platform operator for support. Platform membership required low maintenance effort (11), and scheduling promotions fitted well into the owners' planning of marketing activities (2).
BO.2	Target group-specific digital communication with their (potential) customers in the physical environment had high relevance for most business owners (13). Eight owners considered the existing filters a useful option, but only two have applied them. The businesses suggested additional filters for age groups (5), more specific interests (3), spending power (2), home location (2), and interactions with other stores (1). Conversely, four businesses disapproved customer segmentation and viewed targeting as discriminatory measure.
BO.3	Half of the businesses viewed the reports, and all of them found them relevant and comprehensible. While five owners gained new information from the data, three respondents saw those as a confirmation of their existing knowledge base. The conversion rate (ratio of visitors to passersby) was the central KPI for business owners (5). One respondent suggested making global promotion statistics available on the high street level to learn best practices and continuously improve their promotions.
BO.4	From the businesses' point of view, the platform fostered the co-creation of customer experience (16). Among others, the platform yielded functional and hedonic value by redeeming promotions (3); by improving customers' planning and search activities (2); by giving exclusive content and information that they would not receive otherwise (2); by offering joint events (2); and by linking digital content to physical locations (1).
BO.5	Given the small number and a rather homogeneous set of test customers, which were not a target group for most businesses (11), the business owners did not report measurable effects regarding new customer acquisition or additional revenue (17). Nevertheless, all businesses would continue using the platform if it would become available to the public, and every second one would suggest the platform to other local entrepreneurs (9).
BO.6	The majority of partaking businesses would be willing to pay a royalty to be part of the platform (15), but they expected their investment to yield a measurable benefit (9). When asked for a favorable pricing model, the businesses suggested performance-based pricing that takes into account the number of created or redeemed promotions (7) or a "freemium" model that allows businesses to manage their profile free of charge but requires a paid subscription to access the full range of functions (4).
BO.7	The businesses suggested extending the platform with additional information services such as a parking spot locator (2), joint sweepstakes (2), a high street bonus system like *Payback* in Germany (1), and the ability to showcase products and services using multimodal presentations (3). However, one respondent reminded us not to overload the platform with too much content but to focus on a well-defined set of service offerings.

The field study confirmed that the IT artifact is a valid way to reach the stated objectives: It is an affordable, technically and operationally feasible solution to the problem of how to digitalize high streets with its independent SME businesses. It enables the co-creation of value in communication and service encounters among the actors in the high street ecosystem. It can foster positive customer experiences that have functional and hedonic value. The IT artifact can positively influence high street customer journeys from an economic standpoint, thus, contributing to strengthening the high street's competitive position against other retail channels.

Finally, the field study showed the platform's value to generate insights about the high street. Figure 4.11 uses aggregated trip data to depict high street customer frequencies. The distribution of the first customer journey entry, to some extent, reveals the customers' entry points to the high street. The overall distribution of customer journey entries reveals the hot spots, which, according to the city's marketing manager, largely correspond to historic customer frequency data of the city.

(a) Distribution of the First Journey Entry **(b)** Overall Distribution of Journey Entries

Figure 4.11: Customer Frequencies during the Field Study

4.3 Fulfillment of Requirements

The applicability and utility of the IT artifact and the fulfillment of its objectives have been demonstrated through a comprehensive situated implementation and a field study with multiple stakeholder groups. We conclude the assessment of the IT artifact by reviewing it against the specified requirements (Becker, 2010).

In response to the service providers' requirements (see Table 3.2, p. 34), the digital platform is an intuitive-to-use (SP.6) marketing instrument to attract (SP.1) and individually address customers (SP.2). From a technical perspective, the high street information and targeted promotion service offerings satisfy these requirements, although their effect is contingent on how business owners actualize the IT artifact (Volkoff and Strong, 2013) and on the quality and relevance to customers of the content they create (Bauer and Strauss, 2016). The digital platform does not relieve business owners of responsibility for market analysis and audience research (Gedenk, 2019) but supports them with reporting and customer behavior analysis tools in measuring and improving campaign success (SP.3). For example, the field study revealed that undergraduate students are particularly receptive to location-based advertising for inexpensive goods and food, leading to unplanned spending, an observation previously confirmed by Spiekermann et al. (2011) and Hui et al. (2013). Promotions for products and services that require planning and evaluation in the pre-purchase stage of the customer journey are more effective when delivered ahead to the high street visit (Luo et al., 2014). Given that neither the businesses nor the platform can predict the time of the customer's next visit, businesses should ensure that promotions are consistently available for customers to find in the app as they plan their high street visits.

Provider-generated information like promotions require maintenance effort from the businesses (SP.6). To increase the range of options to draw customers into the venues (SP.1), a geo-recommender service was designed that uses customer-generated behavioral information to suggest relevant businesses to customers. Since a substantial number of recorded customer journeys is required to train a recommender (Adomavicius and Tuzhilin, 2015), its implementation becomes feasible only after the platform has been well-established in a high street (*P.13*). The feasibility and relevance of data-driven service offerings are further limited by the number of users on either side, as recommendations as a form of filtering are meaningful only if there is a sufficiently large population of stores from which to choose. Likewise, limited numbers of users might not generate enough journey data. However, it is reasonable to assume that a geo-recommender triggers behavioral responses, as the effects of mobile recommendations are well-known in contextual marketing theory (see e.g., Ghose, Kwon, et al., 2019; Ghose, Li, et al., 2019; Gavalas et al., 2014; Ström et al., 2014; Luo et al., 2014).

By integrating the IT artifact with existing communication channels on the users' smartphones, customers gain new ways to enter a joint sphere with the businesses and contact them (SP.4). The joint sphere between customers is addressed through ratings and reviews of stores in the app, but a VC is conceptually designed to allow for more complex social interactions. Similar to a geo-recommendation service, a VC requires that a substantial number of users participates in order to yield value, and therefore, it could not be evaluated in the field study. Instead, an online survey was fielded to determine whether customers would participate in a VC for high streets and what gratifications would motivate them to do so (Section 4.4).

Despite the inherent drawbacks of the utilized beacon technology, the IT artifact fulfills all requirements related to context elicitation (Table 3.3, p. 36). Customers record their trips through the app (CON.3), which automatically reasons upon beacon sightings (CON.1) inside and outside participating venues (CON.2). By stating their interests and demographics, customers provide additional contextual information to use in other service offerings (CON.4). The designed LBS and the underlying `BeaT` algorithm are technology agnostic. Because of the rapid technological progress in the field of radio-based positioning, BLE beacon technology will likely be superseded in a few years by more reliable technologies, such as local 5G networks, ultra-wideband or hybrids thereof (Fraunhofer IIS, 2019; Witrisal et al., 2016). Until then, each beacon placement must be adjusted and measured with multiple devices to get satisfactory signal rates.

Concerning the requirements for data privacy (Table 3.4, p. 38), this work opts for a privacy-by-default approach that stands in stark contrast to known privacy-invading uses of beacon technology in practice (for a recent overview see Kwet, 2019). The platform transparently informs the customers upfront on data-processing practices (PRV.1) and refrains from sharing personal data with third parties. Geospatial data is collected after the user has consented (PRV.2) and purposefully started a trip (PRV.4). The design of the beacon technology confines the tracking perimeter (PRV.5).

The privacy self-service bundles the users' rights given by the EU GDPR (PRV.3). Figure 4.12 shows excerpts from the implemented privacy self-service: Users can learn about and adjust their consents, view all personal information the platform operator has stored, send requests via e-mail, and read the privacy policy. Users can also view and export usage logs as comma-separated values (csv) files. Further, the privacy self-service lists all user interaction with promotions, and allows single bits of information and the full user account to be deleted.

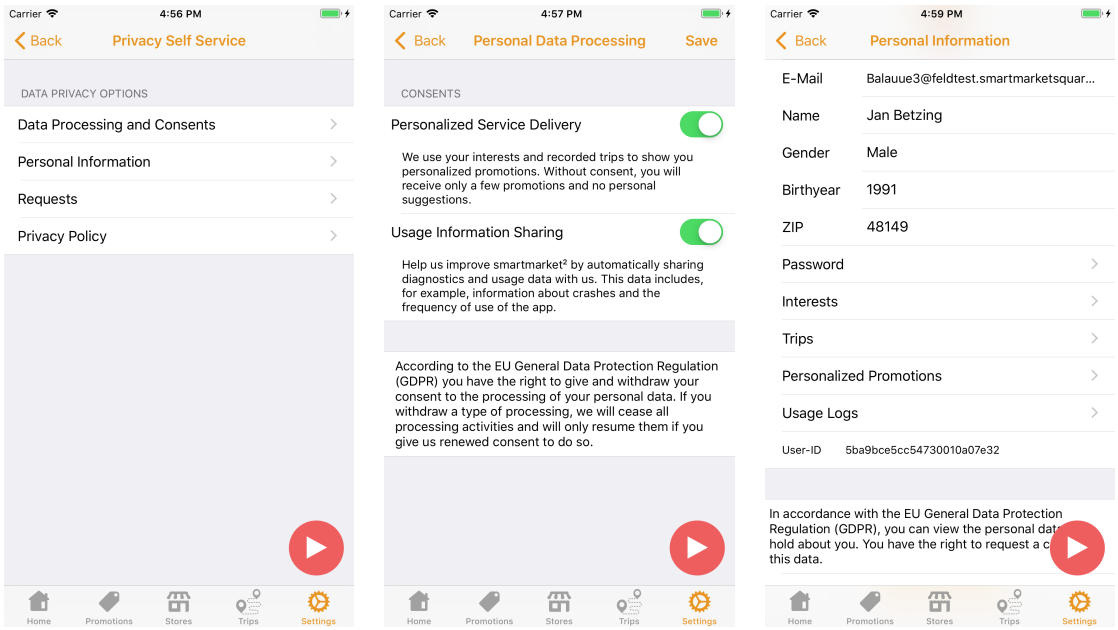


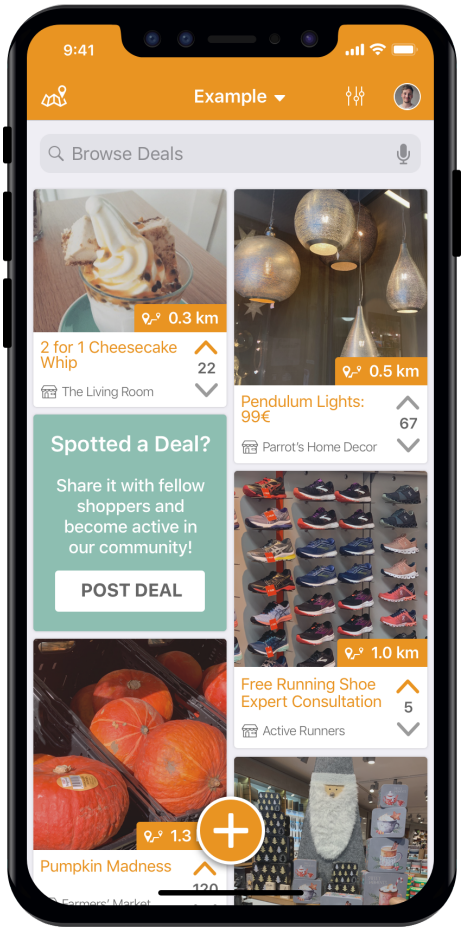
Figure 4.12: Privacy Self-service Interfaces (excerpt)

4.4 Prospects for a Virtual High Street Community

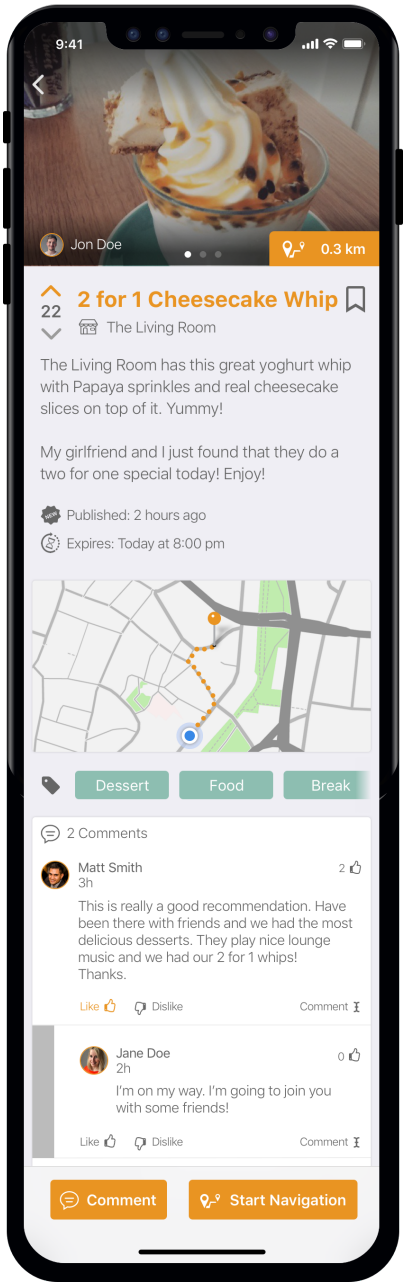
Retail-related VCs can yield favorable outcomes like increased customer patronage and turnover for businesses, and utilitarian, experiential, and social gratification for customers (Martínez-López et al., 2016; Tynan et al., 2014; H. Kim et al., 2008; Landry et al., 2005). A deal community (Bergmeier et al., 2016) for the high street is a kind of WOM marketing for the local businesses (Nisar et al., 2019), which customers evaluate as more credible than retailer-provided communications (Cheung et al., 2014). As content producers, customers can create more content than the local businesses can, and the VC can include content about venues that are not yet part of the platform. Both aspects can increase the attractiveness of the overall digital platform and the high street.

Peters and Bodkin (2018) showed that individuals form loosely coupled local communities in stationary retail and co-create value with each other in-store. These communities share traits with VCs (Muniz and O'Guinn, 2001). In particular, their members exhibit "a feeling of connectedness to others through shared similarities [...] and through social interactions with other customers" (Peters and Bodkin, 2018, p. 9). While their findings suggest the potential for digital interaction on a local VC, whether customers would use a VC service within the platform and, if so, what would motivate them to use it remain open questions.

Building on Dholakia et al.'s (2004) seminal model of customer participation in VCs, an online survey with 402 participants was fielded in *P.14* to investigate these motivators. Figure 4.13 shows mockups of the local VC, which instantiate the conceived design (Section 3.2.2.3).



(a) Main Feed



(b) Offer Detail View

Figure 4.13: Mockups for a Virtual High Street Community Service

SOURCE: adopted from *P.14*

Respondents were first introduced to the fictitious VC and saw the mockups before they answered questions about their motivations and behavioral intentions to participate in the VC. A VC can support customers in exploring the "hidden treasures" of the high street and can raise customers' awareness of both previously unknown and known businesses. In consequence, VC participation might result in physical reactions, so customers were asked whether using the local VC would motivate them to visit the high street.

Results indicate that functional purposes like receiving and sharing information, and decision support are the primary motivations for participation (cf. *P.14* for detailed results). Customers would also use the VC for hedonic purposes like discovering new areas of interest and entertainment, particularly when they are bored. Social purposes for using a VC like making new friends and satisfying the need for self-affirmation are less relevant to customers. There is a general interest in a local VC service, as 87 percent of respondents would use it to consume information, but they have less favorable attitudes about creating content (20 %) and actively participating in the community (39 %). Customers value a local VC as a medium for discovering the high street (91 %) and report strong intentions to visit both newly discovered venues (92 %) and previously known ones (53 %). The results indicate that a VC service can alter high street customer journeys, as 73 percent of respondents expect their VC use to increase the number of shops they visit and the overall duration of their high street visits. However, the present study does not allow a conclusion to be drawn about customers' long-term behavior and the economic effects of VC use, but it yields findings on the viability of a VC service in the digital platform.

The study reveals three intertwined threats to the service offering: First, the VC's value depends on users to create new content regularly (Evans and Schmalensee, 2010), but only every fifth user said he would become a content creator. Therefore, the platform operator should introduce a VC service only after the platform has established a considerable customer base from which to recruit content generators (Akar and Mardikyan, 2018). Local businesses and the operator may have to offer customers extrinsic incentives like monetary rewards or exclusive promotions to convert information consumers into creators (Kraut and Resnick, 2012). Second, any form of publicly-displayed user-generated content risks abusive use and requires moderation, among other things, to comply with legal requirements (Niemann, 2019). Third, deals are valid for short periods. Co-destruction of customer experience can occur when businesses do not honor deals on the VC because they have expired (Frow et al., 2014), so the platform operator has to ensure that outdated deals are marked as such or removed.

Against this backdrop, a VC service can strengthen the digital platform's value propositions and facilitate value co-creation between customers. However, making such a service offering would pose an economic and organizational burden for the platform operator that must be offset by the indirect network effects it yields for businesses and the high street (Katz and Shapiro, 1985). A VC is arguably more viable as an extension to an established and matured multi-sided community platform than it is to an emergent one like *smartmarket*^{2}.

5 Closure

> *"Sometimes, a bold leap of imagination or deep intuitive insight may be what a design project requires instead of a rigorous but ultimately more limited by-the-book design theorizing, in order to have a substantial impact on organizations and society and to make substantial knowledge contributions at the end."*
>
> *Drechsler and Hevner (2018), p. 94*

This thesis stands in light of the prevalent socio-economic challenges of degrading high streets and customers' rising expectations about digital service offerings in BaM (Bollweg et al., 2019). Against this backdrop, the thesis' goal is the design, development, and evaluation of a multi-sided digital community platform for high streets. The IT artifact should foster the co-creation of value between customers, local businesses, municipal entities, and a platform operator and strengthen the high street's competitive position against other retail channels.

The DSRM process was applied to address this objective (Peffers et al., 2007). We investigated the thesis' domain and the outer environment of the resulting IT artifact (Simon, 1996), the digitalization of high street retail. A review of ICTs at the retailer-customer interface revealed their capabilities and contributions to individualization and cost-optimization strategies. The review particularly highlighted eliciting customers' contexts as a prerequisite for digital service. We learned customers' preferences for dominant types of digital touchpoints in BaM retail by surveying the likelihood of their use. We also shed light on related shopping companion apps to understand customers' expectations about high-quality apps, since customers interface with the digital platform through a mobile app.

Then, based on this descriptive knowledge and the elicitation of requirements, the IT artifact was designed. The design process yielded several prescriptive knowledge contributions in the form of meta-artifacts (Drechsler, 2019) like design principles, conceptual models, and an algorithm. In particular, the customer's context is elicited

through beacon-based journey-tracking. The platform also provides information and targeted advertisements, and has recommendation capabilities that can translate into new service offerings.

Finally an expository instantiation was built to demonstrate that the developed concepts could be implemented in a working system and allowed us to assess the IT artifact in its "*immediate* nomological net" (Benbasat and Zmud, 2003, p. 186). The platform was evaluated through a large-scale field study that showed its organizational feasibility and utility for the high street stakeholders and that yielded qualitative and quantitative data on the its impact on the surrounding real-world socio-technical system (Venable et al., 2016). Next, the thesis' theoretical contributions and potential impact on practice are discussed (Bichler et al., 2015), followed by an outlook on the future of multi-sided digital community platforms.

5.1 Contributions to Theory and Practice

The DSR paradigm has gained popularity because of its focus on and indivisible linkage of research rigor and relevance to practice (Gill and Bhattacherjee, 2009; Kuechler and Vaishnavi, 2011). The German *Wirtschaftsinformatik* community seeks to build theory-ingrained IT artifacts for and with practitioners (Bichler et al., 2015; Sein et al., 2011; Winter, 2008), which often occurs in federally funded joint research projects like *smartmarket*^{2} (*P.2*). The IT artifact is conceived vis-à-vis requirements voiced by the potential adopters. Ongoing bi-directional knowledge transfer between practitioners and researchers has aligned research and business objectives (Österle and Otto, 2010). Österle et al. (2011) named four criteria with which to assess the contributions of DOIS: *abstraction*, *originality*, *justification*, and *benefit*. This thesis complies with all criteria.

First, it presents several research outcomes and *abstract* meta-artifacts that apply to a wide range of problems and situations (Baskerville and Pries-Heje, 2014) and makes individual contributions to marketing, service science, computer science, and IS research: The framework conceived in *P.2* informs researchers about the particularities of federally funded joint research projects like *smartmarket*^{2} and explains how design-oriented IS research can take place in industry-academia consortia. *P.3*'s assessment of shopping companion apps yields not only customer preferences that

retailers can use to improve their service delivery through the mobile channel but also an adapted MASQ scale with which to measure the quality of these mobile IS (Stiakakis and Petridis, 2014). *P.4* and *P.5* offer decision support for retailers in planning and designing customer-facing digital service offerings in BaM stores. The identified capabilities provided by in-store technologies allow practitioners to evaluate existing and future ICTs according to their strategic benefit and extend the shopper-focused decision calculus from retail management to include an IS perspective (Inman and Nikolova, 2017). Further, retail management's traditional view of online-offline channel integration (Herhausen et al., 2015) is inverted by "mirroring" digital service from e-commerce back to the BaM servicescape. *P.6* and *P.7* integrate views from service science and marketing to define the emerging concept of digital customer experience, provide design principles for IS that foster the co-creation of experiential value, and make the customer journey visible and explainable through a DSML. *P.8* takes a legal perspective and gives design principles for privacy-transparent apps that apply to any mobile service that processes personal data. Most notably, this thesis shows how the individual papers' contributions can be synthesized into an overarching IT artifact design and an expository instantiation that demonstrates its applicability to a specific setting: the high street. The platform establishes a digital companion to a physical service ecosystem and facilitates value co-creation between its actors (*P.1*, *P.9*–*P.12*). The platform core can be extended to accommodate the various service requirements and particularities of the application's setting. Besides high streets, the platform can yield value to other forms of retail, such as shopping malls and factory outlet centers that bundle a wide variety of businesses. In addition, the journey-tracking component can be used in venues where customers traverse a series of locations such as wards in a hospital or stages in an airport (*P.11*).

When the IT artifact is compared to existing digital platforms for high streets in Germany (Bärsch et al., 2019; CCEC, 2019; cima, 2018), its *originality* in terms of eliciting and applying customers' contexts in service delivery and the range of service offerings becomes apparent. A comparison with rival IT artifacts performed in Bartelheimer et al. (2018) showed that the platform is conceptually unique in terms of the integrated online-offline, multi-actor nature of digital interaction (cf. *P.9*). The academic IS community has also acknowledged the originality of the research and awarded the customer-journey-tracking prototype with the "Best Demo Award" at the 14^{th} *International Conference on Wirtschaftsinformatik* in 2019 (*P.11*).

Academic *justification* is given through a thoroughly applied DSRM process and recourse to kernel theories like S-D Logic from service science and customer journey theory from marketing. Requirements were elicited from the literature and practice, target adopters evaluated the IT artifact, and the objectives and requirements have been fulfilled.

Finally, the conceived IT artifact provides *benefits* to all high street stakeholders. Customers can use the platform to learn about the high street, benefit from personalized promotions, and interact with others to co-create value. Municipal entities can use it to gain insights for planning activities. Local businesses gain mechanisms with which to address their customers in the digital realm and analyze their behavior. In general, establishing and operating the platform for a high street is economically feasible, as beacons are a comparatively cheap technology, the backend is neither resource-intensive regarding computational power nor storage, and resource-intense tracking is performed on the end-users' devices. As Bichler et al. (2015) noted, the impact of academia-grown IT artifacts that purport to solve organizational, economic, or societal problems can seldom be assessed directly. The field study yielded evidence on the platform's utility, but the limited diversity of test customers hampers the study's ecological validity (Recker, 2012). Digital interaction to co-create value took place during the field study, and businesses and the high street as a whole may benefit from exposure, increased patronage, and higher spending. However, the IT artifact's actual contribution to alleviating the issue of degrading high streets can be assessed only ex-post through longitudinal studies with an artifact instance that is established in practice.

Beyond providing descriptive and prescriptive design knowledge on the digitalization of high street retail, the thesis further contributes to research in several ways. First, the IT artifact provides a technical foundation on which other researchers can base analyses of customer behavior in high streets. With the help of the platform's tracing of digital interactions and survey research, measuring the co-creation of digital customer experience (Klaus and Maklan, 2013; Lemon and Verhoef, 2016) and the customer-perceived value-in-use of LBS in high streets becomes feasible (*P.6*). Second, this work contributes to research by using the platform as a case through which to study the organizational and managerial implications of data-driven smart service that spans the boundaries of single organizations (Beverungen et al., 2019). The field study was made possible through the shared co-opetition mindsets of the participating businesses (Ritala et al., 2014), but further research is needed to under-

stand the drivers of and barriers to co-opetition. In addition, the interplay between value creation on the organizational level and the high street ecosystem level requires further investigation (Möller and Rajala, 2007) because high street customers' experience accumulates from the episodes of contact with the individual businesses (*P.6*, *P.7*), and a single incident can affect the overall value perception. Third, this thesis responds to de Reuver et al.'s (2017) call for design-oriented research on digital platforms. The platform presented here is one of a few practical instances of the otherwise mostly academic phenomenon of engagement platforms (Breidbach and Brodie, 2017), so it serves as a case study to make the concepts of actor engagement and S-D Logic tangible (Storbacka et al., 2016).

This thesis' central contribution to practice is the multi-sided digital community platform. High street cooperatives, municipal entities, and third-party providers can adopt the complete platform design or parts of it to instantiate new digital platforms in their regions or cities. Existing local platforms and omnichannel initiatives can extend their service offerings with customer journey tracking and LBS that build on behavioral data to make additional value propositions to their stakeholders. Although an academic prototype does not fulfill the same quality standards as business-grade software must, it makes the design accessible to practice and can serve as a hands-on demonstrator and blueprint with which to implement the service offerings. However, the identified requirements and design specifications of the IT artifact are not exhaustive, as each application setting is expected to have its own requirements that cannot be anticipated in full. In particular, the platform does not specify a pricing mechanism since making a direct profit is not necessarily required, and operating costs may be paid by the city or a marketing organization. As Lüke's (2019) survey of platform operators showed, the primary reasons to run a local platform are related to revitalizing the high street, creating public awareness, and acquiring new customers, all of which create *indirect* returns through higher business revenues, corresponding taxes, and the increased attractiveness of the city center.

Federally funded joint research projects tend to focus on industrial dissemination. Several actors expressed interest in the platform or parts of it. The IT artifact was presented in panel discussions with local retailers and customers in Aachen[48] and Münster[49] and at trade fairs and conventions, such as the 2019 BMBF-funded service

[48] `https://smartmarketsquare.de/podium-aachen`
[49] `https://smartmarketsquare.de/podium-muenster`

conference "Service Systems Innovation,"[50] the 2018 and 2019 installments of the Retail Information Systems conference (HIS Tagung)[51], and CeBIT 2018[52], among other venues. Having users experience a prototype for themselves is the strongest form of communication to practice. The platform instance in Paderborn was featured in newspapers, radio, and local (WDR) and national (RTL) German television, among other outlets.[53]

5.2 Outlook

There is consensus among politics and trade associations regarding the unavoidable transformation of the retail industry and the associated issues for SME high street retail (Junker and Pump-Uhlmann, 2019; HDE, 2019; IFH Köln, 2018; BMWi, 2017b). The e-commerce sector continues to innovate new digital service offerings like conversational assistants and try-at-home scenarios with augmented reality (Plotkina and Saurel, 2019; Tuzovic and Paluch, 2018), threatening to take even more market share from stationary retail. At the same time, academia and practice are discussing scenarios for the future in which the appearance of high streets is expected to change: vacant spaces and excess sales areas are converted into mixed-use settings that comprise office use, residential space, and restaurants (Junker and Pump-Uhlmann, 2019). New forms of urban and spatial planning consider a more experiential urban lifestyle and embrace the concept of "smart cities", in which ICTs have a central role in increasing the quality of urban living (Nilssen, 2019; H. Kumar et al., 2018). In all approaches, retail retains its place in the high street, but BaM servicescapes become increasingly digitalized (Pantano and Dennis, 2019; Pantano et al., 2018). Only time will tell for certain to what extent SME BaM retailers will be able to respond to customers' demands and create an environment in which digital and physical customer experiences unfold. It would be naïve to assume that all retailers will become service providers that co-create value with their customers, as businesses must find ways to recoup the associated investment costs. However, this work highlights the benefits of platform-based digital service for local businesses, suggesting in particular the joint digitalization of the high street that lowers barriers and in which businesses share the costs and benefits.

[50] https://digivation.de/ssi/
[51] https://his-tagung.de
[52] https://smartmarketsquare.de/cebit2018
[53] https://smartmarketsquare.de/news/presseschau

This thesis shows that multi-sided digital community platforms like the IT artifact it presents take a step in addressing the potential erosion of high streets with the help of ICTs. Once these platforms establish themselves and acquire substantial user bases, extensions like the geo-recommender and the VC for local deals, which are currently conceptual, become feasible. Future research can uncover the extensions' economic effects for the high street and how they impact customer behavior.

The design and prototype presented here represent the state of knowledge in 2019. In anticipation of the constantly changing environment in which the IT artifact is likely to operate (Simon, 1996), the platform is designed in a modular fashion to make it adaptable to changing conditions and to preserve or even increase its utility over time (Gregor and Jones, 2007; Gill and Hevner, 2013; Drechsler and Hevner, 2018). Based on the findings and suggestions gained from the field study, the IT artifact's design and instantiation will be improved in future research with the hope that multi-sided community platforms for high streets eventually become a building block in municipalities' and cities' smart city agendas (H. Kumar et al., 2018) and contribute to a "better world" (Walsham, 2012).

More immediately, the *smartmarket*^{2} platform will be used in a public beta test in the second half of 2019 to foster dissemination to practice. The researchers partnered again with the city of Paderborn. Because of the positive WOM about the field study among the group of local businesses owners, additional businesses will join the platform, and the venues of the city center's local funfair will participate. The public is invited to become beta-test customers, and the mobile apps will be available through the respective app stores. Depending on the end-users' responses and the success of the beta test, the platform may be adopted by the high street permanently, which would be a considerable achievement for an academia-grown IT artifact.

A Appendix

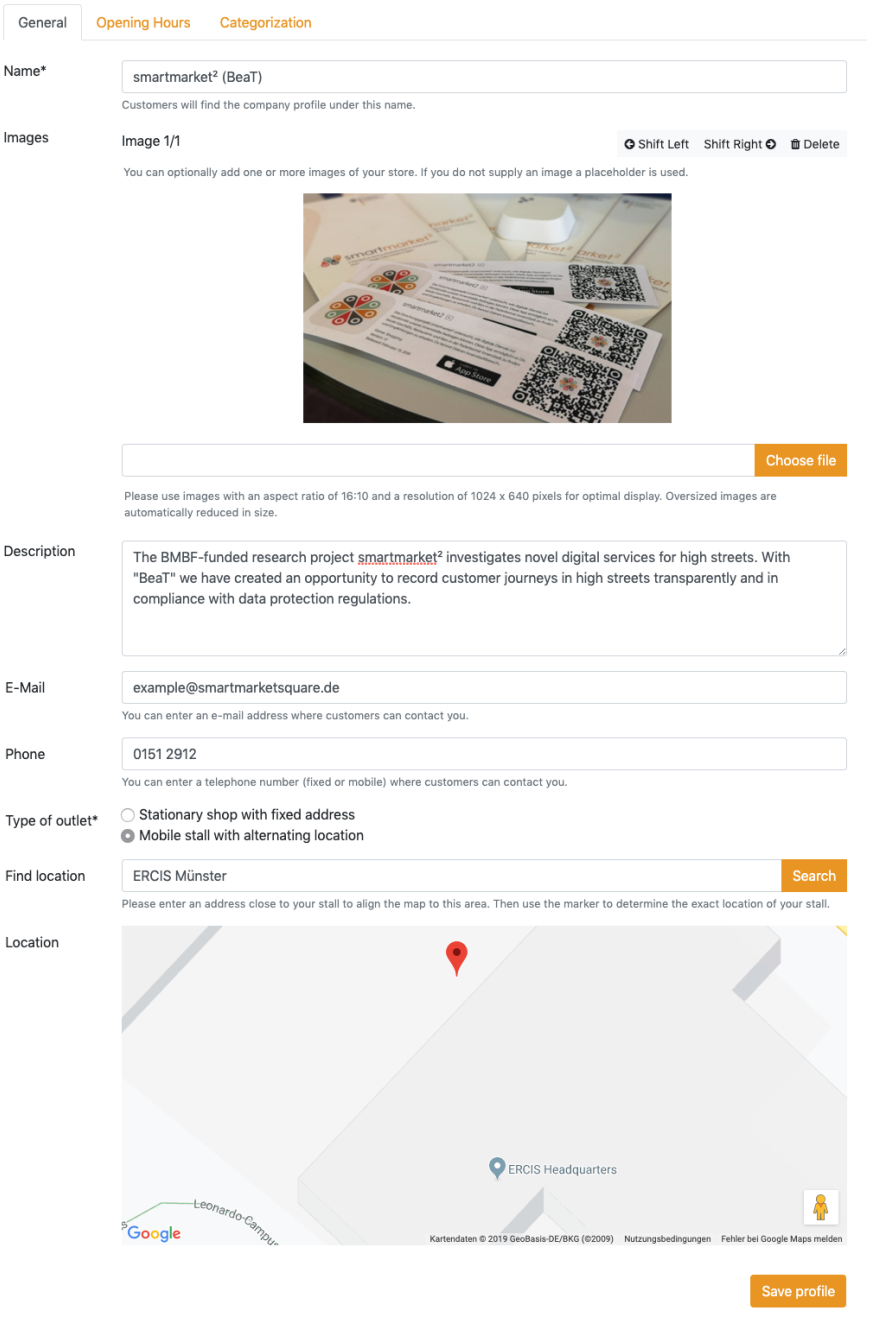


Figure A.1: Creation of a Store Profile in the Management Portal (excerpt)

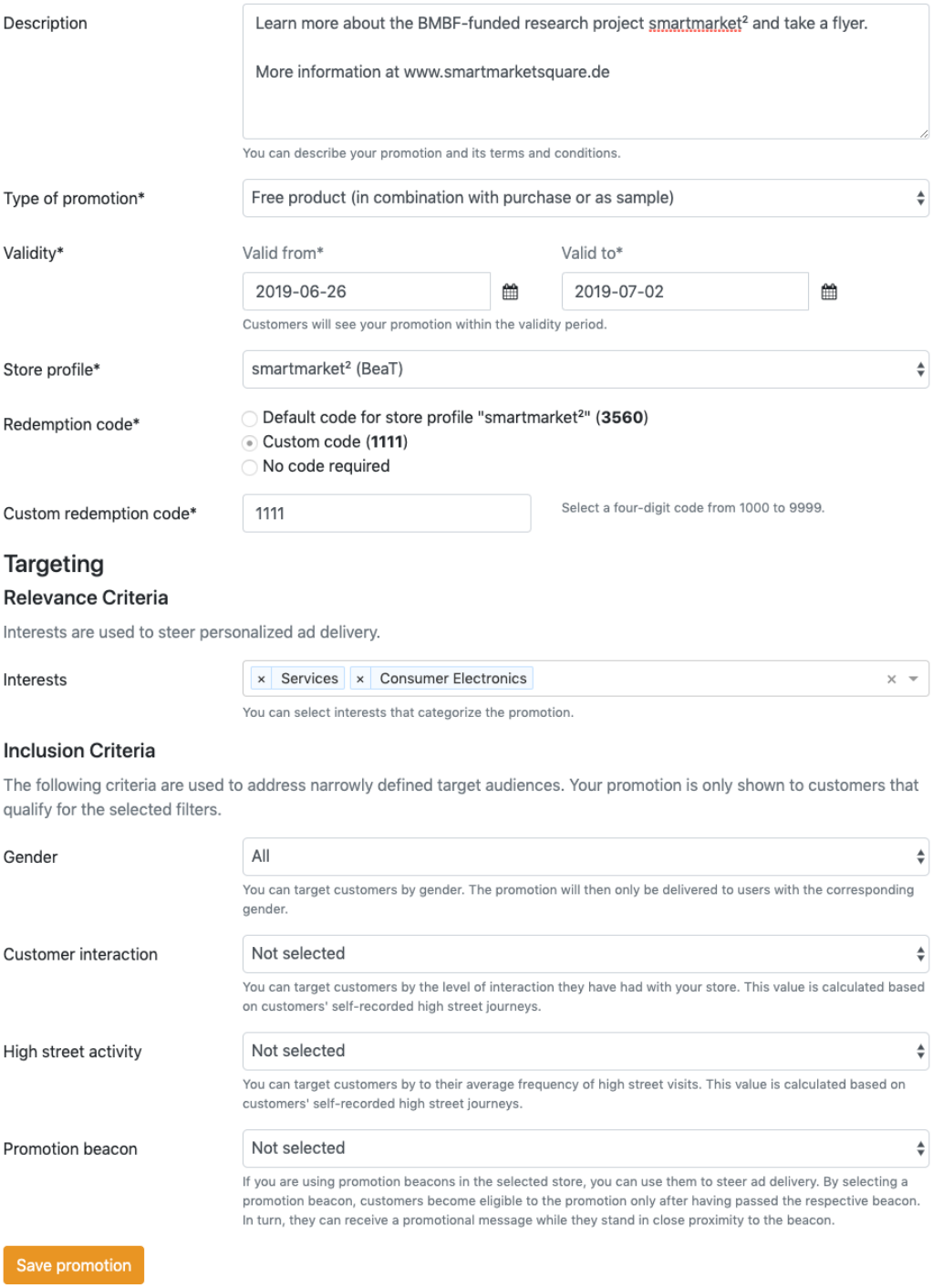


Figure A.2: Creation of a Promotion in the Management Portal (excerpt)

Part B
Publications

6 Interaktive, digitale Einkaufserlebnisse in Innenstädten

Fact sheet of publication *P.1*

Title	*Interaktive, digitale Einkaufserlebnisse in Innenstädten*
Authors	Jan H. Betzing Daniel Beverungen Jörg Becker Martin Matzner Gertrud Schmitz Christian Bartelheimer C. Ingo Berendes Marina Braun Andera Gadeib Moritz von Hoffen Christian Schallenberg
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The final publication is available at `https://link.springer.com/article/10.1365/s40702-017-0343-0`.

Interaktive, digitale Einkaufserlebnisse in Innenstädten

Zusammenfassung. Erfahrungen mit dem Online-Handel und der alltäglichen Nutzung digitaler Technologien haben das Kaufverhalten und die Erwartungshaltung der innerstädtischen Kunden nachhaltig verändert. Insbesondere die kleinen und mittelständischen Einzelhändler und Fachgeschäfte sind angesichts abnehmender Marktanteile herausgefordert. Der einzelne Händler kann oftmals nicht mit den digitalen Diensten der Großfilialisten und den Preisen des Online-Handels konkurrieren. Zur Abgrenzung von Konkurrenten legen daher viele Händler den Fokus auf kundenseitige Einkaufserlebnisse. Digitale Technologien, die Einzug in den Alltag der Kunden gehalten haben, können in die physische Umgebung der Ladengeschäfte integriert werden, um neue Formen der Interaktion zwischen Händlern und Kunden zu schaffen, die potentiell zu positiven digitalen Einkaufserlebnissen beitragen.

Dieser Artikel fokussiert auf interaktive, händlerübergreifende Lösungen im Sinne eines digitalen Marktplatzes. Wir skizzieren einen möglichen Gestaltungsansatz einer händler- und kundenübergreifenden mobilen Plattform, die neue digitale Technologien einbindet und dem physischen innerstädtischen Marktplatz als digitaler Kompagnon zur Seite steht. Diese Plattform vereint die Gruppen der innerstädtischen Händler und Innenstadtbesucher und ermöglicht die Interaktion zwischen beiden Parteien auf verschiedenen Ebenen. Ein digitaler innerstädtischer Marktplatz kann Beiträge dazu leisten, ein digitales Einkaufserlebnis zur Stütze des gesellschaftlich geschätzten, aber durch den Online-Handel herausgeforderten, „Einkaufserlebnis Innenstadt“ zu schaffen.

Abstract. The emergence of online shopping and digital technologies have transformed consumers’ shopping behavior and have also risen their expectations towards the digital profile of high street retailers. However, small and medium-sized retailers in particular—who cannot compete with the large-scale

digital initiatives conducted by major retail chains and pure online retailers—struggle to retain and attract customers to their stores. Eventually, their market share might decline. Improving customer experience creation is a viable path to re-build a competitive edge for high street retailers. By introducing new digital technologies into their stores and by integrating customers' devices into their physical servicescape, new types of interactions between retailers and customers emerge that allow co-creating digital customer experience.

This article proposes building and implementing a digital platform that local retailers can use to collectively offer digital customer experience. We sketch the design of a mobile platform that accompanies traditional high street retailing with a digital counterpart. The platform connects local stores with digital customers and enables different levels of interaction among its users. In doing so, the platform enables the co-creation of digital customer experience, strengthening the competitive position of retailers in consumers' buying decisions.

6.1 Einkaufserlebnisse in Innenstädten im Wandel

Die Attraktivität der Innenstädte wird durch den Mix aus Läden, Restaurants, städtischen und kulturellen Einrichtungen bestimmt (IFH Köln, 2017). Dabei haben kleine und mittelständische Händler und Fachgeschäfte das Bild der Innenstädte in Deutschland über Jahrzehnte hinweg geprägt. Der demografische Wandel und der stetige Verlust von Marktanteilen gegenüber Online-Handel und Großfilialisten sind Entwicklungen, welche die zukünftige Ausrichtung des kleinen und mittleren Einzelhandels maßgeblich beeinflussen. Während die durchschnittliche Wachstumsrate des Online-Handels in Deutschland bei 12% p.a. liegt (IFH Köln, 2017), nimmt der Markanteil der traditionellen Fachgeschäfte ab (HDE, 2016). Im Jahr 2016 erzielte der Online-Handel einen Umsatz von 61,24 Mrd. Euro in Deutschland, womit 12,7% des Einzelhandelsumsatzes auf den Online-Handel entfielen (bevh, 2017).

In der Vergangenheit konnten sich Fachgeschäfte insbesondere durch persönliche Beratung profilieren. Inzwischen bietet der Online-Kanal vergleichbare Angebote auf einem zumeist niedrigeren Preisniveau. Kunden können Produktinformationen und Preise jederzeit und von jedem Ort über mobile Endgeräte abrufen und vergleichen. Ebenso findet die individuelle Beratung über den Online-Kanal statt: Kunden erhalten zum einen individuelle Empfehlungen und Angebote durch die händlerseitige Analyse kundenbezogener Informationen. Zum anderen interagieren

Kunden über digitale Kanäle mit Beratern der Online-Händler sowie über soziale Medien mit anderen Kunden mit ähnlichen Interessen. Am Kundentrend des Research Shoppings zeigt sich ferner, dass Kunden während ihres Informations- und Kaufprozesses nicht auf einen bestimmten Kanal oder Händler angewiesen sind (Gensler u. a., 2017). Stattdessen kombinieren sie verschiedene Kanäle miteinander, um von den Vorteilen des Offline- und des Online-Kanals zugleich zu profitieren. Dabei ist es aus Kundensicht irrelevant, ob die Kanäle durch denselben Händler bereitgestellt werden. Beim Showrooming informieren sich die Kunden vor Ort im Ladenlokal über ein Produkt, kaufen dieses aber online. Beim Webrooming gehen die Kunden den entgegengesetzten Weg (Gensler u. a., 2017). Diese Beispiele zeigen, wie der Online-Handel und die Nutzung digitaler Technologien das Verhalten und die Erwartungshaltung der Kunden nachhaltig verändert haben. Trotz dieser deutlich veränderten Erwartungshaltung bietet der stationäre Einzelhandel immer noch Vorteile im Sinne einer relativen Attraktivität gegenüber dem Online-Handel, die von den Kunden als Mehrwert wahrgenommen werden. Hierzu zählen bspw. soziale Interaktion, gewöhnlich sofortige Verfügbarkeit der Ware, Datensicherheit (Kunde kann anonym bleiben), Unterhaltung (multisensuale Sinnesansprache) und die persönliche Sicherheit (Vor-Ort-Begutachtung) (Heinemann, 2011; Schobesberger, 2007).

Der innerstädtische Einzelhandel muss auf die gestiegene Erwartungshaltung der Kunden reagieren und neuartigen Nutzen für die Kunden stiften. In diesem Zusammenhang nennt die Literatur die Schaffung von *Einkaufserlebnissen* als Möglichkeit, um sich vom Wettbewerb abzugrenzen (Leischnig u. a., 2012). Da traditionelle Fachgeschäfte häufig nicht mit den Preisen des Online-Handels konkurrieren können, liegt ein strategischer Fokus auf erlebnisbezogene Faktoren nah. Ein Ansatz besteht darin, die durch den Online-Handel geprägten Kundentrends auf Ihre Eignung für den innerstädtischen Einzelhandel zu prüfen, und weitergehende neue Konzepte zu entwickeln, wie digitale Interaktion den innerstädtischen Einzelhandel beleben kann. Digitale Technologien, die bereits Einzug in den Alltag der Kunden gehalten haben, können aufgegriffen werden und in die physische Umgebung der Ladengeschäfte integriert werden, um die Händler-Kunden-Schnittstelle zu stärken und darüber digitale Einkaufserlebnisse zu ermöglichen. Dies erfordert die Integration des Online- und Offline-Kanals. Hierbei lassen sich zwei Arten der Integration unterscheiden (Herhausen u. a., 2015): (1) Der Kunde hat im Ladenlokal Zugriff auf das Online-Angebot des Händlers, um Produktinformationen einzusehen und di-

gitale Dienste zu nutzen. (2) Der Kunde kann sich über den Online-Kanal über das physische Geschäft informieren und beispielsweise Öffnungszeiten, Produktverfügbarkeit oder aktuelle Angebote einsehen. Weitere Services umfassen die Abholung online bestellter Ware im Geschäft sowie die Bestellung von Ware im Geschäft zur Lieferung nach Hause. Der Kunde kombiniert einzelne Kundenkontaktpunkte nach seinen Bedürfnissen entlang des Kaufentscheidungsprozesses beliebig miteinander. Das kundenseitige Einkaufserlebnis erstreckt sich somit über die Grenze zwischen Online- und Offline-Welt.

Großfilialisten greifen diese Kundentrends bereits in Omnichannel-Strategien auf und integrieren neue digitale Kontaktpunkte wie Smartphone Apps in ihre Geschäftsmodelle. Die Umsetzung und der Betrieb solcher Lösungen sind kosten- und ressourcenintensiv und bedürfen technischen Fachwissens. Angesichts abnehmender Marktanteile und fehlender technischer Expertise bedeutet die Umsetzung digitaler Strategien für den kleinen und mittelständischen Einzelhandel eine große Herausforderung (Bollweg u. a., 2016). Wie kann der einzelne Händler die Vielzahl möglicher digitaler Technologien bewerten, auswählen und einführen, um dem Kunden passgenaue digitale Schnittstellen anzubieten? Es ergibt sich die Annahme, dass das individuelle Fachgeschäft nicht mit dem Online-Handel und den digitalen Initiativen der Großfilialisten konkurrieren kann.

Wir sind der Auffassung, dass die mittelständischen innerstädtischen Händler, die vielerorts bereits in lokalen Interessengemeinschaften und Verbänden organisiert sind, auch bei der Einführung digitaler Technologien zusammenarbeiten sollten. Eine koordinierte Gestaltung kann digitale Einkaufserlebnisse über die Grenzen des einzelnen Händlers hinweg ermöglichen und sich damit von den Lösungen der Großfilialisten abheben, die auf die jeweilige Kette begrenzt sind. Bestehende händlerübergreifende digitale Initiativen tragen jedoch aus Kundensicht wenig zur Entstehung eines digitalen Einkaufserlebnisses bei, da sie zumeist nur eingeschränkte Funktionalitäten (z. B. digitale Visitenkarten, Coupons, Sonderangebote) anbieten und wenig Interaktion an der Händler-Kunden-Schnittstelle erlauben. Dieser Artikel fokussiert deshalb auf *interaktive händlerübergreifende Lösungen*, die den Innenstadtbesuchern neuartige digitale Einkaufserlebnisse ermöglichen.

6.2 Digitale Technologien für den Einzelhandel

Dem innerstädtischen Einzelhandel stehen eine Vielzahl neuer Technologien zur Auswahl, um Online- und Offline-Kanäle miteinander zu integrieren und digitale Händler-Kunden-Schnittstellen anzubieten. Digitale Technologien unterstützen dabei verschiedene Arten der Interaktion. Bei der klassischen Person-zu-Person-Beratung kann das Verkaufspersonal beispielsweise mit Tablets oder Smartphones ausgestattet werden, um Produkt- und Kundeninformationen einzusehen und somit eine persönliche und umfassende Beratung zu bieten. Ebenso können Kunden über Selbstbedienungssysteme wie Selbstbedienungskassen oder Shopping-Assistenten im Sinne einer Person-zu-Maschine-Interaktion mit den Geräten im Laden interagieren. Neuartig sind Maschine-zu-Maschine-Interaktionen, bei denen das Endgerät des Kunden mit Geräten des Händlers wie Beacons, NFC-Tags oder WLAN kommuniziert. Die Einführung digitaler Händler-Kunden-Schnittstellen umfasst nicht nur die für den Kunden sichtbaren IT-Artefakte wie Tablets im Ladenlokal (Front-Stage-Technologien), sondern auch für den Kunden unsichtbare Hintergrunddienste zur Bereitstellung der benötigten Informationen (Back-Stage-Technologien). Abbildung 6.1 systematisiert digitale Technologien für den Einzelhandel nach ihrer Sichtbarkeit für den Kunden.

Bevor Händler personalisierte digitale Kundenansprachen und Beratungsdienstleistungen anbieten können, müssen Stamm- und Transaktionsdaten wie Produktinformationen und Warenbewegungsdaten mithilfe von Enterprise-Resource-Planning-Systemen (ERP) bzw. Warenwirtschaftssystemen (WWS) erfasst und diese Informationen über Systemgrenzen hinweg integriert werden. Ebenso muss der Händler auf dem Weg zu personalisierten Echtzeitangeboten an allen Kundenkontaktpunkten kanalübergreifend Verhaltensdaten erfassen. Durch die Speicherung von Kundenbeziehungen und Einkaufsverhalten entsteht ein digitales Abbild des Kunden in Customer-Relationship-Management-Systemen (CRM). Zum jetzigen Zeitpunkt verzichten jedoch insbesondere kleine Händler und Fachgeschäfte häufig auf die Nutzung von ERP/WWS- und CRM-Systemen.

Die meisten Kunden im Ladengeschäft bleiben so für den Händler anonym, während sich Kunden in Onlineshops und Smartphone-Apps mithilfe eines Kundenkontos leicht identifizieren lassen. Verfahren des In-Store-Tracking erlauben es zwar, Kundenbewegungen aufzuzeichnen und zumindest teilweise einzelnen Kunden

Abbildung 6.1: Digitale Technologien im Einzelhandel

zuzuordnen. Die Sammlung personenbezogener Verhaltensdaten setzt jedoch das Einverständnis des Kunden und eine datenschutzkonforme Erfassung, Verarbeitung und eventuelle Löschung der Informationen voraus.

Kostenfreie WLAN-Hotspots in der Innenstadt werden von zwei Dritteln der Kunden erwartet (IFH Köln, 2017). Für den Betreiber bietet die Hotspot-Anmeldeseite einen Einstieg zur Identifikation des Kunden und zur Weiterleitung des Kunden auf das eigene digitale Angebot. Darüber hinaus können Kundenfrequenzen und Verweildauer aufgezeichnet werden. So wird das Smartphone des Kunden zu einer zusätzlichen Marketing-Plattform. Das Smartphone bietet jedoch noch weitere Schnittstellen zum Händler. Es kann die Signale von nahegelegenen Bluetooth-Beacons identifizieren und per App gesteuert kontextbezogene Nachrichten anzeigen. Elektronische Preisschilder ermöglichen ferner nicht nur die Umsetzung von Bestpreisgarantien oder automatischen Aktionspreisen für verderbliche Ware, sondern können RFID-Codes anzeigen oder über integrierte NFC-Tags mit den Smartphones der Kunden interagieren. Loyalitätsprogramme bieten eine weitere Möglichkeit, Kundendaten zu erfassen und den Kunden an Kontaktpunkten im Geschäft sowie am Point-of-Sale zu identifizieren.

Die gesammelten Stamm- und Transaktionsdaten des Kunden werden aus den verschiedenen Kanälen zusammengeführt und in Hintergrundprozessen analysiert. Im Idealfall erhält der Kunde über die Kanäle seiner Wahl individualisierte Ansprachen.

Aus Kundensicht stehen hier insbesondere mobile Anwendungen für Smart Devices, großflächige Displays, Interaktion mittels Social Media sowie Selbstbedienungssysteme im Vordergrund. Dem interessierten Leser sei das umfangreiche Verzeichnis digitaler Technologien für den Handel von (Willems u. a., 2017) empfohlen.

Die genannten Technologien können einige Dimensionen eines digitalen Einkaufserlebnisses realisieren. Ungeachtet dessen ergeben sich zwei zentrale Problemstellungen: Zum einen wird die Nutzung der Technologien durch kleine und mittelständische Händler neben den genannten Problemen häufig bereits durch die nur unzureichende Erfassung von Stamm- und Transaktionsdaten sowie die fehlenden organisatorischen Strukturen zur Sammlung von Kundendaten und digitalen Pflege von Kundenbeziehungen verhindert. Zum anderen wird das volle Potential dieser Technologien nicht ausgeschöpft, wenn diese nur von den Filialisten in Isolation genutzt werden. Dann entstehen Datensilos innerhalb der einzelnen Ketten, bei denen nur ein unvollständiges Bild des Kunden erfasst werden kann. Auf Innenstadtebene existieren so in verschiedenen Geschäften fragmentarische Informationen über denselben Kunden. Im gleichen Sinne interagieren die Kunden nur mit den Produkten und anderen Kunden eines einzelnen Händlers. Es entsteht eine „Store-Community“, aber keine Gemeinschaft der Innenstadtbesucher.

Wir vertreten die Auffassung, dass erst, wenn sich die Händler zusammenschließen und die Technologien gemäß den Möglichkeiten des Einzelnen kombinieren und miteinander im Sinne eines händlerübergreifenden Netzwerks integrieren, eine holistische Datenperspektive auf den lokalen Handel und den Innenstadtbesucher entsteht. Diese bildet die Basis für ein innenstadtweites digitales Einkaufserlebnis, dessen basale Eigenschaften im Folgenden beschrieben werden.

6.3 Digitale Einkaufserlebnisse

Einkaufserlebnisse sind in den letzten Jahren sowohl in der Kundenverhaltensforschung als auch als Bestandteil der unternehmerischen Strategie immer stärker in den Fokus gerückt. Das kundenseitige Einkaufserlebnis (eng. Customer Experience) bezeichnet in Anlehnung an Leischnig u. a. (2012) die sensorischen, kognitiven, physischen, affektiven und sozialen Reaktionen eines Kunden auf seine Erfahrungsumwelt, die einen bleibenden Eindruck bei ihm hinterlassen (Leischnig u. a., 2012,

S. 433). Dabei können Einkaufserlebnisse während des Kaufentscheidungsprozesses an allen Kundenkontaktpunkten entstehen, an denen eine Interaktion zwischen Kunde und Händler stattfindet. Aus verschiedenen Interaktionen formt der Kunde dynamisch seine erlebnisbezogenen Erfahrungen, wobei vergangene Interaktionen in die Bewertung zukünftiger Erlebnisse einfließen. Das *digitale* Einkaufserlebnis beschreibt den Teil des Einkaufserlebnisses, der durch die Interaktion mittels digitaler Schnittstellen geschaffen wird. Die in Abbildung 6.1 gezeigten Front-Stage-Technologien bieten neuartige Kontaktpunkte zum Kunden, welche bisherige Kaufentscheidungsprozesse komplementieren oder ganz neue Formen der Interaktion ermöglichen. Beispielhaft kann eine innerstädtische Händlergemeinschaft eine gemeinsame Smartphone App bereitstellen, die über aktuelle Trends informiert, regionale Produkte vorstellt und an strategisch interessanten Punkten das Einscannen von Codes zum Abrufen weiterführender Informationen ermöglicht. Es ergibt sich ein digitales Einkaufserlebnis als Wechselspiel zwischen verschiedenen Kanälen.

Am Beispiel dieser App lassen sich die Dimensionen des Einkaufserlebnisses (Bruhn und Hadwich, 2012) und deren potentielle Realisation beschreiben. Die *sensorische Dimension* umfasst Umweltreize, die über die Sinneswahrnehmung auf den Kunden wirken. Zur Gestaltung der App können optische und klangliche Reize genutzt werden, in der physischen Welt stehen darüber hinaus jedoch auch haptische, geschmackliche und olfaktorische Reize als weitere Gestaltungsparameter zur Verfügung. Möchte sich ein Nutzer beispielsweise über regional produzierten Honig informieren, können ihn hochwertige Abbildungen oder Videos auf positive Weise beeinflussen. Ein Video von Bienen, welche über eine Blumenwiese fliegen, kann zudem durch die Erzeugung von Emotionen und Stimmungen die *affektive Dimension* realisieren. Obendrein kann die multimediale Interaktion das Denken und die Kreativität im Sinne der *kognitiven Dimension* anregen. Die *physische Dimension* bezieht sich auf körperliche Aktivitäten als Reaktion auf die Stimuli, beispielsweise das Aufsuchen eines Marktstands zum Kauf des Honigs. Die *soziale Dimension* bezieht das Umfeld des Kunden mit in die Erfahrung ein und stellt auf ein ausgelöstes Zugehörigkeitsgefühl mit dem Produkt oder anderen Individuen ab. Die bewusste Wahl eines regional produzierten Produkts kann beispielsweise eine Zugehörigkeit mit anderen umweltbewussten Personen auslösen. Ferner könnte der Kunde über die beispielhafte App Erfahrungen mit dem Produkt teilen und umgekehrt durch die Meinung anderer Kunden in seinem Kaufprozess beeinflusst werden.

Ob und auf welche Art digitale Kontaktpunkte die Dimensionen des Einkaufserlebnisses realisieren, ist durch eine hohe kundenseitige Subjektivität geprägt und abhängig von verschiedenen Einflussfaktoren. Diese liegen zum Teil außerhalb der Kontrolle des Händlers, wie zum Beispiel der Kontakt zu anderen Kunden, die demographische und kulturelle Zugehörigkeit, die Persönlichkeit und das soziale Umfeld des Kunden (McColl-Kennedy, Gustafsson u. a., 2015). Am Beispiel der App zeigt sich, dass der Händler zwar die technische Systemqualität (keine Abstürze) und die Aktualität der Informationen sicherstellen kann, zahlreiche externe Einflussfaktoren aber unkontrollierbar sind. Zum einen muss der Kunde bestimmte technischen Kenntnisse mitbringen und die Bereitschaft aufbringen, diesen Kontaktpunkt anzunehmen. Ohne Beteiligung des Kunden kann kein Einkaufserlebnis entstehen. Zum anderen kann die Einbindung kundenseitiger Geräte wie Smartphones ein Risiko bedeuten, wenn zum Beispiel die Rechenkapazität nicht zur Nutzung der App ausreicht oder unzureichender Internetempfang besteht. Diese Probleme können negative Einkaufserlebnisse erzeugen, die der Händler nicht verhindern kann.

Inwiefern ein händlerseitiges Angebot zur Entstehung eines positiv bewerteten Einkaufserlebnisses beiträgt, wird durch den Einkaufserlebniswert beschrieben, wobei ein hedonistischer, symbolischer und funktionaler Einkaufserlebniswert unterschieden werden (Tynan u. a., 2014). Der *hedonistische* Einkaufserlebniswert resultiert aus der positiven Bewertung der durch das Erlebnis ausgelösten Gefühle, entstandenen Beziehungen und bewirkten neuartigen Einsichten. Der *symbolische* Einkaufserlebniswert erfasst die positive Bewertung der durch das Erlebnis ausgelösten sozialen Anerkennung und seiner positiven Folgen für das eigene Selbstbewusstsein. Der *funktionale* Einkaufserlebniswert entsteht durch die positive Bewertung der funktionalen Konsequenzen des Erlebnisses, wie der umfassenden Lösung eines Problems oder Erhöhung der Qualität einer Leistung. Darüber hinaus spiegelt er sich auch darin wieder, inwieweit das Erlebnis zu einer Realisierung von Effizienzvorteilen geführt hat, da zum Beispiel die für eine Problemlösung notwendige Zeit und kognitive Anstrengungen reduziert werden. Insgesamt beinhaltet der Einkaufserlebniswert somit gleichermaßen hedonistische und utilitaristische Bewertungsgrundlagen. Zudem ist die Wirkung des wahrgenommenen Wertes auf (verschiedene) Verhaltensabsichten inzwischen in zahlreichen Studien bestätigt worden (z.B. Graf und Maas, 2008, sowie die dort angegebene Literatur) sodass auch ein positiver Einfluss

des wahrgenommenen Einkaufserlebniswertes auf weitere ökonomisch relevante Verhaltensabsichten angenommen werden kann.

Auf den ersten Blick mag die Bereitstellung digitaler Kontaktpunkte und Interaktionsmöglichkeiten so erscheinen, als ob der Händler ein Erlebnis für den Kunden gestaltet und vorbereitet hat, welches dieser nur abzurufen braucht. Im Sinne der Service-dominanten Logik (Vargo und Lusch, 2008) ist die händlerseitige Bereitstellung von Interaktionsmöglichkeiten jedoch vielmehr als Nutzenversprechen zu verstehen, welches der Kunde als aktiver Mitgestalter (Ko-Kreator) des Einkaufserlebnisses annehmen kann. Die Entstehung des kundenseitigen Einkaufserlebnisses ist ein individueller Prozess, der durch den Kontext des Kunden und die Interaktion mit seinem umliegenden Ökosystem geprägt wird (McColl-Kennedy, Cheung u. a., 2015). Der Kunde nutzt händlerseitige Ressourcen wie eine solche Smartphone-App oder eine individuelle Beratung in Kombination mit eigenen Ressourcen wie dem Smartphone, um das individuelle Einkaufserlebnis im Sinne der Ko-Kreation aktiv zu gestalten. Somit sind digitale Kontaktpunkte als Hilfsmittel zu sehen, durch welches Händler und Kunden miteinander interagieren und durch welche der Händler aktiv an der kundenseitigen Erlebnisgestaltung mitwirken kann. Das digitale Einkaufserlebnis wird somit einerseits durch die Interaktion mit dem Händler und dessen Technologien und anderseits durch vielfältige äußere Einflüsse des persönlichen Umfelds geprägt.

Aus Sicht des Händlers bieten digitale Kontaktpunkte aber nicht nur eine Grundlage für die potentielle Realisierung der verschiedenen Erlebnisdimensionen, sondern bieten zudem neue Ausgangspunkte zur Kontaktanbahnung und Intensivierung des Kundenkontakts. Durch die digitale Präsenz kann der Kunde auf den Händler aufmerksam werden und dann entscheiden, ob und über welchen Kontaktpunkt er mit diesem digital oder in der physischen Welt interagieren möchte. In besonderem Maße relevant ist die beschriebene Erfassung des Kundenkontexts und des Kundenverhaltens. Hierzu stellen digitale Technologien ein wertvolles Mittel dar, um individuell auf Kundenbedürfnisse einzugehen, das Einkaufserlebnis vor und im Ladengeschäft zu verbessern und insbesondere um Kunden mehr Freiheit bei der Wahl der Kontaktpunkte zu geben.

6.4 Der innerstädtische Marktplatz als mobile Plattform

Es ergeben sich vielfältige Möglichkeiten, die Dimensionen des digitalen Einkaufserlebnisses anzusprechen. Im Folgenden skizzieren wir einen möglichen Gestaltungsansatz einer händler- und kundenübergreifenden mobilen Plattform, die neue digitale Technologien einbindet und die traditionellen Stärken der Fachgeschäfte wie die persönliche Beratung und das Erleben der Produkte vor Ort um neuartige und ergänzende digitale Dienstleistungen erweitert. Diese Plattform steht dem physischen innerstädtischen Marktplatz als digitaler Kompagnon zur Seite. Es ergeben sich drei virtuelle „Sphären der Betrachtung“ (Grönroos und Voima, 2013): (1) Die Sphäre der Händler, in welcher durch digitale Technologien Schnittstellen zum Kunden bereitgestellt werden. (2) Die gemeinsame Sphäre, in der Händler und Kunden direkt miteinander interagieren und in Ko-Kreation gemeinsamen Nutzen generieren und (3) die Sphäre der Kunden, in welcher der Händler keinerlei Einfluss auf die kundenseitige Wertschöpfung hat. Der Fokus der Plattform liegt auf der Auswertung der gemeinsamen Sphäre und der Ko-Kreation des Einkaufserlebnisses, denn durch die Interaktion erhält der Händler die Möglichkeit, aktiv zur Entstehung eines positiven kundenseitigen Einkaufserlebniswertes beizutragen. Abbildung 6.2 zeigt die Betrachtungssphären.

Die mobile Plattform sowie die dazugehörige App werden multilateral konzipiert, d.h. es wird die direkte Interaktion zwischen zwei oder mehreren Akteuren ermöglicht, wobei jeder Akteur Mitglied der Plattform sein muss. Die Bereitstellung und der Betrieb der Plattform und App erfolgen durch einen Dritten als Intermediär. Dies könnte z.B. eine lokale Werbegemeinschaft sein, wie sie in vielen Innenstädten gegründet wurde, um den lokalen Einzelhandel zu vernetzen und zu repräsentieren.

Kunden bringen ihre Smart Devices und ihren Kontext als Ressourcen in die Wertschöpfung ein, während Händler Stamm- und Transaktionsdaten bereitstellen. Sowohl aus Händler- als auch aus Kundensicht ergeben sich mehrere funktionale Ausbaustufen, abhängig von den technischen Möglichkeiten des Händlers und der Zustimmung des Kunden zur Sammlung verhaltensbezogener Daten.

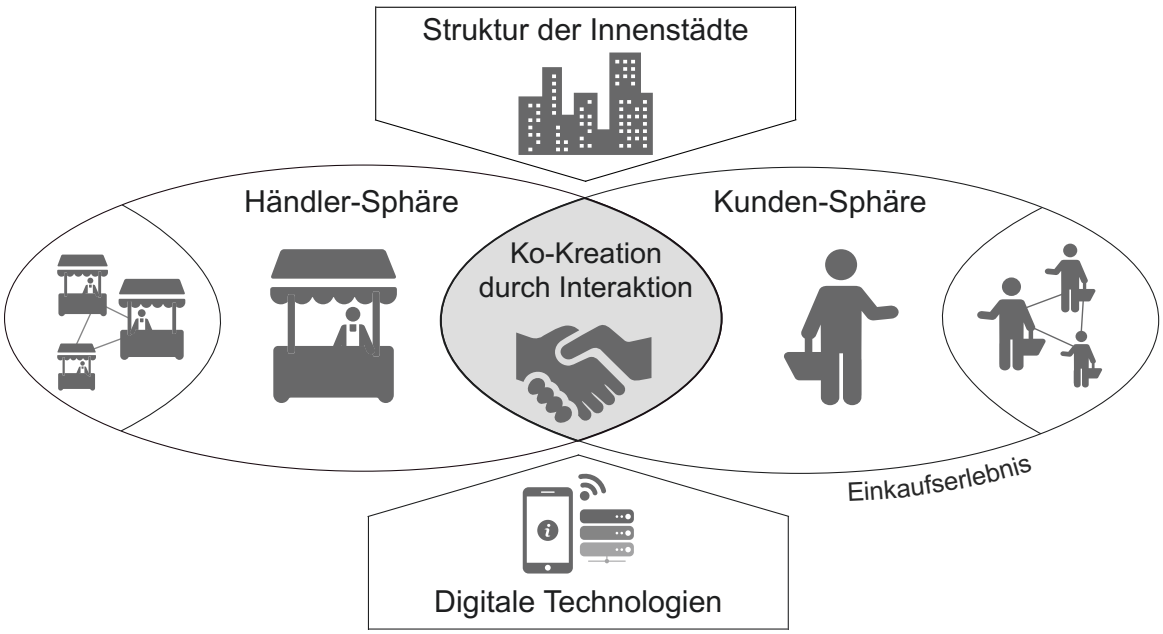

Abbildung 6.2: Betrachtungssphären eines innerstädtischen Marktplatzes als mobile Plattform

Als Basisfunktionalität stellen Händler manuell Inhalte auf der Plattform ein, d.h. sie pflegen Stammdaten wie Name, Beschreibung, Öffnungszeiten, Adresse, Fotos, Kontaktmöglichkeiten und Aktionsangebote. Ähnlich eines digitalen Stadtführers können sich Kunden mithilfe der App über Geschäfte in ihrer Umgebung informieren, sich zu diesen navigieren lassen, diese bewerten und Kommentare zu den Geschäften und Aktionsangeboten hinterlassen. Hierbei sind die technischen Anforderungen an den Händler niedrig. Dennoch kann bereits ein positiver funktionaler Einkaufserlebniswert geschaffen werden. Es entsteht eine Community der Innenstadtbesucher, bei der sich diese untereinander Empfehlungen aussprechen. Wenn ein Kunde beispielsweise vom regionalen Honig eines Markthändlers begeistert ist, nimmt er ein Foto des Honigs auf und teilt dieses Foto mit der Community. Basierend auf der Idee des Social Sharing teilen Kunden ihre Erfahrungen bildlich in der App, verlinken diese mit Händlern und versehen diese mit Schlagworten. Aus den gesammelten Fotos wird fortlaufend eine virtuelle Pinnwand des direkten innerstädtischen Umfelds erzeugt. Ferner können Kunden über die Plattform Direktnachrichten an die beteiligten Händler verschicken.

Als weitere Ausbaustufe binden Händler, die über ERP-Systeme bzw. WWS verfügen, diese über eine Schnittstelle an die Plattform an, um Zugriff auf Artikel- und Kundenstammdaten zu schaffen. Kunden können die Produkte über die App ein-

sehen und diese für die kurzfristige Abholung reservieren. Für die Aktualität und Qualität der Artikel- und Händlerinformationen ist trotz der Schnittstellenanbindung der jeweilige Händler verantwortlich. Der Intermediär steht hingegen hauptsächlich als fachlicher und technologischer Berater zur Seite. Er trägt dafür Sorge, den Händlern den Einstieg in die mobile Plattform durch Schulungen und direkte Unterstützung im Problemfall zu erleichtern. Neben der Plattform bietet der Intermediär zudem als hybrides Leistungsbündel vorkonfigurierte Beacons zur Nutzung an. Händler benötigen keine technischen Vorkenntnisse, denn die Beacons müssen nur an strategischen Punkten wie Eingängen oder Aktionsflächen angebracht und der genaue Standort über die Plattform zugewiesen werden. Sobald ein Kunde in den Signalbereich des Beacons eintritt, werden vordefinierte Aktionen in der App ausgelöst. Händler legen hierzu über eine intuitive Oberfläche Interaktionsregeln (Ereignis-Bedingung-Aktion) nach dem „Wenn dies, tue das“-Schema fest. *Ereignisse* umfassen standortbezogene Faktoren wie das Betreten eines bestimmten Bereichs, zeitbezogene Faktoren wie eine bestimmte Tageszeit oder die Aufenthaltsdauer im Geschäft sowie das Scannen von QR-Codes, welche Händler über die Plattform erzeugen können. Im Gegensatz zu Beacons, welche automatisch mit dem Smartphone kommunizieren, muss der Kunde aktiv den jeweiligen QR-Code scannen. *Bedingungen* steuern die Interaktionsregeln nach kontextuellen Faktoren wie der Wetterlage oder den Präferenzen des Kunden. *Aktionen* umfassen die allgemeine oder individuelle Ansprache des Kunden per Nachricht sowie die Weiterleitung auf vordefinierte Elemente wie Angebote innerhalb der App. Zudem dient die App als Navigationshilfe. Anhand des GPS-Signals werden Kunden durch die Innenstadt geleitet. Durch Ortung des Beacon-Signals können Kunden auch innerhalb der Geschäfte zu interessanten Punkten geführt werden.

Bevor Kunden individuell angesprochen werden können, müssen diese in die Speicherung und Analyse verhaltensbezogener Daten einwilligen. Ohne Freigabe erhält der Kunde nur allgemeine Inhalte aus seiner Umgebung. Andernfalls wird aufgezeichnet, mit welchen Händlern der Kunde interagiert hat und für welche Produkte er sich interessiert. Dazu werden innerhalb der Innenstadt über Beacons und innenstadtweites WLAN Bewegungsdaten über besuchte Geschäfte und Verweildauern erfasst. Anhand der vergleichenden Analyse des Verhaltens anderer Kunden kann die Relevanz einzelner Händler, Produkte und Angebote für den jeweiligen Kunden identifiziert werden. Somit findet eine für den Kunden unsichtbare, indirekte Interaktion mit anderen Kunden statt. Die Erfassung und Auswertung dieser

Daten geschieht im Hintergrund, sodass die analytische Komplexität vor den Kunden und Händlern verborgen bleibt. Die Händler erhalten vereinfachte Kennzahlen wie die kontextuelle Relevanz oder die Wiederbesuchsrate des Kunden, welche sie dazu befähigen, Kundenverhalten zu verstehen und durch Ableitung konkreter Maßnahmen angemessen darauf zu reagieren. Beispielsweise können häufig wiederkehrenden Kunden beim Betreten des Geschäfts individuelle Angebote und Preisnachlässe unterbreitet werden. Ferner können Kunden Willkommensangebote für bisher nicht besuchte aber als relevant ermittelte Geschäfte in der Umgebung unterbreitet werden. Mit der Zeit verbessert sich die Qualität der Verhaltensanalyse durch Informationen darüber, welche individuellen Nachrichten aufgerufen und welche individuellen Angebote tatsächlich eingelöst werden. Zu guter Letzt können Händler kooperativ Cross-Promotionen anlegen. Hierbei werden Kunden, die mit dem einen Händler interagiert haben, Angebote des anderen Händlers unterbreitet und vice versa. Fasst man den Funktionsumfang des digitalen Marktplatzes zusammen, werden sowohl Kunden als auch Händler zu Informationsproduzenten und -konsumenten im Sinne der Ko-Kreation.

6.5 Zusammenfassung und Ausblick

Dieser Beitrag diskutiert ein abstraktes Konzept für einen digitalen Marktplatz, welcher es kleinen und mittelständischen Händlern gemeinsam erlaubt, neue digitale Technologien einzusetzen, um die Kundeninteraktion weiterzuentwickeln. Das Ziel für die Händler: Die Kundenkommunikation soll auf zusätzliche Kanäle ausgedehnt und ein unmittelbarer Kundenzugang über digitale Kanäle langfristig gesichert werden. Darüber hinaus ermöglicht die Auswertung kundenbezogener Daten die Identifikation händlerübergreifender Bewegungsströme und Verhaltensweisen, aus denen sich Gestaltungsempfehlungen für Händler und Städteplaner ableiten lassen.

Auf dem Weg zur Umsetzung eines solchen digitalen Marktplatzes müssen zahlreiche ökonomische und technologische Fragestellungen untersucht werden. Ökonomische Studien können beleuchten, inwiefern die Ko-Kreation von digitalen Einkaufserlebnissen tatsächlich zu einem hohen kundeseitig wahrgenommenen Einkaufserlebniswert führt. Ferner ist zu analysieren, in welchem Ausmaß der Einkaufserlebniswert weitere ökonomisch relevante Verhaltensabsichten wie Kauf- und Zah-

lungsbereitschaft beeinflusst. Darüber hinaus benötigt der Marktplatz ein Geschäftsmodell zur Deckung der Kosten von Entwicklung und laufendem Betrieb. Neben direkten Gebühren für teilnehmende Händler ergeben sich potentielle Einnahmequellen aus Beratungs- und Schulungsleistungen sowie den zusätzlichen Zahlungsbereitschaften und dem Verkauf anonymisierter Bewegungsdaten. Aus einer technologischen Perspektive ist eine Bewertung verschiedener Technologiekomponenten und Gestaltungsparameter im Hinblick auf die funktionale Eignung erforderlich. Alternative Komponenten unterscheiden sich hinsichtlich des Funktionsumfangs, der Kosten und der Kompatibilität mit der Gesamtarchitektur. Dieser funktionalen Betrachtung muss eine Kundenakzeptanzanalyse zur Seite gestellt werden. Eine Vernetzungsperspektive würdigt, dass es sich bei dem digitalen Marktplatz um ein hochgradig kooperatives Szenario handelt, welches die Zusammenarbeit vieler lokaler Akteure erfordert. Der Ansatz lebt von der Anzahl der beteiligten Händler und Kunden sowie der Anbindung an eine „innerstädtische Dateninfrastruktur“, welche komplexe Fragen hinsichtlich der Machbarkeit aufwirft. Neben der direkten Unterstützung durch den Intermediär bedarf es zentraler lokaler Ansprechpartner, die durch innerstädtische Organe wie dem Stadtmarketing, Werbegemeinschaften oder Verbände gestellt werden und die Lösung gegenüber Händlern und Kunden vermarkten. Zuletzt ist der digitale Marktplatz nicht in sich abgeschlossen, sondern sollte mit bestehenden Ökosystemen des Handels sowie der Internetwirtschaft vernetzt werden.

Trotz vielfältiger Herausforderungen sind wir der Auffassung, dass der digitale innerstädtische Marktplatz realisiert werden und Beiträge dazu leisten kann, ein digitales Einkaufserlebnis zur Stütze der gesellschaftlich geschätzten, aber durch den Online-Handel herausgeforderten, „Einkaufserlebnis Innenstadt“ zu generieren.

Danksagung

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7 New Service Development Through Action Design Research in Joint Research Projects

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New Service Development through Action Design Research in Joint Research Projects

Abstract. Information systems research on smart services receives numerous contributions that result from joint research projects. Such projects bring together researchers from academia and industry; both conducting applied research while developing marketable services. This paper contributes a conceptual meta-framework, which represents and describes joint research projects in service research based on the integration of previous conceptualizations. It combines the service marketing perspective of new service development (NSD) with the industry-academic collaboration perspective of action design research (ADR). The framework provides the entire IS community with a better understanding how joint research projects are conducted. Researchers that work in such projects can adopt the framework concepts and organize their projects accordingly. To demonstrate the framework's application, we use the case of the development of a smart service in electric vehicle domain.

7.1 Introduction

National and international research funding includes funding instruments that are accessible only to joint consortium projects comprising partners from both academia and industry. In recent years, the development of new services in the context of such consortium projects has been a focal theme not only on the funding policy agenda of the European Union, but also on national agendas. For instance, the German Federal Ministry of Education and Research (BMBF) has set up the research program "Innovations for Manufacturing, Service, and Work" to fund joint research

projects by the year 2020 with a cumulative budget of one Billion Euro. The goals set out in the program description are representative for the entire class of funding instruments: First, "... applicable solutions shall be found, in order to maintain and generate jobs in Germany". This implies a mandatory dissemination of research outcomes into practice. Second, projects shall demonstrate their support in achieving political objectives based on a set of social, economic, and environmental goals.[54]

A service researcher who aims at receiving funding, typically adopts the following process: In response to a more specific "call" within a program, the researcher develops an outline that addresses the goals described in the call and forms a consortium with suitable partners from academia and industry. The funding institution's main evaluation criterion is the chance of a market success of the project's desired outcomes and its expected contributions to societal and political goals. In case of acceptance, the consortium refines the outline into a full proposal that requires final approval from the financier.

Peffers et al. (2007) and Hevner et al. (2004) are examples that describe how IT-based solutions for observed organizational problems can result from Information Systems (IS) research. The authors coined the term Design Science Research (DSR) for this approach. Joint research projects have peculiarities that are not yet addressed by the common processes in applied IS research such as DSR. For example, the contents of the call restrict the researcher in the set of addressable phenomena. Second, academic researchers must partner with industrial researchers and vice versa. Academia and industry have different strategies and points of view towards writing a proposal and conducting a joint research project. While academia takes a design-oriented perspective towards creating knowledge, industry takes a market-oriented perspective towards gaining economic benefit. The research process is embedded in an organizational context that emerges from the interactions of the academic researchers with industrial partners, funding agencies, public authorities, and other stakeholders. Each stakeholder maintains its individual set of goals towards the joint research project and its results.

These peculiarities lead to difficulties for IS researchers who participate in joint research projects and want to report research results to the IS community. It also represents a challenge for inexperienced IS researchers who do not know about joint

[54] https://www.bmbf.de/de/innovationen-fuer-die-produktion-dienstleistung-und-arbeit-von-morgen-599.html

research projects, but want to reuse results from joint projects or have to review academic manuscripts, which have been produced in the context of such projects. Difficulties also emerge for practitioners who either participate in joint research projects or plan to do so while having a limited understanding of such projects' structures.

Against this background, this paper addresses the following guiding research question: *What are the core concepts of joint research projects in service research?* We set four objectives for this paper. First, we aim at supporting researchers and practitioners in joint research projects to better communicate the specifics of their research processes and research outcomes. Second, we want inexperienced researchers and practitioners to understand the joint research processes and its outcomes better. Our third objective is to provide an instrument that can be used for structuring and formulating both research proposals and overarching research manuscripts such as dissertation projects. The last objective is to demonstrate how the developed instrument can guide and support the development of an actual smart service in the electric vehicle (EV) domain.

We conduct conceptual research and construct a meta-framework that helps to represent and describe the development of marketable services in joint research projects. Our framework adds to the long-standing tradition of industry-academic collaboration in the IS community. It provides a descriptive lens to various industry-academic collaboration settings such as consortium research projects (Österle and Otto, 2010) and engaged scholarships (Schubert et al., 2015). We first depict the specific sets of stakeholders and goals in joint projects and then tap into two principal sources for the theoretical underpinning of our meta-framework: new service development (NSD) (Johnson et al., 2000; Jin et al., 2014) and action design research (ADR) (Sein et al., 2011). NSD maintains a service marketing perspective, as required to address the funding institutions' goal to create services that meet market needs. We will extend its perspective to account for a more diverse set of stakeholders. ADR allows for an engineering-like perspective on the development of IT-enabled services. It captures the iterative development of the business processes, data structures, IT systems, and their interactions within an organizational setting. The meta-framework synthesizes both theoretical perspectives while taking into account the specific sets of stakeholders and goals in the complex joint research project environment.

This paper unfolds as follows. The next section discusses the specific characteristics of project stakeholders and project goals in joint research projects, and describes NSD and ADR as constituents of the framework. Based on this, we present the resulting meta-framework. We then introduce the case of the joint research project *CrowdStrom*, where a smart service is currently being developed. In the next section, we illustrate our framework's utility through its application in the CrowdStrom example. We subsequently review the contributions of our work and discuss possible implications, limitations, and directions for future research. The paper concludes with a summary.

7.2 Research Background

7.2.1 Stakeholders and Goals in Joint Research Projects

Funding institutions praise joint research projects as a mechanism to promote research initiatives of great *societal relevance* (German Federal Ministry of Education and Research, 2014, p. 49). The call for *relevant* research implies the questions, "Relevant to whom?" (Kuechler and Vaishnavi, 2011, p. 126) and "Relevant in what way?". The second question reflects expectations of different stakeholder groups that are associated with a joint research project.

IS research projects address various groups of *stakeholders*. Gill and Bhattacherjee (2009) identified *internal* clients (other researchers of the community) and *external* clients (researchers from other communities) that the IS research community is primarily focusing on. Practitioners such as industry/academic collaborators and consultants are external clients that receive less consideration. This is why IS research has been criticized for deficient practical relevance (Winter, 2008; Mathiassen and Nielsen, 2008). Against this backdrop, DSR has been described as one exemplary way to develop research outcomes that are both scientifically rigorous and relevant to practitioners (Gregor and Hevner, 2013; Österle et al., 2011). Therefore, the research outcomes in DSR projects must demonstrate their practical relevance and yield specific utility for real business problems that can be exactly specified. Researchers who adopt the DSR paradigm hence often partner with industry (Schubert et al., 2015; Österle and Otto, 2010).

Politicians, funding institutions, and project management agencies are stakeholders specific to joint research projects. The former set goals that govern the formulation of funding agendas and programs (German Federal Ministry of Education and Research, 2014). This process may include the participation of social groups, governmental and non-governmental organizations. Their perspective includes not only an economic but also a broader societal relevance of research outcomes. Funding institutions and project management agencies, which are commissioned with the development of agendas and programs, translate these goals into objectives that make up specific calls for research proposals. The objectives are the primary selection criterion for these proposals and for evaluating a project's success. In this way, funding institutions and project management agencies link politicians, social groups, and research projects.

Each external stakeholder maintains different *goals* and needs towards the joint project, from which we distinguish political goals, societal goals, and research needs (Benner and Sandström, 2000). *Societal goals* refer to desired social, environmental and economic results (Porter and Kramer, 2006). For example, the IS community has recently been conducting research on the environmental sustainability of information systems (Malhotra et al., 2013). *Political goals* result from the perception and (possible interest-based) interpretation of societal goals. This interpretation may happen in interactive processes with social groups. *Research needs* emerge from prior research within and across communities and often are induced by technological trends. The IS community has discussed its "grand challenges" in manifestos (Österle et al., 2011), research agendas (Becker et al., 2015), and research priority lists (Ostrom et al., 2015).

Proposal development demarcates the interpretation and implementation of the external goal system by the newly-formed project consortium. *Research goals* summarize the research objectives and research questions addressed by the involved researchers. *Business goals* addressed by the involved practitioners span from strategy-driven plans, such as developing new technologies, services or markets over increasing operational efficiency or profit, to innovation and sense-making processes. Table 7.1 summarizes the main concepts related to stakeholders and goals in joint research projects.

Project Relation	Goal	Content
external to ...	research needs	hot-spots, blind-spots, grand challenges, research priority lists
	societal goals	social, environmental, and economic results
	political goals	societal goals as perceived and interpreted based on interests
internal to ...	research goals	research objectives, research questions
	business goals	profit, innovation, operational efficiency

Table 7.1: Dimensions for Proposal Evaluation and Expected Contributions

7.2.2 New Service Development

NSD is a "normative" process (Johnson et al., 2000) that supports both service researchers and practitioners along its main stages of designing, analyzing, developing, and introducing new services into the market (Roth, 2015). The market-oriented view of NSD accounts for the complex socio-technical nature of a service system (Böhmann et al., 2014; Spohrer et al., 2007), that is the interplay of actors and resources towards co-creating value (Vargo and Lusch, 2017).

NSD processes are sufficiently generic that their stages and activities apply to any service development project. However, firms have to make project-specific adaptations of the generic NSD process (Zeithaml et al., 2017) and may or may not use certain methods and tools to approach the related activities (Jin et al., 2014). A development project can return to earlier stages if later planning and development activities require adapting the service concept, and any activity can result in termination of the project if it reveals that the project is not viable. The NSD process acts as funnel for raw ideas for new service offerings that are refined and filtered out over the course of the process. In the last stages, only the most promising ideas survive and are introduced into the market.

Starting with the *Design* stage, business objectives and an overall strategy for the new service offering are defined (Scheuing and Johnson, 1989). Subsequently, many fitting ideas are generated, filtered by their viability and economic feasibility (Zeithaml et al., 2017), and then expanded into service concepts, including information on the required service system and the customers' needs that the ideas fulfill (Kim and Yoon, 2014). *Analysis* encompasses all activities required to formulate a business plan, that is, conducting at least a complete market assessment and setting up a financial plan (Scheuing and Johnson, 1989). These documents are then used to

gain project authorization from top management. The *Development* stage comprises the actual transformation of the service concept into a marketable service. In the *Full Launch* stage, the new service is introduced to the entire market. Feedback from early adopters and ongoing reviews of the service performance against the service objectives are used to modify and improve the service offering (Storey and Kelly, 2001; Johnson et al., 2000).

7.2.3 Action Design Research

action research (AR), has become an established research method in the IS discipline that aims at solving problems in an organizational setting while creating scientific knowledge at the same time (Susman and Evered, 1978). The underlying credo of AR is to examine the human organization and its processes, being a complex socio-technical system, as a whole within its original environment (Baskerville, 1999). DSR, another prominent research methodology in IS, focuses on building and evaluating innovative IT artifacts that address important issues in organizations (Hevner et al., 2004). Apart from implementations, DSR generates design knowledge in form of constructs, models, and methods (March and Smith, 1995). The relationship between AR and DSR has been controversy discussed (e.g. by Iivari and Venable, 2009; Loebbecke and Powell, 2009; Järvinen, 2007; Becker et al., 2013). Sein et al. (2011) criticize the sequential structure of DSR, in which evaluation activities in organizational contexts are separated from the actual creation of the artifact. In line with the concept of AR, the authors stress that "artifacts emerge in interaction with organizational elements" (Sein et al., 2011, p. 38) and position ADR as new design research method that combines the best from AR and DSR. ADR focuses on the building, intervention, and evaluation of an artifact while taking into account theoretical perspectives as well as influences from the organization's environment (Sein et al., 2011).

The ADR method, comprises the four stages of *Problem Formulation (1)*, *Building, Intervention, and Evaluation (2)*, *Reflection and Learning (3)*, and *Formalization of Learning (4)* (Sein et al., 2011). During the *Problem Formulation* stage, the organizational problem is identified and articulated. Determining the scope of the project and the practitioners' participation as well as agreeing upon research goals set common ground for future collaboration between researchers and practitioners. Based on the results from stage one, the actual IT artifact is designed in an iterative process of

Building, *Intervention* in the organization and a continuous *Evaluation* (BIE). Parallel to the first two stages the researcher performs continuous *Reflection and Learning*, to gain knowledge that can be applied to a broader class of problems. In stage four, the project specific learning is further developed into a formalized learning, which constitutes a general solution concept for a class of problems and can be characterized as design principles (Van Aken, 2004; Sein et al., 2011).

7.3 NSD Through ADR in Joint Research Projects

We now synthesize the theoretical perspectives of NSD and ADR while taking into account the specific sets of stakeholders and goal systems in the joint research project environment. We apply the lens of meta-framework development, which is a "conceptual method for building theory based on the integration of previous frameworks" (Beverungen, 2014, p. 191). Figure 7.1 exhibits "NSD through ADR in joint research projects"—a *meta-framework*, which is the main outcome of our work. This meta-framework ought to serve as an instrument for the development of research proposals and research manuscripts spanning the individual constituents of the envisioned research project.

Our meta-framework provides means to represent and describe all stages of conducting joint service research projects, from proposal development to dissemination. Each set of concepts relates to one subsection of this paper's background section. ADR provides us with an engineering perspective that integrates all building, intervention, and evaluation activities within the organizational context of the joint research project. The method realizes the actual development of the artifact, including all types of collaboration between academia and practice. NSD accounts for an overarching market-oriented perspective that focuses on business model considerations with regard to the service system, actors and their interactions, revenue streams, value co-creation, resources and activities, and other aspects. By integrating both perspectives, the meta-framework supports the different stakeholders in integrating their goals into the service system.

The left box of the meta-framework represents the initial project-external goal systems. We distinguish between three different types of such goals stemming from the various stakeholders: *research needs*, *societal goals*, and *political goals*. Research

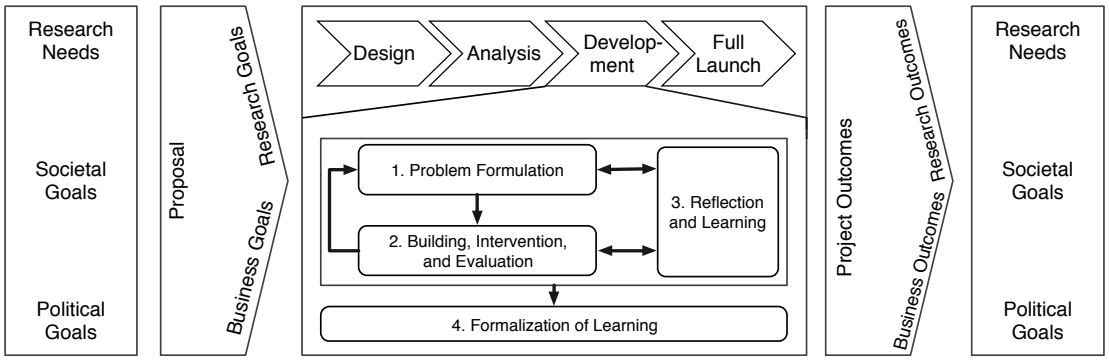


Figure 7.1: New Service Development through Action Design Research in Joint Research Projects

needs depict hot-spots, blind-spots, grand challenges, and priorities identified and formulated by research communities or other academic groups. Societal goals describe desired social, environmental, and economic results of the research. Political goals refer to the interest-based interpretation of societal goals.

The project *proposal* describes the mechanisms by which a project consortium translates project-external goals into project-internal goals. The translation happens with the precept of defining project-internal goals that both match the project-external goals and are compatible with the project members' individual goal systems. They may comprise of *research goals* and *business goals*. The proposal is represented next to the goal system. The complementary concept of *project outcomes* represents the project outcomes' contribution to project-internal goals. These outcomes are a lever for contributing to the initial project-external goals of the project's external stakeholders depicted on the left-hand side. Moreover, joint research projects not only impact existing research needs, societal goals, and political goals. Instead, the project outcomes may reveal new or additional research needs, and highlight new or updated societal and political goals. Consequently, the framework closes with the impact of the project outcomes on the project-external goal system.

The figure's central element depicts the industry-academic collaboration in developing new services. The NSD process (Johnson et al., 2000) as shown in the figure's upper section provides means to structure joint service research projects from early conception to market launch. Goals from the project environment are transferred into business/research goals and finally into a profitable and goal-compliant business model. The development stage is refined applying the ADR stages suggested

by Sein et al. (2011). These stages summarize the researchers' and practitioners' efforts to create all necessary components to get the new service up and running.

7.4 The CrowdStrom Case: a Joint Research Project

CrowdStrom is an ongoing joint research project concerned with the development of a new service in electric mobility domain, which allows individuals to share their privately owned charging points for EVs with other public users. We (the authors) participate as academic research partners in the project. This section gives an overview of the CrowdStrom project, which will subsequently serve as a case of our framework's application.

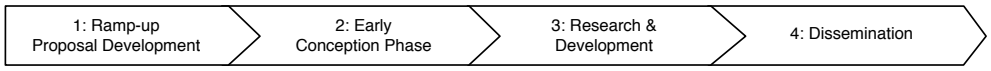


Figure 7.2: Project Steps

The joint research project's course of action can be divided into four steps, as indicated by Figure 7.2 and by the following subsections. The case description is based on the project documentation, research diaries, notes from weekly team meetings that reflect the project's progress, and notes from focus group meetings. The latter bring together members from the different research projects within the same funding program to exchange ideas, discuss common issues, and transfer gained knowledge. Discussions with project partners and the project management agency serve as additional sources of information.

7.4.1 Step 1: Ramp-up and Proposal Development

In 2012, the BMBF publishes the call "Service Innovations for Electric Mobility" to fund service science research in the e-mobility domain. In response, service researchers address the call while taking into account the political goals (e.g., "having one million EVs on German roads by the year 2020" and "Germany to become technology leader in the e-mobility domain") as well as related societal goals (e.g., climate protection, urban challenges) expressed therein. As part of the CrowdStrom project application, a joint consortium including a local utility that operates charging points and a technical services corporation that functions as certifying body for

IT systems is formed. Information systems, marketing, and human resource management researchers complete the consortium. Together, the consortium members transfer and categorize the political and societal goals – in view of the general research needs of their disciplines – into project members' business goals and research goals.

The consortium wants to support the diffusion of EVs by mitigating a main barrier to customer adoption of EVs, that is the lack of a well-developed public charging infrastructure (Rezvani et al., 2015). To achieve a sufficient nation-wide charging infrastructure that can handle the proclaimed 1 Million EVs, Germany requires a total of 950,000 public and non-public charging points by 2020 (Nationale Plattform Elektromobilität, 2016). However, a typical "chicken-and-egg problem" arises, as potential buyers of EVs wait for further development of the infrastructure, and the resulting limited demand for EVs deters investors from developing that infrastructure.

The CrowdStrom project seeks to develop a smart service that encourages the increasing number of private persons as well as small and medium-sized firms to make their charging points available to public users. Utilizing existing idle charging stations mitigates the lack of a sufficient public charging infrastructure and consequently reduces barriers to customer adoption of EVs. The service makes use of context data from peer-users and peer-providers such as locations, technical parameters and status information of EV and charging point to match supply and demand on the platform, as both, the EV as well as the charging point are smart products that can transmit and receive various forms of data (Beverungen et al., 2019).

After the BMBF selected the project outline, the consortium wrote a full proposal that includes the main research & development activities, a project plan, financial details, responsibilities of the consortium members, as well as expected outcomes without final specification of the service characteristics. The full proposal was accepted by the BMBF in December 2012 and the project receives funding for three years starting in 2014.

7.4.2 Step 2: Early Conception Phase

Soon after the full proposal was approved by the BMBF, the consortium formulated ideas for concrete service characteristics by sketching multiple alternatives and eval-

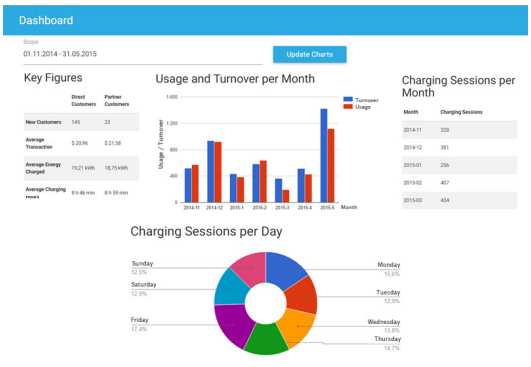
uating them regarding their economic viability. The needs of potential customers, industry partners and researchers are taken into account. Operational objectives are derived from the general objectives, and strategies that are required for reaching these objectives are defined. The consortium decides in favor of a Sharing Economy business model that is similar to business models of successful companies such as Airbnb and Uber (Plenter et al., 2017).

A central service provider acts as an intermediary, who runs a peer-to-peer Internet platform. It connects the private individuals that provide charging stations, the so-called peer-providers with the private individuals that use these charging stations, the so-called peer-users. Peer-providers define prices for charging at their stations and intermediary charges a fee from the peer-users. The technical feasibility of the concept is examined by the local utility and the IS research group. Finally, the project's working structure is derived and thereof responsibilities are distributed.

7.4.3 Step 3: (Actual) Research & Development

Different kinds of processes and IT artifacts have to be created to get the CrowdStrom service up and running. The iteratively developed CrowdStrom prototype comprises a web portal and a mobile application (App) to be used by peer-providers and peer-users, as well as a back-end that encapsulates the business logic and serves data to the client applications (Betzing, von Hoffen, et al., 2017). Figure 7.3 presents the mobile App for peer-users and the dashboard for peer-providers.

(a) CrowdStrom App – View for the Peer-User to Find Charging Points



(b) CrowdStrom Web Portal – View for the Peer-Provider to Access Usage Statistics

Figure 7.3: IT Systems Developed for the CrowdStrom Service

Peer-users take the App or the web portal to search for and reserve charging stations nearby. They can learn about the station's current status, ratings, opening hours, supported charging standards, and supported socket types. When a peer-user reserves a specific charging point, it becomes unavailable for other users for fifteen minutes. Within this time frame, the user has to reach the station, authenticate himself by means of a RFID card that has a unique identifier, and start the charging session. The central back-end system manages all required flows of data and technical processes related to charging the car. Charging stations connected to the back-end are remote-controlled using the *Open Charge Point Protocol* (OCPP) (Schmutzler et al., 2013). This de-facto standard allows CrowdStrom to support most charging stations that are available on the market. Furthermore, peer-providers are provided with statistics and visualizations thereof in a dashboard. These statistics include details about past charging sessions such as the total number of transactions, total kilowatt hours [kWh] served, and distribution of transactions throughout the day and week. Besides usage data and statistics, the web portal enables peer-providers to manage their charging stations, e.g., (de-)active a charging station or adjust opening hours and prices.

This step does not only include the implementation efforts, but also researching service parameters such as the particular pricing model or required provider incentives and provider locations (Plenter et al., 2018), and then integrating them into the service concept and the IT solution.

7.4.4 Step 4: Dissemination

During the dissemination, the project's business and research outcomes are exploited to satisfy the overall goals stated in the project proposal. The consortium currently prepares CrowdStrom's launch, which will be conducted as a phased launch consisting of three stages: First, only charging points from the local utility will be integrated, so the technical and procedural quality of the service system can be field-tested. Second, any peer-provider in the project region may participate. Third, the service will be available nationwide. Marketing strategies are being developed, and different business scenarios are analyzed while considering external factors such as the pace of the EV market development and estimations for the price developments of charging equipment. Over the course of the project, research outcomes are being published in order to transfer new knowledge into the research community. Further,

the consortium has regular meetings with practitioners from the e-mobility domain and attends symposia to foster dissemination within the general public.

7.5 Demonstrative Application of the Meta-Framework

The described steps in which CrowdStrom is conducted can be mapped into our meta-framework as Figure 7.4 illustrates. The initial ramp-up and proposal development step of the CrowdStrom project was concerned with the transformation of project-external goals into project-internal goals and it ended with the formulation of the project proposal.

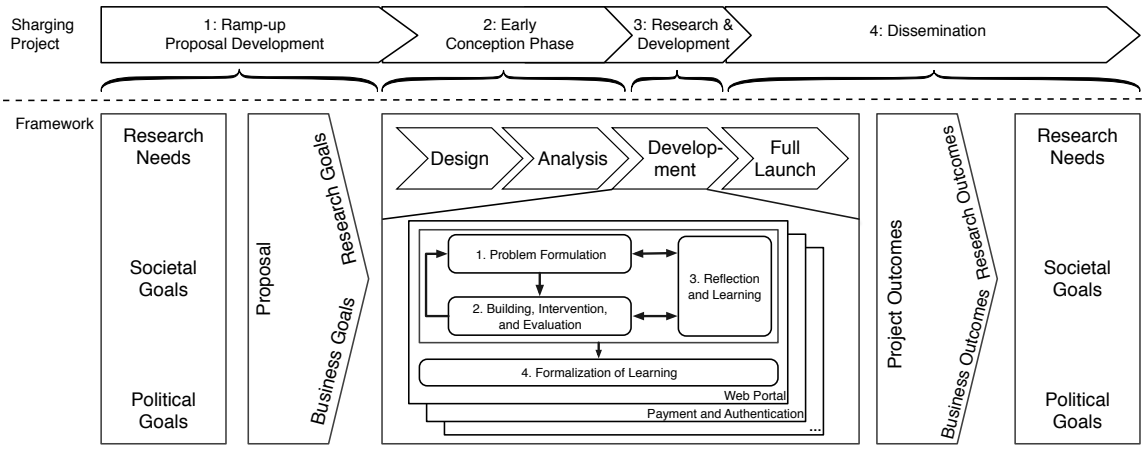


Figure 7.4: Project Phases Mapped to the Framework

The full proposal included specific project goals that are compatible with the business partners desires and our research interests and which were developed to address the broad political and societal goals in view of our discipline's research needs (cf. Figure 7.5). For example, the combination of societal (environmental-friendly transportation) and political (one million EVs by 2020) goals influences the business goal of our industry partner to develop a tight-knit charging infrastructure in the project region. Similarly, the academic project partners transform research needs combined with political and societal goals into research goals such as the conceptual design and prototypical development of a peer-to-peer platform for EV charging.

Particularly in the beginning of the project, there is a risk of project partners having differing goals and objectives towards the project, which can result in colliding interests that impede the project's success. In the case of CrowdStrom, we conducted

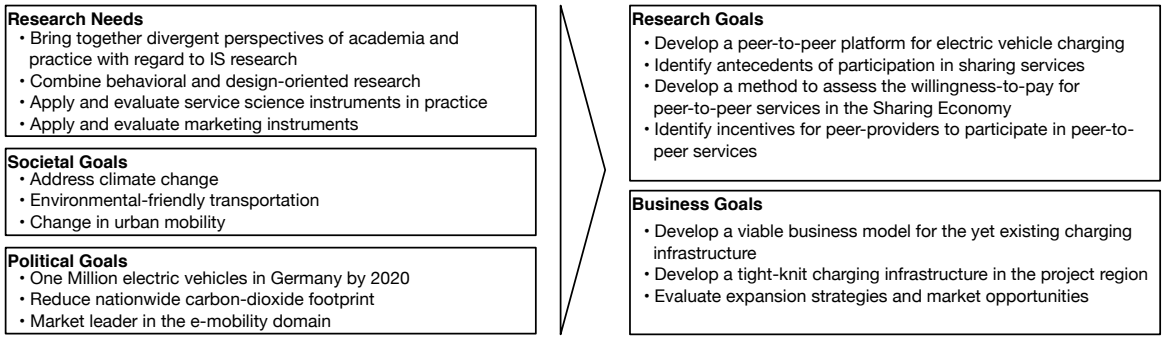


Figure 7.5: Transformation of Project-external Goals into Project-internal Goals

a workshop with all project partners to align those multifaceted goals towards a joint project goal and solution objectives. The framework serves to structure the project-external and project-internal goal systems and can become an input to project management methods to align all project partners.

The following early conception phase corresponds to the *Design* and *Analysis* stages in the meta-framework, which is in line with the NSD approach, where service alternatives shall be generated, evaluated, and then selected during the first two stages of the process. Table 7.2 gives the mapping of project activities to all stages of the NSD process. After being evaluated in both, technical and economic terms, the Sharing Economy service concept was selected. The early conception phase ends with the conclusion of all *Design* and *Analysis* activities and provides the basis for the subsequent artifact development.

Design	**Analysis**	**Development**	**Full Launch**
Development of different business model concepts	Evaluation of the economic viability of the concepts	Online platform consisting of a front-end for peer-users and peer-providers, and an administrative central system back-end	Definition of a three-stage launch plan: 1. pilot partner 2. regional peer-providers 3. nationwide launch
Design and screening of service characteristics	Analysis of the technical feasibility of the concepts		
	Selection of the Sharing Economy service concept	Mobile application for Android and iOS	

Table 7.2: Activities within the NSD Stages

Building the required IT artifacts for the service directly corresponds to the *Development* stage in the meta-framework. Each of the individual artifacts that is being

developed during the Research & Development stage has been created in an instance of the ADR method.

To demonstrate the application of the ADR method and its stages, we use the example of developing payment and authentication methods for the CrowdStrom service. Peer-users should have the ability to access the peer-providers' charging points without being assisted by the respective peer-provider. Therefore, we elicited and assessed the processes necessary to enable third parties to autonomously access charging points. User authentication to connect the EV to the charging point and the subsequent payment were identified as crucial processes. The *formulated problem (1)* was to identify suitable methods for user authentication and payment. The following *building, intervention, and evaluation (2)* iteration started by surveying 179 local citizens to elicit consumer preferences on common and innovative methods for authentication and payment. The results of the survey were then presented to and discussed by the whole project team in a workshop, which evaluated the technical feasibility, the suitability and possibilities to implement the elicited methods in the partnering utility's existing infrastructure. Unfortunately, the elicited preferences and workshop results did not match, as the methods with the highest user preferences were not compatible with the existing charging points. In ADR's spirit of *continuous reflection and learning (3)*, the insights gained were considered in another iteration. Another workshop with the project partners was conducted to find a method that both has high user preference and that fits the technical restrictions of the charging points. The resulting choices of authentication via App, text message, RFID card, and payment via direct debit were consequently implemented into the software prototype (Matzner, von Hoffen, et al., 2015). In two field tests, the method's implementation and underlying processes were evaluated in real-world organizational settings. The first one used two charging points and some EVs from the fleet of the utility. For the second field test, we provided a private person with a charging station, which then was used by other test participants in the role of peer-customers. Finally, a compromise was found which has high customer preference and which can be implemented w.r.t. the existing charging infrastructure. Especially in joint research projects, one has to balance advantages and disadvantages of users' preferences with financial aspects of implementing new solutions and processes compared to using existing ones. The project team *formalized this learning (4)* in the project documentation and in Matzner, Plenter, Betzing, et al. (2018).

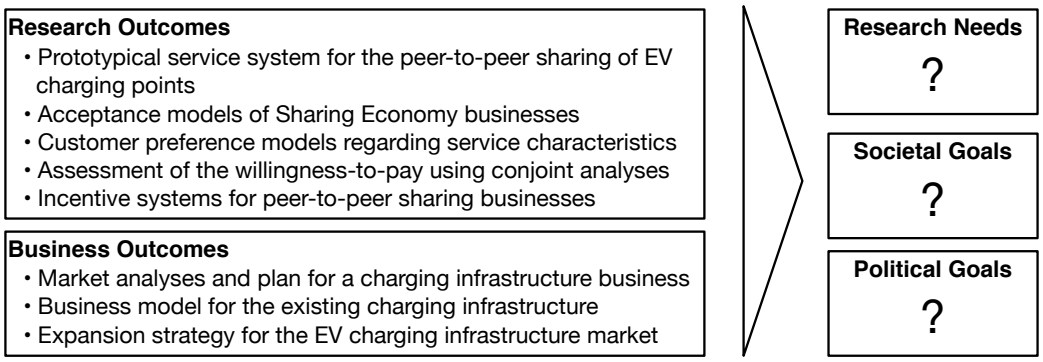


Figure 7.6: Project Outcomes

Dissemination activities span over the right-hand side of the meta-framework. This step focuses on the multi-staged launch of the newly developed service. It corresponds to the *Full Launch* stage of the NSD process (cf. Table 7.2). However, project outcomes go beyond the full launch, as the project not only achieves business goals but also research goals. Figure 7.6 gives an overview of the research and business outcomes achieved in the project. The outcomes amount to the project-internal goal system (cf. Figure 7.5). Research outcomes are being disseminated within the respective communities. The aforementioned launch is currently in preparation. Nevertheless, the transformation of project outcomes into an updated project-external goal system cannot be fully analyzed yet, because the project has not been completed and the project outcomes are not finalized. For now, the project members already identified new research needs and problem areas that require political intervention. For example, there is a need for clarifying the legal status of private charging stations, which can be currently interpreted as part of the energy supply nets, which makes them subject of heavy regulations and which would entail a bureaucratic burden for private peer-providers.

7.6 Discussion, Implications & Reflections

We subsequently justify some general design decisions and then point out the implications of our research for different stakeholder groups in joint research projects. Lastly, we reflect upon limitations and potential remedies thereof.

7.6.1 Discussion of Design Decisions

Although the perspectives of NSD and ADR inform our understanding of joint research projects, their activities and steps cannot be distinctively mapped to the phases of joint research projects. Instead, the activities overlap to some extent. In the *Ramp-up and Proposal Development* step in joint research projects some project activities actually resemble *Design* and partly *Analysis* activities of NSD. These include the formulation of business objectives and the generation of ideas to meet the business objectives (Scheuing and Johnson, 1989), which usually take place in the *Design* stage. In joint research projects, however, business objectives and ways to achieve them must be defined at the time the project outline is written. Additionally, the full proposal must also contain preliminary project and financial plans, responsibilities and individual work packages of the consortium partners. These documents are usually prepared during the *Analysis* stage of NSD. This peculiarity of attracting funding for the joint research project using a full proposal could justify to split the NSD process and place the *Design* phase into the proposal box. However, a split would come at the cost of the meta-framework being less generalizable and applicable for other industry-academic partnerships. Furthermore, the documents created in the context of the full proposal only serve as a baseline for project approval and are subject to ongoing refinements over the course of the project. Consequently, the NSD process is still properly conducted step-by-step, once the project is approved, and thus remains as a whole in the main part of the framework. Additional potential overlaps emerge when synthesizing the stepwise model of NSD with the iterative ADR approach. On the one hand, we acknowledge that some ADR activities such as the formulation of specific problems already start in the *Analysis* phase of NSD. On the other hand, later iterations may overlap with the *Full Launch* stage of NSD as time goes by. It is worth mentioning that many publicly funded projects do not develop ready-to-market products for immediate commercial exploitation, but primarily knowledge and service blueprints that the consortium can build upon in the sense of an economic dissemination. That is, in the *Full Launch* phase, consortium partners from industry may take the gained knowledge and put it to use in their organizational settings or license it to third parties. Even then, important experiences can be made regarding the evaluation and derivation of formalized learning with respect to ADR. Although this may be an issue when mapping the specific research activities to the meta-framework, it is not critical from a methodological perspective, as NSD also demands feedback-loops where adjustments are made based on

insights gained (Johnson et al., 2000). To sum up, although the ADR iterations also affect the *Analysis* and *Full Launch* stages of NSD, the main research and development activities take place in the *Development* stage, and thus, justify the position of ADR within the overall framework.

7.6.2 Implications for Project Stakeholders

This paper's main *theoretical contribution* is a meta-framework that synthesizes previously unrelated theoretical concepts from the fields of new service development and action design research. It complements prior research results from these two areas with constructs that are specific to joint projects: the sets of project-external goals and project-internal goals as well as the proposal. This meta-framework has various implications for different types of stakeholders. From the perspective of *academic and industrial researchers*, the meta-framework is a means for representing and describing issues related to joint research projects – more specifically, it is useful to address issues in projects that develop new services. Such representation and description, for instance, can be used to facilitate project-internal and project-external communication and discussion as well as planning processes.

The publicly funded joint research project is an instrument that is only used in a few countries. This is why we separate further implications for researchers who are involved in joint research projects from those for researchers who are not involved. To this end, the meta-framework reminds the former to elicit goals, to transfer given project-external goals into compatible project-internal goals, and maintain a corridor of requirements towards the design of processes and IT systems. Those are then input to the actual research & development activities, which hopefully will lead to novel knowledge and also yield new services that meet market needs and societal/ political goals at the same time. For researcher inexperienced with joint projects, our meta-framework provides an entry point into and explanation about the complex structures of such joint projects, including for instance the project stakeholders' and/ or the project members' possibly divergent goal sets.

With our work, we want to make a step towards a better understanding of joint research participants' situations within our IS research community. Other researchers can further benefit from the meta-framework as helpful contextual knowledge when

making sense of research originating from joint projects. In the same line, the framework can be applied when researchers want to reuse and further develop findings from joint projects, when researchers have to review manuscripts that report on joint project results, or when they consider collaborating in a research or publication project with partners from joint projects.

Furthermore, researchers who have the opportunity to apply for funding of joint research projects, but have not yet made use of it, may consider an application based on an improved understanding of this funding instrument. More specifically, from the perspective of *service researchers*, our work emphasizes and reminds scholars on the interdisciplinary nature of service research. This work combines a service marketing perspective (NSD) with an IS engineering perspective (ADR) as it is needed in the "real-world" development of new service businesses—and not just in joint research projects. While our meta-framework illustrates the big picture of NSD through ADR on an abstract level, its user can take it as reference point to tap into more specific instruments and tools included in the research streams of NSD and ADR. Lastly, our work also sketches an innovative real-world instantiation of NSD: CrowdStrom, a joint research project which will have traversed the whole NSD process, including the full launch, in the near future.

From the perspective of *business professionals* in charge of research and development, joint projects can be a helpful instrument to facilitate the development of new services. Joint projects can pave the way for risky innovation projects that—without public funding—would be too expensive to fail in view of uncertain market developments, such as CrowdStrom was. This work maintains that even when receiving public funding, managers retain entrepreneurial freedom and individual responsibility when turning project-external goals into business goals that fit their enterprise strategies. From the perspective of *politicians* and further *societal groups*, our work provides means to illustrate, how joint projects stimulate research and business development activities at the same time. Industrial partners in joint projects only receive partial funding of research expenses and have to commit financial resources themselves, too. As a result, the value for taxpayers' money (in terms of contribution to societal goals) is likely to increase through joint projects, because business development activities have to focus on a set of topics with contemporary societal relevance, given by the funding institutions' implementation of political goals.

7.6.3 Limitations

Our work, being conceptual in nature, does not claim to explore the phenomenon of joint research projects exhaustively but has some limitations that we subsequently discuss and try to resolve. First, the applicability of the proposed meta-framework, and thus, its evaluation has been demonstrated for only one joint research project in this paper. However, we tested the applicability on other joint research projects we have conducted in the past, but which cannot be reported here in detail. We also recently met with academic and industrial members of the aforementioned focus group to discuss and test the applicability of the meta-framework on their individual project settings. It became evident that the meta-framework can be used successfully to represent and describe the ADR perspective on NSD in joint research projects—not just for projects with an IS focus but also for business-driven development projects. While this research relates the idiographic details of one case with established theory, more applications to other joint projects are desirable, for instance, in order to further develop the meta-framework into a procedural reference model that includes specific work practices to assist joint projects.

One obvious initial step would be to complement our conceptual research with a multiple case study methodology that investigates other researchers' joint projects to test meta-framework and propositions. Concerning external validity, the meta-framework then also needs to be applied to cases that feature a variety of characteristics, based on designing a cross-case replication logic (Yin, 2013).

Second, the meta-framework in its current form does not distinguish the different actors participating in a joint project individually. We considered a simultaneous representation of all project partners and their relationships as not feasible due to the complexity that grows with any additional actor. A possible extension could be the inclusion of cyclic processes of design, sense-making, and negotiation (Lyytinen et al., 2008) in which actors bring together and jointly discuss different viewpoints on goals, the proposal, and the activities in the different NSD and ADR stages.

Third, although the impression could emerge, the meta-framework is not capable of providing researchers and practitioners with operational guidelines on, for example, how to conduct the project or how to resolve conflicting aims that could co-exist in a joint research project. Instead, it focuses on illuminating the composition of such a project, core elements of its research process and its outcomes. By doing

so, it provides researchers and practitioners with an instrument that can facilitate participants' understanding of the project and the communication among partners. By decomposing the structure of a joint research project, the meta-framework can be used to formulate in-depth inquiries into its mechanics, which we see as an opportunity for future research.

7.7 Conclusion

This paper illustrated a set of core concepts capable of representing and describing joint research projects in service research. We constructed a meta-framework that synthesizes the basal properties of joint research projects with the service marketing perspective of NSD and the IS engineering perspective of ADR. The meta-framework contains all steps and phases of joint project work, starting with forming the consortium and developing the proposal, to the actual research and development at the core of the project, up to the subsequent dissemination of the research results. It considers the various project stakeholders' perspectives, such as those of funding institutions, service researchers, as well as consortium partners from industry. The meta-framework assists researchers and practitioners in communicating the specifics and outcomes of their joint research projects. Moreover, it also provides guidance to actors inexperienced with the specifics of joint research projects, which is especially important for small and medium enterprises that want to participate in such a collaborative research setting. We illustrated the applicability of our framework by the case of CrowdStrom, a joint research project we are currently conducting. Based on our development and concurrent evaluation activities as well as the learning situated from the project, we will continue to generalize our findings to derive more formalized learning in the spirit of ADR that may support service researchers in future joint projects.

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8 Eliciting Customer Preferences for Shopping Companion Apps: A Service Quality Approach

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Eliciting Customer Preferences for Shopping Companion Apps: A Service Quality Approach

Abstract. Shopping companion apps, which assist customers with their product search and buying decisions, are an emerging phenomenon in the context of omnichannel retail. These retailer-provided apps link the digital with the physical servicescape of the store, allowing for new forms of online and at the same time physical service. So far, there is no dominant design for this type of information system. Both academia and practice lack empirical information about what customers expect from this kind of mobile app. Drawing from service quality literature as the theoretical foundation, we conducted a qualitative content analysis of 1,448 customer reviews of three major shopping companion apps. The analysis yielded 23 aspects that customers expect from shopping companion apps, and that, in turn, can support establishing high mobile service quality. Our results contribute to the knowledge of m-service in retail and quality-driven app design.

8.1 Introduction

The mobile channel is an intimate and direct way for retailers to fulfill their customers' needs (Rudolph et al., 2015; Hagberg et al., 2016) since customers nowadays use myriads of mobile devices in all situations of their daily lives including shopping (Inman and Nikolova, 2017; Pantano and Viassone, 2015). Customers search for products and services, and shop on the move without temporal or spatial constraints (Faulds et al., 2018). Customers are already using their smartphones in-store

to get product information and compare prices (Gensler et al., 2017). brick and mortar (BaM) retailers respond to this changing customer behavior by introducing what we term *shopping companion apps* (Groß, 2015; Rudolph et al., 2015).

A shopping companion app is conceptualized as retailer-provided software, executed on the customer's smartphone that complements the personal and e-service of a BaM retailer by an additional mobile channel that manifests as a digital support to the shopping process inside and outside the store. Customers use these apps to access general shopping features such as product search, and immersive, location-based, and personalized functions such as in-store navigation and product recommendations (Betzing, Hoang, et al., 2018; Inman and Nikolova, 2017). In contrast to third-party apps, shopping companion apps keep the customer in the retailers' self-contained environments (Taylor and Levin, 2014) and allow them to create "seamless omni-channel experience[s]" (Rigby, 2011, p. 68) that match their overall strategies. Shopping companion apps offer several novel features of hybrid customer interaction (Nüesch et al., 2015) and value-added service (Groß, 2015), which are neither usefully realizable just in stationary retail nor in e-commerce (McLean et al., 2018; Rudolph et al., 2015).

Being an emergent phenomenon, shopping companion apps have not yet received much academic investigation (Rudolph et al., 2015), and also instances in practice do not follow a dominant design (Suárez, 2004) but rather vary in form and behavior. Developing and designing shopping companion apps that meet or even exceed the customers' expectations is a challenging endeavor (Khalid et al., 2014). To establish a high-quality shopping companion app as a mobile interface for customer interaction with the retailer, designers must consider smartphone-specific constraints (e.g., display size, mobile Internet) and opportunities (e.g., sensor access, immersion) atop traditional user experience aspects (Hassenzahl and Tractinsky, 2006; Mendoza, 2013).

We draw from service quality (SQ) research to identify what makes up a *high-quality* shopping companion app. SQ is concerned with assessing the quality of interactions between a customer and a service provider (Parasuraman et al., 1985; Grönroos, 1984) and is defined as the degree of "discrepancy between customers' expectations and perceptions" (Parasuraman et al., 1994, p. 111) towards a received or experienced service (Zeithaml et al., 2000). SQ assessments have a long and rich history, ranging from person-to-person service (SERVQUAL) (e.g. Grönroos, 1984; Parasur-

aman et al., 1985), over e-service accessed via personal computers (E-S-QUAL) (e.g. Parasuraman et al., 2005), to m-service accessed via mobile devices (M-S-QUAL) (e.g. Stiakakis and Petridis, 2014; E. Y. Huang et al., 2015). Recent conceptualizations of Mobile App Service Quality (MASQ) now take into account the peculiarities of mobile apps such as immersive human-computer interaction, location independence, and potentially far-reaching access to personal information and sensor data through the service provider (Shankar et al., 2016; Lee and Benbasat, 2004; R. Kumar, 2017; Kuo et al., 2016). However, while the literature acknowledges the importance of high-quality in-store service through the mobile channel as a future competitive edge for retailers (Grewal et al., 2017), there is a lack of empirical information about what customers expect, and also—to the best of our knowledge—there is no domain-specific research for shopping companion apps.

Against this background, our research goal is *a set of customer preferences for shopping companion apps* with special consideration on MASQ. To reach this goal, we apply a twofold approach. First, we turn towards SQ literature as the theoretical foundation to understand MASQ. Second, we conduct a qualitative content analysis (QCA) (Mayring, 2014) of online customer reviews of three major shopping companion apps to retrieve the individual app users' subjective perceptions of SQ. We follow suggestions from human-computer interaction research to analyze the interaction with mobile apps from a user's point-of-view (Mendoza, 2013). From the review corpus, we inductively derive 23 aspects customer prefer for shopping companion apps, which retailers can consider for quality-driven (shopping companion) app design.

The remainder of this paper is as follows: Section 2 introduces MASQ. Section 3 sketches the research approach. Section 4 gives the customer preferences for shopping companion apps, which are discussed in Section 5. We conclude in Section 6.

8.2 Theoretical Background

8.2.1 Service Quality

SQ is known to be an important determinant for the success of a company, impacting "business performance, lower costs, customer satisfaction, customer loyalty and

profitability" (Seth et al., 2005, p. 913). SQ assessments identify the perceived SQ of an individual, which is "a global judgment or attitude" (Parasuraman et al., 1988, p. 16) comparing the customers' expectations and actual perceptions of a service endeavour. Following the so-called disconfirmation paradigm, high SQ is achieved, when the difference between expectations and perceptions is marginal, or the perceptions exceed the expectations (Parasuraman et al., 1985). In contrast, customer satisfaction is "the result of specific service transactions" (Jun et al., 2004, p. 822). Existing models of SQ distinguish different sub-dimensions, which further detail the overarching construct. Parasuraman et al. (Parasuraman et al., 1988), for example, introduced reliability, responsiveness, assurances, and tangibles as dimensions for measuring the quality of interpersonal service. During the last decades, various technological innovations have led academia to propose adjusted and extended SQ models for different types of information systems, domains, and kinds of service. In the context of mobile apps and m-service, adjusted models are subsumed under MASQ. Currently, research on MASQ is sparse (e.g., R. Kumar, 2017; Kuo et al., 2016).

SQ research has created an own literature stream that spreads over the information systems, retail, e-commerce, human-computer-interaction, and marketing domains. To identify the dimensions that may explain high-quality shopping companion apps, we conducted a structured literature review (vom Brocke et al., 2009) across outlets in these domains, without restricting the search basket to allow for an exhaustive coverage. The search took place on 2017-06-21 using SCOPUS, AISeL, Web of Science, and EBSCOHOST. Table 8.1 gives the generalized search query, which was adapted to the syntax of the respective search engine.

Table 8.1: General Literature Review Search Query

```
(("app" OR "mobile" OR "electronic" OR "m-" OR "e-") AND ("service
quality") AND ("*commerce" OR "*shopping") AND ("criteri*" OR
"dimension" OR "measure*"))
```

After performing a one-way forward- and backward search, a sample of 34 papers remained, which yields insights on the determinants and dimensions of Electronic Service Quality (ESQ), Mobile Service Quality (MSQ), and MASQ in the B2C area.

8.2.2 Research Model of Mobile App Service Quality

Figure 8.1 shows the multidimensional, hierarchical research model of MASQ, adapted from (Stiakakis and Petridis, 2014). Synthesized from the identified literature sample, the model comprises the dimensions of SQ, which apply to the case of shopping companion apps.

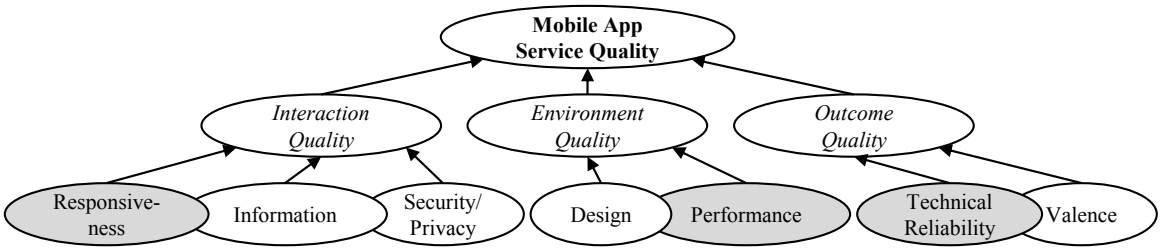

Figure 8.1: Multidimensional Hierarchical Research Model of MASQ, adapted from Stiakakis and Petridis (2014)

The shaded dimensions are either added to or reframed from the initial model by (Stiakakis and Petridis, 2014), based on the literature synthesis and initial results of the QCA. The example of the reliability dimension can illustrate this adaption. Initially, this dimension focuses on the reliability of delivery and fulfillment processes (Collier and Bienstock, 2006; Holloway and Beatty, 2008), which are out-of-scope for shopping companion apps that are used primarily in-store. Reliability in the online customer reviews is often related to technical malfunctions and service dropouts. Hence, this dimension is subsequently denoted as technical reliability. In line with previous hierarchical models (Y. Lu et al., 2009; Stiakakis et al., 2013), the MASQ is comprised of three secondary dimensions, which themselves are comprised by primary dimensions.

The research model in Figure 8.1 is used as the theoretical lens to analyze and structure the qualitative data in the subsequent QCA. Following the QCA terminology (Mayring, 2014), the primary dimensions make up the *content categories*. To allow for a fine-grained analysis, these content categories are further detailed into 22 *characteristics*. Table 8.2 provides the content categories and characteristics related to MASQ, which have been derived from the literature review.

8.3 Research Approach

We analyzed customer reviews of three major, shopping companion apps by Walmart (US), Tesco (UK), and Marks & Spencer (M&S) (UK) to elicit customers' preferences for shopping companion apps. Although the selected retailers trade internationally, the apps under consideration are tailored to their respective home countries of operation. We sampled these apps because they are on the market for more than three years, they address a significant proportion of people in their countries of operation, and a vast number of online reviews make these three apps the subject of discussion. Further, these retailers have a long history in BaM operations. Additionally, we focused on grocery retail as industry because these retailers offer a broad spectrum of product categories, and thus, are potentially relevant for the majority of the population, compared to specialist shops that only address a certain focus group. Electronic customer reviews as a form of electronic word-of-mouth are a valuable source for indicating the quality of apps including the users' personal opinions, bug reports, and desired features (Genc-Nayebi and Abran, 2017). We employ the QCA (Mayring, 2014) as research design and make use of the methods presented in Pagano and Maalej (2013) and Knote and Söllner (2017) to extract and prepare the review sample. The QCA approach is frequently applied to extract information from user-generated content such as reviews (Giannakos, 2014; Spreer and Rauschnabel, 2016).

Following Pagano and Maalej 2013, we first extracted review data from Apple's App Store and Google's Play Store using a paid version of the online service *Heedzy* on 2017-07-03. The raw data contains information on the app name, date, title, and content of the review, the nickname of the customer who created the review, the rating that is provided, and the app version. 10,099 reviews have been extracted in total. This number comprises 6,048 reviews for the Walmart app (1,084 iOS / 4,964 Android), 3,389 reviews for the M&S app (818 iOS / 2,571 Android), and 662 reviews for the Tesco app, where a technical restriction only allowed us to extract reviews from the Apple App Store. Since mobile apps are frequently updated, we only consider reviews written within the last six months, which leaves 8,237 reviews. The review sample was manually pruned by non-informational reviews such as "*Great app!*" and "*Useless!*".

Table 8.2: Content Categories and Characteristics related to Mobile App Service Quality

Dimension	Description	Support
Interaction quality	"Reflects all the quality characteristics of a customer's interaction with the [...] service provider." (Stiakakis and Petridis, 2014, p. 942)	(Y. Lu et al., 2009; Stiakakis et al., 2013; Stiakakis and Petridis, 2014)
Responsiveness	The retailer's ability to promptly and politely solve a customer's issues related with the mobile app. **RES1**: Customer service availability **RES2**: Problem solving ability **RES3**: Politeness and kindness of personnel **RES4**: Guidance and instructions for app usage	(Bauer et al., 2006; Blut et al., 2015; Holloway and Beatty, 2008; Parasuraman et al., 2005; Wolfinbarger and Gilly, 2003)
Information	"The provision of accurate and precise information" (Stiakakis and Petridis, 2014, p. 943) by the retailer. **INF1**: Information adequacy **INF2**: Information usefulness **INF3**: Information correctness	(Collier and Bienstock, 2006; Fassnacht and Koese, 2006; Holloway and Beatty, 2008; Loiacono et al., 2007; Santos, 2003; Stiakakis and Petridis, 2014)
Security and Privacy	"The protection of system and network resources from any external or internal attack and the protection of users' personal data." (Stiakakis and Petridis, 2014, p. 943) **SEC1**: Information security **SEC2**: Data protection **SEC3**: Data collection	(Blut et al., 2015; Holloway and Beatty, 2008; Parasuraman et al., 2005; Santos, 2003; Stiakakis and Petridis, 2014; Wolfinbarger and Gilly, 2003)
Environment quality	Reflects "the context in which [mobile apps] are delivered, [and] quality characteristics of the equipment" (Stiakakis and Petridis, 2014, p. 942) that affect the delivery of the mobile apps.	(Y. Lu et al., 2009; Stiakakis et al., 2013; Stiakakis and Petridis, 2014)
Design	The aesthetics, features, and layout of the user interface. **DES1**: Visual aesthetics and clarity of layout **DES2**: Quality of multimedia content **DES3**: Ease of use and ease of navigation **DES4**: Search function and filters	(Collier and Bienstock, 2006; Fassnacht and Koese, 2006; Holloway and Beatty, 2008; Parasuraman et al., 2005; Santos, 2003; Stiakakis and Petridis, 2014; Wolfinbarger and Gilly, 2003)
Performance	The performance of the mobile app and its resource requirements. **PERF1**: Processing speed **PERF2**: Device storage usage and mobile network usage **PERF3**: Network connection quality	(Collier and Bienstock, 2006; Fassnacht and Koese, 2006; E. Y. Huang et al., 2015; Madu and Madu, 2002; Parasuraman et al., 2005; Stiakakis and Petridis, 2014)

continued ...

…continued

Dimension	Description	Support
Outcome quality	Reflects the technical quality of and the customer's satisfaction with the service delivery.	(Y. Lu et al., 2009; Stiakakis et al., 2013; Stiakakis and Petridis, 2014)
Technical reliability	The accurate and consistent operation of the mobile app. **REL1**: Mobile app reliability **REL2**: Availability of provided services **REL3**: Continuous operation after updating	(Fassnacht and Koese, 2006; E. Y. Huang et al., 2015; Santos, 2003; Stiakakis and Petridis, 2014; Swaid and Wigand, 2009; Wolfinbarger and Gilly, 2003)
Valence	The customer's ex-post impression of the service delivery. **VAL1**: Overall satisfaction with the provided service **VAL2**: Satisfaction with the scope of provided services	(Bauer et al., 2006; Fassnacht and Koese, 2006; Loiacono et al., 2007; Stiakakis and Petridis, 2014; Tan and Chou, 2008; Vlachos et al., 2011)

continued …

Customer reviews in foreign languages and reviews concerning the retailer's general assortment, delivery quality, and price politics were excluded, which leaves a final sample of 1,448 reviews (795 Walmart, 433 M&S, 220 Tesco) for further investigation.

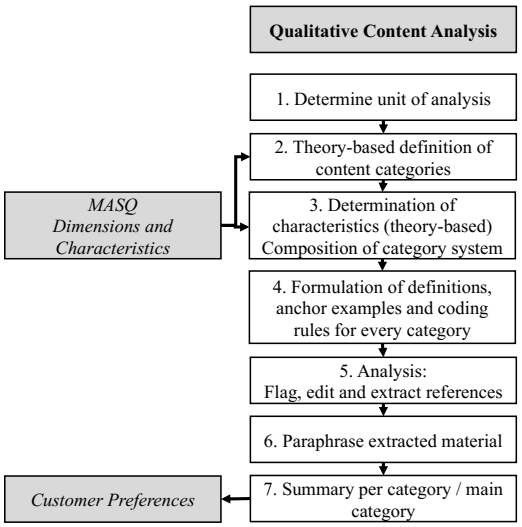

Figure 8.2: Research Approach, adapted from vom Brocke et al. (2009) and Mayring (2014)

Figure 8.2 shows the QCA process based on its content structuring approach, which supports the deductive assignment of reviews to content categories (Mayring, 2014). The review corpus containing the users' expectations and suggestions was grouped and analyzed for each content category. Anchor examples are used as references to illustrate the elicitation of customer preferences. Since online customer reviews usually contain more than one aspect (Pagano and Maalej, 2013), reviews were sub-classified regarding the characteristics, which results in 1,307 codings. We used *QCAmap.org* to support the coding process (Mayring, 2014).

8.4 Results

8.4.1 Relevance of MASQ Dimensions

We assigned the customers' statements to the content categories and characteristics, which allows weighting the relevance of the MASQ dimensions. Table 8.3 provides the distribution of customer review codings. The amount of codings per characteristic varies between five and 298.

Table 8.3: Frequency of Characteristics Mentioned in the Online Customer Reviews

Content Category	$\sum$	**Mentions per Characteristic**			
Responsiveness	93	RES1: 27	RES2: 52	RES3: 5	RES4: 9
Information	103	INF1: 29	INF2: 28	INF3: 46	
Security and Privacy	67	SEC1: 35	SEC2: 16	SEC3: 16	
Design	452	DES1: 38	DES2: 20	DES3: 298	DES4: 96
Performance	140	PERF1: 119	PERF2: 10	PERF3: 11	
Technical Reliability	394	REL1: 312	REL2: 19	REL3: 63	
Valence	58	VAL1: 45	VAL2: 13		

In effect, customers emphasize some of the dimensions and characteristics with higher importance than others. For example, *ease of use and ease of navigation* (DES3) as a part of the *design* dimension seems to be more important than attentive customer service (RES3) as a part of the *responsiveness* dimension. Regardless of the provided functionality, customers expect fast response times (PERF1) and reliable service (REL1) and use the review function of the app stores as an outlet to complain when issues arise.

8.4.2 Customer Preferences Regarding Shopping Companion Apps

The three shopping companion apps under review provide a similar range of functions: Access to the particular online shop, click & collect, store finder, in-store inventory checking, aisle locator, promotions, loyalty programs, and product scanning. In the following, we focus on the non-functional aspects of app and service delivery. From the review corpus, we found rich hints what customers expect from shopping companion apps and identified 23 aspects that retailers could pick up to improve their m-service offerings. Table 8.4 lists the aspects, which we have structured by the primary dimensions of the MASQ model (Figure 8.1).

Table 8.4: Customer Preferences for Shopping Companion Apps

#	Aspect	Description
Responsiveness		
01	**Trained customer service**	Customer service should be able to assist the customers knowledgeably and politely with any inquiries related to the retailer's mobile services, app functionality, and in-store issues.
02	**In-app guidance**	The app should include an onboarding process to introduce the retailer's range of provided m-service offerings and should provide a help section with usage instructions.
03	**Omnichannel customer service**	Customer service should be available through all channels the retailer offers and provide personalized service to customers independently of the selected channel.
04	In-app customer service	The app should provide direct access to customer service (e.g., by text, voice or video chat) and display easy to find contact information.
05	Responsive customer service	Customer service should respond timely to customer requests, even during times of high request volumes.
Information		
06	**Real-time information**	Any information shown in the app (e.g., prices, stock information) should be up-to-date, correct, complete, and consistent to information provided by the retailer through other channels.
07	Adequate and clear information	Any information shown in the app should be provided to the customer in a relevant, clear, and intelligible manner.
08	Update descriptions	Customers should receive detailed update and release notes.
Security and Privacy		
09	Request permissions	The customer's personal and payment data should be collected, stored, and processed only after permission for the particular purpose is granted.
10	Restrict permissions	Permissions should only be requested when they are required and appropriate for the app's provided set of functions.
Design		

continued ...

...continued

#	Aspect	Description
11	**Limit advertisements**	Although customers expect to receive offers through shopping companion apps, advertisements should be used with moderation and not distract users from fulfilling their current objective.
12	**Accurate product search**	The app should include a product search engine that returns adequate results, which may also take the customer's current in-store context into account.
13	**Convenient product filters**	The app should provide filters to ease digital and physical information and product search processes.
14	High-quality multimedia content	Multimedia content such as product images and videos should be in high-quality and fit to the screen resolution.
15	Clear design and intuitive layout	The app should have a clean and simple design that fosters its intuitive use.
16	Short navigation paths	All functions of the app should be easily accessible and not deeply nested.
Performance		
17	Technical responsiveness	The app should start up quickly and react fast to the customer's interactions.
18	Reasonable resource utilization	The app should have a small footprint regarding app and update sizes, local storage occupancy, and (mobile) network traffic.
19	Reduced background activity	The app should keep background activities to a minimum to limit battery drain.
Technical Reliability		
20	Reliable operations	The app should provide its service reliably without crashes or service outages.
21	Sustainable updates	Updates should be non-breaking and sustain existing functions.
Valence		
22	**Scope of features and services**	A single app should incorporate all m-service offerings that the retailer provides.
23	Continuous improvement	The retailer should use a continuous improvement process to react to ever-changing customer expectations.

continued ...

Customers voiced some preferences that are specific to the context of shopping companion apps. For example, because shopping companion apps enhance the physical servicescape of the store with digital service, customer service should be able to support both the retailer's m-service and issues that arise in-store. Nevertheless, trained customer service—of course—is also relevant to any other m-service. We highlighted the aspects that include such peculiarities regarding shopping companion apps in boldface. However, to provide a complete picture of the customers' preferences, we also include more general aspects in Table 8.4, which may apply to other types m-service too.

Customer reviews frequently contain experiences on service encounters with the service provider. Customer service representatives constitute a direct personal contact within the otherwise human-to-machine context of shopping companion apps. Customers expect service personnel that will respond in a timely fashion when they require assistance, is reachable through the channel of their choice, and can quickly, professional, and politely resolve their issues. We found that customers, among other things, complain about a lack of contact channels and unavailable representatives ("*No one to call no one to email*"), and the quality of employee training ("*The employees are clueless on how to even help you*"). However, they also mention positive service experiences ("*Had problem just called and they had it fixed in 2 mins thanks*").

Especially for shopping companion apps whose information is changing at a fast pace (offers, stock information), users expect correct, current, and complete data that is relevant to their situation ("*Used every day to keep updated with offers and developments*"). Incorrect or useless information discourages users ("*If someone is using the app and looking for the store nearest to them, why would you have a distribution center come up as the closest store and then direct people there?*") and can result in lost sales.

Regarding the app itself, customers expect guidance on the use of the app ("*Can't find instructions on how to use, and there are features that are not all that intuitive*") and want to be informed of changes introduced by app updates ("*When YOU update your app, you need to specify what changed - features, bug fixes, etc. BS like WE MADE IT BETTER is not an update description*").

Similarly, the retailer has to be transparent on the collection and processing of personal data so that customers gain trust and grant the requested permissions ("*Major privacy concern I just used the app to make a purchase. Without my knowledge or permission, it stored my credit card information.*"). In effect, permissions and data should only be requested when they are required for the proper provision of the app's service and features ("*Unwarranted permissions - why does it need access to WiFi info, media files and photos, contacts - no, really M&S, and no explanation*").

Design and usability are the most frequently reviewed aspects in our sample (see Table 8.3). While app designers receive numerous hints of varying relevance from the reviews, we suggest executing a structured usability assessment (Albert and Tullis, 2013). Users particularly name aspects such as a clean and simple design ("*Good size text and clear with suitably neutral colours which are pleasing to the eye*"),

intuitive navigation ("*The app is far quicker & easier to use than the website*"), high-quality multimedia content ("*doesn't get 5 stars because of the ui and graphics. Low resolution or not optimized for retine screens*"), a reliable search engine, and filtering functions ("*Why doesn't this app allow me to sort my results? Like price high - low?*").

Customers expect well-performing apps ("*Opening app takes a long time*"), which make reasonable use of cellular data ("*Too data intensive. [...] it is taking FOREVER to load [...]*"), on-device storage ("*With storage space at a premium on my phone, I am seriously reconsidering the necessity of having this app*"), and background processing activities ("*It is active in the background to such a degree that it is a constant drain on my battery*"). Although the preferences regarding technical reliability seem obvious and should be taken for granted, customers reported a significant amount of technical issues for the apps under consideration. App developers need to make sure that the range of offered m-services and features is functioning correctly without bugs ("*Nullpointer exception when trying to add anything to the basket*") and continues to work after updating ("*Still can't use scanner...every since November 2016 update*").

The valence dimensions subsume the subjective feelings and perceptions customers have after using the retailer's m-service. We suggest to regularly assess the customers' feelings towards the app, e.g., by using an in-app survey mechanism to identify the individual pain points. Lastly, the apps under review apply two different strategies. Either, all customer-facing m-service offerings of the retailer are bundled in a single app, or there are multiple apps that all fulfill a single purpose. A frequently named ex-post evaluation was not to spread features across multiple apps but to follow the first strategy ("*You have so many apps doing different things! [...] Link them for easy use*").

8.5 Discussion

Informed by extant SQ knowledge and real-world customer reviews of three major shopping companion apps, we provide a set of 23 aspects customer expect from shopping companion apps, structured by a multidimensional hierarchical model on MASQ. Nevertheless, fulfilling these aspects is not a *sufficient* condition for high MASQ *per se*, although they are based on the individual customers' written expectations and perceptions. As with most design decisions, there is no one-size-fits-all

approach since customers may have different or even contradicting expectations of the same service. Nevertheless, the derived preferences provide a good picture of what the majority of customers desire with regards to shopping companion apps. While these aspects can aid app developers and support quality-driven app design, their implementation might be difficult. Inherent with using customer reviews as data source, we draw from customers' wishful thinking that may conflict with the retailers' economic and business capabilities.

Since the earliest conceptions of SQ, most models are based on the disconfirmation paradigm (Grönroos, 1984), which states that quality is the result of the comparison between perceived and expected performance (Parasuraman et al., 1985). However, a small difference in performance as the indicator for high SQ is subject to critique by some scholars (e.g., Buttle, 1996). Following the conceptualization, high SQ is achieved as long as the customer's expectations are met or exceeded, even though these expectations might be meager. In our understanding, the SQ is high when the expectations of a large majority of customers are exceeded. Suppose we have a large sample, outliers having particularly low respective particularly high expectations rule themselves out. Consequently, we used a large sample of 1,448 customer reviews to capture a representative set of customer expectations. On a further note, we confirm Knote et al's (Knote and Söllner, 2017) observation that the users' perceptions and evaluations strongly depend on their current situations and previous experiences with other apps, which are taken as a reference point for comparisons.

The elicited customer preferences constitute a snapshot in time that reflects current customers' perceptions and foci. Over time, these foci may change as new technologies and services evolve. For this reason and the subjective nature of SQ, we refrained from stating explicit design guidelines that retailers have to implement to achieve high MASQ.

As with any research, our work comes with some limitations. First, our results may be prone to selection bias because the same set of researchers performed the derivation of content categories and characteristics related to MASQ as well as the subsequent coding of the online customer reviews.

Second, we did not take into account the specific graphical user interface (GUI) components and structures defined by the different mobile operating systems. These design conditions may influence both the customers' service expectation prior to the app usage, and their perception when interacting with the shopping companion

apps on a smartphone. However, the scope of and interface to the provided functionality of the samples apps only slightly differed between Apple iOS and Google Android.

Third, the sampled apps all focus on grocery retail, which may constrain the generalizability of the derived customer preferences regarding shopping companion apps that focus on other retail industries such as apparel or sporting goods to some extent.

Fourth, there are inherent limitations when dealing with online customer reviews in general and reviews of mobile apps in particular. As customers can post online reviews anonymously (Pagano and Maalej, 2013), no customer information is available on the analyzed set of reviews. Consequently, we cannot make a detailed statement whether our sample is representative. Further, within the corpus of seemingly authentic online customer reviews published by real customers, there can be spam and misleading reviews (von Hoffen et al., 2018). Due to the anonymity of reviewers, we cannot rule out *manipulation* by developers and app providers to praise their product. We have no means to identify fake reviews. However, these reviews usually tend to praise or condemn the app under review without going into detail. Since we are only interested in information on the service delivery, we can quickly discard non-informational reviews such as "Useless rubbish!"—being a fake review or not.

Moreover, the majority of customers only posts a single review, but a small number of customer rates a mobile app several times (up to nine times in our sample). By using the app over a longer period, users become familiar and might identify further aspects worth reviewing. Therefore, we kept those reviews in the corpus. Admittedly, the number of reviews per customers has to be treated carefully because a single customer also can write reviews using multiple nicknames, which can bias results in a small sample.

Customers tend to report remarkably satisfying or dissatisfying aspects involving exaggerations and generalizations when reviewing products and services (von Hoffen et al., 2018). Although we use single anchor examples for clarification, our preferences abstract from single reviews and always summarize the judgments of many customers, in line with Mayring, 2014, so that single exaggerations do not bias our analysis.

We collected the most current 10,099 online customer reviews of the three shopping companion apps across a time span of six months. During this period, the apps have received multiple updates. For simplification, we did not include version numbers in the QCA. Thus, comparisons across app versions are not possible, and changes in the perceived MASQ cannot be traced back to new app releases.

Lastly, the manual coding process follows a strict procedure (Mayring, 2014). However, it may be biased by personal opinions and subjective evaluations. A fully automated process for the QCA, ranging from the extraction of online customer reviews from the app stores to summarizing the results per category using advanced text mining tools or cluster analyses could help to overcome this issue. Nevertheless, a manual process seems appropriate in the context of subjective online customer reviews that may contain ironic and ambiguous statements, which are hard to identify for automated tools (Pagano and Maalej, 2013; von Hoffen et al., 2018).

8.6 Conclusion and Outlook

M-commerce is a significant growth area for retailers, and mobile shopping companion apps are an emerging phenomenon that has not found much attention in academia so far.

To remedy this situation and set the field, this paper first introduced a working definition for shopping companion apps. We built upon kernel theory from SQ and introduced a multidimensional, hierarchical research model of MASQ that comprises the content categories and characteristics relevant to service delivered through mobile apps. From analyzing close to 1,500 real-world customer reviews of three major shopping companion apps, we identified 23 aspects customer expect from this kind of app. Our results can aid service and app designers towards providing mobile service and shopping companion apps that exhibit high MASQ.

In this paper, we investigated shopping companion apps from a customer's point-of-view. In future work, we will investigate the overall service system that spans between retailers and customers and between groups of customers. Special consideration will be put on the interactions between the involved parties and on the

co-creation of shopping experiences that are facilitated by m-services and apps. Finally, we follow the dual mission of design science to advance theory while developing and evaluating innovative IT artifacts for practice. The customer preferences elicited in this work will subsequently inform our overarching design science research project on m-service in BaM retail.

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9 In-store Technologies in the Retail Servicescape

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In-store Technologies in the Retail Servicescape

Abstract. Brick and mortar (BaM) retailers start to integrate digital in-store technologies into the physical servicescape to leverage individual shopping experiences for their customers and competitive advantage for them. This research provides a starting point for BaM retailers, who lack guidance on how these technologies support their business strategies. We review the literature regarding the digital capabilities provided by customer-facing in-store technologies and identify their relations and contributions to the archetypal business strategies individualization and cost-optimization. We thereby extend the shopper-focused decision calculus by a technological view that relates the capabilities of in-store technologies, impacts on customers, and impacts on the retailers' business strategies.

9.1 Introduction

The digital era and the advent of omnichannel retailing transform consumers' shopping behavior in favor of digital channels and raise their expectations towards the digital profile of BaM retailers (Hagberg et al., 2016; Willems et al., 2017; Betzing, Beverungen, Becker, et al., 2017; Bollweg et al., 2016; Brynjolfsson et al., 2013). Retailers react by integrating digital in-store technologies into the physical servicescape to leverage both the benefits of e-commerce such as multimedia product presentations, recommendations, and reviews and the benefits of the physical store such as personal service, touch and feel of the merchandise, and instant availability (Brynjolfsson et al., 2013). However, especially small and medium-sized retailers—without a large IT organization—that want to integrate these technologies into their business model can easily get lost by the variety of technologies to choose from and may

lack a starting point for their assessments (Willems et al., 2017). In consequence, they often select technologies without examining the potential contributions to their strategies (Inman and Nikolova, 2017).

Much research exists on the digitization of retail (e.g. Hagberg et al., 2016; Brynjolfsson et al., 2013), the creation of digital shopping experiences (e.g. Betzing, Beverungen, Becker, et al., 2017; Lemon and Verhoef, 2016), organizational changes related to in-store technology (e.g. Pantano and Timmermans, 2014), their acceptance by customers (e.g. Roy et al., 2017), and the technologies itself (e.g. Willems et al., 2017). To date, there is — to the best of our knowledge — no attempt to provide retailers with a structured overview of the digital capabilities provided by contemporary customer-facing in-store technologies from a strategical point of view (Inman and Nikolova, 2017).

Consequently, our research goals are (1) to identify the digital capabilities that contemporary customer-facing in-store technologies provide to the retailer and (2) to identify their relations and contributions to the archetypal business strategies individualization and cost-optimization. These strategies build upon the theoretical lens of the shopper-focused decision calculus (Inman and Nikolova, 2017).

The remainder of this paper unfolds as follows: Section 2 gives the research background and strategic key concepts our analysis builds upon. Section 3 provides the applied research method. Section 4 presents the identified capabilities and shows their association to the key concepts. Section 5 links our findings to the shopper-focused decision calculus theory. Section 6 discusses our results and concludes this paper.

9.2 Research Background

The introduction of digital technologies in retailing is not a new phenomenon, dating back to the 1960s (Hagberg et al., 2016). While previous advances such as enterprise resource planning (ERP) mainly improved operational processes invisible to the customer, the nature of current developments is different. Self-service terminals, in-store assistants, and mobile payment are just a few examples that are directly visible to the customers. We define in-store technologies in retail as bundles of hard- and software that change or enhance the interface between retailers and

customers within the physical retail setting. These technologies augment the servicescape by new customer touchpoints that facilitate technology-enhanced person-to-person, person-to-machine, and even machine-to-machine encounters (Glushko, 2010). Willems et al. (2017) remind us that "technology in retailing is and should remain a means to an end rather than an end in se" (Willems et al., 2017, p. 2). Consequently, we take a retailer's perspective on the technologies' influence on his or her profit equitation. Primarily, the expected total benefits of ownership (TBO) must outweigh the total cost of ownership (TCO). The TBO depends on manifold internal (e.g., integration in the servicescape, organizational change) and external factors (e.g., customer acceptance, competition, obsolesce) and cannot be quantified in full. From a strategical point of view, benefits manifest in competitive advantage resulting from cost-optimization or differentiation through individualization (M. E. Porter, 1998). The former aims at efficient operations whereas the latter aims at effective operations, which can be achieved by meeting customers' individual needs better than the competition, which in turn, positively affects revenue. The shopper-focused decision calculus theory argues in a similar vein (Inman and Nikolova, 2017). Retail technology has the potential to decrease the retailers' costs and/or increase their revenue by extracting a consumer surplus, increasing the sales volume, attracting new customers or strengthening the retailer's bargaining power to suppliers (Inman and Nikolova, 2017). The authors primarily focus on the customers' reactions to selected in-store technologies and treat the influences of retail technology to business strategy as a black box. This work contributes to the shopper-focused decision calculus by shedding light on this black box.

Since innovation cycles in customer-facing technology are fast, reviewing contemporary in-store technologies only reflects a snapshot in time. Therefore, we use generalized digital capabilities as abstract proxies for these technologies and show instances for clarity. In the context of our work, digital capabilities denote sets of features or services provided by an in-store technology and should not be confused with organizational capabilities in the sense of intangible assets known from the resource-based view. Digital capabilities can be used to classify future technologies and help to identify their merits. Against this background, our analysis of the capabilities and their relations focuses on the following two archetypal strategies:

1. *individualization* subsumes all contributions of in-store technologies to fulfilling the individual customer's needs effectively. Individualization revolves around establishing and maintaining a relation to the customer with the aim of increasing

both the individual customer's basket size, and the overall number of customers. Further, differentiation through individualization aims at lowering the customer's opportunity cost, which manifests by either lowering the shopping effort or raising the shopping convenience.

2. *cost-optimization* subsumes all contributions of in-store technologies to fulfilling the retail operations efficiently. The primary goal of cost-optimization is to keep a certain service quality but decrease the retailer's cost through automation or offloading tasks to customers.

9.3 Research Method

The analysis performed in this work is based on the approaches for systematic literature reviews proposed by vom Brocke et al. (2009) (vom Brocke et al., 2009) and Webster and Watson (2002) (Webster and Watson, 2002). Following Cooper (1988) (Cooper, 1988), we define the scope and goal of the review in identifying the digital capabilities that contemporary in-store technologies provide, and outlining their relations and contributions to the presented strategies. We focus on theoretical designs and practical applications of in-store technology w.r.t. the retailer-consumer interface. A search (Webster and Watson, 2002) across relevant journals and conference papers in information systems, computer science, marketing, and business administration was conducted on Scopus on 2017-06-18. Using Willems et al.'s (2017) inventory of customer-oriented retail technologies (Willems et al., 2017), we exploratively derived and refined our search query for various technologies and research streams related to in-store technology (cf. Figure 9.1).

```
TITLE-ABS-KEY ( ( "retail*" OR "sale*" ) AND ( "technolog*" ) AND ( "digital␣sign*" OR "assisted␣
    selling" OR "biometric*" OR "convenience" OR "interactive" OR "personal" OR "shelf␣allocation"
    OR "shelf␣manag*" OR "customer␣behavior*" OR "consumer␣behavior*" OR "recommend*" OR "pervasive"
    OR "customer␣preference*" OR "consumer␣preference*" OR "advert*" OR "customer␣loyal*" OR "consumer␣
    loyal*" OR "customer␣retention" OR "consumer␣retention" OR "automati*" OR "self-service" OR
    "co-creation" OR "prosumption" OR "value␣co-creation" OR "purchase␣behavior*" ) ) AND DOCTYPE ( ar
    OR cp ) AND PUBYEAR > 2008 AND ( LIMIT-TO ( SUBJAREA , "COMP␣" ) OR LIMIT-TO ( SUBJAREA , "ENGI␣
    " ) OR LIMIT-TO ( SUBJAREA , "BUSI␣" ) OR LIMIT-TO ( SUBJAREA , "SOCI␣" ) OR LIMIT-TO ( SUBJAREA ,
    "DECI␣" ) OR LIMIT-TO ( SUBJAREA , "MULT␣" ) )
```

Figure 9.1: Literature Search Query

Due to the speed of technological innovation, we limit the literature search to the last eight years. The initial search yielded 2,147 results, whose relevance was evaluated analyzing their titles and abstracts (vom Brocke et al., 2009). Based on the initial

screening, 81 relevant publications were analyzed in detail. A one-level backward and forward search lead to 14 additional publications. The final literature sample consists of 95 publications. Although this selection must be seen as representative excerpt, the abstract nature of the digital capabilities allows for a comprehensive view.

9.4 Digital Capabilities of In-store Technology

We conducted an exploratory analysis of the 95 identified documents[55]. Figure 9.2 provides an overview of the derived digital capabilities, grouped by their main strategic impact. Five capabilities each primarily account for individualization and cost optimization strategies. We additionally identified three capabilities related to the elicitation of the customer's context. The capabilities are not mutually exclusive, i.e., one technology can support multiple capabilities, and one capability can both support the individualization and cost optimization strategies. In the same way, the capabilities can be combined, with one enhancing the operations of the other. We detail out our findings in the following:

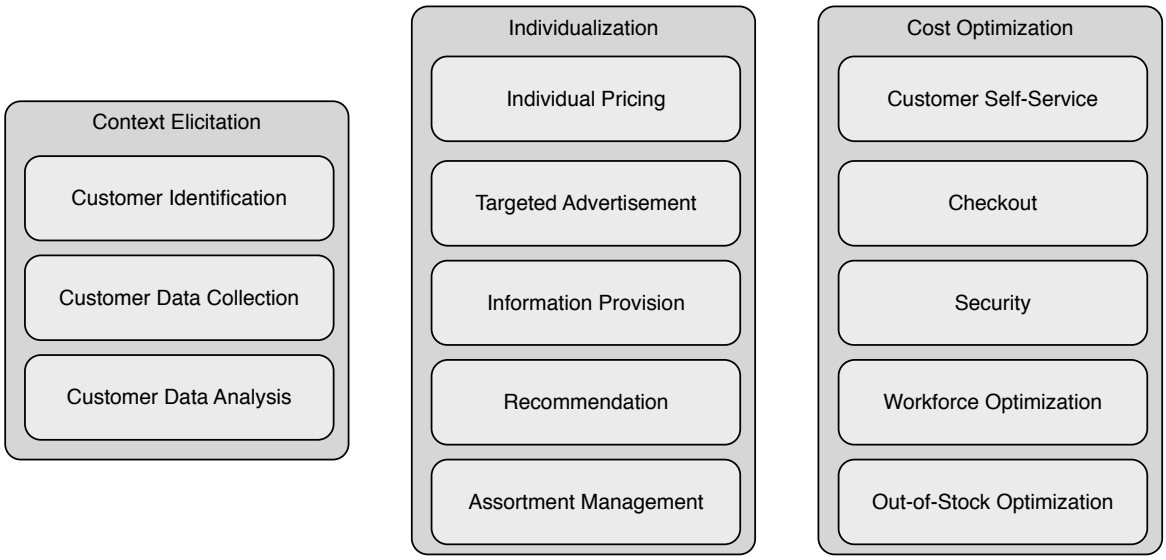

Figure 9.2: Digital Capabilities Provided by In-store Technologies

[55] A concept matrix (Webster and Watson, 2002) that relates the literature to the digital capabilities presented in Figure 9.2 is available online at `https://goo.gl/yYufZU`.

Digital information on the customers and their shopping behaviors provide the foundation for most capabilities. Context elicitation, on the one hand, allows to approach the customer individually, and on the other hand to optimize overall store operations. Identification and data collection take place as soon as the customer enters the vicinity of the retailer (Hoyer et al., 2012). Sensor- and vision-based technologies such as cameras, smart devices, wireless communication, and robots can be individually combined to personally identify the customer or at least individual traits, and his or her in-store shopping activities (Frontoni et al., 2013; Bertacchini et al., 2017; Kamei et al., 2012; Mancini et al., 2013; Chu et al., 2013; Hwangbo et al., 2017; Ravnik et al., 2014; T.-W. Lee et al., 2014; Zhou et al., 2009; Kam-Yiu Lam et al., 2013; Karmouche and Salih-Alj, 2012). Customers that already have a relation to the retailer can actively identify themselves at self-service terminals or the point of sale (PoS) using barcodes, QR-codes, loyalty cards, and NFC-equipped smart devices (Chu et al., 2013; Zhou et al., 2009).

Cameras with biometric face recognition capabilities that monitor the shop floor can identify inter alia the customer's gender, age, height, face, emotion, gestures, speech, and sentiment (Hwangbo et al., 2017; Ravnik et al., 2014; T.-W. Lee et al., 2014). They also provide a feedback channel for digital customer touchpoints such as digital signage by monitoring the customer's interaction with the channel.

Sensor-equipped robots directly interact with the customers and adapt to their behavior w.r.t. the customer's reactions (Bertacchini et al., 2017). Interconnected robots can act cooperatively, e.g., outdoor robots interacting with pedestrians can inform in-store robots about potential customers entering the shop (Kamei et al., 2012). Manifold options exist to capture the customer's location and movement patterns using satellite navigation, Bluetooth-based beacons, WiFi, and cameras (Kamei et al., 2012; Mancini et al., 2013; Kam-Yiu Lam et al., 2013; Pierdicca et al., 2015). RFID-tags (radio-frequency identification) can be attached to products (Zhou et al., 2009), loyalty cards (Chu et al., 2013), and shopping carts (Karmouche and Salih-Alj, 2012), to track customers and their shopping baskets, purchases, and interaction with digital product information and the products itself (Hwangbo et al., 2017; S.-H. Huang et al., 2014). Vision-based systems identify, how long customers look at a product, if the product is picked up and bought or if it is placed back again (Frontoni et al., 2013; J. Liu et al., 2017).

Customer data analysis generates insights from the collected information. Common approaches apply predictive analytics, data mining, and artificial intelligence to reason upon customer behavior (Yan and Zeng, 2009; Zuo and Yada, 2015; Kamei et al., 2010; H.-B. Li et al., 2012). Central insights on the individual customer level are the prediction of purchase behavior, i.e., the customer's willingness to pay and purchase probabilities for products (Yan and Zeng, 2009; Kamei et al., 2010; Nakahara and Yada, 2011) as well as the customer's preferences (Ogino et al., 2011). Aggregated information on movement patterns, hot spots, item popularity, interaction with digital touchpoints, and PoS data enable continuous improvement of the service delivery (Mankodiya et al., 2013). Both individual and aggregated insights set the foundation for the individualization and cost optimization capabilities.

Retailers having knowledge on the customer's willingness to pay and purchase probabilities can provide the customer with individual pricing, i.e., setting product prices that provide a good trade-off between maximizing the purchase probability and the extraction of customer surplus (M. E. Porter, 1998). Individual prices are presented using digital signage, electronic shelf labels, self-service terminals, and mobile apps (Zhou et al., 2009; Longo et al., 2013). Coupons, exclusive discounts, and individual product-service bundles are common means to achieve individual pricing (Kam-Yiu Lam et al., 2013). Like how gas stations vary their prices over the day, retailers can exploit different price sensitivities over the day and automatically adjust their prices using electronic shelf labels (Inman and Nikolova, 2017).

Individual prices can be combined with targeted advertisement and product recommendations to create a tailored shopping experience (Betzing, Beverungen, Becker, et al., 2017; Lemon and Verhoef, 2016). Digital signage, digital shopping carts, and self-service terminals that employ viewer analytics adapt to the current audience to display those advertisements to the customer that best fit his or her preferences and maximize purchase probability (Tian et al., 2012; C.-C. Chen, 2014). Interaction can be initialized, once the customer directs his or her attention to the advertisement (Kim, 2012). Forms of interaction include personalized messages, changing the display content following the picked-up item (Hwangbo et al., 2017), sharing discounts (Kaasinen and Yoon, 2012), and downloading display content to a smart device (Lee and Yoon, 2014). Mobile shopping companion apps present current promotions, provide individual offers, create shopping lists, and manage the customer's loyalty status (Kam-Yiu Lam et al., 2013; Pierdicca et al., 2015). Location-based push messages are a means to draw the customer's attention, e.g., informing the customer of

promotions when standing close to the product in question (Bourimi et al., 2011). Digital shopping carts allow changing their display content in accordance with the items in the cart (Sheltami and Shakshuki, 2009), e.g., to recommend products that fit the current selection or to display additional information regarding the selected items.

The latter refers to the information provision capability, where retailers provide research-supporting shopping aids (Angela Chang and Kukar-Kinney, 2011). Extending the customer's information base increases the customer's convenience and its product research efficiency (M. E. Porter, 1998; Hoyer et al., 2012). Smart devices, digital signage, digital shopping carts, self-service terminals, and robots can give further product-related information (e.g., the number of stock left, product presentations, manuals, the origin of ingredients, the terms of warranty, and customer reviews) (Bertacchini et al., 2017; Bourimi et al., 2011; Strohbach and Martin, 2011). Product recommendations in the form of alternatives and complementary merchandise to the current product (Walter et al., 2012) can be presented in the same way to assist the customer in evaluating alternatives (Hoyer et al., 2012). Applications of augmented reality such as smart mirrors, and virtual reality such as car simulators, allow trying products virtually (Melià-Seguí et al., 2013; Begole et al., 2009). Smart mirrors can also suggest accessories matching the tried garments and recommend relevant products (Melià-Seguí et al., 2013). As with all instances of personalization, information on the customer's current and historical contexts must be considered (Angela Chang and Kukar-Kinney, 2011).

Retailers leverage customer insights such as shopping paths, item view counts, and sales data to improve their offerings (Walter et al., 2012). Assortment management is tasked with optimizing the range of offered goods and their placement. The goal is to maximize the product return on investment (ROI) w.r.t. shelf space allocation (H.-B. Li et al., 2012). Popular items are placed along frequent shopping paths and complemented by related high-margin products to stimulate additional sales (S.-H. Huang et al., 2014; Syaekhoni et al., 2016).

In-store technologies are a means to introduce new services or replace the manual labor of existing services by automation (Pantano and Timmermans, 2014; Angela Chang and Kukar-Kinney, 2011). Information provision and recommendation capabilities are mainly aimed at increasing revenue, while the following instances of automating manual labor at the retailer-consumer interface are aimed at decreasing

cost. Electronic shelf labels, for example, replace manual labeling (Zhou et al., 2009). They further help reducing potential spoilage and excess inventory by automatically adjusting prices w.r.t. nearing expiry dates (Inman and Nikolova, 2017).

Customer self-service using in-store terminals (C.-C. Chen, 2014), smart devices (Pierdicca et al., 2015; Bourimi et al., 2011), and robotic service encounters (Bertacchini et al., 2017; Kamei et al., 2012) replaces person-to-person encounters and lets the customer perform tasks of the retailer (Glushko, 2010). Self-service terminals and mobile apps are research-supporting aids, which improve the customer's knowledge such as the location of the product (Angela Chang and Kukar-Kinney, 2011). In-store navigation and way-finding is a crucial function of self- service because not finding merchandise is a primary reason for customers leaving the store (Stone, 2011). Stationary touchpoints provide maps and directions (Mankodiya et al., 2013; C.-C. Chen, 2014; Kim, 2012), whereas mobile touchpoints directly navigate customers to the item in question (Bertacchini et al., 2017; Strohbach and Martin, 2011).

Self-checkout terminals already shift the checkout task to the customer. The consistent procedural nature of the checkout process holds further cost saving potentials from automation (P. Kumar, 2005) by speeding up the payment transaction and scanning of items. Contactless payment using NFC-enabled cards or smart devices fastens the process over cash or card-based transactions that involve entering a PIN or signing (Cocosila and Trabelsi, 2016). Attaching RFID-tags to the items enables faster scanning of products compared to conventional methods such as barcodes (Hauser et al., 2015; Grabia, 2015).

RFID-tags also double as an anti-theft security feature, rendering older electronic article surveillance tags obsolete (Hauser et al., 2015). Security also benefits from the customer identification, data collection, and customer analysis capabilities, which can aid security staff in identifying suspiciously behaving customers (Y.-k. Wu et al., 2015). The current generation of cameras and RFID-tags fulfills multiple purposes such as customer and stock tracking (Hauser et al., 2015; Thiesse and Buckel, 2015) as well as providing security features, rendering old systems obsolete, and thus abolishing the cost of maintaining multiple systems.

Aggregated information on in-store customer behavior also aids in workforce optimization (T.-W. Lee et al., 2014). Predictive analytics on the expected customer frequency are used to schedule employees more efficiently and to prevent queues

to accumulate by constantly calculating the optimal number of registers (T.-W. Lee et al., 2014; P. Kumar, 2005). Like identifying suspicious behavior, video analysis supports staff in identifying customers in need of assistance (Bertacchini et al., 2017). Staff can interact with customers in technology-enhanced service encounters, in which employees use smart devices such as tablets, watches, and glasses to get information on the customer and the respective products (Glushko, 2010).

Lastly, video- and sensor-based stock detection in the shelves enable live stock-level tracking and improved inventory management (Melià-Seguí et al., 2013; Thiesse and Buckel, 2015; Frontoni et al., 2014). Staff can be notified in case of nearing or existing out-of-stock situations. Thiesse and Buckel (2015) show that the cost of RFID-based replenishment is offset by the performance benefits over periodic manual checks of the shelves (Thiesse and Buckel, 2015). Preventing out-of-stock situations mitigates lost sales and reduces customer dissatisfaction over unavailable merchandise (Stone, 2011).

9.5 Digital Capabilities in the Shopper-focused Decision Calculus

The shopper-focused decision calculus guides retailers regarding potential impacts of retail technology on shoppers and the retailer's profits (Inman and Nikolova, 2017). Drawing from equity theory, the authors empirically assess the customers' perceptions and reactions to retail technology on retail patronage and word-of-mouth as mediators of technology adoption (Inman and Nikolova, 2017, p. 15). However, the potential contributions of contemporary in-store technologies to the archetypal business strategies remain a black box. We presented digital capabilities of contemporary in-store technologies and now incorporate them into an enhanced form of the shopper-oriented decision calculus (see Figure 9.3).

In-store technology capabilities are divided into enabling and executing capabilities, whereas the former elicit the customer's context either atomic on the individual customer level or aggregated on the store level. The latter is enabled and informed by the gained insights and execute the customer-facing services. In-store technologies themselves can be classified as context-aware if they can recognize and capture different situations using vision- or sensor-based technologies. Shopping-support

systems influence the customer's shopping process directly by interacting with the customer (e.g., recommender systems, shopping assistants) or indirectly by altering the store environment (e.g., digital signage, assortment management). In-store technologies can combine both enabling and executing capabilities and can be both context-aware and shopping-support systems.

The customer's perceptions mediate the potential influences of the capabilities on the archetypal strategies individualization and cost optimization. Following Inman and Nikolova's (2017) argumentation (Inman and Nikolova, 2017, p. 17, 24), the acceptance of new technologies has an immediate impact on the retailer's profits. When customers, for example, do not adopt self-service terminals, their TCO are not offset by the realized TBO. Mediate effects are visible from customers altering their retail patronage. Good recommendations, for example, might lead customers to favor the service of the particular store over other stores, whereas negative experiences with in-store technologies might lead customers to choose a competitor in future. Similarly, customer word-of-mouth communication on their good and bad experiences moderates the impact of in-store technologies on the retailer's profit.

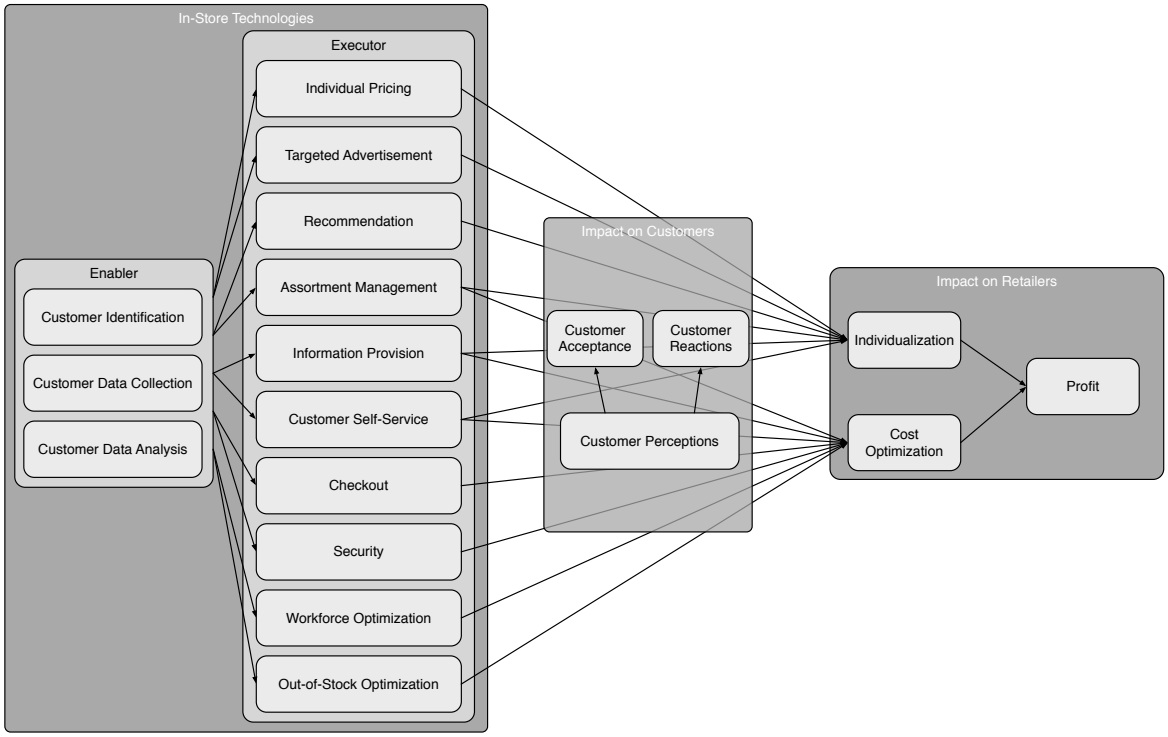

Figure 9.3: Augmented Decision Calculus

Individual pricing, targeted advertisements, and recommendations are essential capabilities for providing individual shopping experiences (Lemon and Verhoef, 2016). Research-supporting shopping aids (Angela Chang and Kukar-Kinney, 2011) for information provision and customer self-service can both increase revenue through individualization and decrease cost by automating manual labor. Assortment management in a similar fashion increases revenue by optimizing the range and placement of offered goods, might improve customer satisfaction over better assortment, and decreases cost from excess inventory. Checkout, security, workforce optimization, and out-of-stock optimization are central capabilities to decrease cost by automating manual labor and by alleviating losses due to human mistakes, spoilage, theft, or employees being unproductive.

9.6 Discussion and Conclusion

We identified digital capabilities of in-store technologies and related them to the retailer's profit equitation. Our results serve as a starting point for retailers that want to adopt in- store technologies. The augmented decision calculus can become part of the sophisticated retailer's toolbox along other strategical lenses such as technology acceptance, investment management, and customer experience management.

Our results support the general assessment of new technologies but do not remove the need for a thorough evaluation of internal and external factors influencing the ROI. Retailers have to consider among other things the influence on different customer segments, organizational change (Pantano and Timmermans, 2014), competitors, the sustainability of competitive advantage (M. E. Porter, 1998), and legal implications of context-aware technologies (Bourimi et al., 2011). Moreover, the relevance and applicability of the individual technologies and capabilities depend among other things on the type of goods sold as well as the retailer's IT maturity and investment budget. Furthermore, the calculus does not consider the influence of an existing IT infrastructure on investment decisions and their profit implications. Future research can apply an integrative lens on the retailer's enterprise architecture regarding the integration, combination, and recombination of existing technologies to fulfill the capabilities. Since we abstract from particular instances of technology, we refrain from comparing the benefits and risks of individual technologies and do not attempt to rank or quantify their potential profit impacts. The digital capabilities

are exploratively derived from contemporary literature on in-store technologies. We do not claim completeness of capabilities and ask other researchers to contribute and further extend our results. Moreover, is necessary to evaluate the augmented decision calculus in future research. We imagine conducting two-sided case studies, which validate the derived capabilities and hopefully provide support for their impact on the profit equitation. These results should be contrasted to surveyed customer perceptions, reactions, and measured adoption.

The speed of innovation urges especially small and medium-sized retailers, who are threatened by e-commerce, to continually assess new in-store technologies regarding their potential impact on profit and fit into their overall technological landscape. The presented set of digital capabilities supports retailers in understanding and classifying new technologies w.r.t. their contributions to the profit equitation. By incorporating the capabilities into the decision calculus, we provide retailers with a comprehensive tool for strategic thinking. Lastly, this research provides a comprehensive overview of contemporary in-store technologies for BaM retail, which informs our overarching research project to design and evaluate technology-enabled service systems for co-creating digital customer experiences in BaM retail.

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10 Mirroring E-service for Brick and Mortar Retail: An Assessment and Survey

Fact sheet of publication *P.5*

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Mirroring E-service for Brick and Mortar Retail: An Assessment and Survey

Abstract. The digital transformation increasingly impacts the competitive retail market structure in favor of e-commerce and digital business models, while many brick and mortar (BaM) retailers are struggling to meet customers' expectations. Supported by the customer adaption of e-commerce and digital technologies, this paper applies the lens of channel complementary theory to BaM. We examine, which e-service touchpoints from e-commerce can be transferred to the physical servicescape of BaM retail to complement customer journeys. Drawing from the dominant design theory, we first assess leading e-commerce solutions to identify dominant e-service touchpoints, which are then mirrored for their application in BaM retail. Second, we surveyed 250 shoppers to elicit the likeliness of use regarding these touchpoints. Our results provide a foundation for both academia and retail to advance the knowledge of relevant e-service touchpoints in BaM.

10.1 Introduction

The digital transformation is an ongoing organizational change process that leverages technology-enabled innovation to optimize existing business processes and to digitally (re-)engineer business models (Matt et al., 2015; Gray and Rumpe, 2017). In retail, the digital transformation increasingly impacts the competitive market structure in favor of e-commerce and digital retail business models and also bolsters customers' expectations towards e-service offerings in BaM (V. Kumar et al., 2017; Hagberg et al., 2016; Verhoef et al., 2015). In particular, small and medium-sized

enterprise (SME) brick and mortar (BaM) retailers, which comprise the majority of stores in Germany, face strong competition with pure online players and large retail chains that embrace technological innovations (Bollweg et al., 2018; Betzing, Beverungen, and Becker, 2018). Over the last years, e-commerce in Germany steadily realized double-digit growth rates (Statista, 2017; Heinemann, 2017), while SME retail turnovers are projected to decline by up to 30 % until 2020 in many cities (Eichholz-Klein et al., 2015). To cope with the digital transformation, large retail chains are heavily investing in channel management to become omnichannel retailers that are able to seamlessly interact with customers through any physical and digital channel expected by them (Saghiri et al., 2017; Lemon and Verhoef, 2016). While selecting appropriate channels and technologies to adopt for this purpose is already challenging for large retail corporations (von Briel, 2018; Inman and Nikolova, 2017), it can appear like a Herculean task for SME BaM retailers (Betzing, Beverungen, and Becker, 2018). However, BaM retailers that are unable to develop new (digital) strategies to address customers' expectations, are threatened to become "amazon-ed" (Cahn, 2018). When asking customers for their reasons to choose e-commerce over BaM retail, comparably lower prices to BaM retail (36 %, Statista (2017))—contrary to popular belief—are only one aspect mentioned, while a considerable number of customers also names comfort and ease of use (50 %, Statista (2017)), 24/7 availability (39 %, Statista (2017)), and low purchasing efforts as motivators (Statista, 2017; Q. (Lu et al., 2018). Hence, non-financial levers do exist in e-commerce that could turn out to be beneficial in the BaM context (e.g., the integration of 24/7 e-service to increase BaM store visibility).

Particular to e-commerce is the offering of *e-service touchpoints*. An e-service is understood as the application of digital competencies "through deeds, processes, and performances for the benefit of another entity or the entity itself" (Vargo and Lusch, 2008, p. 26), where the "delivery is mediated by information technology" (IT) (Rowley, 2006, p. 341). Literature differentiates touchpoints into instances and classes (Heuchert et al., 2018). The former touchpoints describe moments of contact, i.e., any "instance of communication between a customer and a service provider" (Halvorsrud et al., 2016, p. 846). This contact belongs to a touchpoint class, which denotes "an abstract interaction interface to the customer" (Heuchert et al., 2018, p. 4). When using the term (e-service) touchpoint, we refer to a touchpoint class. Established technologies that provide access to these touchpoints in the physical servicescape of BaM retail are, for example, smartphone and in-store terminal applications (apps) (Faulds

et al., 2018; Betzing, Hoang, et al., 2018). Against this background, it is fair to assume that *mirroring*—adapting e-service touchpoints, originally provided in e-commerce, to the physical servicescape—represents a good starting point for BaM retailers to transition towards an omnichannel environment.

Still, retailers can select from a wide variety of conceivable e-service touchpoints to offer as value propositions that potentially create value for and with the customer (Vargo and Lusch, 2008; Voorhees et al., 2017; Willems et al., 2017). In particular, it remains unclear, whether customers in the physical servicescape of BaM retail are likely to use the same e-service offerings they are used to in e-commerce. Empirical studies on omnichannel retail are sparse (von Briel, 2018), and BaM retailers are lacking guidance regarding the selection and mirroring of e-service touchpoints (Betzing, Hoang, et al., 2018). To shed light on this matter, our research question reads as follows: *What e-service touchpoints, enabled by smartphone and in-store terminal applications, should be mirrored to the physical servicescape of brick and mortar retail?*

We followed a two-step approach to answer this question. First, we identify a set of major touchpoints offered by leading e-commerce platforms, group them, and mirror them for their application in a traditional BaM retail servicescape. Second, we surveyed 250 shoppers to elicit the likeliness of use regarding these touchpoints. Our results provide a foundation for both academia and retail to advance the knowledge of relevant e-service touchpoints in BaM retail.

The remainder of this paper unfolds as follows: Section 10.2 positions our study within the body of knowledge. Section 10.3 presents the set of mirrored e-service offerings, whereas Section 10.4 introduces our survey research method and the survey results. Section 10.5 discusses our results and relates them back to theory. We close with an overview of our contributions and an outlook on future research in Section 10.6.

10.2 Theoretical Background

Customers have become accustomed to an increasing level of digital touchpoints in all facets of their lives (Straker et al., 2015), and also expect e-service offerings in traditional BaM environments (Faulds et al., 2018; Lemon and Verhoef, 2016).

In this context, the term hybrid customer interaction is used to describe a behavior, where customers are present simultaneously in both the physical and digital worlds (Nüesch et al., 2015). For example, customers use their smartphones in-store as a "second screen" to compare prices, while interacting with a salesperson (Hosseini et al., 2017). Phenomena such as "showrooming" (Verhoef et al., 2015) or using e-service touchpoints by other service providers during the store visit can be cannibalizing for BaM retailers.

On the other hand, hybrid customer interaction can also be leveraged by retailers, when they are able to provide own e-service touchpoints for customers to use in-store (Herhausen et al., 2015). Our reasoning follows channel complementary theory (Dutta-Bergman, 2004), which explains that traditional and new media formats for implementing communicative functions may exist alongside instead of replacing each other. The theory suggests that the function is a more important consumption driver than the medium itself (Dutta-Bergman, 2004). In our context, e-service touchpoints can be understood as such communicative functions. Some authors provide evidence of channel synergies in retail (Wagner et al., 2013) and suggest a "bricks-and-clicks" approach, where insights from the BaM channel are integrated into an online channel (Herhausen et al., 2015). However, the opposite direction—adapting knowledge from e-commerce to the physical BaM servicescape—has not received much attention. Further, most omnichannel initiatives focus on integrating *existing* digital and physical channels and touchpoints (Verhoef et al., 2015; Lemon and Verhoef, 2016; Saghiri et al., 2017; von Briel, 2018). Yet, particularly traditional BaM retailers that only have the stationary sales channel lack information regarding which e-service touchpoints they should provide to their customers (Wagner et al., 2013). It remains unclear, which e-service touchpoints potentially yield value for customers and would likely be used by them (Blázquez, 2014). So far, there is a scarcity of empirical studies on omnichannel retailing (von Briel, 2018), and only a limited amount of studies gives advice regarding digital technologies and e-service touchpoints to integrate into the physical servicescape (e.g., Willems et al., 2017; Inman and Nikolova, 2017; Betzing, Hoang, et al., 2018; V. Kumar et al., 2017).

This article suggests *mirroring*—complementing a traditional BaM retail channel with e-service touchpoints that have been adapted from proven designs in other channels. The lens of the dominant design theory provides us with a starting point for the investigation. The theory argues that a product category establishes a representative set of functions over time, which is then seen as standard (Suárez and Utter-

back, 1995). The lens has previously been applied to technological milestones such as microprocessor designs, PC operating systems, and television systems (Suárez, 2004; Suárez and Utterback, 1995). The dominance of a technology can be investigated on different levels of analysis. One level is the consideration of "technological artifacts as composed of subsystems that are linked together [...] through specific interfaces" (Suárez, 2004, p. 274). In our context, these artifacts can comprise the whole omnichannel system or a particular digital channel such as an e-commerce solution. As e-commerce is a mature domain (V. Kumar et al., 2017), it is fair to assume that leading e-commerce systems have set such a dominant design, which comprises a set of functions that represent the consolidated requirements of various types of users (Suárez and Utterback, 1995). In the consequence, the e-service touchpoints offered by leading e-commerce systems should meet customers requirements to a large extent and provide value for them. Hence, they also might be relevant for customers shopping in the physical BaM retail servicescape.

While the mirroring approach appears promising for BaM retailers, it remains unclear, if and to what extent customers are likely to use these mirrored touchpoints. Particularly, Suárez reminds us that "a dominant design is not always that design which has greatest technological sweetness" (Suárez and Utterback, 1995, p. 417). Therefore, we subsequently identify a set of dominant e-service touchpoints, and evaluate the customer's likeliness to use them in the BaM servicescape.

10.3 Mirroring E-Service Touchpoints for Brick and Mortar Retail

10.3.1 Identification of Dominant E-service Touchpoints

We assessed leading e-commerce solutions to identify the e-service touchpoints commonly offered in e-commerce. This assessment covers both the propriety solutions of the three German e-commerce market leaders (*amazon.de*, *otto.de*, and *zalando.de*) (Statista, 2016) and the five leading commercial off-the-shelf e-commerce solutions in the German market (*Shopify*, *Magento*, *WooCommerce*, *XT:Commerce* and *Shopware*) (Datanyze, 2018). As the latter solutions can be customized by the retailers to serve their needs, we selected concrete instances. To cater for potential variances

resulting from national peculiarities, customizing, and different product categories offered, we sampled three major Western European e-commerce retailers for each solution, yielding a sample of 18 online shops.

We employed a qualitative web-content analysis approach (Mayring, 2014), where two of the authors with backgrounds in retail and service science manually simulated typical customer journeys on the online shops. In an open coding process, we inductively derived a total of 35 different e-service touchpoints that guide, support or enable the customer during its customer journey. Since we focus on the dominant design, we only kept those touchpoints that were offered by at least four online shops. Further, logistics-related touchpoints, as well as ones that require an online shop (e.g., *Click & Collect* and *Click & Reserve*), have been eliminated, because they do not constitute an independent BaM e-service touchpoint. 19 unique e-service touchpoints remained.

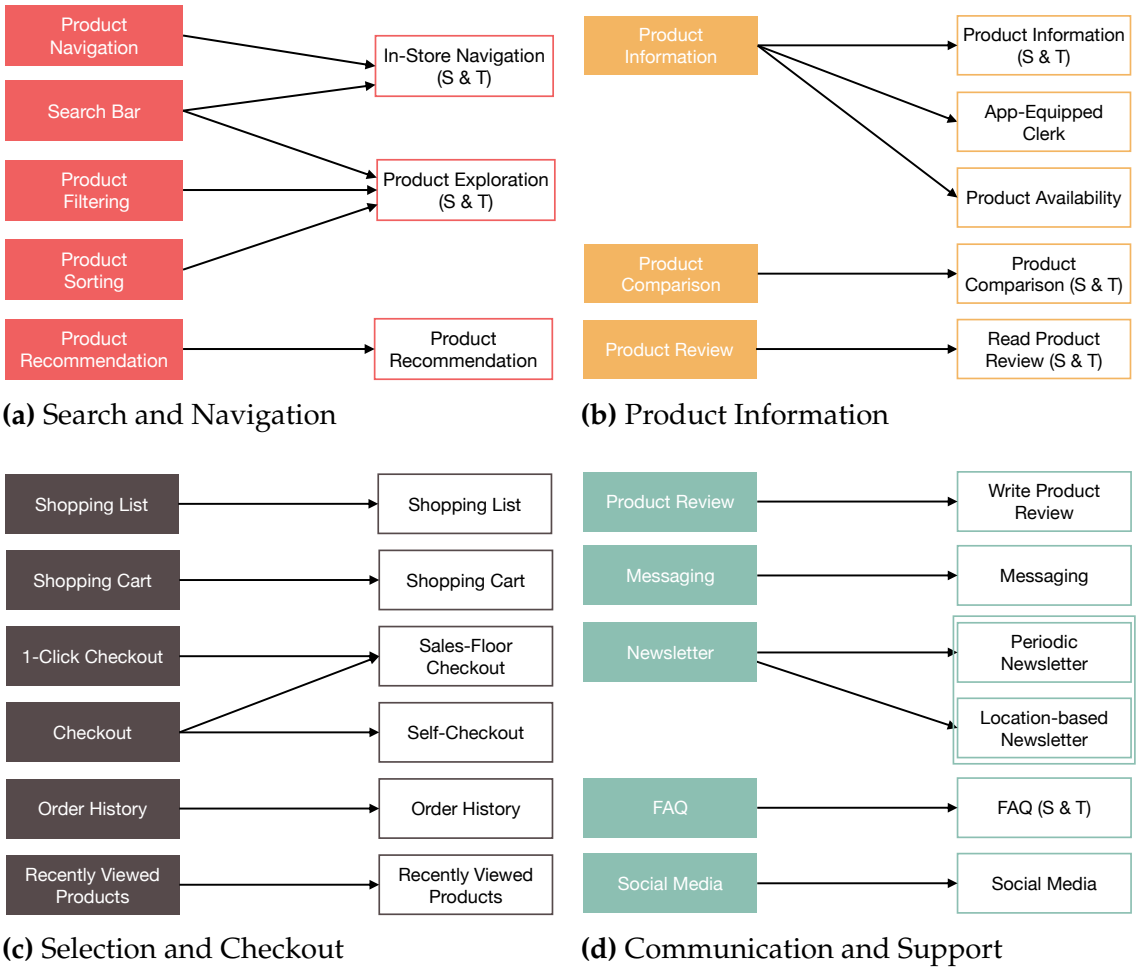
Figure 10.1 shows the identified e-service touchpoints from e-commerce and maps them to their mirrored BaM e-service counterparts. Some e-service touchpoints were mirrored into more than one touchpoint, whereas other e-service touchpoints have been merged into a single mirrored touchpoint, yielding a total of 20 mirrored BaM e-service touchpoints. Based on the type of value proposition, we grouped the touchpoints into four distinct categories that occur along the customer journey, viz., search and navigation, product information, selection and checkout, and communication and support.

10.3.2 Mirrored E-Service Touchpoints

10.3.2.1 Search and Navigation Touchpoints

are research-supporting shopping aids (Angela Chang and Kukar-Kinney, 2011) that help customers in the pre-purchase phase of their journey (Lemon and Verhoef, 2016) to find and locate relevant products and services from the retailer's offered portfolio. These touchpoints reduce the search time and potential information overload customers might experience.

In-Store Navigation Touchpoint: 83 % of the e-commerce solutions under consideration provide a global text search to directly track down desired products. This touchpoint is typically enhanced by auto-completion to assist with spelling and to provide



(a) Search and Navigation

(b) Product Information

(c) Selection and Checkout

(d) Communication and Support

Figure 10.1: Mirroring of e-commerce touchpoints to BaM e-service touchpoints, grouped by touchpoint category (e-commerce touchpoint $\overset{\text{mirroring}}{\rightarrow}$ mirrored BaM e-service touchpoint)

first results before the search request is completed. Mirrored to the BaM context, this e-service touchpoint is particularly useful for large department stores and for customers unfamiliar with the store layout. It can support customers in locating a desired product and provides them with in-store directions. This touchpoint is feasible for both in-store terminals and smartphones. A smartphone-hosted app may use the tracking capabilities of the underlying device to provide real-time turn-by-turn navigation to a product.

Product Exploration Touchpoint: Due to their typically extensive product portfolios, online shops provide various means to browse and explore the portfolio. Sorting (e.g., lowest price or best reviews first) and filtering (e.g., product categories, brands) capabilities are provided to narrow down the product portfolio. Even though BaM stores fall short in terms of portfolio sizes when compared to online retailers (Bryn-

jolfsson et al., 2011), most retailers still offer a wide range of products. While e-commerce search touchpoints give direct product access, the portfolio might be harder to perceive in-store due to product presentation. In effect, potential BaM customers can experience issues in their orientation and selection process. Mirroring existing product exploration touchpoints to the BaM environment is facilitated by accessing the retailer's product data through terminals and smartphones, allowing the customer to apply the known filtering and sorting operations.

Product Recommendation Touchpoint: More than two-thirds of the considered e-commerce solutions feature a product recommendation engine. Based on behavioral customer data such as order history and recently viewed products, the e-service recommends products similar to previously considered items (content filtering) or ones that customers with similar taste have bought (collaborative filtering) Balabanović and Shoham, 1997. By now, recommended products make up to 35 % of e-commerce purchases MacKenzie et al., 2013. A mirrored product recommendation service takes into account behavioral customer data such as order history, shopping lists, or even their current in-store location. A smartphone app collects this information and, in turn, makes product recommendations.

10.3.2.2 Product Information Touchpoints

assist the customer with retrieving of detailed information about considered products, and aid in the product selection process. As such, they primarily take place in the pre-purchase phase of the customer journey (Lemon and Verhoef, 2016).

Extended Product Information Touchpoint: Urged by the inability of customers to physically experience products online, retailers responded by providing extensive textual and multi-media product presentations, which has led to online retailers giving more detailed information than their BaM counterparts. Customers can access a mirrored product information touchpoint by scanning product tags with their smartphones to receive detailed multi-media product information. Similarly, customers can carry products to an in-store terminal, scan their tags, and retrieve the information.

App-equipped Clerk Touchpoint: Some customers prefer personal service over e-service to get product information. Typically, store associates must have basic knowledge of all products in their responsible department. In case of detail questions, they

might not be able to provide a correct answer. By providing store associates with a product information touchpoint (e.g., via a smart device), they can quickly look up the requested information for the customer.

Product Availability Touchpoint: Two in three analyzed online shops inform on product availability, i.e., whether a selected item is in stock, how many pieces are left, and send notifications when an out-of-stock product becomes available again. In a BaM store, product availability is visually apparent. However, even if a product is not on display, it might be available in the back room or a nearby warehouse. Through the introduction of a product availability touchpoint, which can be accessed by scanning a product's shelf label or manually searching a product, customers can access backstage warehouse availability information, trigger a refill or get a refill notification. As such, frustration from out-of-stock situations can be mitigated.

Product Comparison Touchpoint: As seen in the extended product information touchpoint, many online stores allow to compare the information linked to different products (e.g., size, price, and technical features) in a tabular fashion to improve the customer's selection process. Hence, a mirrored e-service touchpoint may allow scanning the tags of multiple products with a smartphone or in-store terminal app in order to obtain structured information for an efficient comparison.

Read Product Review Touchpoint: Product reviews, typically written by other customers, are one of the major information sources for online shoppers in their decision process Floyd et al., 2014. The touchpoint can be mirrored as an extension to the product information service. In effect, the collective experience of the community in the form of ratings and reviews can be shown next to the retailer-provided product information.

10.3.2.3 Selection and Checkout Touchpoints

support customers by helping them to plan future purchases, retaining control of the current purchase process, facilitating the checkout process, and keeping track of the past purchases (Lemon and Verhoef, 2016).

Shopping List Touchpoint: E-commerce solutions frequently allow registered customers to create shopping lists or wish lists to save product references for later consideration. Interestingly, this touchpoint does not have its origins in the digital

realm but was previously mirrored from traditional paper-based lists from the offline world. Now, the e-service implementation can be mirrored back to the physical realm. Customers can use a smartphone app to add selected products to a shopping list. Besides remembering relevant products, shopping lists allow for easy access to recurring purchases and to prepare store visits in advance.

Shopping Cart Touchpoint: Similar to shopping lists, shopping carts first had a physical representation before getting implemented in e-commerce. Digital shopping carts (or shopping bags) contain all selected products, display the subtotal and commonly allow to search and filter their contents. Mirrored back as an e-service for BaM, customers scan selected products before placing them into the physical shopping cart. Using their smartphones, customers can keep track of their projected spending and compare their selection to previously created shopping lists.

Sales-Floor Checkout Touchpoint: In e-commerce, customers do not have to wait in a queue or depend on a cashier to complete the checkout process, which renders it very efficient. One way to mirror a more efficient checkout to the physical realm lies in equipping store associates with smart devices to scan products and check out the customer on the sales-floor. Hereby, a potential queue at the sales counter can be skipped.

Self-Checkout Touchpoint: Another way to digitally increase checkout efficiency is self-checkout. While these systems originally were introduced as a means for retailers to reduce labor cost (Dean, 2008), they can also facilitate efficiency gains for customers (e.g., skipping queues). In conjunction with the shopping cart touchpoint, a mobile self-checkout becomes feasible, where customers would only have to complete their purchase with electronic payment. This touchpoint satisfies shoppers' demand for "sofortness", similar to what they are used to from e-commerce.

Order History Touchpoint: In online shops, registered users usually can access prior orders to find out what has been bought. Mirrored to a smartphone app in the physical realm, a digital order history can help to keep an overview of what has recently been bought, and also to support recurring purchases such as groceries. The touchpoint also supports keeping track of the spendings over time.

Recently Viewed Products Touchpoint: During online shopping, customers often interact with dozens if not hundreds of different products, which makes it hard to keep track of the items recently viewed. Respective touchpoints support customers

by caching the accessed items. While BaM store portfolios are not as extensive as their online counterparts, they might still be sufficiently large to make it difficult for customers to keep track of all viewed products and retrieve the most desirable one (e.g., make a choice from different tried-on clothes). Again, customers can use their smartphone to scan the tags of considered products.

10.3.2.4 Communication and Support Touchpoints

are used throughout the whole customer journey (Lemon and Verhoef, 2016) to facilitate marketing, customer engagement, and customer care.

Write Product Review Touchpoint: Besides customers digitally consuming reviews, providing ratings and reviews themselves can also be mirrored by means of a smartphone app to the BaM context. By providing their opinion, customers support other shoppers and may also help retailers to adjust their product portfolio w.r.t. the customer reviews.

Messaging Touchpoint: Even though online retailers do not have the traditional shop-floor personnel, many of them provide customer service by means of a (video-)chat interface. Mirrored to a BaM store, an instant messaging touchpoint can ease interactions with store associates, especially when no associate is nearby.

Newsletter Touchpoint: Newsletters typically inform about a retailer's special offers or events. In contrast to conventional mass mailing such as catalogues, digital newsletters can be personalized. Personalized digital newsletters in a BaM environment can be viewed by the customer through a smartphone app. Further, a location-based newsletter touchpoint can exploit the smartphone's technological capabilities to enable location-based proactive newsletters that are sent out when a customer is passing by the store.

FAQ Touchpoint: Beyond product-related information, online retailers typically provide a list of answers to so-called "Frequently Asked Questions" (FAQ), which deal with topics such as warranty handling, delivery times, return policies or payment methods. Since FAQs are not customer-specific, this touchpoint can be mirrored both via smartphone and in-store terminal. An FAQ touchpoint helps to clarify time-consuming questions in advance that might otherwise be asked during consultations with store associated or at the checkout counter.

Social Media Touchpoint: At its beginnings, online shopping was a mere functional activity without a prevalent social component. With the rise of social media, the concept of "social commerce" emerged Hajli, 2014, where customers share their shopping experiences with others. While customers in BaM can directly interact with friends and other shoppers in-store, access to social media would enable interaction with a much larger group of acquaintances and strangers online. A retailer-provided social media touchpoint can, for example, facilitate discussions between customers or enable customers to showcase newly bought items.

10.4 Assessment of Mirrored E-Service Touchpoints

10.4.1 Survey Research Approach

Quantitative survey research (Recker, 2012) was employed to identify the shoppers' likeliness of use regarding the mirrored e-service touchpoints. We conducted a hypothetical thought experiment where participants were asked to imagine being in a fictitious "smart store", instead of presenting and surveying particular instances of the envisioned touchpoints. In an online survey, the participants were first introduced to the study context and the four categories of touchpoints that the fictional smart store will offer to complement traditional store operations (see Section 10.3). Afterward, each e-service was briefly introduced in one paragraph. Given the nature of the study where touchpoints were presented on a rather abstract level, we did not apply measures such as the Technology Acceptance Model (Davis, 1989), which are focused on well-specified particular instances of technology. Instead, for each touchpoint, we surveyed its likeliness of use by means of a single item five-point Likert-scale (e.g., "*how likely would it be for you to use such a product availability service?*"). When applicable, the question was asked twice—both for accessing the touchpoint in-store through a smartphone and through an in-store terminal. Finally, participants had to provide demographic information. In light of the overall relevance of BaM retail in society, we did not limit the survey to a particular audience. Instead, we recruited a diverse sample of more than 300 participants of at least 18 years of age from the Western world using *prolific.ac*. The recruiting platform aims at providing researchers with representative samples of users regarding age, gender, and educational level. Mason and Suri 2012 show that online labor markets

are appropriate for conducting behavioral research and that respondents' behavior closely resembles the behavior of participants in traditional offline settings. An attention check question (adapted from Oppenheimer et al. (2009)) was used to filter inattentive participants, which yielded 250 valid responses. The mean age of the respondents was 32.69 years (median 31 years, SD 9.96 years) and 53.60 % were female. Participants countries of origin were the United Kingdom (145), the United States (52), Canada (12), Portugal (9), the Netherlands (4) and sixteen other European countries (28). The average completion time for the survey was 9 minutes and 37 seconds. Participants were rewarded £1.15.

10.4.2 Survey Results

Figure 10.2 provides the distribution of the likelihood of use of the mirrored e-service touchpoints. The touchpoints are grouped by the four categories, and within each category, the e-service touchpoints are sorted in descending order by their average rating. The global average rating is 3.58 points. The social media service ranked worst with an average of 2.23 points, while the self-checkout service ranked best with an average of 4.35 points.

An inter-group comparison revealed that respondents are most likely to use selection and checkout touchpoints (∅ 3.92 points). Product information touchpoints (∅ 3.79 points) and search and navigation touchpoints (∅ 3.73 points) ranked similarly, whereas respondents are much less likely to use communication and support touchpoints (∅ 2.94 points). The social media ($\sigma^2 = 1.71; \sigma = 1.31$), periodical newsletter ($\sigma^2 = 1.64; \sigma = 1.28$), location-based newsletter ($\sigma^2 = 1.60; \sigma = 1.27$), and messaging touchpoints ($\sigma^2 = 1.48; \sigma = 1.22$) were also the most controversial ones.

Pairwise Spearman's rank coefficients ρ between each e-service and the respondents' age indicated no significant relationships for most touchpoints, except for product comparison via in-store terminal ($\rho = .48; p < .001$), reading product reviews via in-store terminal ($\rho = .45; p < .01$), and accessing FAQs on an in-store terminal ($\rho = .39; p < .01$), which all show a positive relationship to increased age. On the contrary, the social media service ($\rho = -.43; p < .01$) has a negative relationship to increased age. Regarding relationships between the respondents' gender and their answers, Kendall's τ_b did not indicate significant relationships, except for a

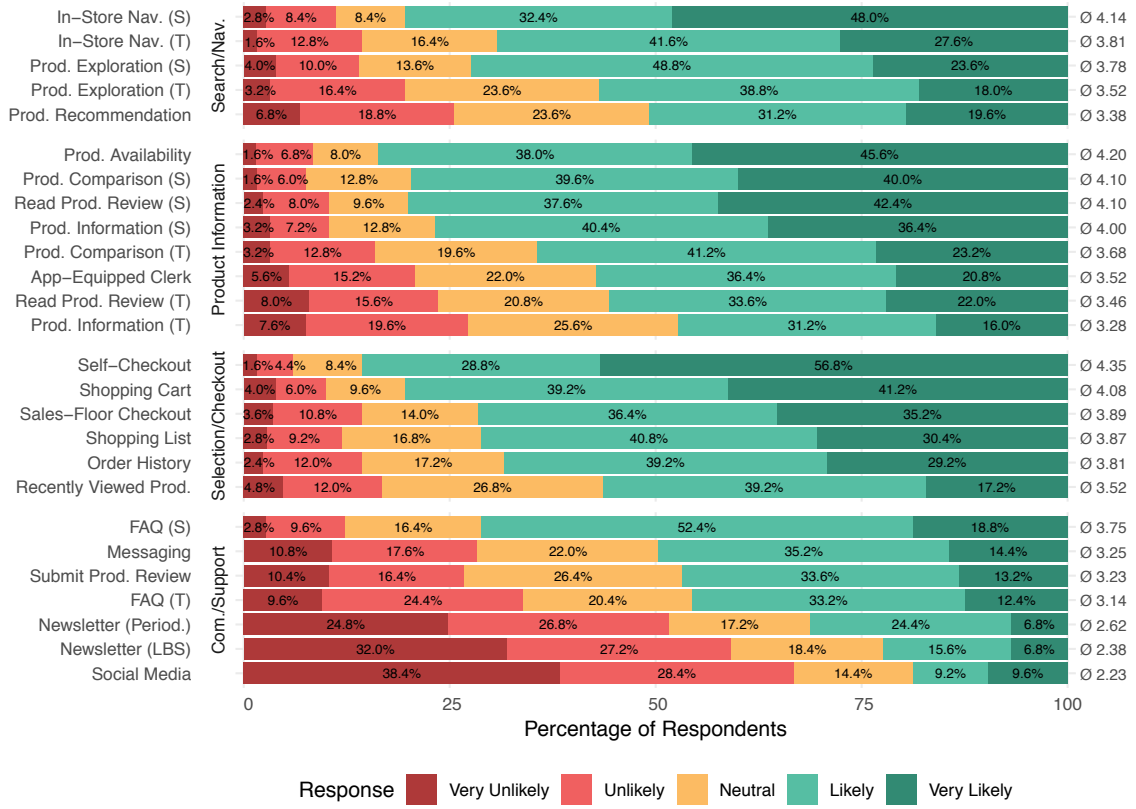


Figure 10.2: Distribution of likelihood of use per e-service touchpoint (grouped by touchpoint categories; within groups ordered descending by average score)

weak positive relationship between female respondents and the messaging service ($\tau_b = .16; p < .01$). However, women on average voted .08 points higher than men. Although not statistically significant, women, in particular, had a higher likeliness to use a smartphone (.31 points) or an in-store terminal (.38 points) to read product reviews compared to male respondents.

Six e-service touchpoints were surveyed regarding the two service interfaces smartphone (denoted (S) in Figure 10.2) and in-store terminal (denoted (T) in Figure 10.2). Results show that respondents prefer smartphones over terminals by an average of .50 points, and every e-service was ranked higher when accessed via a smartphone app. Differences were lowest for the product exploration service (.26 points) and highest for the extended product information service (.71 points). No unfamiliarity effects regarding mobile devices and e-commerce were evident, which could have influenced participants' responses. 99.20 % of respondents report owning a smartphone and 182 participants (72.80 %) report using their smartphone or tablet

in-store. All but one participant (99.60 %) have purchased goods and services online at least once. Nine participants (3.60 %) use e-commerce on a daily basis; 105 participants (42.00 %) report weekly e-commerce activities; whereas every second participant roughly shops online once a month. Ten participants use e-commerce as infrequently as once a year.

10.5 Discussion, Limitations, and Future Research

We mirrored e-service touchpoints for their application in BaM, and assessed shoppers likeliness to use them to complement traditional service. Our findings offer several implications for academia and practice.

First, an overall positive response towards complementary e-service touchpoints provides support for channel complementary theory in the domain of BaM retail (Dutta-Bergman, 2004) and supports the assumption that customers have a positive sentiment towards e-service in BaM retail. The results show that customers are likely to use e-service touchpoints in the physical retail servicescape to complement and improve their customer journey. In particular, selection and checkout touchpoints have a very positive response. It is fair to assume that most customers are used to the well-rated self-checkout touchpoint (Wang and Shih, 2009) and a mere-exposure effect might have occurred, i.e., respondents rated the touchpoint well just because of familiarity (Zajonc, 1968). Nevertheless, most well-rated touchpoints comprise research-supporting and solution-oriented shopping aids (Angela Chang and Kukar-Kinney, 2011), which increase customers' shopping effectiveness (find the right products) (Betzing, Hoang, et al., 2018) and efficiency (fast service with high quality) (Meuter et al., 2003; Blázquez, 2014).

Next, the customers' age has a positive impact towards the likeliness to use in-store terminals instead of smartphone apps. Also, it has a negative impact towards the use of social media. These findings support prior studies on the use and adoption of self-service technology (Meuter et al., 2003; Dean, 2008; Wang and Shih, 2009). According to these studies, technology anxiety and effort expectancy have been found to determine the intention to use self-service technology. In-store terminals closely resemble other well-established self-service technologies such as ATMs or ticket machines that are common for a few decades. Consequently, also older customers

are familiar with these types of technology and might be more confident in using them (Wang and Shih, 2009). The proliferation of smartphones, on the contrary, has just started in the last decade, which implies comparably less experience with this technology (Dean, 2008) and potentially higher technology anxiety (Meuter et al., 2003). Nevertheless, customers overall prefer smartphone apps to access e-service touchpoints. While location-independence, the degree of customer-retailer connectivity, and perceived control over the shopping process are known influences on the use of smartphone apps in retail (Faulds et al., 2018), future research is needed to clarify the determinants of in-store smartphone app usage. Lastly and in line with Yoo and Gretzel (Yoo and Gretzel, 2008), female customers are more motivated to provide product reviews (e.g., to help the other customers and the retailer).

As with any research, our work comes with some limitations. Inherent to the survey research method are potential negative side effects or biases. Considering the rather "demanding" responses from the survey, some respondents might suffer from a "good-subject effect" where participants try to guess the purpose of a survey to give pleasing answers (Nichols and Maner, 2008). Additionally, we did not survey participants' prior experiences with the non-mirrored touchpoints, which will likely have influenced individual responses. This leaves room for further research on the influence of prior experiences in one channel on other complementary channels. As regards the unit of analysis of our study, we assessed the likeliness of use regarding the mirrored e-service touchpoints, without providing concrete touchpoint implementations and contextual factors. The relevance of e-service touchpoints is likely to differ, among others, based on the categories of goods sold and the size of the store. For example, an in-store navigation service might be more useful in a large fashion store that sells a plethora of different articles, than in a small delicatessen store where customers can find products easily without digital support. Also, the relevance of product information touchpoints might also be related to the complexity of the product, i.e., customers might require less information on a broom than on a robot vacuum cleaner. Nevertheless, our assessment provides a foundation and justification for BaM retailers to conduct individual, detailed analyses of e-service touchpoints that are feasible and economically viable for them.

omnichannelling and e-service touchpoints in BaM are still emerging and developing at a fast pace (Inman and Nikolova, 2017; Willems et al., 2017), leaving ample room for further research. First, retailers require instruments for decision support regarding the introduction of e-service touchpoints, as there is a variety of oppor-

tunities that can be considered by BaM retailers. In particular, SME retailers with limited financial resources require support, as high upfront cost are known as a strong inhibitor for the adoption of digital channels (Karjaluoto and Huhtamäki, 2010). This raises the question of whether the introduction of novel e-service touchpoints is feasible for SME BaM retailers. Further empirical work is required to investigate retailer-sided adoption and customer acceptance of e-service touchpoints in BaM retail with special consideration on the categories of goods sold, the size of the store, and the retailer's competitive strategy (e.g., individualization vs. cost optimization) (Betzing, Hoang, et al., 2018). Such research could result in a decision calculus that embeds impact, adoption, and success factors. Second, besides in-store terminals and smartphone apps, there are other digital technologies that enable the implementation of e-service touchpoints in the physical servicescape (Betzing, Hoang, et al., 2018; Willems et al., 2017; Inman and Nikolova, 2017). Further research could compare and contrast these partly complementary technologies w.r.t. the e-service touchpoints provided and effects on the customers observed. Third, in the long run, a set of common e-service touchpoints in the physical servicescape might eventually prevail. Using the multiple case study method, research can then identify a dominant design (Suárez and Utterback, 1995) of BaM e-service touchpoints to further support touchpoint management in BaM retail. However, even with such a dominant design, ongoing research is needed due to the continuous nature of the digital transformation (Matt et al., 2015). As illustrated in our discussion of the different e-services in Section 10.3, e-commerce and BaM retail mutually stimulate each other in terms of digital innovation. First, e-commerce tried to introduce touchpoints similar to those known from BaM (e.g. social components). Now, e-service touchpoints get introduced to the physical servicescape. This interplay provides an interesting area for ongoing investigations.

10.6 Conclusion

Given that many traditional BaM retailers struggle to keep up with the digital transformation and the induced competitive disadvantage, this paper offers two primary contributions to research and practice: First, we applied dominant design theory to identify major e-service touchpoints that are commonly implemented in leading e-commerce software solutions, grouped them according to their value proposition,

and mirrored them to complement the physical servicescape of BaM. Second, we assessed these touchpoints by means of an online survey. In support of channel complimentary theory, results showed that customers are likely to use e-service touchpoints in-store. Customers preferred touchpoints that aid in product search, information, and selection as well as facilitate an efficient customer journey. Communication, social and support services, on the contrary, were surprisingly undesirable. In line with related studies, in-store terminals have been identified as the preferred choice of the older generation, while smartphones are the overall favorable method to access e-service. Future research can build upon these insights to design and implement pilots for the most promising e-service touchpoints together with retail organizations. Subsequent empirical studies can then shed light on the advantages provided by, and customer acceptance and use of these mirrored e-service touchpoints.

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11 Design Principles for Co-Creating Digital Customer Experience in High Street Retail

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Design Principles for Co-Creating Digital Customer Experience in High Street Retail

Abstract. While customers increasingly embrace online shopping, many retailers in high streets struggle to attract profitable customers to their stores and retain them. Establishing digital customer experiences may increase customers' value perceptions, improving the competitive position of high street retailers. Customer experience creation in retail is a multi-faceted construct that, amongst others, depends on the service interface, atmosphere, assortment, price, past experiences, and the social environment in which retail service is co-created while customers shop. However, extant customer experience theory insufficiently accounts for the transformative power of recent mobile technology that enables digital and contextual service. In a conceptual approach, we develop eight propositions to frame digital customer experience, enabled by mobile technologies. In line with these propositions, we propose eight design principles that enable and constrain IT artifacts for co-creating digital customer experience.

11.1 Introduction

For centuries, city centers, with their high streets, markets, and central shopping districts, have been lively and vibrant places for social activities, culture, exchange, and shopping. High street retail now is subject to structural transformation, induced by the digitalization and by changing shopping behavior (Betzing, Beverungen, Becker, et al., 2017). Customers increasingly turn towards digital channels to shop, which diminishes revenues for small and medium-sized independent retailers that lack a digital strategy, leaving them in a struggle to retain their market

position (Bollweg et al., 2016). A recent study predicts for Germany that by 2020, more than ten percent of retail stores will be shut down (Eichholz-Klein et al., 2015). While many high street retailers fail to counteract this trend effectively, e-commerce strongly innovated on customer experience creation in recent years. Coming down a long road from tiny product online images and cumbersome order processes, they now offer online-fashion-magazines (e.g., *NET-A-PORTER*), personal video advisory chats (e.g., *Butlers*), and personal style guides (e.g., *Stilight*). Besides fulfilling hedonic needs, online shops yield utilitarian value (Tynan et al., 2014), since they are available 24/7, provide home delivery, numerous payment options, and digital interactions with personnel and other customers through social media. Moreover, online shops capitalize on analyzing personalized data to offer customer-specific recommendations or promotions (Spann et al., 2013).

We maintain that improving the in-store customer experience and thus better fulfilling customers' expectations is a viable path for high street retailers to retain or increase their market share, leveling some of the advantages of online retailers (Betzing, Beverungen, Becker, et al., 2017; Brynjolfsson et al., 2013). Customer experience has been defined as "internal and subjective response customers have to any direct or indirect contact with a company" (Meyer and Schwager, 2007, p. 117) and conceptualized in a model for customer experience creation (Verhoef et al., 2009).

The increasing diffusion of mobile technologies profoundly transforms interactions between customers and retailers and our understanding of the conventional customer experience construct. Customers now are "online in-store" (Heinemann and Gaiser, 2015, p. 11) and use smart devices for price comparison, experience reports, and product search. Smart devices that access the Internet and sense situational information on location, identity, status, and time yield potentials for personalized service offerings (Bauer and Spiekermann, 2011; Glushko, 2016).

Against this background, we discuss how smart mobile technologies and contextual information on customers enable *digital customer experience* creation. Our research goal is to develop design principles that guide and constrain IT artifacts, which are required to co-create such digital customer experience in high street retail. In line with other papers that identify design principles that challenge current design theories (Chaturvedi et al., 2011), our paper is conceptual. Our research is embedded in a larger design science research project (Peffers et al., 2007; Hevner and Chatterjee, 2010) to design and evaluate service systems for co-creating digital customer experi-

ences in high street retail. This paper covers the initial research stage by identifying the problem, motivating its relevance, and establishing a theoretical foundation that informs the subsequent design of IT artifacts.

In Section 2, we discuss current customer experience theory, context-aware service systems, and mobile technologies. In Section 3, we motivate updating customer experience theory by investigating the influence that contextual data supplied by mobile technology has on the determinants and moderators of customer experience. In Section 4, we sketch design principles to guide the design of IT artifacts for digital customer experience creation. In Section 5, we conclude with a research agenda.

11.2 Research Background

11.2.1 Customer Experience Theory

Companies have started to recognize the importance of actively managing the customer experience. As a multidimensional construct, customer experience comprises the customer's "cognitive, emotional, behavioral, sensorial and social responses to a firm's offerings during the customer's entire purchase journey" (Lemon and Verhoef, 2016, p. 74). Any responses result from communication between retailers and customers (*communication encounter*), from interaction with staff or service applications (*service encounter*), and from the actual use of a product or service (*usage encounter*) (Payne et al., 2008). Verhoef et al. (2009) developed a holistic conceptual model of customer experience creation in which they identify the social environment, service interface, retail atmosphere, assortment, price and promotions, retail brand, customer experiences in alternative channels, and previous experiences with the company as independent variables impacting on customer experience (Verhoef et al., 2009, p. 32). Situational factors (e.g., type of store, location, and season) and consumers' orientation (e.g., hedonic or utilitarian) moderate the determinants' effects on an individual customer's experience (Verhoef et al., 2009).

Although the term *context* is not explicitly named in the conceptual model, both information on the situational factors and the consumer's goals characterize the situation in which a customer experience is created. Context has been conceptualized as "any information that can be used to characterize the situation of an entity.

An entity is a person, place or object that is considered relevant to the interaction between a user and an application, including the user and the application itself" (Dey and Abowd, 1999, p. 3). Consequently, contextual information on consumers can yield insights for retailers to support customer experience creation (Bauer and Spiekermann, 2011).

From a Service Science perspective, contextual information is a resource that can be used to co-create value in service systems for high street retail (Payne et al., 2008; Dey and Abowd, 1999; Vargo and Lusch, 2017). The Service-dominant Logic of Marketing (S-D Logic) refers to "value-in-context" to emphasize that value is co-created using a dynamic, context-dependent configuration of actors and resources (Vargo and Lusch, 2017). Mobile devices and other hardware must be added to and integrated with other resources in a service system so that customers can provide their contextual information and retailers can personalize their service delivery. Drawing from Dey and Abowd (1999), we conceptualize a service system to be context-aware, "if it uses context to provide relevant information and/or services to the user" (Dey and Abowd, 1999, p. 6), where relevancy depends on the user's situational needs.

11.2.2 Mobile Technology for Context-Aware Service in Retail

Service designers can select from a wide range of available hard- and software technologies such as smart devices, sensors, cameras, and digital signage to augment the retail servicescape (Betzing, Hoang, et al., 2018; Inman and Nikolova, 2017). Customers further carry myriads of sensor-based Internet-enabled mobile devices with them, which can also be integrated into the servicescape. Combining the customers' and retailer's devices with back-stage systems allows capturing, processing, and using contextual information anytime and anywhere. The notion of pervasive commerce subsumes customer interaction with digital technology in-store (Bauer and Spiekermann, 2011). Digital technology can augment all parts of the customer journey, including active and passive touchpoints (Betzing, Beverungen, Becker, et al., 2017). Active touchpoints comprise person-to-person and person-to-machine interaction, where customers and retailers apply digital technology to facilitate the encounter (Payne et al., 2008). Machine-to-machine communication between customers' and retailer's devices (e.g., Wi-Fi access points, Bluetooth beacons) augments passive touchpoints. In contrast to active touchpoints, passive touchpoints can initiate communication automatically in the background.

Previous work on context-aware mobile services can be related to different communication and service encounters. Smartphones can be used for mobile customer segmentation and user fingerprinting (Hamka et al., 2014). Advances in biometric face recognition and passive monitoring allow monitoring customer behavior, movement patterns, and interaction with digital touchpoints (Ravnik et al., 2014; Frontoni et al., 2013). These approaches provide the means for very precisely targeted communication encounters.

In-store service encounters comprise among other things recommendations, checkout, and payment (Betzing, Beverungen, Becker, et al., 2017). Researchers take cocreation into account and have proposed situation-aware and personalized mobile recommendation systems (Walter et al., 2012). Kowatsch and Maass (2010) analyze, how mobile recommendation agents influence customer behavior (Kowatsch and Maass, 2010). Dahlberg et al. (2015) illustrate, how other forms of payment such as mobile payment using Near-field Communication (NFC) technology in smart devices replace traditional payment in retail stores (Dahlberg et al., 2015). There is first evidence of the acceptance and positive impact of mobile services on the retail shopping experience (Inman and Nikolova, 2017).

Even against this background, research on digital customer experience creation that is enabled by the technologies mentioned above is scarce (Betzing, Beverungen, Becker, et al., 2017; Lemon and Verhoef, 2016; Balaji and Roy, 2016). Widespread networked mobile devices and accompanying software systems provide the technological foundation for identifying and using contextual information to create digital customer experience. The customers' digital footprint can be recorded in-store and be interlinked to customer information from other channels. Retailers can use this strategy to adapt and further evolve digital services into the physical servicescape, which were formerly exclusive to e-commerce.

11.3 Digital Customer Experience in High Street Retail

Combining the benefits of e-commerce (e.g., product information, ratings, recommendations) and high street retail (e.g., immediate product availability, haptic and visual product inspection, personal advice) in context-aware service systems transforms our understanding of customer experience creation. We define digital cus-

tomer experience to be the subset of customer experience that is facilitated using digital touchpoints (Betzing, Beverungen, Becker, et al., 2017). Digital customer experience consequently spans across all forms of communication, service, and usage encounters that incorporate digital and mobile technology (Payne et al., 2008). We now revisit and extend current customer experience theory (Verhoef et al., 2009) to include more detailed aspects of the customer's context that are provided by mobile technologies. Regarding the determinants and moderators of customer experience, we derive eight propositions on how mobile technology and digital contextual information enable digital customer experience creation in high street retail, and thus, we conceptualize digital customer experience creation based on updating the extant literature (Verhoef et al., 2009; Lemon and Verhoef, 2016).

Person-to-person service encounters co-create value in interpersonal actions (Glushko, 2016). Store personnel, other customers in the store, and the own peer group (Tauber, 1972) make up the *social environment* in which customer experience is co-created (Verhoef et al., 2009). Customer experience is influenced by interactions of customers with service staff and other customers, even if not all of these persons are physically present in the front-stage of the service system (i.e., in a store), but remain in the back-stage (e.g., at home) (Payne et al., 2008). With mobile technology such as smartphones, customers can reach out to a much larger social environment. On the one hand, customers can go online in the store to access user-generated online reviews and online communities (Heinemann and Gaiser, 2015), a reference group of acquaintances and strangers. On the other hand, customers can connect to their known and trusted reference group comprised of family, friends, and acquaintances that remain back-stage, during shopping in a retail store. While it is fair to say that people are embedded in the value- and belief-systems upheld by them and their social references groups, we argue that the ability to communicate with other people synchronously or asynchronously goes beyond these belief-systems. For instance, the ability to chat with family members on whether to buy some jeans might have a more immediate effect on a purchase decision than has a feeling that buying the jeans is consistent with (or deliberately contradicts) the general belief system held by one's family. Based on the observation that a person's social environment is an important factor for customer experience creation (Verhoef et al., 2009), mobile technology provides an opportunity also to take a person's digital social environment into consideration.

Proposition 1. *Mobile technologies enable connecting customers with their social reference groups and with acquaintances and strangers in online communities, even if these people are not physically present in the same retail store.*

As regards *service interfaces*, mobile technologies provide means to personalize interactions between customers and retailers (Kowatsch and Maass, 2010) and to extend service interfaces beyond the physical boundaries of stores. Potentials for digital customer experience creation arise in the identification of customers and their location within the store, through new touchpoints for communication and service encounters, indoor navigation, the collection of behavioral information, and the automatic interaction with in-store hardware (Inman and Nikolova, 2017; Ravnik et al., 2014; Frontoni et al., 2013). Collected contextual data can be combined with sociodemographical information. Given the technical means to identify customers across different channels, information on past service encounters as well as information on the customer's shopping history that originates from other channels such as online shops can be analyzed in back-stage processes. These processes comprise techniques from customer relationship management, data analytics, and recommender systems (Walter et al., 2012; Kowatsch and Maass, 2010). Customers can receive personalized content such as recommendations or special offers directly on their smart devices. At the same time, service personnel can be supplied with behavioral information on the customer to better tailor their service interactions to the customer's needs (Betzing, Beverungen, Becker, et al., 2017). On the other hand, customers can check product reviews and prices online, beyond the retailers' influence. For both reasons, retailers must consider the different influences that digital channels can have on the in-store service interface.

Proposition 2. *Mobile technology enables digitized and personalized interactions between customers and service persons, informed by data analytics in the back-stage of a service system.*

Customer self-service on smart devices, info terminals, and self-checkout augments the *retail atmosphere* with technology. Info terminals and digital signage can automatically react to identified customers and initiate an interactive session with the customers and their devices (Frontoni et al., 2013; Lazaris and Vrechopoulos, 2014). Audio-visual installations can highlight specific products and support navigation. Whereas traditional customer touchpoints are located in-store, beacon technology enables retailers to reach into the community space outside their store (Shankar et al.,

2016). Nearby customers can receive personalized offerings on their mobile devices, for instance, rewarding their loyalty and luring them into the store. Inside a store, mobile technology can augment the servicescape, for example with virtual reality. The success of these digital channels can be measured easily, for example by the number of people that have received notifications and by the number of people that subsequently participated in these communication encounters (Payne et al., 2008).

Proposition 3. *Mobile technology augments the physical servicescape in stores with virtual environments. Thus, it extends the servicescape into community spaces, beyond the physical boundaries of stores.*

E-commerce benefits from the low marginal costs of storage space, which allows for "long tail" business models in which the available *assortment* exceeds the product palette of physical stores by far (Hinz et al., 2011). Customers value product diversity and large assortment sizes but can be overwhelmed as to which product alternative to choose from (Hinz et al., 2011). Online shops support product discovery and product selection processes by providing advanced search technologies and recommendations. Moreover, online marketplaces such as Amazon or eBay aggregate and integrate the product ranges of many online retailers to increase their assortments even further (Brynjolfsson et al., 2011).

Technological advances now allow bringing the concept of online marketplaces to physical shopping districts. When information on the physical product ranges of local retailers is digitally available, groups of local retailers can combine their inventory data in digital marketplaces that serve as shared digital front-end for all connected stores. In effect, customers in shopping districts would get access to an extensive assortment available in their immediate physical proximity. Therefore, we propose to combine the benefits of online marketplaces (large assortment, advanced search technologies) and high street stores (immediate product availability, haptic and visual inspection). Based on shared inventory data, retailers might even recommend products provided by other local retailers on a commission basis and generate cross-selling effects (Betzing, Beverungen, Becker, et al., 2017). For example, a tailor might recommend matching shoes from a nearby store to a customer by sending a product link to the customer's smartphone. Furthermore, retailers connected to such digital marketplaces might provide combined offers such as receiving a 20% coupon on shoes when buying a suit. Also, out-of-stock situations and resulting customer frustration can be mitigated, when retailers can refer customers to nearby stores

that have a product in stock. Lastly, hybrid offline-online offers such as digital shelf space can mitigate the problem of limited shelf space. That is, a high street retail store has the most popular items in stock and an extended product range available at a remote warehouse (Glushko, 2016), which can be shipped directly to customers' homes.

Proposition 4. *Mobile technology enables groups of retailers to combine their assortments to overarching assortments in high street retail. Besides, retailers can establish hybrid offline-online assortments.*

High street retailers face high overhead cost and *price* pressure from rival e-commerce offerings (Hinz et al., 2011). Based on mobile technologies, retailers can perform customer segmentation and use contextual information for price differentiation (e.g., discounts and personalized promotions for loyal customers) (Hamka et al., 2014). For instance, the location-based service provider *Foursquare* measures loyalty regarding "check-ins", i.e., how often a customer has actively visited a place and checked-in online on his mobile device. Additionally, smart devices equipped with NFC technology can free up space in the customers' wallets by replacing traditional code- or radio-frequency-based loyalty/reward cards (Dahlberg et al., 2015) to identify the client as a member in the loyalty program.

Proposition 5. *Mobile technology enables price differentiation among identified customers as well as implementing loyalty programs on an individual level of detail.*

About *previous customer experiences*, current offline retail falls behind online retail for two reasons. First, since service encounters are not documented, and customers seldom give vocal feedback on their experiences, retailers do not know how satisfied customers were in previous encounters. Thus, they lack knowledge on the quality and crucial elements of their service. Apart from stores that use loyalty programs to identify their customers or the stores that "know" their customers on a personal basis, customers remain anonymous for most offline retailers (Glushko, 2016). This anonymity prevents identifying their previous experiences (Meyer and Schwager, 2007; Lemon and Verhoef, 2016). With mobile technologies, retailers might identify customers and link them to customer reviews provided on online rating platforms, such as Yelp. Therefore, retailers can compensate bad experiences in the past or further strengthen customer loyalty. Besides, retailers might also access experiences their customers have had in other stores or with online shops.

Proposition 6. *Mobile technology enables a more focused development of customer loyalty, based on identifying customers and reviewing their past customer experiences in offline stores and online shops.*

Customers increasingly use multiple *channels* to interact with retailers, i.e., the customer's journey spans across online and offline channels as well as person-to-person and self-service encounters (Verhoef et al., 2015). Tightly integrating information flows between these channels is necessary to get a holistic picture of the customer (Meyer and Schwager, 2007) and to provide personalized service (Glushko, 2016). The identification of the customer at all communication and service encounters, even across different channels, is a crucial prerequisite for omnichannel retail in general and for integrating mobile technology and digital contextual information in a service system in particular. In traditional person-to-person service encounters, customers can identify themselves by stating their names or through loyalty cards, so that the store personnel can look up the customer in their information systems. The technologies mentioned above provide capabilities for machine-to-machine communication, where the information systems in the store can automatically interact with smart devices the customer carries while browsing through the store (Inman and Nikolova, 2017; Shankar et al., 2016). To identify a particular customer, the customer's devices must be linked to the client's central account. This linkage can might be set up when the customer installs the store's app on his smartphone and logs in with his account. To sum up, our propositions for creating digital customer experience require customer identification and data integration across all personal and non-personal, online and offline touchpoints (Lazaris and Vrechopoulos, 2014), which can be done through mobile technology. With omnichannel strategies (Verhoef et al., 2015) the online channel can support in-store shopping through digital services.

Proposition 7. *Mobile technology enables retailers to identify customers at all touchpoints and allows them to implement omnichannel strategies.*

With the proliferation of mobile technologies, *situation moderators* become detectable as digital context information. Contextual information provided by mobile technology includes information about the person carrying the devices, about the location of these devices, and about the distance of persons/devices to other persons/devices (Bauer and Spiekermann, 2011). With these data, high street retailers can implement entirely new data-driven service. For instance, aggregating contextual data enables analyzing how groups of people move along high streets (Betzing,

Beverungen, Becker, et al., 2017), an analysis that is unfeasible in non-digital environments, whereas it has been performed for many years in online retail. Likewise, due to personalized Information Systems, *consumer moderators* can be assessed with mobile technology.

Using and analyzing contextual information is bounded by the willingness of customers to provide data on their context to other actors. Literature reminds us that customers often draw a fine line between positive experience through added-value and privacy concerns through misuse of data (Acquisti et al., 2015). The EU General Data Protection Regulation, effective May 2018, aims at decreasing privacy issues through transparency. It mandates service providers to inform users of the purpose and terms of personal data processing before data are collected in a more comprehensive and user-friendly way (European Union, 2016). Previous research further underlined that customers are more willing to consent to provide contextual information if they are fully informed of the app's behavior regarding data collection, processing, and sharing with third parties (Schaub et al., 2015). When customers understand why sensitive information is needed and what their benefits are, they can give informed consent.

Proposition 8. *Given that sufficient levels of data security and privacy are complied with, mobile technology can elicit situational moderators and consumer moderators that influence customer experience, enabling retailers to personalize service and analyze the behavior of customers and groups of customers in downtown areas.*

11.4 Design Principles for Digital Customer Experience Creation

Our overall goal is to design service systems that foster digital customer experience creation in high street retail. Engineering these service systems requires developing innovative IT artifacts that enable the actors involved to engage in experience co-creation. To inform the design of these IT artifacts, we now identify design principles that build on the propositions we developed in the preceding section. Design principle (DP) are justified statements or rules that guide and constrain design actions (Chaturvedi et al., 2011; Peffers et al., 2007; Hevner and Chatterjee, 2010). In the spirit of design science research, design principles are inferred from kernel

theories that inform how useful and relevant IT artifacts need to be designed and implemented (Gregor and Hevner, 2013). Building on the notion of a service system (Spohrer et al., 2009), we systematize our design principles with a framework (see (Figure 11.1)) in which digital customer experience is co-created by networked customers and networked retailers.

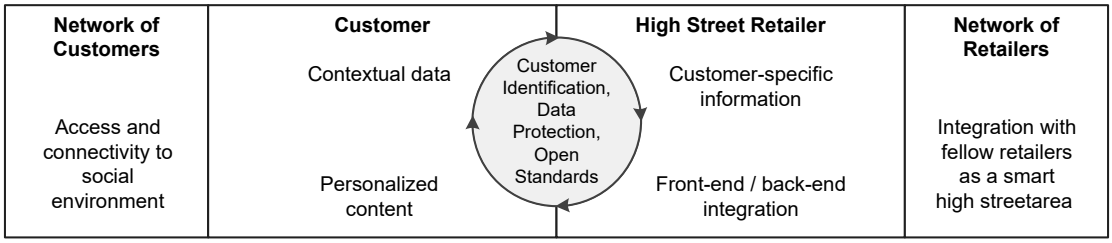

Figure 11.1: Service System for Digital Customer Experience Creation in High Street Retail

By introducing mobile- and self-service technology to the servicescape, retailers transform existing touchpoints and add digital touchpoints to the service interface (propositions 3, 7). To provide personalized service (propositions 2, 5, 6, 8), every touchpoint should (a) identify the user, (b) access contextual information, and (c) collect data on the current encounter. It is fair to assume that customers expect the same seamless and convenient interaction they know from online shops from service encounters with mobile- and self-service technology. Thus, all devices involved in customer interactions should identify users automatically. For instance, when customers enter the store, they would receive a welcome message on their phone (service front-stage), while the visit is logged at back-stage systems. While browsing the store, they can read personal recommendations on info terminals. Finally, the point of sale terminal at the check-out recognizes the user and updates the customer's record.

DP 1. *IT artifacts must seamlessly identify customers at all digital touchpoints.*

European and national data protection laws restrict businesses from collecting and processing data on customer behavior without prior consent. Also, customers might easily feel overwhelmed and out of control, when digital technologies automatically collect their data. Consequently, fair use of information, transparency on data processing practices, and data protection policies have to be major features when developing IT artifacts and setting up the service system (proposition 8).

DP 2. *IT artifacts must comply with international and national data protection laws. They need to inform users of data processing practices and request the informed consent of a user. Data protection regulations and ethical standards must be respected.*

Connecting people and digital entities with each other is a prerequisite for creating digital customer experiences. Network configurations are ever changing, since network participants, IT services, and mobile technologies change and evolve at fast speed. Open standards and protocols build the foundation for designing IT artifacts that interface with these technologies and adapt to their evolution at the same pace (propositions 1, 2, 4, 7).

DP 3. *IT artifacts should use open standards and protocols to interact with both external IT services and mobile devices via direct communication.*

With the consent of a customer (proposition 8), mobile technology provides contextual data, including the customer's current location, trajectory, preferences, and past purchases in offline or online channels, creating an omnichannel shopping experience (propositions 3, 6, 7). In-store-hardware automatically connects to the user's devices to obtain and send data, connecting stores with customers.

DP 4. *IT artifacts must network customers' mobile devices with in-store hardware, to obtain contextual data from customers and to send data to their devices.*

Traditional person-to-person encounters benefit from contextual data. Service personnel should be provided with the collected data on customers entering their store, to provide personalized service encounters (proposition 2, 6). In a similar vein, information on past encounters with the customer allows for individual price differentiation, e.g., by rewarding the customer for his loyalty (proposition 5).

DP 5. *IT artifacts that support service persons should present user-specific information, if available, automatically upon service encounters.*

Integrating IS in the front-stage and back-stage of a store is a prerequisite for creating digital customer experiences. For instance, mobile technology requires access to the retailer's inventory control systems to run product availability checks, issue reservations, use payment services, or access augmented reality applications (propositions 2, 3, 7).

DP 6. *IT artifacts require access to systems in the back-end of retail stores.*

Digital customer experience unfolds its full potential only when reaching beyond single retailers. The combination of inventory data from multiple retailers to an integrated high street assortment yields cross-selling potentials by extending product recommendation across stores and cross-promotion potentials (propositions 2, 4). For instance, when buying a suit at a boutique, the service person can recommend matching shoes from a nearby store. This approach can also mitigate out-of-stock situations by referring customers to another retailer that has the requested product in stock. Therefore, IT artifacts that enable digital customer experience should allow for easy integration of multiple participants.

DP 7. *IT artifacts should be designed for networks of retailers, allowing them to create a seamless digital customer experience in a smart high street.*

Customer experience is also influenced by a customer's social environment. Based on mobile technology, customers interact with their peers through social networks and online customer review services (proposition 1). Retailers can tap into these data to elicit their customers' experiences, even if not identifying individual customers. For example, a digital shopping adviser can build on online reviews on digital platforms. Linking customers to their reviews is another way of providing better-personalized service to them (proposition 6).

DP 8. *IT artifacts should explore the customers' social environment, including interfaces to online social networks and online review platforms.*

11.5 Conclusion

Improving in-store customer experience is a viable path for high street retailers to rebuild a competitive edge. With the omnipresence of smart mobile technologies, interactions between customers and local retailers are transformed, allowing additional communication channels and service encounters. However, current customer experience theory (Verhoef et al., 2009; Lemon and Verhoef, 2016) insufficiently accounts for the transformative power of digital and context-aware service systems in high street retail.

We contribute to theory by suggesting avenues to conceptualize *digital* customer experience creation, based on revisiting and extending (conventional) customer

experience theory. We developed eight propositions for digitizing the customer experience construct. Building on these propositions, we postulated eight design principles that guide and constrain the design of IT artifacts that serve to co-create digital customer experience. Also, we contribute to practice by highlighting how digital customer experiences can be fostered with current mobile technologies.

In future work, we will design and evaluate IT artifacts that enable digital customer experience in high street retail. We imagine a community platform that brings together retailers and customers and considers the peculiarities of the individual high street. It comprises a customer-facing shopping companion app and a back-end system for retailers to plan, issue, monitor, and evaluate digital interactions with their customers. In a cyclic action design research approach, we will design and evaluate all IT artifacts in close cooperation with retailers and customers in four city centers in Germany.

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12 Data-driven Customer Journey Mapping in Local High Streets: A Domain-specific Modeling Language

Fact sheet of publication *P.7*

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Data-driven Customer Journey Mapping in Local High Streets: A Domain-specific Modeling Language

Abstract. In high street retail, abundant research has focused on conceptualizing, empirically investigating, and improving customer experience at touchpoints throughout the customer journey. However, IT—including, smartphones, near-field communication, and broadband access to the Internet—permeates local high streets increasingly and is profoundly transforming the way in which customer experience is co-created throughout a high street customer journey. Current customer experience notations are unable to express customer journeys based on data retrieved from a digitized physical servicescape. The purpose of this paper is to design a domain-specific modeling language (DSML) that enables analyzing and designing customer journeys in a digitized high street retail setting. From a design-oriented standpoint, the developed High Street Journey Modeling Language (HSJML) can be used to design and implement online-offline customer journeys in digitized high streets. From an empirical perspective, the HSJML provides the constructs required for mapping, analyzing, and predicting online-offline customer journeys in local high streets, based on analyzing event-logs from retail platforms.

12.1 Introduction

Customer experience is central to both service researchers and practitioners seeking sustainable competitive advantage by focusing on customer value co-creation

(McColl-Kennedy, Gustafsson, et al., 2015; Lemon and Verhoef, 2016; Betzing, Beverungen, and Becker, 2018). Previous research has identified "satisfaction, trust, re-visit intention, re-purchase intention and loyalty [...] as outcomes of positive customer experience" (McLean et al., 2018, p. 326). Being highly subjective and continuous in nature, the customer experience accrues along the customer journey, a time-logical sequence of touchpoint instances a customer has with one or more service providers and other actors in the purchase process (Halvorsrud et al., 2016; Voorhees et al., 2017).

Digital technologies increasingly permeate high street retail and profoundly impact customers' decision processes and journeys. Customers have myriads of digital and physical touchpoints with retailers (Brynjolfsson et al., 2013). Along the purchase process, customers seamlessly switch between digital and physical channels as well as service providers, sometimes using multiple channels in parallel (e.g., using a smartphone while interacting with a service person), which transforms customer journeys into sequences of intermingling online and offline service encounters (Haugstveit et al., 2016; Bartelheimer et al., 2018). Albeit the complexity of potential customer journeys increases, so does the amount of digital evidence customers leave behind. Nowadays, high streets see an uptake of local multi-sided digital community platforms, which network local customers, retailers and other high street stakeholders, and provide digital service (Bartelheimer et al., 2018). Instead of performing time- and cost-intensive surveys, customer journeys might now be inferred and modeled directly from the data collected on these platforms (Betzing, 2018).

As opposed to the prospects of data-driven customer journey mapping, traditional customer journey theory (e.g., Shostack, 1987) insufficiently accounts for intermingling online-offline touchpoints, and the perspective of multiple actors (e.g., multiple retailers, intermediaries, other customers), who attribute to the overall high street customer experience (Lemon and Verhoef, 2016; Betzing, Beverungen, and Becker, 2018). Likewise, existing notations such as customer journey mapping and service blueprinting (Bitner et al., 2008; Voorhees et al., 2017) fall short of explaining how online-offline customer journeys unfold in digitized physical servicescapes.

In line with the dual mission of design science research to advance theory while solving organizational problems (Sein et al., 2011), the purpose of this paper is twofold. Our primary research goal is to design a DSML (Frank, 2013) as an IT artifact (March and Smith, 1995) that can be used to model current and design future

customer journeys in digitized local high streets. On a more abstract level, the DSML might later evolve into a nascent theory for design and action, prescribing how to design online-offline customer journeys. Second, the DSML departs from current conceptualizations of customer journeys, which view customer journeys as dyadic (as opposed to networked), analog/digital (as opposed to an integrated online-offline view), and isolated customer-provider interactions (as opposed to a multi-layered experience that is focused on the high street as unit of analysis). Our approach, therefore, points at a strong need to update current theory on customer experience and customer journeys for high streets.

The paper unfolds as follows: Section 2 provides a shared understanding of customer journeys. In Section 3, we describe our research method. In Section 4, we sketch our High Street Journey Modeling Language and demonstrate its application in Section 5 with modeling a customer journey in a high street retail scenario. The proposed modeling language is the first notation for modeling and designing complex online-offline customer journeys in digitized high streets, as becomes evident from a conceptual comparison with other modeling notations in Section 6. We conclude with an outlook on future research in Section 7.

12.2 Research Background

12.2.1 Customer Journeys

The customer journey perspective roots in a mind shift in service design and marketing research from assuming what the market wants to develop products and services from a customer's viewpoint. Since then, scholars evolved the customer journey approach to understand typical customer behavior (Lemon and Verhoef, 2016), to prototype experiential services (Zomerdijk and Voss, 2010; Teixeira et al., 2012), to assess perceived service quality (Halvorsrud et al., 2016; Rosenbaum et al., 2017), and to design for customer experience (Følstad and Kvale, 2018).

As the customer journey terminology is fragmented at best (Rosenbaum et al., 2017) and there exists no ontology for the field, we draw from the structured literature reviews contributed by Følstad and Kvale (2018), Heuchert et al. (2018), and Bernard and Andritsos (2017) to establish a shared understanding of the core constructs.

First, customer experience is the "evolvement of a person's sensorial, affective, cognitive, relational and behavioral responses to a [service offering] by living through a journey of touch-points along prepurchase, purchase and postpurchase situations and continually judging this journey against response thresholds of co-occurring experiences" (Homburg et al., 2017, p. 384). This definition already encompasses many constructs relevant to the customer journey. Table 12.1 provides the full set of constructs that are relevant for depicting customer journeys in a digitized world.

Construct	Explanation
Customer	"The stakeholder experiencing a service" (Bernard and Andritsos, 2017, p. 51).
Service Provider	A firm or individual who engages in a business relationship with a customer (Bartelheimer et al., 2018).
Intermediary	A facilitator of service encounters between customers and service providers that does not take part in the encounter itself (Storbacka et al., 2016; Bartelheimer et al., 2018).
Customer Journey	A time-logical sequence of touchpoints a customer has with one or more service providers and other actors during the purchase process (Halvorsrud et al., 2016; Voorhees et al., 2017; McLean et al., 2018).
Customer Journey Stage	A part of the customer journey that groups associated touchpoints. In retail, customer journeys are often divided into pre-purchase, purchase and post-purchase stages (Lemon and Verhoef, 2016; Bernard and Andritsos, 2017; Heuchert et al., 2018).
Touchpoint	Any instance of discrete interaction between a customer and another actor that is relevant to a service offering (Zomerdijk and Voss, 2010), "including the interaction involving the provision of the service offering itself" (Voorhees et al., 2017, p. 270).
Touchpoint Event	A change of state of an entity, which initiates a touchpoint (Wand and Weber, 1993). Events can arise internal or external to the customer.
Event Type	An abstract class of events with similar properties from which the initiating stakeholder and the channel (i.e., the medium of interaction between two or more actors) can be inferred (Bernard and Andritsos, 2017; Heuchert et al., 2018).
Touchpoint Precondition	A state that must exist a priori to enable a touchpoint event and the associated touchpoint (Wand and Weber, 1993).
Data Trace	Digital information that can be transmitted or processed.

Table 12.1: Constructs for Customer Journeys in a Digitized World

12.2.2 Related Modeling Approaches

Models are used to reduce the complexity of real-world concepts by only depicting aspects relevant to the modeling goal while neglecting irrelevant information. Customer journey mapping comprises a variety of practitioner-driven ways to depict a time-logical sequence of customer touchpoints against a secondary dimension

(Følstad and Kvale, 2018). Albeit being very popular in practice, the method is ill-defined in academic literature. Rosenbaum et al. (2017) even named its use a "managerial hodgepodge" (p. 144), where the vertical axis (secondary dimension) is used for various purposes such as identifying the organizational units responsible for specific touchpoints, customer objectives, and channels. Service management provides more formalized approaches such as service blueprinting (Shostack, 1987; Bitner et al., 2008), multilevel service design (Patrício et al., 2011), and customer experience modeling (Teixeira et al., 2012). However, they focus on service delivery from a single service provider's view, provide tools for designing complex service systems, or aggregate customer data in a way that opposes analyzing individual customer journeys.

Although we fully acknowledge the relevance and benefits of the existing modeling approaches, we maintain that no language is capable to model individual online-offline customer journeys as a sequence of events performed by customers and multiple service providers. Consequently, we design a new event-driven DSML that is able to depict the central concepts of online-offline customer journeys in high streets. Models designed with the proposed modeling language can be used as an ex-post diagnostic tool to understand individual customer retailing behavior and to capture hints on how different touchpoints and actors contribute to the overall customer experience. Furthermore, it provides a graphical notation of the rather intangible "soft" concepts (Heuchert et al., 2018) in customer experience theory.

12.3 Research Method

In line with the dual mission of design science (Sein et al., 2011), the approach of this short paper is to design a DSML as an IT artifact (March and Smith, 1995). A DSML is a modeling language that accounts for the needs of particular settings since it includes technical terms that constitute a particular domain (e.g., retail)—such that its users "do not have to reconstruct technical terms on their own" (Frank, 2013, pp. 133-134). A DSML has to provide a clear representation of all constructs relevant to the model purpose, which allow the modeler to create "well-formed statements about the world" (Becker et al., 2014, p. 339). In doing so, DSML foster model quality and comprehensibility of information models (Frank, 2013). Besides fulfilling the requirements for DSMLs by Frank (2013), the objectives of our DSML comprise

depicting real-world customer journeys from a data-driven perspective that considers the integrated nature of online-offline touchpoints, and that focuses on the high street as the unit of analysis, which comprises touchpoints with multiple actors. To design our DSML, we applied methods from the conceptual modeling literature that fall into three steps (Wand and Weber, 1993; Frank, 2013). First, we specify the language's abstract syntax by proposing linguistic constructs and modeling rules in a meta-model (Becker et al., 2014). Second, we propose a concrete syntax as a graphical notation (Frank, 2013). Third, we clarify the DSML's semantics by demonstrating its usefulness to model a customer journey in a local high street. The result of this design process is the *High Street Journey Modeling Language (HSJML)*, a DSML with which we can model online-offline customer journeys in high street retail settings based on digital evidence.

As regards a theoretical contribution that goes beyond the form and function inscribed into the DSML, we compare HSJML with other approaches that have been proposed for modeling customer journeys. With this conceptual evaluation, we show that HSJML currently is the only approach that features modeling constructs that depart from touchpoint-event-logs in a high street retail setting. While our short paper provides first insights on how online-offline customer journeys in local retail can be conceptualized based on digital evidence, the approach requires performing an empirical evaluation. To pave the way ahead, we sketch a set of hypotheses that can be tested empirically in our subsequent research (Burton-Jones et al., 2009). Acceptance studies can, on the one hand, identify the DSML's soundness to model online-offline customer journeys ensuing from event-logs. On the other hand, the language can serve as a coding schema for data-driven customer journey mapping with data retrieved from digital retail platforms. While HSJML is primarily motivated from an academic standpoint, empirical studies can reveal how practitioners perceive its ease of use and usefulness with regard to their modeling goals (Recker et al., 2011). Furthermore, we propose that future research on HSJML will eventually enable service providers to predict customer journeys and to intervene pro-actively at single touchpoints to impact the overall customer experience.

12.4 A DSML for Online-Offline Customer Journeys

12.4.1 Abstract Syntax

The HSJML takes a holistic, data-driven view on the customer journey. From a sequence of events, both the customer's touchpoints and the retailers' back-stage actions attributing to the journey are derived. Figure 12.1 provides the meta model of HSJML, depicted as Entity-Relationship-Model in (P. P.-S. Chen, 1976) notation.

HSJML depicts singular customer journey instances. The high street service system stakeholders included in the model are the customer, an intermediary and at least one service provider. The customer's actions can be inferred from data traces, and therefore, HSJML does not include any decision nodes or conditional flows. The customer journey is represented by a time-logical sequence of events, each of which is associated with a data trace and a touchpoint. Additionally, each event belongs to an event type that specifies the semantics of the touchpoint. Touchpoints belong to different stages of the customer journey (Lemon and Verhoef, 2016). Preconditions are optional activities that a service provider has to execute beforehand in order to enable an event and the associated customer touchpoint. Again, data traces denote information that different service providers and the customer have provided to the intermediary in the back-stage to enable the customer journey. For each element in the model, additional information can be attributed at discretion (this is not depicted in Figure 12.1 for simplification).

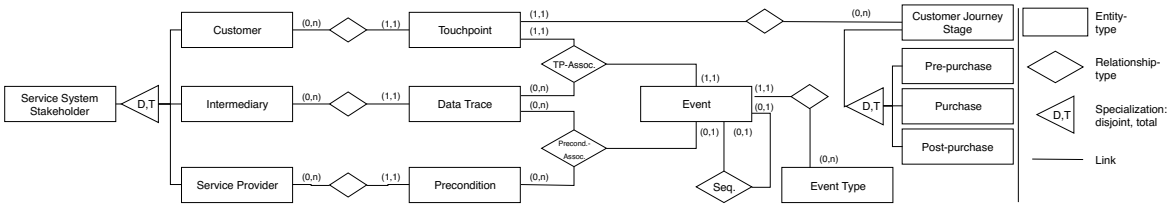

Figure 12.1: Meta Model of the proposed HSJML

12.4.2 Concrete Syntax / Semantics

The design of HSJML has been informed by established modeling notations such as BPMN 2.0, from which we borrowed pools and lanes as structuring elements (OMG,

2011). A HSJML model consists of one pool each for the customer, the intermediary, and the service providers involved. The intermediary's pool is divided into data lanes facing the customer and the service providers, and a center lane that contains the sequence of identified events for a particular customer journey. The data lanes can be used to depict data traces between the customer and the intermediary, and between service providers and the intermediary, respectively. Data traces can be added freely without constraints. Each discrete state in the customer journey is depicted in HSJML by a tuple containing an event, a touchpoint, and an optional precondition. Table 12.2 provides an overview of the representational elements, which are available in HSJML and can be used to model a customer journey. The sequence flow between events is depicted by directed arrows. Two types of undirected associations can be used to link an event with data traces and a touchpoint respectively precondition. Touchpoints visualize the interactions between the customer and another actor, as interpreted from the triggering event. The touchpoint background is shaded, depending on respective the journey stage.

Customer, Service Provider, Intermediary	
Customer Journey	Sequence Flow Precondition Association Touchpoint Association
Touchpoint	**Pre-purchase** touchpoint **Purchase** touchpoint **Post-purchase** touchpoint
Touchpoint Event, Event Type	Customer has **performed a platform look-up.** Customer has **entered the high street area.** Customer has **left the highstreet area.** Customer has **received a personalized offer.** Customer has **published a review.** Customer has **entered service provider's vicinity.** Customer has **left service provider's vicinity.** Customer has **redeemed a personalized offer.** Customer has **concluded a purchase.** Customer has **entered service provider's entrance area.** Customer has **left service provider's entrance area.** Customer's **position** has been **tracked.** Customer has **marked** sth. **as favorite.** Customer has **received a recommendation.** Customer has **started a navigation.** Customer has **contacted a retailer.**
Touchpoint Precondition	**Precondition:** Requirement that was fulfilled before event was triggered.

Table 12.2: Concrete Syntax for HSJML

12.5 Demonstration of Utility and Evaluation of Form and Function

The scenario used to demonstrate and evaluate the HSJML is taken from the consortium research project "*smartmarket²*". Central to *smartmarket²* is a multi-sided platform, which networks different groups of actors in high street retail. The platform facilitates touchpoints between these actors and collects event-log data in the back-stage. A typical high street shopping scenario facilitated by *smartmarket²* looks as follows:

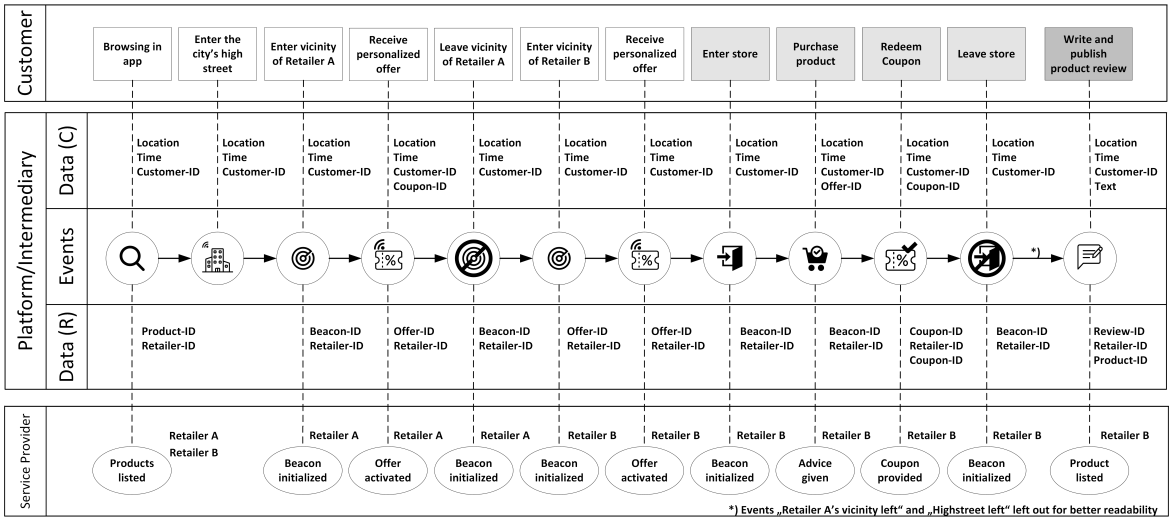

Figure 12.2: Exemplary High Street Customer Journey, as Modeled with the HSJML

At home, Mr. Davis takes his smartphone and opens the smartmarket² app to browse local retailers' offerings, products, prices, and events taking place in the city center. Quickly, he found interesting products that he wants to inspect at a retailer's store, so he organizes his shopping tour on the high street. He passes along different retailers until he approaches retailer A's store. A uses beacons, small Bluetooth transponders, which broadcast a signal that can be processed by passersby's smartphones. Based on the signal, the smartmarket² app notifies Mr. Davis that retailer A is nearby and provides him with the retailer's offers. However, Mr. Davis is not interested in A's offers and continues the shopping tour until he passes retailer B, from whom he also receives personalized offers. This time, Mr. Davis is interested and enters the store. In-store, he consults a service person and then purchases the product offered, using a previously received mobile discount coupon. Satisfied with the product and the service received, Mr. Davis, later on, writes a positive review on his experience in the smartmarket² app.

Figure 12.2 reconstructs Mr. Davis' shopping trip using event-log data collected by *smartmarket*[2].

12.6 Conceptual Comparison to Related Modeling Approaches

Language	**HSJML**	**BPMN 2.0**	**Customer Journey Mapping**	**Service Blueprinting**	**Multi-level Service Design**	**Customer Journey Modeling Language**
Source	this paper	(OMG, 2011)	(Rosenbaum et al., 2017)	(Bitner et al., 2008)	(Patrício et al., 2011; Teixeira et al., 2012)	(Haugstveit et al., 2016)
Goal	Data-driven construction and analysis of customer journeys	General process modeling	Service Innovation	Service Innovation	Service Innovation	Documentation and analysis of service delivery
Granularity	Individual	Individual	Aggregated	Both	Aggregated	Individual
Available Constructs						
Customer Journey	Yes	Partly (seq. flow)	Yes	Yes	Yes	Yes
Stages	Yes	No	Yes	No	Yes	No
Touchpoints	Yes	Partly (generic tasks)	Yes	Partly (only with a focal provider)	Yes	Yes
Events / Event Types	Yes / Yes	Yes / Partly	No / No	No / No	No / No	No /Partly (touchpoints are specialized)
Data	Yes	Partly (messages and data objects)	No	No	Partly (IT artifacts)	No
Multiple service providers	Yes	Partly (multiple pools)	No	No	No	Partly (support for multiple actors)
Intermediary	Yes	Partly (pool)	No	Partly (back-stage processes)	No	Partly (support for multiple actors)

Table 12.3: Construct-based Conceptual Comparison of Related Modeling Approaches

We have shown that HSJML is able depict high street customer journeys as a sequence of events. To demonstrate its superiority for the given application scenario, we compared HSJML to related modeling approaches from different schools of thought (Table 12.3). All related approaches can be used to visualize customer journeys in high streets but do so only to a limited extent. First, HSJML is the only data-driven approach that shapes customer-specific chains of events from event-logs and, therefore, enables the construction, description, and analysis of individual customer journeys with digital evidence. Second, customer journey mapping and multi-level service design depict expected customer journeys on an aggregated level, where insights from multiple customers are combined. Third, except for BPMN 2.0, the related approaches assume a focal service provider and do not cope with the multi-actor nature of high street retail. HSJML explicitly builds on and represents the logic of an intermediary as a facilitator of service encounters (Storbacka et al.,

2016). Lastly, BPMN 2.0 is a generic process modeling language, which does not include any domain-specific customer journey constructs such as stages, touchpoints, and high street events.

12.7 Contribution, Limitations, and Outlook

Digital technologies have profoundly transformed high streets into digital and at the same time physical servicescapes. New forms of behavioral customer data become available through digital interactions, which call for new methods to visualize and describe these online-offline customer journeys on high streets. In this short paper, we developed and demonstrated HSJML as a domain-specific modeling language for high street retail and conducted a conceptual construct-based analysis vis-á-vis rival modeling approaches.

As an IT artifact, HSJML can be used to visualize high street customer journeys. HSJML is the only modeling language that can depict multi-actor, online-offline customer journeys in high streets. As a conceptual tool, the language can be used to conceptualize customer journeys a priori. A posteriori, the language can be used for data-driven customer journey mapping, analyzing digital evidence recorded on high streets (e.g., data gathered by intermediaries, such as digital platforms). The resulting models can, therefore, serve as a diagnostic tool to understand, analyze, and predict how individual customers traverse a high street.

From a theoretical perspective, HSJML departs from traditional customer journey mapping and customer experience theory in two ways. First, HSJML is the first modeling language to conceptualize customer journeys with the high street as a unit of analysis, whereas related approaches focus on individual touchpoints or dyadic retailer-customer interactions. Our view implies that stores can be networked with each other, and customers interact with multiple stores while traversing a high street. Second, we conceptualize a customer journey as intermingled online-offline interactions, enabled by a digitized physical servicescape, whereas current theory views customer journeys as consisting of separate online or offline interactions.

In subsequent research, we will evaluate the language's organizational impact in order to develop generalized design knowledge. In particular, we will identify the language's ability to enable designers to specify customer journeys in high streets,

and its ability to perform data-driven customer journey mapping for a high street as a unit of analysis. Inspired by (Burton-Jones et al., 2009) and (Recker et al., 2011), the following hypotheses might guide the empirical evaluation of the HSJML for designing and interpreting customer journeys in digitized local high streets:

- **Hypothesis 1**: As regards online-offline customer journey in high streets, HSJML will outperform related modeling languages in terms of *representational fidelity*, enabling designers to conceptualize effective customer journey maps.
- **Hypothesis 2**: As regards online-offline customer journey in high streets, HSJML will outperform related modeling languages in terms of *representational efficiency*, enabling designers to conceptualize customer journey maps more efficiently.
- **Hypothesis 3**: As regards online-offline customer journey in high streets, HSJML will outperform related modeling languages in terms of *interpretational fidelity*, enabling stakeholders in a high street to more effective understand customer journey maps.
- **Hypothesis 4**: As regards online-offline customer journey in high streets, HSJML will outperform related modeling languages in terms of *interpretational efficiency*, enabling stakeholders in a high street to more efficiently understand customer journey maps.

Since design is a search process (Hevner et al., 2004), the design of the HSJML comes with limitations. First, as the requirements defined for designing an artifact can never be complete, by definition (Alexander, 1964), the current abstract syntax is necessarily non-exhaustive and—just like our short paper—is a snapshot in an ongoing research effort that will be iteratively refined. On the one hand, the evaluation might hint at the need for conceptual extensions. On the other hand, the set of event types provided is an informed selection that can be freely expanded to cater for other potential events in a journey. Second, currently there are no modeling tools available that can build HSJML models automatically from event-logs. We rely on human coders to interpret event-logs and manually model customer journeys as depicted in Figure 12.2. To do so, we provide a set of shapes for the flowcharting tool Microsoft Visio. Third, reconstructing customer journeys from event-logs requires data to be available for all touchpoints. While multi-sided local community

platforms are becoming more common in high street retail, their adoption by customers is hampered by privacy concerns regarding personal data (Bartelheimer et al., 2018; Betzing, 2018). Moreover, to yield insights from non-digitized, physical touchpoints (e.g., interpersonal service), retailers would have to collect information on the service encounters manually. Nevertheless, with ongoing digitalization and platforms that implement and clearly communicate privacy-preserving behavior, larger amounts of event-log data will become available in the future.

Eventually, data-driven customer journey mapping can be realized, where techniques from process mining are applied to analyze event-logs. Data and information from existing customer journey models can be combined with event-logs to discover, conform and enhance customer journeys (van der Aalst, 2016). Instead of relying on human interpretation to build HSJML models, the models will then be constructed from event-log data automatically. Bernard and Andritsos (2017) propose a technical representation of customer journeys that serves as input for existing process mining tools such as ProM to derive insights (van der Aalst, 2016). However, their approach lacks a domain-specific graphical representation—a gap that HSJML closes. Process mining can be used to derive "de facto" models from data, and to compare these models with previously established "de jure" models to identify if and how customers respond to provided cues (e.g., receiving personalized offers through the platform). By aggregating data from multiple customer journeys, metrics such as throughput times and points where customers are often lost can be derived as insights that directly relate to customer experience. Further, transition probabilities might enable predicting the customer's next moves or even predict whole customer journeys in a high street in real-time. Finally, event-logs and analyses can be enriched with external data (e.g., weather data) to yield context-savvy insights.

To conclude, HSJML provides the foundation for the event-driven construction and visual analysis of customer journeys in high street retail. With the further development of HSJML, the availability of event-log data, and the adaption of process mining techniques, valuable insights regarding online-offline customer journeys and customer experience created therein can be derived to advance theory and practice.

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13 The Impact of Transparency on Mobile Privacy Decision Making

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The Impact of Transparency on Mobile Privacy Decision Making

Abstract. Smart devices provide unprecedented access to users' personal information, on which businesses capitalize to offer personalized services. Although users must grant permission before their personal information is shared, they often do so without knowing the consequences of their decision. Based on the EU General Data Protection Regulation, which mandates service providers to comprehensively inform users about the purpose and terms of personal data processing, this article examines how increased transparency regarding personal data processing practices in mobile permission requests impact users in making informed decisions. We conducted an online experiment with 307 participants to test the effect of transparency on users' decisions about and comprehension of the requested permission. The results indicate increased comprehension of data processing practices when privacy policies are transparently disclosed, whereas acceptance rates do not vary significantly. We condense our findings into principles that service providers can apply to design privacy-transparent mobile apps.

13.1 Introduction

Smart devices, which collect personal information such as users' location, calendar, and contacts, allow for new app-based business models that provide location-based (e.g., navigation, targeted advertising), social (e.g., friend finder, social networks), and personalized (e.g., mobile recommendations, mobile banking) services (Dhar and Varshney, 2011; J. Tan et al., 2014). Such networked business models have substantial implications for data privacy because personal information is shared between and processed by a high number of actors (Wohlgemuth et al., 2014). Mobile operating systems feature safeguards against unauthorized access to personal

information, and apps must request permission from users for these services prior to installation or at run time (Aydin et al., 2017; Balebako et al., 2015). App providers can enrich run time permission requests with custom explanations by adding a textual description to the mobile operating systems' inbuilt formal request dialogues (J. Tan et al., 2014). Alternatively, apps can present one or more dedicated screens that provide visual and textual explanations before triggering the actual request dialogue. However, so far app providers typically fail to comprehensively inform users about their data collection and sharing practices (Balebako et al., 2013). In turn, users often make decisions without realizing their consequences (Almuhimedi et al., 2015; Lin et al., 2012). In addition, users do not fully understand how data are processed and shared since transmissions run in the background of apps (Wetherall et al., 2011). The case of Cambridge Analytica, which used a mobile app to collect private information from 50 million Facebook users for voter-profiling, is one of many examples of privacy invasions that happen without users' knowledge (Rosenberg et al., 2018). Apart from illicit service providers that abuse data, even honest providers often fail to comprehensively explain their data practices. Users have the opportunity to read privacy policies that should make them aware of the personal data collection and sharing practices. However, studies confirm that privacy policies are ineffective because of their length and convoluted legal language (Schaub et al., 2015; Tsai et al., 2011; McDonald and Cranor, 2008).

In response to ongoing transparency issues, policymakers and consumer advocates have increasingly emphasized the need to strengthen consumer rights regarding personal information (Gimpel et al., 2018). Based on the European Union (EU) General Data Protection Regulation (GDPR) (Regulation (EU) 2016/679), which we consider as an exemplary legal framework, we investigate, how an increase in transparency on data processing compared to service providers' current communication practices affects users' privacy decision making in mobile contexts. The EU GDPR replaces the 1995 Data Protection Directive (95/46/EC) and harmonizes the privacy laws across the EU member states. The regulation mandates, among other things, that service providers must comprehensively inform users about the purpose and terms of personal data processing before users' data are collected (European Union, 2016). Users can then decide whether to opt-in giving *informed* and *active consent* (Carolan, 2016). One could expect that increased transparency would lead users to make such consent decisions with careful consideration (Schaub et al., 2015). However, in light of reports in the media that many popular apps contain privacy threats such as dis-

closing location information to third parties (Aydin et al., 2017), users might react by not consenting to any data use at all. Without consent, business models that rely on personal data are at risk. Against this background, the central research question is:

RQ: *How does increased transparency regarding personal data processing practices in mobile permission requests impact users in making informed decisions?*

The goal of our study is not to verify that users are concerned about privacy, but to determine whether increased transparency actually leads users to make *informed decisions*. We also investigate whether businesses that do transparently inform users have to fear that the number of users who consent to the collection of business-critical personal information will decline. We used a parallel-group experimental design with three conditions to test the effect of transparency on users' decisions about and comprehension of the requested permission. The results indicate that the participants' comprehension of data processing practices increases when increased transparency is established while acceptance rates do not significantly vary. We condense the findings of the study and interpretation of the regulation into design principles that aid app service providers in designing privacy-transparent apps that help their users to give informed consent. Following Gimpel et al. (2018) and Tsai et al. (2011), we maintain that increased transparency and protection of privacy can be an asset for service providers, rather than a liability.

The remainder of this paper is structured as follows: Section 2 provides more information on transparency regarding mobile privacy decision making and the EU GDPR. Section 3 presents the research design. Section 4 provides the results of our study. Section 5 discusses the findings and derives design principles for app service providers, whereas Section 6 concludes the article.

13.2 Research Background

Personal data are defined as "any information relating to an identified or identifiable natural person [...]; an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors

specific to the physical, physiological, genetic, mental, economic, cultural, or social identity of that natural person" (Art. 4, No. 1, European Union, 2016). The terms "personal data" and "personal information" are used as synonyms in the literature and throughout this article. Data processing comprises any operation regarding personal data, including collection, analysis, storage, use, sharing, and deletion (Art. 4, No. 2, European Union, 2016). Privacy is understood as "an individual's ability to control the terms by which their personal information is acquired and used" (Chellapa and Sin, 2005, p. 186).

13.2.1 Transparency of Personal Data Processing Practices

Personal data, most of which are collected in online-based environments, have become a corporate asset with growing monetary value (Wohlgemuth et al., 2014), and service providers extract value from personal data such as customer preferences, social networks, and geographic locations (Schwartz, 2004). For example, Alphabet and Facebook have become multi-billion dollar companies, and are the leaders of the digital advertising market because they are profiling service users' data to allow businesses to more effectively target customers suited for their product portfolio (Kosinski et al., 2015).

Although service users can read privacy policies, most users do not comprehend service providers' personal data processing practices (Schaub et al., 2015). Abundant research has shown that service users are unable to fully understand the convoluted legal language of privacy policies (McDonald and Cranor, 2008; Schaub et al., 2015), and consequently, many people do not even bother reading them (Tsai et al., 2011). This leads to a lack of transparency that manifests in information asymmetry between user's and service provider's knowledge of processing practices (Jensen and Potts, 2004; Acquisti et al., 2015).

In response to the economic significance of personal data and its potential impacts on service users, policymakers and consumer advocates around the world are requesting more transparency regarding service providers' data processing practices (Executive Office of the President, 2015). They further concluded that regulations have to intensely focus on enabling individuals to actively make decisions about future usage and disclosures of any collected personal data (Podesta et al., 2014).

In Europe, the recent EU GDPR is the central regulation that mandates service providers to more transparently inform users about personal data processing (European Union, 2016) than they did so far (Robinson et al., 2009). Transparency aims to enable individuals to make more informed and privacy-conscious decisions regarding the disclosure of personal information (Tsai et al., 2011).

13.2.2 EU General Data Protection Regulation

The EU GDPR, which came into effect on 25th May 2018, is meant to reduce information asymmetry by strengthening data protection for EU citizens (European Union, 2016). It mandates that any processing of personal data must follow the principles of lawfulness, fairness, and transparency (Art. 5, No. 1a).

Lawfulness (Art. 6) requires an active consent, defined as "any freely given, specific, informed and unambiguous indication of the data subject's wishes by which he or she, by a statement or by a clear affirmative action, signifies agreement to the processing of personal data relating to him or her" (Art. 4, No. 11). This definition of consent requires that users have a choice, actively opt in ("freely given"), consent to data processing for a "specific" purpose, have received information regarding data processing ("informed"), and be presented the consent form in a clear, understandable way that distinguishes this consent from other contractual terms ("unambiguous") (Art. 7, No. 1 and 2).

For a user to be "informed", the service provider must reduce information asymmetry prior to collecting personal data from the data subject (Art. 13). Most importantly, users must be informed about the "identity and contact details of the [service provider]" (Art. 13, No. 1a), "the purpose of the processing" (Art. 13, No. 1c), and "the recipients [...] of the personal data" (Art. 13, No. 1e). Further, for processing to be fair and transparent, users must be informed of "the period for which the personal data will be stored" (Art. 13, No. 2a), the right to access the information (Art. 15; Art. 13, No. 2b), the rights to rectify and erase data (Art. 16; Art. 17; Art. 13, No. 2b), the right to withdraw consent at any time (Art. 13, No. 2c), and "the existence of automated decision making, including profiling" (Art. 13, No. 2f). Finally, all information should be provided "in a concise, transparent, intelligible and easily accessible form, using clear and plain language" (Art. 12, No. 1).

Users can make active consent decisions by accepting or declining permission requests, such as giving an app access to location services or contacts. For the decision to be informed, users must have previously received all of the information listed above. The EU GDPR is a legal norm, but does not provide explicit guidelines on how to establish transparency and display the necessary information. Developers can textually provide the mandated information within the permission request (J. Tan et al., 2014), so that the privacy decision is put into context and the users are given a choice. Additionally, users must be able to access a long-form privacy policy at any time.

We identified five dimensions affecting user's comprehension of the consequences of their actions: users should know what personal information will be used (collected data), when and how often it will be collected (time of collection), how the information will be processed (processing), with whom it will be shared (sharing), and how long it will be retained (erasure). Transparently providing the EU GDPR-mandated information in mobile permission requests should enable users to make informed consent decisions. We assess, whether this form of information provision increases the comprehension of these five dimensions and suggest our first hypothesis:

H1: *More transparent provision of information regarding personal data processing practices in mobile permission requests increases users' comprehension of the consequences of the consent decision.*

With reduced information asymmetry and increased comprehension of data processing practices, users' perception of the risks associated with disclosing personal information might increase as well. Privacy calculus theory (Dinev and Hart, 2006) explains that users perform a risk-benefit analysis in which the willingness to provide personal information is positively related to the perceived value of information disclosure and negatively related to the perceived risks thereof (Xu et al., 2011). However, research showed that this rational view of maximizing benefits while at the same time minimizing risks, corresponding to expectancy theory (Dinev and Hart, 2006), not always holds for real-world user behavior (Keith et al., 2013). The "privacy paradox" (Acquisti and Grossklags, 2005; Adjerid et al., 2018) subsumes discrepancies between users' conservative behavioral intentions and their more liberal real-world behavior. In effect, some users ignore long-term privacy costs in favor of short-term functional and monetary benefits (Gimpel et al., 2018).

Consequently, we assume that with increased comprehension of personal data processing practices, many users will react with skepticism, raise privacy concerns, and deny permission requests (Keith et al., 2016). Although the privacy paradox might mitigate the effect as some users supposedly trade risks for short-term benefits, we expect to see an overall decrease in the number of users consenting. Therefore, the second hypothesis for this study reads as follows:

H2: *More transparent provision of information regarding personal data processing practices in mobile permission requests decreases the number of users who consent to the use of their data.*

13.2.3 Mobile Privacy Decision Making

Previous research on mobile privacy decision making has highlighted issues regarding the provision of privacy-related information. In general, mobile users value control over their personal information (Pentina et al., 2016), but they are often unaware of the data collection and sharing practices of apps they use (Almuhimedi et al., 2015; Shklovski et al., 2014). When informed about their actual practices, many users are upset and respond by uninstalling the apps (Balebako et al., 2013; Harbach et al., 2014; Shklovski et al., 2014).

Although mobile permission-based access systems should protect users from unwittingly disclosing private information, privacy notices and permission requests provide insufficient explanations of the types of data collected, frequency of collection, entities with which data are shared, and reasons for doing so (Balebako et al., 2013; Lin et al., 2012). Studies have also confirmed that users have difficulty understanding the default mobile permissions (Kelley et al., 2012; Felt et al., 2012) and that their beliefs about apps' behaviors often do not align with their actual behavior (Lin et al., 2012). Some works have proposed highlighting threats to privacy using mobile security extensions like application and network analysis (Aydin et al., 2017), privacy nudges (Acquisti, 2009; Balebako et al., 2013), and just-in-time disclosures of data sharing (Almuhimedi et al., 2015).

Others have sought to improve the design and timing of privacy notices. Harbach et al. (2014) augmented permission requests with examples of users' personal data to demonstrate the consequences of consent. Kelley et al. (2013) designed a privacy

fact sheet. Schaub et al. (2015) presented a framework for designing privacy notices, taking into account the timing, channel, modality, and control of notices. Balebako et al. (2015) compared the impact of timing on users' ability to recall privacy policies as a proxy for an informed consent. Their results indicated that permission requests shown at run time are more salient than is displaying permissions at the time of installation.

Previous research on human-computer interactions further reminds us of the ineffectiveness of warnings, prompts, and permission requests due to users' habits (Böhme and Grossklags, 2011; J. Tan et al., 2014; Harbach et al., 2014). Some users get used to such requests and respond automatically, without making an informed decision. For example, Fisher et al. (2012) showed that 15 percent of respondents granted all location permission requests on Apple iOS. It is fair to assume that habituation effects will also affect permission requests that transparently explain data processing practices.

Following proven practices from mobile app design (Marrs, 2016), privacy information can be presented through onboarding, which is "the process of familiarizing a customer with a firm's service offering" (Voorhees et al., 2017, p. 274). Mobile app designers frequently include short introductory tutorials that explain the app's key benefits. Commonly, this process will comprise a few swipe-through screens that combine images or videos with explanatory text. Studies show that a multi-modal presentation of instructional materials can improve the effects of learning, in line with cognitive load theory (Sombatteera and Kalyuga, 2012). The GDPR's transparency principle also proposes using visualization where appropriate (Recital 58). In addition, mobile operating systems' permission request interfaces have word count limits, so developers can only briefly state the mandatory information (Keith et al., 2016), whereas an onboarding process can utilize the full screen of the mobile device. Therefore, we propose an onboarding process as an alternative design, where visual cues accompany a textual representation of the EU GDPR-mandated privacy information. After the user has received the information, he or she is asked to provide consent using the operating system's permission request dialogue. In addition to potentially counteracting habituation, onboarding has higher expressive power than solely text-based permission requests. The onboarding process might reduce the cognitive load required to understand the risks associated with disclosing personal information compared to the text-based request. Thus, the established transparency might negatively affect users' consent decisions in comparison to cur-

rent nontransparent practices. With regard to an onboarding process, we propose a second set of hypotheses:

H3: *More transparent provision of information regarding personal data processing practices in an onboarding process increases users' comprehension of the consequences of a consent decision.*

H4: *More transparent provision of information regarding personal data processing practices in an onboarding process decreases the number of users who consent to the use of their data.*

13.3 Method

Design. Similar to other studies on mobile privacy notices (Balebako et al., 2015; Harbach et al., 2014; Kelley et al., 2013; J. Tan et al., 2014), we conducted a web-based experiment and presented participants with app screens framed with a phone border to resemble a virtual smartphone. The experimental design caters to ecological validity as it features both the look and the feel of a real-world mobile app, and a realistic real-world use case. We designed the privacy note and app permission request in accordance with previous research. Following Schaub et al. (2015), the permission request should appear in direct context to the processing practices and block the current application's operations when it wants to access a restricted resource for the first time (Schaub et al., 2015). Our app resembles the flow and user interface (UI) of Apple iOS (version 10, which was current during the experiment) because this operating system uses just-in-time permissions for many years (J. Tan et al., 2014), while Google Android only recently adopted this behavior (Aydin et al., 2017).

Material and procedure. The use case of our fictitious app—called *shop.io*— is a mobile shopping platform for high streets (Bartelheimer et al., 2018). Retailers register as partner shops, present their businesses, and engage in targeted location-based marketing, which is facilitated by Bluetooth beacons that retailers install in their shops. These small tokens broadcast a uniquely identifiable signal to which smart devices can react (Betzing, 2018). A customer-facing mobile app, which is the subject of our study, allows the user to find local shops and obtain personalized offers.

When the customer enters a partner shop, *shop.io* receives the shop beacon's signal and tracks the customer's visit. The system profiles the customer's shopping preferences based on tracked shop visits and uses collaborative filtering to recommend relevant shops and offers that match the user's interests (Bartelheimer et al., 2018). Location-based business models like *shop.io* depend on customers' decisions to allow the app to access location services, and to consent to the processing of location information; the use of beacons requires that the app continuously accesses location services in the background to identify beacon signals, even when the user is not actively interacting with the app (Betzing, 2018). These concerns, in combination with users' desire for location privacy (Eastin et al., 2016; Kelley et al., 2013; Keith et al., 2013), lead us to test for the "location always" permission instead of other permission requests, such as access to calendars or contacts.

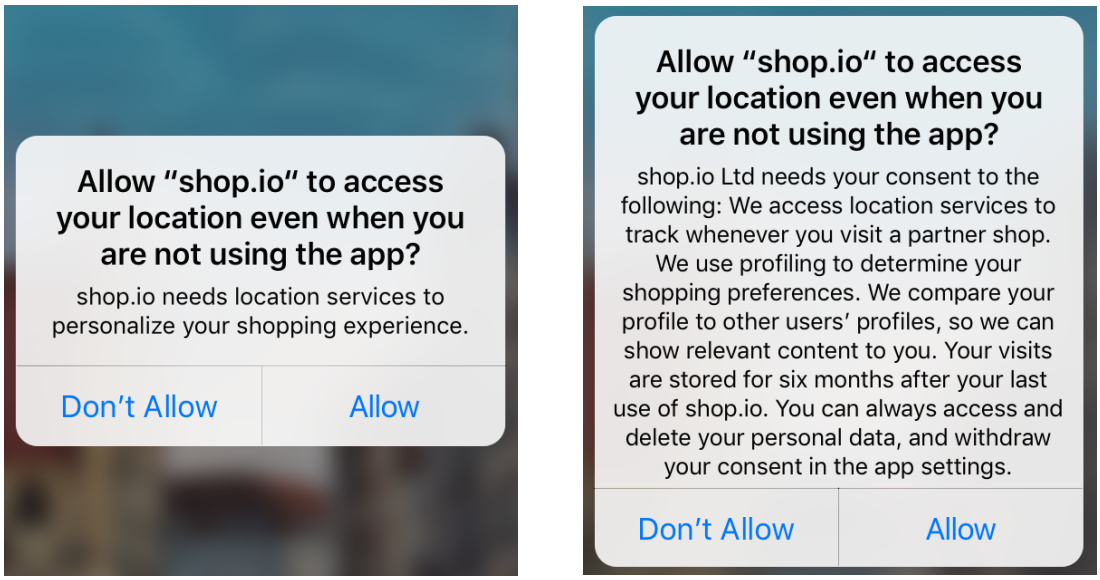
Participants were introduced to the experiment with a detailed description of the setting in which they were hypothetically located. They received a fictive promotional leaflet for *shop.io* (see Figure 13.1) that lists the key benefits of the app and closely resembles real-world app advertisements. Tech-savvy users could infer the app's functionality and behavior from this leaflet. Some statements were directly related to questions regarding comprehension asked in the experiment. Participants then saw the virtual phone's home screen with the app icon and imagined that they were opening *shop.io* for the first time.

Our experiment was a hypothetical thought experiment, so participants were asked to select the answer they would choose in real life. After deciding, participants answered ten comprehension questions related to the five dimensions (i.e., collected data, time of collection, data processing, data sharing, and data erasure). The questions are shown in Appendix 13.A.1. Then, participants provided personal and demographic information and were presented with a simple debriefing that explained the purpose of the study.

Conditions. To test the hypotheses, we used a parallel group experimental design with three conditions: a baseline condition and two treatment conditions. The baseline condition resembles current app practices; developer-specified explanations for permission requests are vague and do not provide details about the app's data processing practices (J. Tan et al., 2014). Figure 13.2a shows a request for the "location always" permission. The headline and buttons are predefined by iOS, and developers can define only the body of the permission request.

Figure 13.1: Leaflet that Promotes the Fictional *shop.io* App

To test for hypotheses *H1* and *H2*, the first treatment condition (henceforth, *EU notice*) uses the same UI but replaces the marketing-driven text with a short-form privacy notice (see Figure 13.2b). This treatment features increased transparency and is compliant with the EU GDPR. The text, which we developed in consultation with a legal expert, closely resembles the wording of the regulation and fulfills, to the best of our knowledge, the prerequisites for an informed consent decision (cf. Section 2): the identity of the service provider (*shop.io* Ltd) and a request for consent; the purpose of collection (to determine shopping preferences and show relevant content); which personal information is collected (visits to partner shops) and when it is collected (every time a shop is visited); a statement that *shop.io* profiles and compares various



(a) Baseline Condition **(b)** EU Notice Condition

Figure 13.2: Location Permission Requests

users' personal data to other users' data; how long the information is stored; and the users' rights regarding access to and deletion of personal information and the option to withdraw consent at any time.

To test for hypotheses *H3* and *H4*, the second treatment condition uses an onboarding process (henceforth, *onboarding*) which presents the same EU GDPR-mandated information as the EU notice but in a multi-modal fashion. We consulted existing practitioner guidelines regarding mobile privacy notices published by the US National Telecommunications and Information Administration and the OECD. The former suggests a standardized structure for short-form notices (NTIA, 2013), but the proposed data categories have been identified as difficult to understand (Balebako et al., 2015). The OECD recommends a process of preparing a long-form privacy policy, developing a simplified notice, testing its usability, and deploying the notice (OECD, 2006). However, as Schaub et al. (2015) remarked, the OECD fails to address what the policy should look like. Therefore, our onboarding process is inspired by real-world examples (Marrs, 2016).

Figure 13.3 shows the four onboarding screens and the subsequent permission request. Each screen is consistently structured and focuses on one aspect of data processing. The screens feature a headline, visualization, mandatory information regarding the data processing, and statements that limit the extent of processing. For

example, the first screen states that visits to partner shops are tracked but that no other location information is collected. In this treatment, most EU GDPR-mandated information is provided before the permission request is shown. In effect, the explanation only states that it is a consent form, the name of the service provider, and the purpose of data collection.

Participants were randomly assigned to one of the three conditions. The baseline and the EU notice conditions instantly showed the respective location permission requests, whereas participants in the onboarding condition had to go through the onboarding screens before seeing the location permission request.

Measures. The decision variable was binary; participants were asked to either accept or deny the permission request. The comprehension score variable was composed of five comprehension dimensions, each of which had two true/false questions. As suggested by Dolnicar and Grün (2014), participants could choose to respond *don't know* to prevent contaminating the data with guesses. The comprehension score was continuously coded between -10 points and +10 points (+1 per correct and -1 per incorrect answer).

Following the location permission request, participants' privacy preferences were tested and typed according to the Westin privacy index, which categorizes individuals as either a privacy pragmatist, a privacy fundamentalist, or a privacy unconcerned individual (Taylor, 2003). We replicated Westin's approach by asking the same three standardized questions (Kumaraguru and Cranor, 2005, p. 13, 15) on a four-point Likert scale and also use the same classification key (p. 13). We also controlled for habituation (Böhme and Grossklags, 2011; Harbach et al., 2014; Fisher et al., 2012). To identify users with privacy habits, we both determined the .25 quantile of the decision time as a reference time for quick decision makers and asked two questions using five-point Likert scales (see Appendix 13.A.2).

Participants. The minimum feasible sample size , 252 participants, 84 per condition, was estimated using G*power analysis (Faul et al., 2007). This number of participants enables us to make a fairly accurate and reliable statistical judgment (power$= 0.95$) based on a medium effect size as well as to detect any effect between the three study groups that may result from providing them with different degrees of transparency regarding personal data processing (Cohen, 1988).

We recruited 382 EU residents who were at least eighteen years of age via the online recruitment platform *prolific.ac* on the 21^{st} and 22^{nd} of March 2018. This platform is appropriate for random-sample populations (Berinsky et al., 2012), and the behavior of the respondents on online recruiting platforms closely resembles that of participants in traditional laboratory experiments (Mason and Suri, 2012). Further, prolific.ac allowed us to lock participants to use desktop PCs only to keep this situational variable constant. We pre-tested the study with 45 additional participants from prolific, discussed the experiment in depth with fellow researchers to ensure its clarity and comprehensiveness, and set up a questionnaire to accurately measure the comprehension level.

Unfamiliarity effects were prevented a priori by pre-selecting participants that primarily use an Apple iOS device. We also surveyed for smartphone experience and found that 87.3 percent of the respondents had more than four years of experience. To ensure high data quality, respondents who either failed an attention check question (from Oppenheimer et al., 2009) or failed a simple comprehension check question were removed. This process left us with a sample of 307 participants. The mean age of the participants was 33.69 years (median 32 years, SD 11.06 years), and 67.75 percent were women (see Table 13.1). Each session lasted an average of six minutes, and respondents were paid £1 for participation, which resembles the approximate average hourly wage in the UK of £10. Participants were evenly distributed among conditions. Slight variations are the result of filtering. In total, 105 participants were assigned to the baseline condition, 104 were assigned to the EU notice condition, and 98 were assigned to the onboarding condition.

Table 13.1: Descriptive Statistics of the Sample

	N	Gender		Age	
		Female	Male	Mean	SD
Baseline	105	71	34	35.59	11.61
EU Notice	104	68	36	32.51	10.13
Onboarding	98	69	29	32.89	11.26
Σ	307	208 (67.75%)	99 (32.25%)	$\bar{x} = 32$	$\sigma_x = 11.06$

Figure 13.3: Five-step Onboarding Process

13.4 Results

13.4.1 Descriptive Results

In support of hypotheses *H1* and *H3*, which propose that users' comprehension increases when privacy-related information is presented more transparently, participants in the treatment conditions achieved higher comprehension scores than did those in the baseline (Table 13.2). Thus, it is reasonable to claim that they made more informed consent decisions (Figure 13.4a). Appendix 13.A.4 gives the distribution of comprehension performance across conditions.

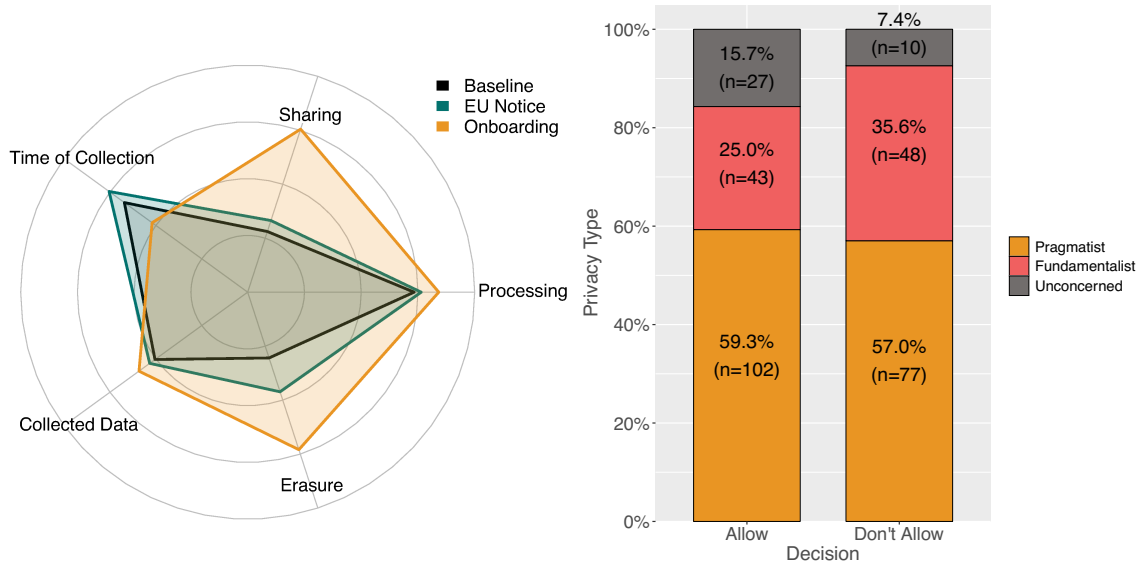
Table 13.2: Descriptive Statistics of the Results

	N	Comprehension		Decision		Privacy Type			Habituation
		Mean	SD	Don't Allow	Allow	Unconcerned	Pragmatist	Fundament.	
Baseline	105	-0.02	2.68	45 (42.9%)	60 (57.1%)	10 (9.5%)	61 (58.1%)	34 (32.4%)	6 (5.7%)
EU Notice	104	1.38	3.54	44 (42.3%)	60 (57.7%)	16 (15.4%)	60 (57.7%)	28 (26.9%)	9 (8.7%)
Onboarding	98	3.76	3.07	46 (46.9%)	52 (53.1%)	11 (11.2%)	58 (59.5%)	29 (29.6%)	9 (9.2%)
Σ	307	$\bar{x} = 1.66$	$\sigma_x = 3.47$	135 (44%)	172 (56%)	37 (12%)	179 (58.3%)	91 (29.6%)	24 (7.8%)

The comprehension scores of participants in the baseline condition were the lowest of almost all dimensions, followed by participants in the EU notice condition (see Appendix 13.A.4, Table 13.5). The scores of those in the onboarding condition were much higher than the scores of those in the other two conditions in almost all dimensions. With a maximum of 10 points and a minimum of -10 points, the baseline group achieved an average of -.02 points (EU notice 1.38 points; onboarding 3.76 points) over all dimension areas with homogeneous distribution as the standard deviation is almost identical across conditions (SD baseline 2.68; SD EU notice 3.54; SD onboarding 3.07). Furthermore, we descriptively analyzed how much time participants needed to make their decisions across conditions (see Appendix 13.A.3).

The distribution of the permission request decision is similar for all conditions. In the baseline condition, 57.1 percent of the participants allowed access to location services (EU notice 57.7 percent; onboarding 53.1 percent), which might indicate that increased transparency does not affect respondents' decisions.

Table 13.2 also provides descriptive statistics concerning the the shares of habituated users, as well as distribution of the three types of privacy preferences. In total, 7.8 percent of the participants made privacy-related decisions out of habit, as did 5.7



(a) Distribution of Different Dimensions of Comprehension by Treatment Groups

(b) Distribution of Permission Request Decisions by Privacy Types

Figure 13.4: Dimensional Segmentation of Comprehension Results and Distribution of Privacy Types

percent of those in the baseline condition, 8.7 percent of those in the EU notice condition, and 9.2 percent of those in the onboarding condition. Although we expected the onboarding process to counteract habituation, there is no evidence that it does. With regard to the three types of privacy preference, more than half of the participants were privacy pragmatists and around a third were privacy fundamentalists, with fewer reporting to be unconcerned about privacy. The resulting distribution of privacy types (Table 13.2) can be interpreted as a reliable replication of Westin's 2003 study (presented in Taylor, 2003), in which 26 percent of adults were classified as privacy fundamentalists, about 10 percent were unconcerned, and 64 percent were pragmatists. In our study, a large majority (73 percent) of unconcerned participants allowed access to their data for location services, while the other two groups' decisions were more balanced (Figure 13.4b).

13.4.2 Inferential Results

Table 13.3 presents the regression results. We conducted a linear regression to test the effect of increased transparency, in the form of an EU GDPR-compliant notice and the additional onboarding process, on participants' comprehension as well as a

logistic regression to test the effect of the treatments on users' decisions. The strong positive relationship indicated by Figure 13.4a was confirmed with the following linear regression model:

$$\begin{aligned}\text{Comprehension Score}_i = \beta_0 + \beta_1 \times \text{EU Notice}_i + \beta_2 \times \text{Onboarding}_i + \beta_3 \times \text{Pragmatist}_i + \\ \beta_4 \times \text{Unconcerned}_i \ + \beta_5 \times \text{Fundamentalist}_i + \gamma' \times \text{Controls}_i + \varepsilon\end{aligned} \tag{13.1}$$

where i indexes the individuals, β_0 is the intercept, β_1 and β_2 are the effects of the respective treatment (i.e., EU notice and onboarding), β_3, β_4, and β_5 are the coefficients for the privacy type which are dummy variables, γ' is the coefficient for the controls_i, which were *Habit*, *Age*, and *Gender*, and ϵ represents the error term.

Table 13.3: Regression results (odds ratios for model [3] and [4])

Model #	[1]	[2]	[3]	[4]
Dependent variable	Comprehension Score (continuous)		Decision (binary)	
EU Notice	1.40** (.43)	1.47** (.43)	1.02 (.28)	.93 (.29)
Onboarding	3.77***(.44)	3.80*** (.44)	.85 (.28)	.79 (.29)
Pragmatist	-	.42 (.40)	-	1.17 (.26)
Unconcerned	-	.59 (.61)	-	3.16** (.43)
Fundamentalist	-	-.45 (.39)	-	.31 (.26)
Habit	-	-.09 (.63)	-	2.15 (.48)
Age	-	.03 (.02)	-	.99 (.01)
Gender	-	-.55 (.38)	-	.98 (.25)
Intercept	-.02 (.30)	-.75 (.72)	1.08 (.48)	1.61 (.45)
N	307	307	307	307
AIC			426.60	429.76
BIC			437.78	452.13
Adj. R2	.19	.20		
F-statistic	37.81***(df = 2; 304)	11.99***(df = 7; 299)		

Notes: * p <.05, ** p <.01, ***p <.001; standard errors are in parentheses.

We used the baseline condition as the reference condition. Model [1] (Table 13.3) contains only the treatment variable (condition), while Model [2] also includes the covariates indicating the privacy preferences of each individual and the control variables. In Model [1], the comprehension scores of participants in the EU notice condition increased significantly to 1.40 ($p < .01$). This effect was amplified when the control variables were added (Model [2]: 1.47, $p < .01$). The effect was even greater for the onboarding condition (Model [1]: 3.77, $p < .001$; Model [2]: 3.8, $p < .001$). Therefore, the study provides evidence that the users' comprehension of the consequences of the consent decision increases when there is increased transparency regarding data processing.

To test hypotheses *H2* and *H4*, we used the following logistic regression model that contains the same index, intercepts, and coefficients as the linear model, excluding the linear-specific error term:

$$Pr(\text{Choice}_i = 1) = logit^{-1}(\beta_0 + \beta_1 \times \text{EU Notice}_i + \beta_2 \times \text{Onboarding}_i + \beta_3 \times \text{Pragmatist}_i + \beta_4 \times \text{Unconcerned}_i + \beta_5 \times \text{Fundamentalist}_i + \gamma' \times \text{Controls}_i) \quad (13.2)$$

In line with Model [1] and Model [2], Model [3] features only the treatment variable, while Model [4] also incorporates the covariates for the privacy type and the control variables (Table 13.3). The results indicate that participants' consent decisions were not significantly negatively affected by a more transparent provision of information regarding data processing (EU notice: Model [3]: 1.02, p = .94, Model [4]: .93, p = .94; onboarding: Model [3]: .85, p = .56, Model [4]: .79, p = .43), so we reject hypotheses *H2* and *H4*. Therefore, increased transparency does not decrease the number of users who consent to data processing.

When we control for privacy preferences, the coefficients of the treatment conditions remain largely unchanged, indicating that the effect is robust, except the EU notice condition significantly caused privacy-unconcerned participants to consent to data processing (EU notice: 10, p = .056). Participants who were unconcerned about privacy were 2.41 times more likely than those with other privacy preferences to accept the permission request (p = .03). The results for the comprehension score largely reflect the findings from the main analysis, except for unconcerned participants in both conditions, who show an insignificant improvement in comprehension (EU notice: .99, p = .45; onboarding: 1.89, p = .20).

13.4.3 Qualitative Results

All participants were asked to provide a rationale for their decisions by means of an open-ended question immediately after decision making. The responses were split into two data sets: 172 cases of acceptance and 135 cases of denial of the permission request. We conducted a qualitative content analysis that followed the content structuring approach presented by Mayring (2014). Two researchers independently analyzed the data set to exploratively create a category-based coding scheme that

allows responses to be assigned to at least one non-mutually exclusive category. The coding scheme was iteratively revised until a consensus among both researchers was reached and every response could be assigned.

Table 13.6 in Appendix 13.A.5 provides inter-rater agreements regarding both subsets and individual categories using percent agreement and Cohen's Kappa. The results indicate a very high agreement for both the acceptance (95.60 % agreement; overall Cohen's Kappa .840) and rejection (96.48 % agreement; overall Cohen's Kappa .853) subsets (Landis and Koch, 1977). In instances of disagreement, the researchers discussed the respective codes until a complete consensus was established.

Seven categories were derived from the responses related to acceptance of the permission request. Table 13.8 in Appendix 13.A.5 provides the categories, their descriptions, and number of mentions. Evidence from the responses was added for clarity. All quotes are taken verbatim without correcting punctuation or spelling. Most respondents reported receiving personal benefits (111, 64.53 %) or allowing the app to properly execute its service (89, 51.74 %) as rationales for consenting to the request. In total, 56 respondents (32.56 %) reported both personal benefits and functional reasons. Ten respondents (5.81 %) acknowledged habituation and eight respondents (4.65 %) stated that they did not care about the consequences of their decision. Although, *shop.io* is a fictional app, ten respondents (5.81 %) explicitly stated that they trusted the app. Eight of the respondents within this category received the onboarding treatment. Lastly, five participants (2.95 %) reported feelings of control as they explicitly or implicitly knew that they could revoke the location permission and their consent later on.

Table 13.9 in Appendix 13.A.5 lists eight categories of rationales for why participants denied the location permission request. Most frequently, respondents disliked the feeling of intrusiveness evoked by tracking (45, 33.34 %), giving the app permanent access to location data (43, 31.85 %), or providing personal information in general (42, 31.11 %). Across groups, about a third of participants reported that they would grant *shop.io* access to location data if the information is only collected when the app is opened (i.e., when the user is actively interacting with the app). Twenty-one (15.56 %) participants had bad experiences in the past, recalling battery drain and high use of mobile data due to background location services. Some users (19, 14.07 %) decided out of habit and stated that they completely disabled location features or

denied all requests. Seventeen respondents (12.60 %) did not understand why *shop.io* required location services and denied the request. Further, ten participants (7.41 %) feared a data breach, intrusion by hackers or unauthorized sharing of personal information. Lastly, seven participants (5.19 %) denied the request because they were not interested in the app and the functions enabled by location services.

13.5 Discussion

13.5.1 Interpretation of Results

Transparency regarding personal data processing practices in mobile permission requests does influence users in making more informed decisions (H1, H3). Both an EU GDPR-compliant notice and an onboarding process are suitable designs that app providers can apply when developing privacy-transparent mobile apps. Since an EU GDPR-compliant notice suffices to give users all of the information required by law, an onboarding process that exclusively informs on data privacy might—at first—appear over-engineered. However, onboarding had the superior comprehension rates to both the baseline and the EU notice designs. From an ethical perspective, service providers should aim at maximizing comprehension. Although legally sufficient, over time the EU notice design (with its brief textual explanation) might come with social penalties if superior practices of disclosure such as onboarding will establish themselves on the market. We maintain that onboarding should be preferred generally to maximize comprehension, and particularly in cases of complicated services that require explanation. Nevertheless, in our case, the onboarding process also had a negative effect on some respondents. Among the seventeen users that did not understand the necessity of granting the permission request (Table 13.9), nine received the onboarding treatment, which explains in detail that location is sensed through Bluetooth beacons and not via GPS. Although technically correct, this statement caused confusion since users associate the location permission request primarily with GPS. However, Apple iOS uses the same permission and dialogue for both Bluetooth beacons and GPS. This limitation is specific to our case but reminds us that providing more information can sometimes increase the risk of misunderstandings.

We expected that more transparently informing users about data processing practices would reduce acceptance rates (H2, H4). However, users showed no significant differences in their consent decision in either of the two treatment conditions. One the one hand, this might suggest that users are prejudiced, react regardless of the treatment, and are not impacted by increased transparency. On the other hand, a lack of behavioural change at the aggregated level can mask changes at the individual level. Some users who would have previously declined might have become convinced by the given information, while other users might have become alienated.

The qualitative analysis of users' rationales for deciding on the permission request reveals that most participants follow the traditional privacy calculus and weigh permanent tracking against personalized services and monetary benefit (Xu et al., 2011). Regardless of their decision, the established transparency might reduce the users' cognitive load related to their privacy calculus. In contrast to related studies by Shklovski et al. (2014), no participant expressed helplessness or reported lack of transparency as a reason for denying the permission request.

We also find evidence for the privacy paradox (Acquisti and Grossklags, 2005; Adjerid et al., 2018). In total, 43 participants were classified as privacy fundamentalists (16 baseline, 16 EU notice, 11 onboarding), but provided their location information to receive personal benefits. Further, with regard to the effect of transparency and perceived control on user behavior, related work names the "Peltzman effect," in which users offset their increased feelings of control and trust by engaging in riskier disclosures (Brandimarte et al., 2013). The EU notice and onboarding treatments do explicitly present the users' rights to access and delete collected data, which can increase users' perceived control relative to the baseline condition. However, given that no statistically significant differences in users' decisions were evident in our study, we cannot confirm the existence of the Peltzman effect.

While this study focuses on the influence of increased transparency on making informed privacy decisions, it also stimulates the need for further research. Trust is a known influence on the willingness to provide personal information (Dinev and Hart, 2006). Given its expressive nature, an onboarding process could be used by service providers to market their reliability and seriousness regarding the protection of personal information. The qualitative analysis provides preliminary evidence that particularly the onboarding design can evoke feelings of trust (cf. Appendix 13.A.5,

Table 13.8). For example, one participant stated to agree "*because the app explains privacy so well that I'd enable location permission*." However, further studies are required to explore whether transparent information provision facilitates cognitive and affective trust (Johnson and Grayson, 2005), if there is an interplay between trust and the different privacy types (Kumaraguru and Cranor, 2005), and how trust mediates the consent decision in such a scenario.

In our case, less than two-thirds of participants consented to data processing (Table 13.2). In the real world, this would cause businesses models like *shop.io*, which rely on tracking personal information, to lose potential customers. The most frequently mentioned reasons for declining the permission request were related to privacy concerns and location tracking (cf. Appendix 13.A.5, Table 13.9). In particular, 33 participants disliked that the app had constant access to location services, preferring to control tracking themselves. One participant stated: "*I don't mind if I am using the app, but its a bit creepy to constantly track my location* ." In response, service providers should consider hybrid approaches to personal data collection, where a secondary means of collection eclipses a primary one. Collecting less personal information might lead to a reduced range of functions, but it would be more likely to retain privacy-conscious users. Instead of automatically tracking users, *shop.io* could track shop visits through "check-ins" or users could manually select their favorite shops, which would still enable the provider to personalize the service to some extent. Nevertheless, requesting access to a reduced set of personal information after the user denied the primary means of data collection might appear as bold or even "greedy" to some users and might have a negatively impact trust. In total, 7.8 percent of respondents were classified as habituated based on the quantitative analysis, while the qualitative analysis revealed that 11.4 percent of respondents acted out of habit. About six percent of respondents stated that they accept all requests or do not care about the consequences of their decisions (cf. Table 13.8). Another six percent of respondents stated to deny all location permission requests (cf. Table 13.9). In effect, even when transparently providing information to users, there will be a fraction of potential users who service providers cannot influence either way.

13.5.2 Implications for App Service Providers

Although the EU GDPR only protects the data of EU citizens, it is the most far-reaching regulation concerning transparency and data privacy to date (Carolan,

2016), and thus, should be kept in mind by any privacy-conscious service provider. In its first months of being effective, the regulation most prominently impacted users by omnipresent notifications for updated privacy policies and requests for consent (Hern and Waterson, 2018). Researchers also measured a reduction of third-parties that service providers share their service users' personal data with. For example, the number of third-party cookies (e.g., by ad networks) on European news websites declined by 22 percent (Libert et al., 2018). On the contrary, some service providers lock out EU customers or have shut down their service entirely instead of making their offerings compliant (Hern and Waterson, 2018). While making existing business models and services compliant with the EU GDPR is a challenge, it is possible to design new services for transparency. The literature suggests the related concept of *privacy-by-design*, which describes practices to embed privacy into information systems design and development (Schaar, 2010), such as requiring only a minimum amount of personal information for service delivery and utilizing appropriate technical means to protect data (Gimpel et al., 2018).

To identify the primary requirements for service providers concerning the design of privacy notices in particular and mobile privacy management in general, we consulted the EU GDPR. Against the backdrop of the study results and our interpretation of the regulation, we derived six design principles for privacy-transparent mobile apps (Table 13.4), which app service providers can apply in conjunction with the privacy-by-design approach (Schaar, 2010).

Service providers must design for privacy-by-default (DP 1) so that no personal information is collected and processed before informed consent is given (Art. 25 EU GDPR). As this study showed, transparency can be established by a short-form notice (DP 2) that includes all EU GDPR-mandated information (Art. 13). Regardless of whether app designers use a textual description or an onboarding process, the mobile operating system's permission dialogues should be used as a mechanism to request consent (DP 3). With a single input, the user gives both legal consent to data processing and technical access to the underlying data sources.

Given the goals of transparency and legal compliance, service providers must provide users with extensive control over their personal data. We suggest self-service privacy management (DP 4) within mobile apps that implements the rights users have through the EU GDPR. This system should disclose all information that the service provider has collected on the user (Art. 15), such as prior shop visits in the

Table 13.4: Design Principles for Privacy-transparent Mobile Apps

#	Name	Description
1	Privacy-by-Default	Design the app so it collects no personal information before obtaining consent from the user.
2	Short-form Notice	Provide users with short-form EU GDPR-mandated information in the form of a notice or an onboarding process to enable them to give an informed consent.
3	OS Dialogues	Make use of mobile operation systems' permission request dialogues to ask informed users for consent to a particular purpose.
4	Privacy Self-service	Provide the system with a privacy menu that allows users to inspect the personal information that is collected about them (right to access), correct inaccurate data (right to rectification), export collected data (right to data portability), delete their personal data (right to be forgotten), and withdraw given consent (right to object).
5	Long-form Policy	Provide users with a long-form privacy policy that follows the principles of lawfulness, fairness, and transparency.
6	Plan B	Design the app to ask for consent to less privacy-intrusive means of data collection if consent to the primary means is denied.

case of *shop.io*. The system should also allow users to request rectification of inaccurate data (Art. 16), decide which data to keep and which to delete (Art. 17), and export collected data (Art. 20). In addition, the legal expert we consulted stressed that withdrawing a consent must not be more complicated than giving the consent (Art. 7, No. 3). Consequently, app service providers must implement means for users to withdraw consent within the app (Art. 21). Further, as a part of privacy self-service, users must be able to inform themselves about all data processing practices in detail. Therefore, the short-form notice must be accompanied by a long-form privacy policy (DP 5) that is lawful, fair, and transparent (Art. 5). Lastly, as shown before, the study revealed that a binary choice is too restricting; some users might be comfortable with sharing only a subset of personal information or with deciding case by case. Consequently, when a binary choice is denied, service providers should revert to less intrusive methods of data collection (DP 6) with which some users might be more comfortable.

13.5.3 Limitations

Our study features certain limitations. First, our treatments were designed using the EU GDPR as underlying framework. Because the regulation is an abstract norm, it does not give concrete design requirements. While our study and design principles are one potential interpretation, there might be other ways to transparently provide information that will impact users differently. Moreover, users might want to receive further information such as technical details regarding the types of and protective measures applied to involved IT systems, which are categories of information that go beyond those mandated in the EU GDPR. Further, we only tested the impact of the "location always" permission, which is known to raise substantial privacy concerns.

We conducted a hypothetical web-based experiment that resembles real-world conditions by mimicking the look and feel and use case of an Apple iOS app. However, the experimental conditions may have biased the results. In particular, the level of acceptance might have been negatively affected by the random sample used in the experiment. A random sample is unlikely to be as interested in the app's features as a sample of tech-savvy users; those who download the app are more motivated to use it and are more likely to consent to data processing. Further, the level of comprehension might be positively biased because we asked users to read the text carefully. In the real world, users' primary desire is to use the app and privacy notices and permission requests are often seen as a distraction (Jensen and Potts, 2004).

13.6 Conclusion

In this work, we demonstrated that increasing the transparency of data processing practices in the context of mobile privacy decision making does increase users' comprehension of their consent decisions but does not influence the decision outcome. We designed two treatments and identified six design principles that app service providers can use to design privacy-transparent mobile apps. Augmentation of standard permission request dialogues with privacy-related information and a dedicated onboarding process support users in making informed decisions.

Data-driven service can be a boon or a bane for users as the perceived benefits of personalization are often more visible than the perceived risks of sharing personal data. Mobile privacy decision making is particularly complicated because mobile devices provide far-reaching access to personal data but their interfaces complicate the communication of privacy-related terms of service. Increased transparency is an essential requirement for making informed consent decisions and might fundamentally influence users' behavior regarding (mobile) privacy decision making in the long run. This stream of research will be fruitful for future interdisciplinary research at the intersection of information systems, computer science, law, psychology, and service marketing. As the EU GDPR will continue to impact both users and service providers, we hope to see studies on the longitudinal impact of increased transparency on users' privacy-related behavior and service providers' business models soon.

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13.A Appendix

13.A.1 Comprehension of the Consequences of Consent Decisions

We asked ten questions to assess the participants' comprehension of the consequences of their consent decisions using a binary choice with a *don't know* option. Each dimension of data privacy was surveyed with two questions. The questions were sorted so that questions of the same dimension were not visible at the same time to prevent users from answering by a process of elimination.

- Collected Data
  - The app monitors the products I have bought.
  - The app records whenever I visit a partner shop.
- Time of Collection
  - The app can access my location information at any time, even when I am not using it.
  - The app accesses my location information only when I am actively interacting with it.
- Processing
  - The app uses profiling to determine my shopping preferences.
  - My shop visits are processed with data on other users' visits to find shops that I might like.
- Sharing
  - Partner shops I visit can access my collected personal data.
  - shop.io sells user profiles to third parties.
- Erasure
  - shop.io retains my personal data until further notice.
  - shop.io will delete my personal data upon my request.

13.A.2 Identifying Habituation

We asked two questions to determine if a participant decides on app permission requests as such by habit, using a five-point Likert scale (never, very rarely, occasionally, frequently, very frequently).

- How often do you **accept** app permission dialogues without reading them?
- How often do you **decline** app permission dialogues without reading them?

13.A.3 Submit Times across Conditions

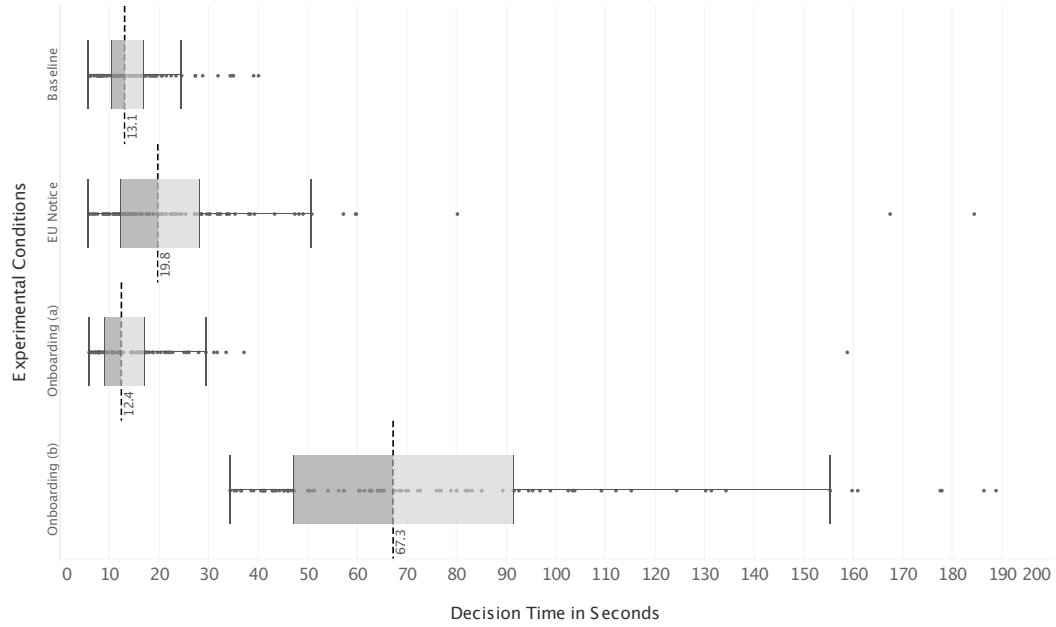

Figure 13.5: Submit Time for each Experimental Condition

We measured how much time participants took to make a decision (Figure 13.5). The box plots represent the distribution of total time taken for the final decision across the three groups. For the onboarding condition, the data are further segmented; (a) only considers the time taken for the final location permission request, and (b) sums up the time measured for the entire onboarding condition including the four screens presented to the participants ex ante. Participants in the onboarding condition took considerably more time for the entire process, which is plausible as they were confronted with substantially more text. However, it is worth mentioning that these participants took less time to make a decision regarding the actual permission request compared to the other two conditions, despite the fact that the provided text is twice the length of the marketing-driven text in the baseline condition.

13.A.4 Distribution of Comprehension Performance across Conditions

Table 13.5 presents the distribution of the total scores achieved by the respective number of participants in each condition. This table ranges from -6 to 10 points as

Table 13.5: Distribution of Comprehension Performance across Conditions

	-6	-4	-2	0	2	4	6	8	10	∅
Baseline	3	11	21	37	19	10	4	0	0	-.02
EU Notice	4	8	15	20	21	20	11	4	1	1.38
Onboarding	1	0	5	13	20	21	23	14	1	3.76

no participant scored below -6 points (i.e., each participant gave at least two correct answers). The baseline condition featured the most participants with very low overall scores. With increasing transparency, a clear shift occurred; more participants achieved considerably higher scores in the other two conditions, with a total of 15 participants who had answered at least 9 questions correctly in the onboarding condition. Participants across all groups who denied the permission request achieved a comprehension score that was about 13 percent higher than that of participants who gave permission (1.78 vs. 1.57).

13.A.5 Rationales for Deciding on the Location Permission Request

Immediately after making a decision regarding the location permission request and before seeing the comprehension questions, the participants were asked to provide a rationale for their decision by means of an open-ended question. The data was subject to qualitative content analysis (Mayring, 2014) and was independently coded by two researchers. Tables 13.7a and 13.7b provide the respective inter-rater agreements by content category using percent agreement and Cohen's Kappa.

Tables 13.8 and 13.9 provide the participants' reasons for accepting respective denying the location permission requests. The answers are clustered into content categories. For each category, the numbers of mentions by condition, category descriptions, and anchor examples from the survey are provided.

Table 13.6: Inter-rater Agreements

(a) Inter-rater Agreement regarding Responses for Accepting the Permission Request

Category	Percent Agreement	Cohen's Kappa
Benefit	84.88	.691
Functional	88.95	.777
Habituation	98.84	.894
Trust	100	1
Ignorance	98.84	.851
Control	99.42	.854
Unrelated	98.26	.815
∅	95.60	.840

(b) Inter-rater Agreement regarding Responses for Denying the Permission Request

Category	Percent Agreement	Cohen's Kappa
Tracking	94.81	.884
Permanent Access	98.52	.965
Privacy	92.59	.822
Use of Resources	100	1
Habituation	91.85	.623
Lack of Comprehension	97.04	.841
Fear of Abuse	98.52	.867
Disinterest	98.52	.826
∅	96.48	.853

Table 13.8: Participants' Reasons for Accepting the Location Permission Request

Category	Frequency*	Description	Evidence
Benefit	111 (39, 38, 34)	The respondent gave the permission to receive personal benefits such as personalized service and promotions.	"I want the best deals"
Functional	89 (26, 29, 24)	The respondent named granting the permission a prerequisite for proper service execution.	"To allow them to track what shops I go into"
Habituation	10 (5, 3, 2)	The decision was made out of habit without reflecting its consequences.	"Knee-jerk reaction. I always allow apps access to my location"
Trust	10 (1, 1, 8)	The respondent explicitly stated to trust the app given the previously received information.	"The app gave me a peace of mind after informing me in detail how it will use my personal data - most importantly, my data wouldn't be shared. After that, I felt that I could trust the application."
Ignorance	8 (2, 3, 3)	The respondent explicitly stated to not care for the consequences of the decision.	"There are so much inevitable data miners in this day and age that even if there was something suspicious about it, it wouldn't mean much."
Control	5 (1, 2, 2)	The respondent explicitly stated a feeling of control regarding the option to withdraw consent and revoke the permission later.	"I can easily opt out if/when I delete the app [...]"
Unrelated	10 (3, 6, 1)	The answer did not contribute any meaningful explanation of the respondent's behavior.	"as i know its a survey and not real life"
	* Total number of mentions (Baseline, EU Notice, Onboarding).		Quotes are taken verbatim.

Table 13.9: Participants' Reasons for Denying the Location Permission Request

Category	Frequency*	Description	Evidence
Tracking	45 (15, 17, 13)	The respondent stated a feeling of intrusiveness and disliked to be tracked by the service provider.	"It is scary to know that my location is tracked down even if the data might gets anonymized."
Permanent Access	43 (13, 20, 10)	The respondent named permanent background access to location data an inhibitor, but would grant access to location data for the time the app is actively opened and used.	"Because I'd rather just turn on location sharing when I leave home to go on a shopping trip, rather than always allowing location data to be shared as I feel that's a bit too much."
Privacy	42 (12, 9 ,21)	The respondent stated general privacy concerns that were not specific to the given shop.io scenario.	"I am very paranoid about location services."
Use of Resources	21 (9, 8, 4)	The respondent feared the app's/location service's use of power or data.	"It runs my battery down [...]"
Habituation	19 (7, 7, 5)	The respondent has completely disabled location features or usually denies location permission requests.	"I usually disable all the location function in order to protect my privacy."
Lack of Com -prehension	17 (6, 2, 9)	The respondent did not understand, why the permission is needed.	"The app uses Bluetooth and doesn't need your location"
Fear of Abuse	10 (5, 1, 4)	The respondent explicitly stated a fear of abuse of the location data by third-parties.	"It makes me suspicious that it is collecting this information to sell."
Disinterest	7 (1, 2, 4)	The respondent was not interested in the functions enabled by location services.	"It doesn't seem like an app I would use, I don't really see a benefit for me."
	* Total number of mentions (Baseline, EU Notice, Onboarding).		Quotes are taken verbatim.

14 Designing Multi-sided Community Platforms for Local High Street Retail

Fact sheet of publication *P.9*

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Designing Multi-sided Community Platforms for Local High Street Retail

Abstract. The continuing rise of online retail comes at the expense of small and medium-sized stores in local high streets. Many cities now experience substantial vacancies and the decline of independent and family-owned stores, impeding citizens' perceived quality of living. In this paper, we design the community platform '*smartmarket*^{2} ', with which networks of local retailers interact with networks of customers to co-create a physical and at the same time digital customer experience in a high street. The platform connects with retailers' information systems, while interfacing with in-store technologies to connect with potential customers' smartphones. From a theoretical perspective, the platform exemplifies how previous research on value co-creation, multi-sided (engagement) platforms, and retail communities can complement each other to constitute online-offline customer experience. Based on comparing *smartmarket*^{2} with rival IT artifacts, we abstract nascent design knowledge by conceptualizing a design theory for 'community platforms for high street retail' as a new class of IT artifacts. We conclude the paper with identifying how digital services—including cross-promotions, geographical recommender systems, and geospatial analytics—may be offered on the platform to leverage the competitive position of small and medium-sized retailers in local high streets through online-offline customer experience.

14.1 Introduction

High street retail lives through significant changes, caused by the digital transformation and changed consumer shopping behavior in favor of digital channels (Brynjolfsson et al., 2013; Verhoef et al., 2015; Hagberg et al., 2016). Around the globe, stationery retail loses market share to online businesses (EMarketer, 2016).

In the United States and Germany, for example, online commerce faced continuous double-digit growth rates in recent years (EHI Retail Institute, 2017), while brick and mortar (BaM) turnovers stagnated (Lipsman, 2017). Lately, store closings clearly outstripped new store openings in high streets (Townsend et al., 2017). This phenomenon—termed the "retail apocalypse" (Townsend et al., 2017)—can lead to eroding high streets that impede the quality of living in city centers and urban neighborhoods.

To counteract this development, retailers are innovating on digital customer experience creation (Betzing, Beverungen, and Becker, 2018). Customer experience comprises a customer's "cognitive, emotional, behavioral, sensorial and social responses" (Lemon and Verhoef, 2016, p. 74) to any direct or indirect contact with the firm during all stages of the customer journey. By introducing in-store technologies to their stores' servicescape, retailers enable customers to interact with them digitally (Betzing, Hoang, et al., 2018). Further, large retail chains are integrating their BaM and online businesses following an omnichannel strategy in which customers can easily switch between channels and receive a consistent experience across all physical and digital points of contact (Herhausen et al., 2015). Conversely, former online pure-players now even open BaM showrooms (Bell et al., 2017). However, these innovations have almost exclusively been implemented by large retail organizations. Due to constraints in both their operand and operant resources (Payne et al., 2008), independent small and medium-sized enterprise (SME) retailers have mostly remained unable to establish digital relationships with customers (Bollweg et al., 2016) and struggle to retain their market positions (Coca-Stefaniak et al., 2005). However, SME retailers have a locational advantage, are rooted in their local communities, and in many places, are organized in cooperatives and local marketing organizations that act for the common good to foster the attractiveness of local high streets.

We argue that a lateral network of high street retailers can launch a digital platform that enables new forms of digital customer interactions. Similar to smart city initiatives (Cocchia, 2014), this network could use information systems to connect people, infrastructures, information, and local governments to improve "the economic, social and environmental sustainability of a city" (Neirotti et al., 2014, p. 25). Such networks leverage a service ecosystem that spans across the boundaries of single stores and retail branches. As regards diversity of assortments and personalized

interactions, this ecosystem might even outperform the digital endeavors of large retail chains, which foster one-to-many relationships.

Building on the dual mission of design science to advance theory while supporting practitioners (Sein et al., 2011), the paper's contribution is twofold. First, we report on the design of *smartmarket*^{2} —a digital community platform that enables lateral networks of retailers in a high street to co-create online-offline customer experience (Grönroos and Voima, 2013) with their customers. *smartmarket*^{2} complements the physical touchpoints between local retailers and customers with digital ones, based on interfacing with retailers' information systems and in-store hardware. Second, to advance IS theory, we integrate previous research on the Service-dominant Logic of Marketing (S-D Logic) (Vargo and Lusch, 2017), value co-creation on engagement platforms (Storbacka et al., 2016), and brand communities and social shopping communities (Muniz and O'Guinn, 2001; Carù and Cova, 2015). Our research goal is to develop nascent design knowledge on *multi-sided community platforms for local high street retail*. Therefore, we compare *smartmarket*^{2} with rival IT artifacts and conceptualize the platform as a new class of IT artifacts. By demonstrating its general utility and outlining its superior functions and mechanisms in a nascent design theory we contribute to theory and practice.

Other researchers can build and evaluate advanced digital services, which utilize the core functionality that is provided by *smartmarket*^{2} as a multi-sided platform. Also, future research can investigate how customer experience is co-created based on the interactions of networks of retailers and networks of customers on the specified class of platforms. Practitioners can design specific platforms for their high streets based on instantiating the class of systems proposed here.

The paper unfolds as follows. In Section 2, we discuss related research on the co-creation of value in service systems, multi-sided (engagement) platforms, and virtual retail communities. In Section 3, we describe and justify our design science research method. In Section 4, we outline how *smartmarket*^{2} reflects and integrates related research and state-of-the-art information technologies. In Section 5, we compare *smartmarket*^{2} with rival IT artifacts to conceptualize nascent design knowledge. In Section 6, we sketch how digital services can be designed to extent the core functionality provided by the platform.

14.2 Research Background

The purpose of this paper is to design multi-sided community platforms that enable retailers and customers to co-create online-offline customer experience in a local high street. The design is embedded into three streams of research. First, co-creating customer experience reflects the foundational premises established by S-D Logic. Second, multi-sided platforms are vehicles to facilitate resource integration, enabled by a third party that is not involved in value co-creation directly. Third, service marketing has extensively researched virtual communities to conceptualize customer's offline or online interactions. All three streams of research feature kernel theories that guide and constrain the design of our IT artifact and its subsequent abstraction as a nascent design theory.

14.2.1 Co-Creation of Customer Experience in Service Ecosystems

As a cornerstone of the Service Science discipline, the Service-dominant Logic of Marketing postulates that value is co-created through the exchange of service (Vargo and Lusch, 2016). That is, value is not captured by exchanging goods against monetary compensation, but by integrating resources possessed by other actors with one's own resources. In the past, service marketing scholars took a dyadic view on value creation, where firms provide value-in-exchange for their customers (McColl-Kennedy, Gustafsson, et al., 2015). Against the backdrop of S-D Logic, social and economic actors have no predefined roles but can accommodate them differently for each interaction (e.g., the same entity can act both as a provider and customer) (Vargo and Lusch, 2017). Actors integrate their resources and provide service with "the common purpose of value (co)creation" (Vargo and Lusch, 2011, p. 181).

In retail—one of the core research areas of Service Science—special consideration is put on the co-creation of customer experience (Verhoef et al., 2009), a concept that is also known as service experience and shopping experience (Voorhees et al., 2017). Along the customer journey, the customer engages in a series of service encounters with the retailer and other actors through various physical and digital touchpoints. During these episodes of contact, both parties integrate their resources such as the customer's preferences and the retailer's knowledge to provide service to each other. Moderated by the situational context and other determinants (Verhoef et al., 2009),

customer experience dynamically emerges from these value co-creation practices. The value-in-use created is "phenomenologically determined by the beneficiary" (Vargo and Lusch, 2017, p. 47). Since customer experience accrues over time and is also co-created with other actors such as other customers in-store, retailers cannot view single service encounters in isolation but have to consider their impact on the overall customer experience creation (Verhoef et al., 2015). Moreover, customer experience is not a product or service that retailers can design for customers to retrieve. Instead, retailers offer value propositions and foster interactions to co-create individual customer experience with their customers (Grönroos and Voima, 2013).

Service ecosystems provide the overarching context for the co-creation of customer experience and are conceptualized as "relatively self-contained, self-adjusting systems of resource-integrating actors connected by shared institutional logics and mutual value creation through service exchange" (Vargo and Lusch, 2016, p. 161). Service ecosystems emerge and continuously adjust themselves based on shared institutional logics, such as actors sharing a common belief system regarding high streets (Thornton and Ocasio, 2008). To join a service ecosystem, actors use touchpoints and realize engagement opportunities (Grönroos and Voima, 2013). Service literature conceptualizes engagement platforms as facilitators of interactions (Frow et al., 2015). They are "physical or virtual touch points designed to provide structural support for the exchange and integration of resources, and thereby co-creation of value, between actors in a service system" (Breidbach et al., 2014, p. 594). Storbacka et al. (2016) add that engagement platforms are multi-sided intermediaries that enable resource integration by facilitating interaction between actors of a service ecosystem, while not being engaged themselves.

The extant literature does not feature any design knowledge that describes how engagement platforms ought to be designed to leverage resource integration and value co-creation in service ecosystems. This lack of design theories demonstrates that up to now, engagement platforms have only been investigated analytically, while their design, implementation, and evaluation has remained opaque.

14.2.2 (Multi-sided) Platforms

Analogous to the development (from BaM to online shops) in retail, the rise of new digital technologies led to change from physical to digital platforms (Yoo et al., 2012) and gave rise to the implementation of mobile digital platforms (Eaton, 2012). Platforms are constructed in a modular fashion and "the fundamental architecture of any platform includes a set of stable core components with low variety, and a set of peripheral components with high variety" (McIntyre and Srinivasan, 2017, p. 150). This structural characteristic allows platforms to evolve and adapt to changes in the environment, such as including new actors or adapt to changing institutional logics (Gawer, 2014). Platform design and governance mechanisms regulate the types of interaction and define decision rights and permissions to modify the platform (Smedlund and Faghankhani, 2015).

High street retail is a multi-sided market, and consequently, a community platform for high street retail takes the form of a multi-sided platform, which is an intermediary that enables direct interaction of two or more actors affiliated with the platform (Armstrong, 2006). As Hagiu and Wright (2015) note, actors "on each side consciously make platform-specific investments that are necessary in order for them to be able to directly interact with each other" (p. 163), such as providing operant resources. A multi-sided platform supports transactions between different actors without possessing the offered services (Hagiu and Yoffie, 2009), and—in most cases—fosters indirect network effects between the different actors (Armstrong, 2006; Yoo et al., 2012; Hagiu, 2014).

Research efforts on multi-sided platforms and markets focus especially their economic behavior and market effects. McIntyre and Srinivasan (2017) perform a literature review on platforms that includes research on the economics of industrial organizations, and perspectives on technology and strategic management. IS research takes a twofold perspective. There are numerous papers investigating economic platform effects. Among others, Boudreau and Hagiu (2009) present a basic conceptual framework for interpreting non-price instruments used by multi-sided platforms, Nikou et al. (2014) determine which characteristics of platforms customers prefer most, and Giessmann and Legner (2013) develop business models for Platform-as-a-Service offerings. On the other hand, only a small number of papers develops generalized knowledge on platform design. Schreieck et al. (2016) elaborate on design and governance of platform ecosystems without stating design

principles, Kazan and Damsgaard (2016) design and configure payment platforms by conducting multiple case studies, Staykova and Damsgaard (2017) conceptualize platform evolution as a complex, multi-faceted and dynamic process, and Tura et al. (2017) develop a framework of platform design choices (core actors, value proposition, how to attract key stakeholders and gain network effects). These research efforts have in common that no generalized design knowledge is derived that gives advice on how to build (multi-sided) platforms.

Hagiu (2014) concludes that "successful multisided platforms are the exception" (Hagiu, 2014), although platforms penetrate all industries and markets at increasing speed. This statement implicitly refers to the need of developing and presenting design knowledge on (multi-sided) platforms that researchers and practitioners can use to set up successful platforms. de Reuver et al. (2017) recognize this issue as well by setting up a research agenda for digital platforms, including the design of platforms as IT artifacts and the abstraction of generalized design theories. In contrast, marketing scholars already investigate (multi-sided) platforms in e-commerce for two decades, since virtual communities emerged in the late 1990s (Hagel and Armstrong, 1997).

14.2.3 Virtual Communities in Retail

Communities traditionally are defined to be "persons in social interaction within a geographical area and having one or more additional common ties" (Hillery, 1955, p. 111). The Internet since then broke up geographical boundaries and lead to various forms of virtual communities related to retail such as discussion communities, social networks, shopping communities, and online marketplaces such as Amazon, eBay, and Steam (Hagel and Armstrong, 1997; Olbrich and Holsing, 2011). Interaction in virtual communities is not limited to transactional and functional use (exchanging goods and services), but they also provide social and entertainment value. Social shopping features such as ratings, reviews, user-generated recommendations, and joint interaction and consumption are forms of value and experience co-creation (Olbrich and Holsing, 2011; Carù and Cova, 2015). Social shopping communities project the social interactions of shoppers with their acquaintances and other shoppers from the physical servicescape to an online setting (Wang and Zhang, 2012). Users engage in social practices such as advising others and recommending products to them. Interaction with the community becomes part of many

peoples' shopping experience. Customers patronizing a particular brand or product engage in brand communities to share their experiences, obtain product information and connect to likeminded users (Muniz and O'Guinn, 2001). Organizations set up brand communities purposefully to establish relationships with their customers, increase their loyalty, get feedback, or to design and co-create new products and services with their customers (Martínez-López et al., 2016). Brand communities are also embedded within social networks as organization-managed pages or fan-made discussion groups (Zaglia, 2013).

So far, most interactions in virtual communities take place between single retailers and multiple customers, as well as between groups of customers. Conversely, interactions between groups of retailers are scarcely documented (Thomas et al., 2013). Furthermore, these communities have a very narrow focus and revolve around particular brands, products, or product categories, such as apparel. Finally, there are little (if any) attempts made in research to establish or study social shopping communities in local high street retail.

A community platform for high street retail reintroduces the geographical context to virtual communities. Such a location-based hybrid community has a structural and socio-cultural dimension, where the community has a sense of shared belonging and values regarding the underlying common theme, which is a particular high street (C. E. Porter, 2006). Platform users identify themselves as part of a city or high street and have shared social relationships that are dynamic and evolve over time (Thomas et al., 2013). Interaction and experience co-creation reinforces the institutional logic of the service ecosystem high street.

14.3 Research Method

In line with the dual mission of design science to advance theory while supporting practitioners by developing innovative IT artifacts (Sein et al., 2011), the paper's purpose is twofold. First, we design *smartmarket*^{2} as a digital platform that allows networks of retailers in a high street to co-create an online-offline customer experience with networks of customers. Second, we abstract this IT artifact to conceptualize a class of information systems as an IS design theory, which is a theory of design and action that prescribes how instances of a particular class of information

systems ought to be designed (Gregor and Jones, 2007). The interplay of these results reflects "the importance of **both** the contributions made in the form of viable artifacts and the contributions at more abstract levels" (Gregor and Hevner, 2013, p. 341, emphasis contained in the text).

Against the backdrop of the knowledge contribution framework proposed by Gregor and Hevner (2013), we position our endeavor as an 'improvement' and apply the associated communication schema to structure the remainder of this paper. The core of an 'improvement' is to design a new solution for a known problem. This means that the IT artifact designed should perform better than rival IT artifacts, while at the same time, the design adds to the body of knowledge by contributing new knowledge on how to solve a particular class of problems with a new class of IT artifacts. As regards design and implementation of the IT artifact *smartmarket*^{2}, our nominal research process was adapted from Peffers et al.'s (2007) Design Science Research Method (Figure 14.1). The demonstration and evaluation stages were executed subsequently but have been merged in Figure 14.1 to simplify visualization.

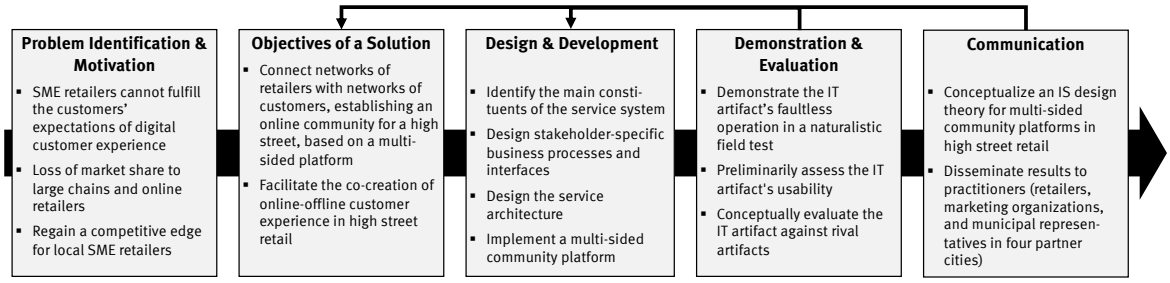

Figure 14.1: Research Process to Create the IT Artifact *smartmarket*^{2} (adapted from Peffers et al. (2007))

We took a problem-centered approach to initiate this process. The identified problem is rooted in the frequent observation that small and medium-sized stores in high streets—many of which have been family-owned for more than one generation—keep losing market share to big online retailers and large retail chains. This development could cause cities to fall into decline and eventually impedes the (perceived) quality of living in city centers. Restoring a competitive edge for local stores is, therefore, an important endeavor to preserve lively high streets in our cities.

Objectives of a solution comprise designing, implementing, and launching a digital multi-sided platform based on which retailers in a particular city center can

co-create online-offline customer experience with their customers. This IT artifact would make the benefits of the digital transformation—which up to now have predominantly enabled the business models of large retail store chains—accessible to SME retailers, ranging from local stores to stands on farmer's markets. With the platform, lateral networks of retailers in a high street could offer their customers unique value propositions that might even compete against the competitive advantage of large online retailers and chains. The design of this IT artifact is rooted in different kernel theories—including S-D Logic, multi-sided platforms, and online retail communities—and conversely, integrates these theories in an innovative way.

Building on these kernel theories, we identified a set of design principles to guide the design of the platform (Betzing, Beverungen, and Becker, 2018). Subsequently, a distributed team of 18 software engineers, business analysts, and information systems scholars at two universities designed and implemented *smartmarket*^{2} in spring and summer 2017 in an agile fashion. We extensively reviewed the IT artifact and demonstrated its correct operation and utility (Venable et al., 2016). Students and other researchers enacted the roles of retailers, customers, and the platform operator in a prototyping approach that successfully simulated a digital high street using our platform.

As regards evaluation, we conceptually evaluated *smartmarket*^{2} against rival artifacts, to frame how it differs from and conceptually extends existing solutions. This analysis showed "how and why the new solution differs from current solutions" (Gregor and Hevner, 2013, p. 346), while we reflected kernel theory to make the reasons for the improvement explicit. Based on this analysis, we abstracted the developed IT artifact to conceptualize an IS design theory that frames IT artifacts that local retailers can use to co-create online-offline customer experience with their customers. This is a 'mid-range design theory' (Gregor and Hevner, 2013) that abstracts our IT artifact to a class of systems. Beyond developing the IS design theory, evaluating the improved IT artifact to extend the kernel theories themselves was outside the scope of this paper and is open to subsequent research.

The class of systems described by the design theory provides core functionality to networks of retailers and customers on a local high street. On top of this functionality, other researchers can design, engineer, and evaluate more specific digital services to digitalize customer experience further. Some exemplary services that can be implemented on the platform include location-aware recommender systems,

geospatial analytics, and cross-promotions that adapt association rule mining to a high street setting.

14.4 Design and Implementation of the Community Platform

14.4.1 Actors

smartmarket[2] is a multi-sided platform that enables different groups of actors to co-create online-offline customer experience, based on establishing a community for local high street retail. Retailers and customers interact in the front-stage both digitally via the platform and face-to-face while in store. Every interaction between the customer and one or more actors co-creates customer experience. Municipal representatives and local operators act in the back-stage of the service system to analyze the condition of a high street and advance its competitive edge. A platform provider is the intermediary that governs the platform to facilitate the interactions of other stakeholders in the sense of an engagement platform. However, the platform provider does not participate in the exchange itself (Storbacka et al., 2016).

Customers strolling their high street can partake in the local community using their mobile devices. By browsing stores and products relative to their current location and by receiving individual promotions, they interact with nearby retailers. Customers collaboratively add to the community by rating and reviewing stores and products, and by giving dedicated feedback to retailers. Customers can share their experience and give recommendations also by taking photos of products and points of interest at the high street, tag retailers, and share them on the platform. A stream of pictures taken nearby invites other local customers to interact with each other and discuss their experience.

Local retailers present their businesses by adding general information such as opening hours, store pictures, and addresses to the platform. Interactions with customers are fostered by making contact channels such as phone, e-mail, and social media profiles available to the members of the community. Retailers also manage product data and promotions, which enable further interaction scenarios.

The *platform provider* develops and operates the overall *smartmarket²* platform, which has multi-client capabilities. Systems and services are provided as an infrastructure or blueprint. While core functions such as user management, data collection and analysis, and the main interfaces have low variety, peripheral functions such as linking local information (e.g., news and events) or custom add-ons have high variety (Gawer, 2014). Consequently, the platform must be instantiated for the use in a particular city and a local high street. Due to this local focus, one instantiation of the platform cannot contain retailers from different city centers.

Local operators such as marketing organizations or cooperatives license *smartmarket²* and run their instances customized to the particularities of their local high street. These 'local heroes' conduct marketing campaigns, govern their local users and are responsible for getting retailers and customers on board. For retailers and customers using the instantiated platform, the local operator constitutes a single point of contact. The local operator also equips retailers with the in-store hardware required to perform digital interactions with customers.

We further identified *municipal representatives* as a relevant stakeholder group, since *smartmarket²* can yield insights regarding customer behavior in city centers and high streets (e.g., hotspots, customer trajectories, and flows), which can be valuable to advanced smart city initiatives (Bellini et al., 2017).

Actors in the service system are not limited to a single role but can adjust their role according to different contexts. For example, the local operator might also run a local store and might want to browse the high street as a customer, too.

14.4.2 Platform Architecture

smartmarket² consists of multiple loosely-coupled components, which are integrated by middleware. Figure 14.2 depicts the platform's implemented service-oriented architecture. Mobile services are customer-facing, whereas web-based services are used by retailers, local operators, municipal representatives, and the platform administrator. Back-end services do not provide graphical user interfaces but run business logic in the back-stage. The platform uses open standards and open-source software wherever possible. The server-side components are all hosted on the Google Cloud Platform, which provides a scalable infrastructure. We further leverage Firebase, a state-of-the-art cloud development platform, which provides cross-service

support functions such as central user management, a content delivery network for static files, push-messaging for the mobile channel, and performance monitoring.

Figure 14.2: *smartmarket*^{2} Platform Components and Service Architecture

The data layer is separated by concerns: Master data on customers and retailers are stored in a document-oriented NoSQL Mongo database that allows for powerful horizontal scaling, high throughput, and low latencies. Transactional and analytical data traverse a message queue and are then persisted in a SAP HANA in-memory database for real-time reasoning (e.g., to calculate recommendations). ArcGIS, a geospatial database and information system is used for trajectory analyses.

The business layer consists of a central NodeJS-based middleware component that hides the complexity of multiple interoperating back-end parts behind a consistent API. This component links all databases and cloud services, handles authentication and authorization, and runs the server-side business logic.

The presentation layer is comprised of various interfaces that are tailored to the different actors' needs. The platform provider, local operators, municipal representatives, and retailers use a responsive web app that is built with the JavaScript-based front-end web application framework Angular 5. Depending on the current user's role, the range of available features and views varies. The platform provider can access all information. Local operators monitor and administer their instances and manage the hardware they provide to their associated retailers. Municipal representatives analyze geospatial information, whereas retailers manage their master data, products, and promotions, and gain insights on their performance. Retailers can use an open API to link product data from their information systems.

Figure 14.3 shows some of the stakeholder-specific interfaces. On the left-hand side is a heat map, which local operators use to monitor the frequency of digital interactions in their high street in real-time. In the middle, an excerpt of the retailer

interface is depicted, which provides retailers with comprehensive insights. A dashboard shows key performance indicators regarding the retailer's digital interactions with its customers. Further views contain, among others, how customers review their experience with the retailer, and how many customers saved the store as a favorite. Various charts visualize historical trends.

Customers use mobile apps for Google Android and Apple iOS to access the platform on their smart devices without temporal or spatial restrictions (see right-hand side of Figure 14.3). *smartmarket*^{2} makes use of the devices' inbuilt location features such as GPS and Bluetooth as contextual information to adapt to the user's situation (Betzing, Beverungen, and Becker, 2018). The apps receive Bluetooth Low Energy (BLE) signals from Beacons while passing retailers in the high street.

Beacons are matchbox-sized, battery-powered transmitters that can autonomously send low-range signals (approx. 10-20m distance) for years without maintenance (Statler, 2016). During development, we experimentally tested the reliability of different Beacon standards. Difficulties regarding signal quality and detection rates surfaced. Being most reliable, we settled for *iBeacon*. The Beacons broadcast a Universally Unique Identifier (UUID), which identifies our Beacons as part of *smartmarket*^{2}, as well as individual major and minor integer values.

Figure 14.3: Interfaces to the *smartmarket*^{2} Platform

The platform provider registers the Beacons at the platform and distributes them to the local operators, which, in turn, assign Beacons to retailers by defining the

individual major and minor values. Lastly, retailers install the Beacons in their stores and configure their locations in the web app.

With the consent of the customer, we identify when a customer's device receives a Beacon signal that carries the *smartmarket*^{2} UUID and record an approximation of the device's distance to the Beacon. From collected data, we can infer a customer's trajectory in the high street, the stores visited, and the time spent in-store. As opposed to continuous tracking using GPS, which might intrude the customer's private space, we only record the customer's store visits. We further analyze the customers' behavior regarding in-app interactions with stores, promotions, and products to personalize their experience. Customers can then receive individual location-based promotions and recommendations while walking the high street or visiting a store.

smartmarket^2 follows the requirements brought forth by EU General Data Protection Regulation (GDPR) (European Union, 2016). The app will not collect any personal information without the user's consent to each particular purpose of data processing. A privacy self-service enables customers to learn about the privacy policy, set their individual privacy preferences, examine (and delete) collected personal data, revoke previously given permissions, and configure the app to fit their needs.

14.4.3 Platform-Facilitated Interaction

Our community platform enables several interaction scenarios between the actors of the local high street ecosystem, which can foster customer experience co-creation. Browsing stores and products in the app is an intuitive form of customer-initiated interaction with the retailer. From a Service Science perspective, a resource integration comprising the customer's device and the retailer's information takes place.

As soon as a customer's smart device picks up a retailer's Beacon signal, a retailer-initiated machine-to-machine interaction takes place. In turn, a more complex interaction scenario unfolds, which is depicted in Figure 14.4 using Business Process Model and Notation 2.0 (BPMN).

If the Beacon event matches pre-defined conditions, the platform generates a personalized promotion or recommendation for the customer, which is then push-messaged to the customer's device and saved in a list of received promotional offers.

Recommendations are based on products and stores the customer has previously interacted with or saved as favorites. Following a push message, an interaction commences when a customer opens the message. Further interactions occur when a customer visits the recommended store or redeems a personalized promotion.

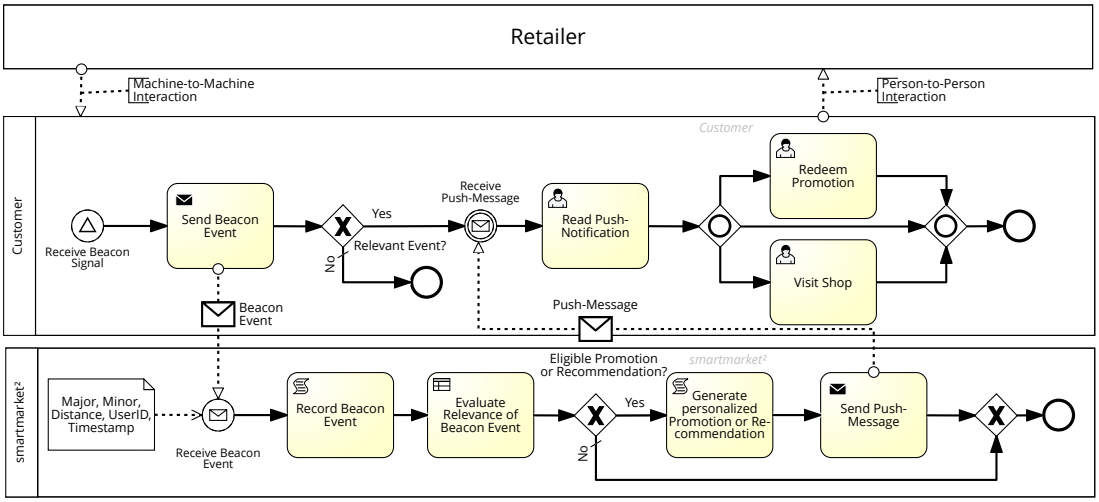

Figure 14.4: Beacon-initiated Interaction between Customers and Retailers

Retailers can use conditions to precisely target their promotions, where the conditions are based on the analyzed Beacon data. For example, a customer that recurrently visits a retailer's store three times in the same month might receive a small present as a form of loyalty promotion. Since networks of retailers work together in *smartmarket*^{2}, in an upcoming design cycle we will implement additional touchpoints between retailers to enable cross-promotions that affect more than one retailer.

Writing reviews on products and retailers, posting pictures of shopping trips, and commenting on other users' content constitute interactions among customers. On the one hand, the core *smartmarket*^{2} platform makes the channels and interfaces between actors available to use in future add-ons and interaction scenarios. On the other hand, the platform mechanisms reflect the shared institutional logics of the service ecosystem high street and foster the co-creation of customer experience through interaction.

14.5 Multi-sided Community Platforms for Local High Street Retail

To design a new class of IT artifacts called *multi-sided community platforms for local high street retail*, we evaluated the *smartmarket*^{2} artifact in three steps. First, we applied a quick & simple strategy, as proposed by Venable et al. (2016), to evaluate the initial prototype. Second, in a summative evaluation, we checked the platform's internal validity and demonstrated its applicability. We tested *smartmarket*^{2} in different scenarios to evaluate its key functionalities, such as handling large amounts of transaction data, which is supported by the selected database technologies and cloud architecture. Subsequently, we performed a series of user acceptance tests (UATs) with students and researchers, based on simulating a high street with several stores that use Beacons to issue personalized promotions. Test customers were asked to stroll through this high street and watch out for push notifications issued by the platform in response to the retailers' Beacon signals. The test was successful and confirmed that the designed community platform works as expected. Nevertheless, we also identified some technical issues and dysfunctional behavior of the platform, e.g., receiving Beacon push notifications highly depended on the type of users' smart devices. These issues were resolved in a second version of the prototype, reflecting the properties of design as a search process (Hevner et al., 2004). Third, since we position our research as an 'improvement' (Gregor and Hevner, 2013) to design a new solution for a known problem, we conceptually compared *smartmarket*^{2} with rival IT artifacts. While the corresponding class of IT artifacts has not been conceptualized in extant literature, some related approaches have recently been developed in practice. These artifacts constitute instantiations of the following three classes of systems

White label solutions for digital business directories span across an individual brand or a single store. These platforms can be licensed and individually instantiated for a specific geographical area such as a high street. "Localpioneers" is a German IT provider, whose solution is currently instantiated in more than 25 cities. A local licensee administers content and attracts retailers to become part of the platform. Customers use a mobile app and a web front-end to access a news stream, map and navigation functionalities, retailer profiles, information about events, and a job board. Beacons are used to inform customers about discounts via push message.

The Localpioneers artifact constitutes a digital business card for retailers and is limited to dyadic interactions between customers and retailers. Moreover, the app users remain anonymous and no personalization takes place. So far, the platform neither enables interaction scenarios between networks of customers nor networks of retailers.

Online (retail) communities link their services back to the physical world. Facebook has introduced "place tips" for businesses as an extension of their pages. By using Beacon technology, retailers can connect with customers online, while they are in a store. Users browsing Facebook in-store will find information on the retailer at the top of their newsfeed. Latest news and upcoming events are paired with user-generated content such as comments, recommendations, and check-ins from friends. While Facebook links a retailer with its customers, and customers with each other, the means of interaction are limited to and mediated by Facebook. There is no local focus and no interaction among retailers. No central local operator manages this ephemeral social community.

Mobile shopping companion apps extend the personal service and e-service of retailers by a mobile channel that links the physical servicescape to the retailer's digital presence. Their focus is on strengthening the customer's relationship to the retailer. Interactions between networks of customers hardly take place and other retailers are not part of the solution. For our comparison, we settled with the ZARA app, which is one of the best reviewed, internationally available shopping companion apps. The app enables customers to find the nearest ZARA store, browse products, receive additional information and recommendations for complementary products, and to order products for home delivery.

In a criteria-based analysis, we conceptually compared *smartmarket*^{2} with these three classes of rival artifacts (Table 14.1). As criteria, we referred to the co-creation of customer experience, to the mechanisms of multi-sided platforms, and to the properties of retail communities. While all artifacts provide digital touchpoints, the extent of interaction scenarios varies considerably. Localpioneers most closely resembles a multi-sided platform that adapts to a local high street but falls short as an engagement platform for co-creating customer experience. Facebook place tips combines the largest online social network with digital touchpoints to foster the co-creation of customer experience in-store.

However, the Facebook solution neglects the peculiarities of local high streets and each retailer acts for its own good. All data are controlled by Facebook, which also mediates all interactions subject to their rules. ZARA provides digital touchpoints to their customers that augment their physical service but does not include other actors in their ecosystem, nor sets up an online-offline brand community. All rival artifacts limit the scope of their own offerings, and no interfaces are made available for third parties or individual operators to enhance the platform with additional services. To sum up, our platform overlaps with rival artifacts but clearly is an improvement regarding the co-creation of customer experience within and across multiple actors in local high streets as a service ecosystem.

Based on comparing our artifact with rival artifacts, we showed that *smartmarket*^{2} conceptually is a unique solution. To abstract the design knowledge behind the instantiated artifact, we conceptualize a design theory to frame a new class of IT artifacts—*multi-sided community platforms for local high street retail*—that is—best to our knowledge—the only platform explicitly conceptualized and instantiated with respect to the theoretical knowledge on engagement platforms in Service Science literature and, therefore, introducing this knowledge in the Information Systems discipline. We formulate the design theory based on Gregor and Jones's (2007) eight components (Table 14.2).

Our design theory is rooted in authoritative kernel theories of Service Science, including value co-creation, multi-sided (engagement) platforms, and virtual communities in retail. By integrating all three theories with an instantiated IT artifact, the design theory combines these theories for the setting of local high street retail. Implementing and testing IT artifacts instantiated from the design theory can reflect back on the kernel theories themselves. Amongst others, it remains to be analyzed if customer experience needs to evolve into a multi-dimensional construct (beyond dyads of retailers and customers), if the proposed type of online-offline experience is superior to omnichannel strategies of single retailers, and what digital services can be implemented based on the core functionality of the platform.

Table 14.1: Conceptual Comparison of *smartmarket*^{2} with Rival IT Artifacts

Aspect	smart-market^2	Local-pioneers	Facebook place tips	ZARA
Co-Creation of Customer Experience				
Digital touchpoints	App, Beacons	App, Beacons	App, Beacons	App, (Barcodes, QR-Codes)
Customer-to-Customer interaction	Yes	No	Yes	No
Retailer-to-Retailer interaction	Partially	No	Not explicitly	No
Customer-to-Retailer interaction	Yes	Yes	Yes	Yes
"Local hero" as point of contact	Yes	Yes	No	No
Integration of local actors	Yes	Yes	No	No
Platform provider is a mediator	No	No	Yes	Yes
Multi-Sided Platform				
Platform provider's revenue stream	License	License	Ads	Selling products
Commercial operation	No	Yes	Yes	Yes
Extensibility	Yes	Partially	No	No
API for product data integration	Yes	No	No	n/a
Multi-client capability	Yes	Yes	No	No
Adaption to local high street	Yes	Yes	No	No
Analytics on retailer level	Yes	No	Yes	n/a
Analytics on city/high street level	Yes	Yes	No	n/a
Retail Community				
Location-based information (pull)	Yes	Yes	Yes	Yes (Store finder)
Location-based information (push)	Yes	Yes	Yes	No
Review retailers	Yes	No	Yes	No
Review products	Yes	No	No	No
User-generated local content	Yes	No	Yes	No
Set favorites	Yes	Yes	Yes (Like button)	Yes (Wish-list)
Navigation to retailer	Yes	Yes	Yes	Yes
Personalized promotions	Yes	No	No	No
Store and product recommendations	Yes / Yes	No / No	No / No	No / Yes
Customer account	Yes	No	Yes (FB profile)	Yes
Focus on local information	Yes	Yes	No	No

Table 14.2: An IS Design Theory of Multi-sided Community Platforms for Local High Street Retail

#	Component	Explanation
1	*Purpose and scope*	The purpose of multi-sided community platforms for local high street retail is to facilitate interactions between networks of retailers and networks of customers to co-create online-offline customer experience. This class of IT artifacts can be instantiated for every city's local high street. Beyond its core functionality, the platform can be augmented with digital services to further benefit high streets as service ecosystems.
2	*Constructs*	Service, customer experience, co-creation of value, engagement platform, multi-sided platform, online community
3	*Principles of form and function*	The community platform will enable local communities of retailers and customers to co-create online-offline customer experience; retailers can design, change, and delete products, send promotions (via Beacons) as well as enable customers to be informed about, review, and favor products, retailers, or promotions. Also, customers receive recommendations for products and retailers, enabled by analyzing (personal/behavior/location) data, subject to data privacy laws. Additional actors can view and analyze data from the platform to analyze the status of and to further advance high street retail.
4	*Artifact mutability*	The IT artifact is mutable to account for the properties of individual cities and high streets at design time. As a platform, it allows designing and implementing additional digital services that build on the functionality provided by the platform. At run time, user-generated content will let each instance of the design theory emerge differently.
5	*Testable propositions*	The community platform can serve to test and extend the kernel theories based on which it was designed, including: (1) The customer experience co-created by networks of retailers and networks of customers is superior to the experience co-created by single customers and single retailers (as in current high street retail) or the omnichannel experience co-created by one retailer with networks of customers (as in online retail). (2) Customer experience is a multi-sided construct that must be extended beyond the dyadic view taken in current literature [co-creation of customer experience]. (3) The platforms enable actors to design and implement additional digital service, based on the core functionality of the platform [multi-sided platforms]. (4) Extant theory on virtual retail communities must be extended with hybrid online-offline communities [virtual retail communities].
6	*Justificatory knowledge*	Kernel theories include the foundational premises posited by S-D Logic, multi-sided platforms/engagement platforms, and virtual communities in retail. This knowledge is integrated with each other and extended to frame an IS design theory.
7	*Principles of implementation*	The platform is instantiated for any local high street in five steps. (1) Identify all relevant stakeholders of the high street (retailers, and local operator); (2) the local operator customizes the platform to adapt it to the specific instantiation (high street ecosystem); (3) retailers place general information, products, and promotions; (4) beacons are initialized on platform and installed in participating stores; (5) the mobile app is promoted and distributed to customers free of charge.
8	*Expository instantiation*	With *smartmarket*^{2}, we provide an instantiation that exposes the class of artifacts' form and function and demonstrates its operation for stakeholder to experience.

14.6 Contribution and Outlook

Customers' expectations towards digital customer experience in retail have almost exclusively been addressed by large retail organizations, leaving SME retailers behind. We propose that with multi-sided community platforms for their local high street, SME retailers can regain a competitive edge.

The contribution offered by this paper is twofold. First, informed by kernel theories from S-D Logic, value co-creation on multi-sided platforms (or engagement platforms), and virtual communities in retail, we designed and implemented the IT artifact *smartmarket*^{2}, which is a multi-sided digital community platform on which local retailers and customers co-create online-offline customer experience. As demonstrated in a criteria-based analysis, the solution differs from existing IT artifacts, since it is the only solution that consequently builds on the properties of all three kernel theories. Also, IT artifacts that foster value co-creation of online-offline customer experience in retail have not been described in extant literature. On that account, we propose a new class of IT artifacts—*multi-sided community platforms for local high street retail*.

Our research is, nonetheless, subject to certain limitations—especially regarding the remaining evaluation. In subsequent steps, we will start a holistic evaluation following Venable et al.'s (2016) human risk & effectiveness evaluation strategy. Starting with a series of formative evaluations in an artificial setting, we can ascertain the platform's general utility and improve its touchpoints, processes, and service delivery mechanisms. With increasing platform maturity, we will conduct naturalistic real-world summative evaluations on high streets—especially to gain insights on the socio-technical impact digital touchpoints make to a high street ecosystem and its actors. Further, the platforms customer acceptance is limited by data privacy concerns. Despite providing users with account and privacy management in accordance with the EU GDPR, it remains unclear wether they are willing to provide their contextual and location-based information, and how incentives can influence their privacy decision calculi.

Regarding the proposed design theory, we will test the propositions developed in this paper to enhance the identified kernel theories. Albeit the class of IT artifacts is particularly designed for high street retail, its adaption for other scenarios such as shopping malls is conceivable. Moreover, the high street ecosystem is not limited to

retailers in the narrow sense but can also include other high street service providers such as hair dressers or restaurants.

As a multi-sided platform, *smartmarket*^{2} provides a set of core features that enable the involved actors to co-create online-offline customer experience. On the one hand, we will further conceptualize how this co-creation of value works, and design constructs to make the value-in-use facilitated by our platform measurable. Given the large variety of conceivable customer journeys on high street level, we will investigate, how the interplay of digital and physical touchpoints attributes to the overall customer experience for different archetypal customer journeys. On the other hand, the platform's core features enable retailers and platform operators to design and implement their own digital services, to further enhance their customers' experience. Amongst others, these services could comprise retailer-to-retailer interactions that implement cross-promotions among different stores (e.g., people who bought new shoes also bought a new scarf), an application of association rule mining that is frequently used in online shops but has remained unavailable on local high streets. As a form of indirect customer-to-customer interaction, future digital services could benefit from the wisdom of the crowd by applying collaborative filtering techniques to geospatial data. Based on the customers' physical locations in and trajectories through a high street, stores could be recommended, that a customer usually not considers but might like. For any particular high street, data exploration might even be done in a virtual reality or augmented reality environment, exploring the data with a head-mounted display or smart glasses. In subsequent research, we plan to design and evaluate these and other digital services in more detail.

Acknowledgment

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15 Beacon-based Customer Tracking across the High Street: Perspectives for Location-based Smart Services in Retail

Fact sheet of publication *P.10*

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Beacon-based Customer Tracking across the High Street: Perspectives for Location-based Smart Services in Retail

Abstract. Easy access to digital analysis of customer behavior and targeted advertising are principal advantages online retailers have over their stationary counterparts. Existing manual and digital means for monitoring customer behavior in high streets are expensive to employ and/or technically complex, making them unfeasible for many retailers. This paper shows an approach for individual stores and high streets as a whole to facilitate spatio-temporal customer data collection based on connected mobile devices, Bluetooth beacons, and an underlying multi-sided community platform. A framework of analytical perspectives on customer data regarding various levels of analysis and beneficiaries is conceived, which provides novel design knowledge on location-based smart services for customer behavior analysis and targeted advertising in high streets.

15.1 Motivation

Online retailers and marketing companies track customers' every click to gain detailed insights into their online behavior and to personalize their service (Phillips, 2016). Existing manual and digital means for tracking customer behavior within physical stores and across high streets, however, are expensive to employ and/or technical complex, making them unfeasible especially for small and medium-sized enterprise (SME) retailers and local owner-operated stores that do not branch at

every other city (Bartelheimer et al., 2018). While these retailers often are vital for the attractiveness and individuality of high streets, they are already challenged by decreasing market share and increasing customer expectations because of positive experiences with e-commerce and omnichannel services (Betzing, Beverungen, and Becker, 2018). So far, SME retailers rarely employ digital technologies to personalize their service and individually address customers, so e-commerce and large chain stores have a significant advantage (Bollweg et al., 2016).

In response, research investigates multi-sided community platforms for high street retail that enable groups of local retailers to provide their customers with a bidirectional digital channel (Bartelheimer et al., 2018). Customers access these platforms via mobile devices to interact with retailers and other customers while shopping, which makes them a viable channel for customer data collection and the provision of personalized location-based service (LBS). Furthermore, Bluetooth Low Energy (BLE) beacons, a pervasive technology for tracking customers' trajectories, by now reached market readiness (Varsamou and Antonakopoulos, 2014). Beacons are small, low-range transmitters that are simple, and inexpensive to deploy and maintain, even in large deployments (Faragher and Harle, 2015). These properties make the technology feasible also for SME retailers with limited financial resources and low digital readiness (Oosterlinck et al., 2017). So far, there is only a small body of knowledge on customer tracking across the realm of single stores (Oosterlinck et al., 2017; S. Lee et al., 2013; Bai et al., 2014) and literature has remained mostly silent regarding personalized LBS in retail that are enabled by spatio-temporal customer data (Bauer and Strauss, 2016).

Against this backdrop, this work answers the following two research questions: (1) How can spatio-temporal customer data be collected on high streets? (2) How can this data be analyzed to yield value for high street stakeholders? To answer these questions, a design science research approach is followed (Peffers et al., 2007) to make two contributions. First, this paper presents a novel conceptual framework that structures analytical perspectives and perceivable LBS on the levels of individual and aggregated spatio-temporal customer data concerning different beneficiaries of these services. In effect, it yields design knowledge on location-based smart services for customer behavior analysis and targeted advertising in high streets. Retailers, city managers, and third-party service-providers can adopt the presented concepts to improve their understanding of their customers' behavior on the store and high street levels to target their customers precisely and mitigate one of e-

commerce and large retail chains' advantages. Second, this work presents a setting to collect spatio-temporal customer data using mobile devices and BLE beacons on high streets, whose implementation extends an existing community platform prototype (Bartelheimer et al., 2018).

The paper is structured as follows: Section 2 gives a background on community platforms in high street retail and on location-based customer analytics. Section 3 provides the research approach, whereas Section 4 shows, how spatio-temporal data can be collected. Section 5 illustrates the analytical framework and its perspectives. Section 6 provides information on the technical demonstration, while Section 7 discusses the framework, and Section 8 concludes with an outlook on the next steps in the research project.

15.2 Research Background

15.2.1 Multi-sided Community Platforms in High Street Retail

High street retail is a multi-sided market that includes among others local retailers and businesses, customers, cooperatives, local marketing organizations, and municipal representatives (Neirotti et al., 2014). In this market, both the high street and individual retailers are units of analysis because the "health" of the high street as a whole has a strong influence on the well-being of its constituents and vice versa.

Bartelheimer et al. (2018) conceptualize multi-sided community platforms in high street retail as a class of information systems (IS) that networks and provides digital service to different stakeholder groups and fosters the co-creation of value on high streets. As such, it constitutes a central IS to link actors, infrastructure, and data in high streets (Neirotti et al., 2014). This class of IS provides a set of stable core components (McIntyre and Srinivasan, 2017), such as the technical infrastructure, general data structures, and client interfaces (e.g., web, mobile app) for various stakeholders. A generic community platform must be instantiated for a high street, and additional functionality in the form of digital services can be designed and implemented to cater to their individual needs. Exemplary customer-facing services provided through community platforms are retrieving information on businesses, products, promotions, and events nearby, rating and reviewing content, and getting

in contact with local businesses. In Germany, we see a market uptake of community platforms with more than 150 local platforms active in 2018 (cima, 2018). However, so far most community platforms focus on static information provision and do not collect information on customers' trajectories in high streets to provide personalized LBS (cima, 2018).

15.2.2 Location-based Customer Analytics and Advertising

Location-based service (LBS) is an umbrella term for all services that use the absolute or relative geographical position of the service user as a resource in service delivery (Kelley et al., 2011). Location-based analytics, a subset of LBS, applies data-analysis techniques to low-level spatial user data to report high-level insights. Traditionally, this data has been gathered by manual traffic counting, photoelectric sensors, surveys, and videotaping (Underhill, 2008), but WiFi- and Bluetooth-enabled smart devices now allow for location-based *smart* services, where the customers' devices become a part of the service system (Beverungen et al., 2019). BLE beacons are battery-powered, matchbox-sized devices that regularly broadcast predefined information to their surroundings. The beacon itself is independent and unaware of the presence of other devices (Faragher and Harle, 2015). The signal spreads in an area around the beacon, inside the so-called geofence. BLE-enabled smart devices in the vicinity can identify the beacon's signal and instantiate interaction between the retailer and the customer (Schulz et al., 2016).

Most related approaches for location-based customer analytics do not include active interaction, but passively track signals emitted by the customers' devices throughout stores and shopping malls without the customers' knowledge (e.g., S. Lee et al., 2013; Schauer et al., 2014; Oosterlinck et al., 2017). These fingerprinting techniques have three major drawbacks: First, the collection of personal information is subject to international data-protection regulations like the EU General Data Protection Regulation (GDPR), which require customers to actively opt-in to personal data collection (European Union, 2016). Second, recent versions of mobile operations use obfuscation techniques as a privacy-enhancing feature (Martin et al., 2017), which interferes with reliable tracking. Third, location-based customer analytics often provides the foundation for location-based advertising (LBA), but fingerprinting can identify only a few of the customer's contextual parameters. For example, S. Lee et al. (2013) infer the customer's current activity from trajectories, and B. Kim

et al. (2011) use visit patterns to predict the customer's next movements. Both approaches provide LBA but do not take into account customer segments, interests, and demographics—information that is usually gathered in traditional customer behavior analyses and targeted advertising (Underhill, 2008).

Against this backdrop, this research refrains from passive fingerprinting but actively incorporates customer data collection in a community platform, where customers can consciously opt-in and freely provide their contextual parameters. Data is not collected for the benefit of a single store or mall operator but to enable LBS that benefit multiple actors, including customers, in the high street.

15.3 Research Approach

This research follows the mission of Design Science Research (DSR) to construct socio-technical artifacts that solve organizational problems (Gregor and Hevner, 2013). It is part of the consortium research project *smartmarket*^{2} on community platforms in high street retail (Österle and Otto, 2010). This paper addresses a particular class of problems—those related to actively monitoring customers' trajectories in high streets.

In keeping with Peffers et al.'s (2007) DSR process, first, the *problem* is identified, and the research is motivated. Whole high streets in general and SME retailers, in particular, are challenged by decreasing market shares and increasing customer expectations. SME retailers rarely have access to customer behavior analytics and targeted LBA with which to personalize their services and improve their customers' experience. The *underlying problem* is a lack of easy and inexpensive means for SME retailers to monitor their customers' behavior while they are in their stores as well as in other stores and community spaces. Subsequently, the *objectives of a solution* are derived (Peffers et al., 2007), informed by kernel theories on community platforms in high street retail and LBS. As for *design*, the DSR process yields two artifacts. First, design knowledge in the form of a conceptual framework has been created, which structures analytical perspectives and perceivable LBS based on spatio-temporal high street customer data. Second, customer data collection through BLE beacons has been *implemented* as an extension to the *smartmarket*^{2} prototype. An artificial formative evaluation strategy was chosen to *demonstrate* the technical viability in

a laboratory setting (Venable et al., 2016). The framework has been iteratively designed and tested using feedback from interviews with exemplary customers, SME retailers, a community platform provider, and city managers of two German cities, as well as feedback from workshops with retail experts. Currently, the framework guides the prototypical implementation of the proposed LBS, which will be subject to a holistic *evaluation* in the near future.

15.4 Customer Data Collection

15.4.1 BLE Beacons on the High Street

The technical prerequisites for collecting spatio-temporal customer data in high streets include rolling out BLE beacons, setting up corresponding data structures in the back-stage IS, and providing customers with a front-stage mobile app that collects the data.

At first, participating retail stores are equipped with BLE beacons that broadcast a predefined payload. The Apple iBeacon standard is selected, which works with all major mobile operating systems. Its payload consists of a Universally Unique Identifier (UUID), major and minor values, and a received signal strength indicator (RSSI) (see, e.g., Schulz et al., 2016; Varsamou and Antonakopoulos, 2014). In the design, the UUID is identical for all beacons in a particular deployment, which allows the user's smartphone to perform a local look-up on a hard-coded UUID table to identify relevant beacons without relying on an online database (Schulz et al., 2016). Major and minor values are used to distinguish among retailers and beacon intents (purposes). Figure 15.1 shows that the *entrance*, *point of sale (PoS)*, and *promotion* beacons are distinct. Entrance beacons are installed at the store entrance(-s) and broadcast at high signal strengths to cover the public space in front of the store. Beacons at the PoS identify customers who visit the store and may have bought something. Promotion beacons, used as triggers for LBA, are attached to specific promotional displays and use low signal strength to cover only a small area.

Based on the RSSI, clients can calculate their distance from the beacons. Nevertheless, studies have identified robust errors in these calculations that result from signal strength attenuation, interference, and multi-path propagation (Bai et al., 2014;

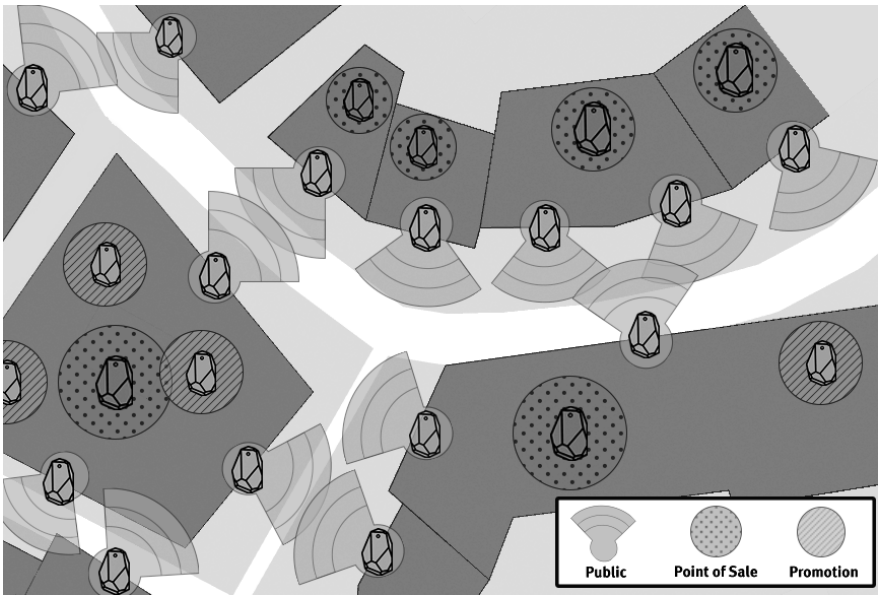

Figure 15.1: High Street with Beacons

Faragher and Harle, 2015). While these errors complicate indoor navigation scenarios, LBA and behavior analyses have lower accuracy requirements, so instead of precise distance estimates, the ranges defined in the iBeacon standard (near, immediate, far) are recorded.

15.4.2 Embedding into the Community Platform

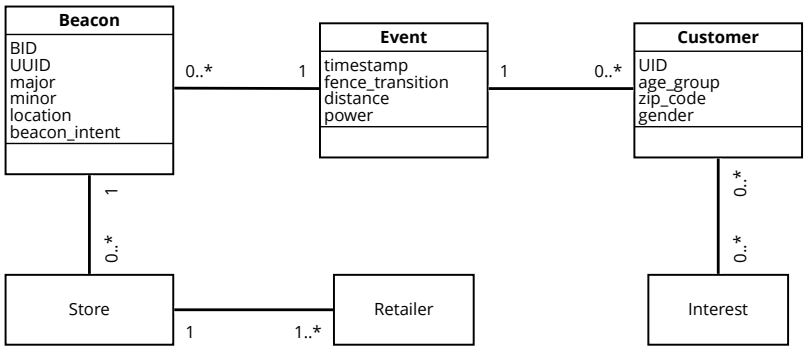

Figure 15.2: Main Data Structures for Customer Data Collection

LBS extend and build upon the prototypical core community platform *smartmarket*[2] that already has central functions like master data management for the stakeholder groups (Bartelheimer et al., 2018). Figure 15.2 depicts an excerpt of the platform's

data structures, which are extended to store spatio-temporal customer data and relate it to the existing objects. Beacons are registered with the community platform before deployment. Each beacon belongs to a specific store of a specific retailer (since some retailers might operate more than one branch within the deployment). Retailers define the intent (purpose) of the beacon and can specify a precise beacon location. During registration, customers are asked to provide (voluntarily) their age group, ZIP code, and gender as demographic context. Customers also select their interests from a predefined list (e.g., beauty and care, books, and electronics). High street customers take part in the community via a mobile app that they use to browse stores and products in their vicinity, rate and review retailers and products, get promotions, and interact with retailers and other customers in the service ecosystem (Bartelheimer et al., 2018). The app is now extended to collect customer data in the background. When a customer first starts the app, he or she traverses an onboarding process that explains the app's main benefits and details data collection and processing practices in accordance with the EU GDPR (European Union, 2016). Then the user is asked for consent to the data practices, to enable Bluetooth, and to authorize access to beacon data.

When a customer enters or leaves the geofence of a beacon that belongs to the community platform, the smartphone sends the beacon payload, timestamp, fence transition, measured distance range, and the beacon's battery status to the platform's back end. On the server side, the transaction is associated with the corresponding beacon and customer. Most beacon events are cached in the client app and are sent periodically in bulk to limit potential battery drain. Promotion beacon sightings are directly transmitted since they can be used to trigger targeted LBA while the customer is near the promotion. Customers' locations are tracked in close distance to the beacons only to promote a modicum of privacy.

15.5 Analytical Perspectives on Spatio-temporal Customer Data

The spatio-temporal information collected from beacon sightings enable new LBS on different levels of analysis that yield value to the various stakeholder groups in the high street service ecosystem. Figure 15.3 provides the main contribution of this

work, a conceptual framework that structures analytical perspectives and conceivable LBS on the micro, meso, and macro levels. In the following, these perspectives are further detailed out with regard to the previously presented scenario.

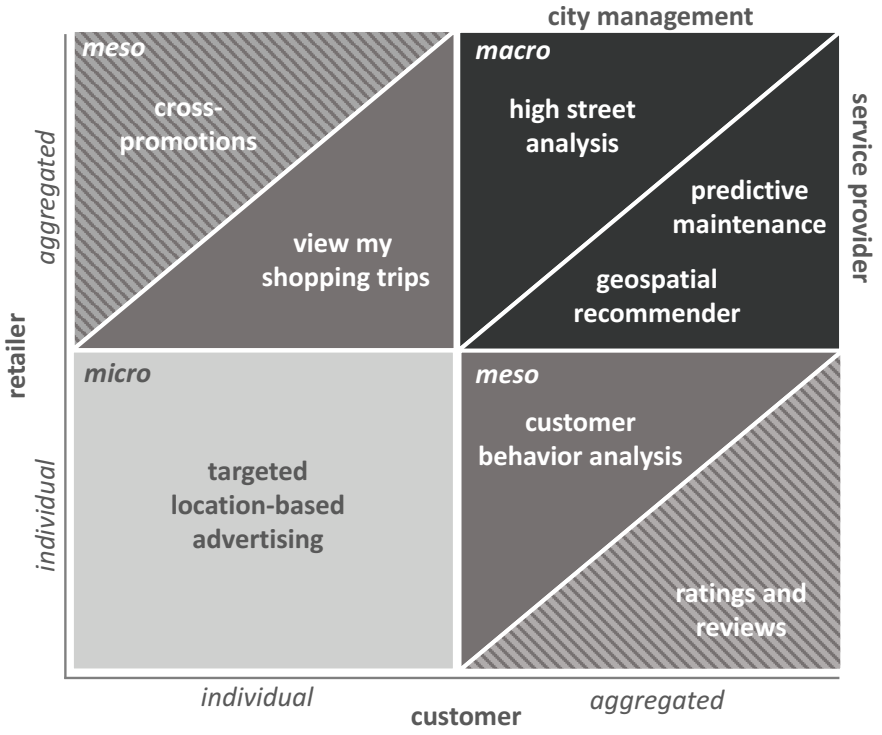

Figure 15.3: Perspectives on Customer Data with Regard to Different Levels of Analysis and Beneficiaries *(The quadrants are divided to highlight the respective beneficiary of a service, which is named on the closest axis.)*

15.5.1 Micro-level Perspective

Micro-level analyses concern the relationship between an individual retailer and an individual customer (third quadrant in Figure 15.3). Collected data is analyzed primarily to provide context for customer segmentation; that is, the resulting service enables retailers to create promotions for a single customer or a target group defined by contextual factors, who then receive tailored promotions that fit their interests.

Several studies suggest a general advertisement overload and identify relevance as a primary criterion to raise customers' awareness (Bauer and Strauss, 2016). Bauer and Strauss urge retailers to bear in mind the benefit the advertisement gives the target audience before launching a promotion. Customers should be able to limit

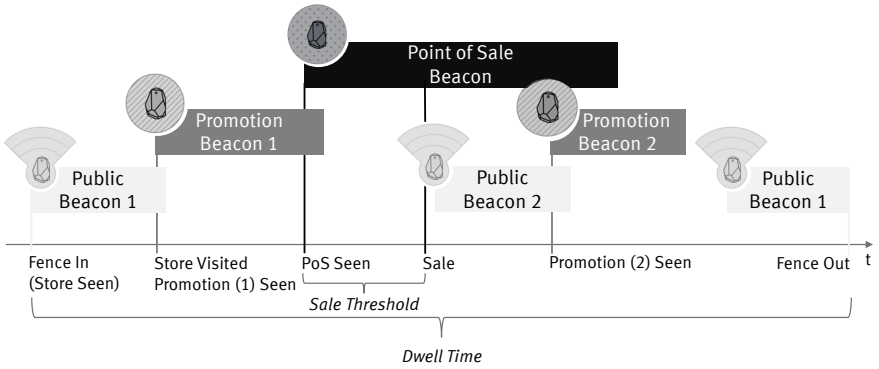

Figure 15.4: Events Inferred from Collected Customer Data

their exposure to location-based promotions to increase their relevance. In effect, customers could be enabled to select their interests, to white- or blacklist individual stores, and to temporarily turn off all promotions. Furthermore, Xu et al. (2011) suggest pull-based over a push-based delivery of promotions to reduce advertisement overload and increase the customer's perceived benefit.

Based on the predefined beacon intents (cf. Figure 15.1) and the low-level beacon events collected, various high-level events can be derived for LBA. As soon as a customer enters the geofence of an *entrance* beacon, the retail store is defined as having been "seen." If the customer subsequently enters the geofence of a *promotion* or *PoS* beacon, the retail store is defined as having been "visited". As Figure 15.4 shows, the dwell time can be inferred from the time when an entrance beacon is first seen to the time when an entrance beacon is last seen, given that, in the meantime, the customer has seen an in-store beacon. Incomplete data, such as a missed second sighting of an entrance beacon, complicates the dwell time calculation; in this case, the dwell time is calculated from the time at which the entrance beacon is first seen to the last sighting of any of the retailer's beacon in a sequence. Additional plausibility checks, such as limiting the number of visits in a given period and suitable data-smoothing mechanisms must be put into place to increase the data quality. However, data-quality requirements for targeted advertisements are comparatively low. (For example, a coarse classification in short $t < 10m$, medium $10 \leq t < 60m$, and long $t \geq 60m$ visits suffices).

Following Bauer and Strauss's (2016) analysis on context attributes that are considered for targeted mobile LBA in the literature, several measures that retailers can use as conditionals are feasible:

- On the *store* level, passersby and visitors can be differentiated. The number of visits and the dwell time are additional attributes that allow the store to target repeated visitors and customers that have spent a set amount of time in the store.
- On the *beacon* level, the number of sightings and the distance to the beacon can be used to trigger, for example, a promotion when the customer is in *immediate* proximity to a particular beacon.
- On the *customer* level, age group, gender, and ZIP code can be used for demographic segmentation.
- On the *app* level, the mobile operating system used, the time since installing the app, and the frequency of app use can be used as conditionals.

All of these attributes can be combined with a relative or absolute period to narrow the targeted scope. For example, the visit rate could be limited to consider only customers who have repeatedly visited the store in the last month. Combining contextual attributes allows for the kind of fine targeting that has until now been exclusive to online advertising (e.g., Facebook ads) and largely unavailable to SME retailers. Conceivable use cases include targeting loyal customers who frequently visit, providing additional information to a nearby promotional display, and increasing the penetration rate by targeting customers who never visited the store.

15.5.2 Meso-level Perspective

On the meso level, one of the two perspectives (retailer, customer) is viewed on the individual level, while the other is viewed on an aggregated level, which results in customer-facing (second quadrant in Figure 15.3) and retailer-facing services (fourth quadrant in Figure 15.3). Some services are only indirectly enabled by spatio-temporal data (highlighted by the striped areas in the quadrants).

From the individual customer's perspective, data collection is a means to an end to receive personalized service and promotions. Also, the spatio-temporal history allows the customer to reflect on the shopping trips made. Like reviewing tracked runs in a fitness app, reviewing the history gives customers insight into their behavior. Based on going through their shopping trips on the community platform, customers can receive further information on single retailers and get in contact. By rating and reviewing a retailer on the platform, customers collaborative to provide

a service for each other. Viewing past shopping trips also extends the customer journey beyond the high street visit, as they are more likely to recall their (positive) experiences, which can encourage them to use high street retail in their buying decisions. Looking up the promotions received during the high street visit at a later time can also stimulate subsequent visits, thereby marking the start of new customer journeys.

From a retailer's point of view, aggregated customer behavior as it relates to a particular store yields valuable insights into the store's customer base and its behavior over time. Individual reports can be created interactively from aggregated customer data by combining dimensions like demographics, store visits, dwell time, beacon sightings, promotions issued, and time. Retailers can analyze aggregated sightings for each beacon at a defined point in time and over a defined period. Time series analyses graphically show rush times and slow times. While retailers often rely on their experience and "gut feeling", they can receive actual numbers to use for staff planning or to adjust their opening hours. For each beacon, retailers can drill down based on the customers' demographics so customer segments can be pinned down to single beacons in particular parts of the store. The resulting service could also make traditional retail key performance indicators (KPIs) visible (Underhill, 2008):

- *Penetration rate*: The ratio of customers who visit the store to all customers who pass by.
- *Loyalty rate*: The ratio of customers who revisit the store to first-time visitors.
- *Engagement rate*: The percentage of customers who view a promotion in the app.
- *Capture rate*: The ratio of customers who received a promotion in the app and subsequently visited the store. The capture rate is a subset of the engagement rate.

Retailers can precisely scope the target group for their location-based promotions. On meso-level, partnering retailers could offer cross-promotions for complementary products, where a customer's visit to the first retailer results in receiving a promotion for the second retailer, and vice versa. Aggregated customer behavior can show which customer segments respond to a promotion, an insight that is difficult to retrieve from traditional print and broadcast ads. Customer behavior analysis

supports retailers in their continuous improvement process to maximize their advertising efficiency and the return on investment in advertising.

15.5.3 Macro-level Perspective

On the macro-level, both customer data and retailer data are aggregated (first quadrant in Figure 15.3). This bird's-eye view concerns the state of the high street as a whole, so municipal city managers and local marketing cooperatives are the main target groups. Depending on individual high street configurations, these bodies act as the central point of contact and as mediators among the high street retailers, united by the common goal of increasing the high street's overall well-being. Typical tasks are event management, tourism management, space management, and coordinating and executing marketing activities. Information about spatio-temporal customer behavior can contribute to customer behavior analyses, which are a central input for planning any activity (Oosterlinck et al., 2017). Expert interviews with city managers in two German cities revealed their central questions regarding customer movements:

- *Pedestrian flows*: How do customers traverse the high streets? Where do they enter and exit the city center? What are the major pedestrian flows? Live information can inform local authorities and first responders in emergencies so they can steer pedestrian and road traffic.
- *Hot and cold spots*: Which areas are frequented the most and which areas are frequented the least? Historical pedestrian flows and crowd-density information can help to optimize infrastructure developments like paths and public facilities and support decisions about space management.
- *Customer loyalty*: How many customers repeatedly visit the high street? How often do customers return? This information helps to distinguish tourists from locals and aids in tourism management.
- *Customer migration*: How do customers move between stores? At which stores do customers begin and end their high street visits? Which are the most frequented stores? Information on anchor stores can support marketing activities that attract additional customers.
- *Scope of visit*: How many stores do customers patronize during a high street visit? How much time do they spend on the high street? These numbers can provide a baseline to so the impacts of marketing campaigns can be quantified.

A near-real-time dashboard that depicts the current "health" of the city is feasible. Besides aiding first responders, real-time analyses can be undertaken while interventions like marketing campaigns and events take place. These reports can be confined to a time dimension and drilled down by demographics, and external data sources, such as weather reports and event guides, can be linked to enrich them.

Further, given the sequence of stores a customer visits, a geospatial recommender service becomes feasible. Similar customers can be clustered, and collaborative filtering techniques can be employed to provide spatial recommendations (Q. Li et al., 2008). Customers can then receive recommendations for stores they have not visited, but similar customers have visited. This LBS can foster positive customer experiences as they make serendipitous discoveries (Lemon and Verhoef, 2016).

Finally, the community platform service provider can use aggregated data for administrative purposes. Each recorded transaction contains the beacon's self-reported battery status, so customers automatically provide maintenance information to the service provider. Although off-the-shelf beacons can run on a single battery for up to four years (Varsamou and Antonakopoulos, 2014), they eventually require a battery change. As a form of proactive maintenance, retailers can task the local platform provider with automatically servicing the beacons before the batteries fail.

15.6 Demonstration

Following Peffers et al. (2007), a demonstration took place to evaluate the technical feasibility of the proposed design and to identify caveats for the presented LBS. Beacon-based customer tracking has been implemented as an extension to the prototypical community platform *smartmarket*^{2}. The testbed comprised the platform, an office building equipped with BLE beacons by different manufacturers (Kontakt.io, BlueUp, LANCOM Systems), and test users who strolled an artificial high street while carrying smartphones with the *smartmarket*^{2} app. These walkthroughs were performed to test the influence of the Beacons' transmission power, broadcasting protocols, and the users' walking speed on the data collection.

As a result, the Apple iBeacon protocol was favored over the competing Google Eddystone broadcasting protocol (Statler, 2016) because the latter was only recognized in 88 % of cases in the setting. The accuracy of distance measurements

and the detection rate depended heavily on the type of smartphone and beacon model used, an observation confirmed by Faragher and Harle (2015) and Schulz et al. (2016). Additionally, fast walking pace leads to lost records when entering a geofence. Smartphones only periodically scan for beacon signals when not already in a geofence to prevent battery drain (Statler, 2016), and these intervals were larger than the user's period of stay in the geofence.

Both issues have significant impact on the LBS presented in the framework: Inaccurate distance measurements could result in showing a location-based ad for a product that is several aisles away. Missing beacon sightings impact dwell time, store migration, and shopping trip calculations, so customers are not appropriately targeted. Missing data also skews the calculation of retailer KPIs. However, both beacon manufacturers and academia (e.g., Varsamou and Antonakopoulos, 2014) advice on signal configuration, beacon placement, and beacon shielding, which improve detection rates. During the test, it further became prevalent that sequential analyses of store visits and shopping trips require synchronized clocks across customers' devices so that the timestamps of beacon sightings are recorded with regard to the same master clock (Oosterlinck et al., 2017). Otherwise, temporal analyses such as the identification of hotspots or pedestrian flows lack explanatory power because of time differences between recorded and actual times of the beacon sightings.

15.7 Discussion

We have seen that spatio-temporal data collection using BLE beacons is technically feasible, but inaccurate and missed beacon sightings can hamper its utility for downstream LBS. Furthermore, LBS that are based on collected beacon sightings suffer from inherent limitations. Since any nearby user can receive beacon signals, employees and people who live in direct proximity to a store might skew reports and incorrectly identify themselves as frequent customers. Schulz et al. (2016) even mention beacon-forging as malicious behavior in which users counterfeit beacon signals, so they receive targeted LBA. However, even when such counterfeiting occurs, promotions are redeemed at the PoS and are subject to store policy.

Overall, customer behavior data's explanatory power for LBS depends on the sample —that is, the number and demographic distribution of customers who use the underlying community platform. Anecdotal evidence indicates that tech-savvy millennials are more likely to participate than are, for example, those in the baby boomer generation. A participatory, beacon-based approach requires customers to carry a smartphone, which must be switched on, have an active Internet connection, have Bluetooth switched on, and have the community platform app installed and authorized to collect beacon information (Statler, 2016). Nevertheless, tech-savvy millennials are a preferable target group in light of the overarching socio-economical goal of strengthening the role of high streets in customers' buying decisions, since these customers are inclined to use e-commerce.

The presented framework not only holds prospects for high street stakeholders (see Figure 15.3) but the underlying data can also serve as a primary source for behavioral research in service marketing. In the marketing literature on stationary retail, archetypal patterns and what influences customers' shopping behavior (e.g., the type of shopping trip, the motives for visiting the high street) are only rarely described and tend to be assessed by means of surveys (e.g., Hunneman et al., 2017), which inherently can suffer from incomplete results and confirmation bias. Given the customers' spatio-temporal data, future studies might elicit archetypal patterns of customer behavior. For example, utilitarian customers who buy only a particular product to satisfy their high street shopping needs could be differentiated from hedonically motivated customers who wander around the high street as a form of leisure. Marketing researchers can also build on the solution presented here to conduct customer behavior analysis in the field.

15.8 Conclusion and Outlook

This research shows an approach how customers' mobile devices, BLE beacon technology, and a community platform as underlying IS can be used to collect spatio-temporal customer data in high streets. The main contribution is a conceptual framework that structures and details the merits of this novel data source on different levels of analysis and for different beneficiaries in the high street ecosystem.

Based on the framework, the various location-based smart services are currently being implemented in the *smartmarket*^{2} community platform. Subsequently and in line with Venable et al.'s (2016) *Human Risk & Effectiveness* evaluation strategy, a formative naturalistic evaluation will take place in near future, which explores the solution's utility in a real-world environment. Selected retailers in a German city center will be equipped with BLE beacons and be set up for targeted LBA. Participants then stroll the high street and use the prototype. In parallel, their digital interactions and spatio-temporal movements are monitored using screen recording and user shadowing to establish a ground truth. Retailers, city managers, and participants will be surveyed ex-post. From a technical viewpoint, the evaluation will help to understand better where differences in structural and geographical properties impact broadcasting of beacon signals and how beacon configuration and placements can be optimized. From an academic viewpoint, evaluation results and the situated implementation of the artifact will be used to further abstract design knowledge in order to advance theory (Gregor and Hevner, 2013). Finally, for customers to adopt the solution, perceived benefits must outweigh the perceived risks of tracking (Schauer et al., 2014; Kelley et al., 2011). Future research will use the prototype to survey and field test customers' acceptance of high street location tracking with regard to customer types, privacy decision-making, and the perceived value of LBS on local community platforms.

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16 Privacy-friendly User Location Tracking with Smart Devices: The BeaT Prototype

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Privacy-friendly User Location Tracking with Smart Devices: The BeaT Prototype

Abstract. Customers use smart devices to share their location data with service providers to co-create personalized, location-based services. However, mobile apps that record movement profiles not only yield value-added service but also bear potential for abuse. Especially apps utilizing GPS-based tracking pose a privacy risk because they could—once enabled—unnoticeably record data in private situations. In response, we developed a privacy-friendly solution, called *BeaT*, that tracks user locations without GPS and gives users full control over the time and scope of data collection. We leverage Bluetooth Beacon technology to confine the perimeter in which tracking takes place. This paper presents the requirements, algorithmic design, prototypical implementation, real-world use case, and evaluation setting for *BeaT*.

16.1 User Location Tracking—Friend or Foe?

Navigating by smart device or tracking a run in a fitness app are exemplary location-based services (LBS) where users share their location with service providers (Dhar and Varshney, 2011). Even though service providers are limited in data exploration by data-protection regulations (e.g., required user consent and opt-in to data sharing), privacy risks and potentials for abuse remain (Schaub et al., 2015; Betzing, 2018). Notably, once a mobile app has been granted permanent access to the GPS sensor, it can access the user's location even in private situations. As seen in the case of the fitness-tracking app *Strava*, unrestricted user tracking can—in the worst case—expose classified information such as the location of secret US military bases (Wool-

lacott, 2018). In response, this paper presents *BeaT, a privacy-friendly user location tracking mechanism for smart devices*, and its application in the *smartmarket*[2] research project, in which the authors developed a LBS for high street customers to track their shopping trips (see Bartelheimer et al., 2018; Betzing, 2018). In addition to retail, BeaT can also be applied in other sectors such as healthcare or hospitality management to track time-logical sequences of user movements.

Motivated by the disadvantages of existing solutions, we state the requirements for BeaT as follows: First, to prevent tracking in private situations, the solution must not use satellite or WiFi-based geolocation or access acoustic and visual sensors (*R1*). Additionally, the tracking perimeter should be defined ex-ante (*R2*). Second, while GPS only supports outdoor tracking, we want to track both indoor and outdoor locations (*R3*). Third, some LBS such as *Foursquare* use check-ins, i.e., users manually record the places they are visiting (Dhar and Varshney, 2011). While this mechanism accounts for user control, it lacks convenience. Consequently, our solution should provide automatic tracking (*R4*) while retaining users' full control regarding the time and scope of data collection (*R5*). Fourth, users associate LBS such as navigation or AR games (e.g., Pokémon Go) with battery drain (Faragher and Harle, 2015). Our solution should limit mobile resource utilization regarding processing power, memory, (mobile) data transfer, and battery to foster user acceptance (*R6*).

16.2 Prototypical Design and Implementation

16.2.1 Technology Selection and Setting

We selected Bluetooth Low Energy (BLE) beacons as the underlying tracking technology because (1) smart devices support the technology for a few years (Statler, 2016); (2) beacons do not reach into private spaces (R1) as they have to be actively deployed in the perimeter within which tracking should commence (R2); (3) the BLE protocol has low mobile resource utilization (R6); and (4) beacons allow for both indoor and outdoor tracking (R3). Beacons are small low-range radio-frequency transmitters that frequently broadcast a predefined payload, consisting of a Universally Unique Identifier (UUID) and two alphanumeric values called major and minor (Statler, 2016). Nearby devices can receive the signal, calculate their proximity to the beacon, and reason upon the payload (Betzing, 2018).

In the *smartmarket*^{2} case, customers can record their journey across multiple retailers that are geographically dispersed along the high street (Bartelheimer et al., 2018; Berendes et al., 2018). In return for their data, customers receive personalized offers from nearby stores. Beacon major values identify the store whereas beacon minor values indicate the purpose and location of a beacon (outside at an *entrance*, inside at a *PoI*, inside at a *PoS*) (Betzing, 2018). These purposes allow to distinguish customers passing by, entering a store, traversing a point of interest (PoI) such as a promotional display within a store, and visiting a point of sale (PoS). Additionally, a back-end database server holds the geocoordinates of each beacon.

Customers use a mobile app to record their shopping trips. On the first start, the app requests access to the Bluetooth sensor. Once granted, the device is able to listen continuously for beacon signals. However, *smartmarket*^{2} is deployed individually for each high street to fulfill R2. Hence, the app only declares a single UUID to monitor. Given that 2^{122} UUID exist (Statler, 2016), it is unlikely to receive a matching beacon signal outside the predefined area. Concerning R4 and R5, smart devices can receive beacon signals automatically in the background, but customers have to actively start and stop tracking in the app before any signal is sensed. Additionally, the app lists active and past trips and allows to inspect and delete the collected information (R5). Lastly, current mobile operating system (OS) indicate active Beacon tracking in the menu bar and inform users on continuous monitoring.

As soon as the user has started tracking and relevant beacons are in range, the app receives a list of these beacons and their coarse distance (far, near, immediate) once every second. A naïve approach is to record this data entirely and transmit it to the back-end server. As this would pose substantial resource utilization and violate R6, we developed a solution to extract and send only relevant information from the raw data stream—BeaT.

16.2.2 The BEAcon Tracking (BeaT) Algorithm

Suppose we have an active trip tr, a set of recently seen majors M (representing stores), and a set of beacon sightings, henceforth called touches T. For each touch t, we call the procedure BEAT, given in Algorithm 2, to update customer journey information.

Input: $(tr, M, t \in T)$ ▷ tr is the current trip; M is a set of active majors; t is a newly received beacon touch

1: **procedure** BEAT
2: $te \leftarrow$ GETBYMAJOR($t.major$) ▷ Try to obtain a trip entry te based on the major of touch t
3: **if** te != none **and** DIFF($te.end, t.time$) $<$ 10 min **then**
4: $tr.end \leftarrow t.time$ ▷ Earmark current t as potential last $t \in tr$
5: $te.end \leftarrow t.time$ ▷ Earmark current t as potential last $t \in te$
6: **switch** $t.type$ **do**
7: **case** "entrance"
8: **if** $te.entrance_first$ == none **then** $te.entrance_first \leftarrow t$
9: **if** $t.dist$ == "immediate" **then** $te.visited \leftarrow$ true ▷ Mark te (store) as visited
10: $te.entrance_last \leftarrow t$ ▷ Earmark t as potential last sighting
11: **case** "PoI"
12: **if** t.dist != "far" **then**
13: te.visited $\leftarrow$ true ▷ Mark te (store) as visited
14: **if** t $\notin te.poi$ **then** SENDTODB(t) ▷ Send PoI touch t to the database server on first sight
15: $te.poi \leftarrow te.poi \cup t$ ▷ Add t to the set $te.poi$ of seen PoI
16: **case** "PoS"
17: **if** t.dist != "far" **then** te.visited $\leftarrow$ true ▷ Mark te (store) as visited
18: **if** t.dist == "immediate" **then**
19: **if** $te.pos_first$ == none **then** $te.pos_first \leftarrow t$
20: $te.pos_last \leftarrow t$ ▷ Earmark t as potential last sighting
21: **if** DIFF($te.pos_first, te.pos_last$) $>$ 30 sec **then** $te.sale \leftarrow$ true
22: **else**
23: ENDEXPIREDTRIPENTRIES() ▷ End expired te and remove respective $te.major$ from M
24: $te \leftarrow$ CREATETRIPENTRY(t) ▷ Create new trip entry te based on touch t
25: $M \leftarrow M \cup t.major$ ▷ Add $t.major$ to active majors M
26: $tr.te \leftarrow tr.te \cup te$ ▷ Add te to current trip tr
27: BEAT(t) ▷ Execute BEAT again, having a te

Algorithm 2: BeaT

First we test, whether there was an interaction with this store ($t.major$) within the last ten minutes. If not, we create a new trip entry te, which represents one element in the customer journey, and add it to the trip tr. Also, inactive trip entries for stores that have not been seen in the last ten minutes are closed and their respective majors are removed from the set M of currently active majors. Depending on the type of touch ($t.type$) and the user's distance to the beacon ($t.dist$), the trip entry is updated. In effect, we store for each trip entry, when the store was first and last seen ($entrance_first|_last$), if the customer has entered the store ($visited$), a set of seen PoI, and if the customer has bought something ($sale$). The latter is approximated by testing, if the customer has been in immediate proximity to a PoS for at least 30 seconds. PoI sightings are directly transmitted to the back-end server so that it can potentially return relevant notifications for the user. Each trip is either terminated in-app by the user or by a timed function that closes a trip after three hours without beacon sightings. The trip tr and all associated te and t are transmitted to the back-end server en bloc and tracking is disabled.

16.3 Evaluation and Outlook

BeaT was added to the prototypical [*smartmarket*^{2}] platform (Bartelheimer et al., 2018), which provides the socio-technical context to investigate user location tracking in the target high street environment. BeaT is the result of multiple cycles of building, testing and evaluation activities. We already asserted the general viability of beacon tracking in an artificial setting (Betzing, 2018). Advancing further along the continuum of Venable et al.'s *Human Risk & Effectiveness* strategy (Venable et al., 2016) to evaluate IT artifacts, we will conduct a summative naturalistic evaluation in the fourth quarter of 2018. About 25 retailers in a German high street will install beacons and we invited more than 500 high street customers to engage in customer journey tracking using BeaT over the course of two months. Besides judging how well BeaT achieves its envisioned environmental utility (Venable et al., 2016), we also designed our field test to shed light on the socio-technical issues of adoption and use of privacy-friendly LBS, which will subsequently yield additions to the knowledge base.

Large facilities such as hospitals, shopping malls, and airports already use BLE beacons to provide indoor navigation (Statler, 2016). Besides its merits for high streets, BeaT could also constitute a viable extension to existing mobile service in these domains. For example, in hospitals, patients could use BeaT to record which doctors and wards (service providers) they have visited and—based on their current patient journey—receive further digital and personal service. Lastly, in future research, we will use the location data collected through BeaT to map, analyze, and predict high street customer journeys (Berendes et al., 2018).

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17 Quantifying the Impact of Geospatial Recommendations: A Field Experiment in High Street Retail

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Quantifying the Impact of Geospatial Recommendations: A Field Experiment in High Street Retail

Abstract. Once the mainstay of shopping and cultural exchange, many high streets increasingly struggle to compete for their customers' wallets and leisure time against digital shopping. Besides superior convenience and broader assortments, data-driven recommendations of products that fit individual customers' needs are particular assets possessed by online stores. While first recommender systems that leverage the properties of physical environments have been designed and evaluated in shopping malls, their applicability, accuracy, impact, and business value have neither been demonstrated nor evaluated in local high streets. We set out to identify and quantify the impact of geospatial recommendations on high street retail in a large German city center. Having equipped 66 local businesses with more than 120 Bluetooth Low Energy beacons and having distributed a mobile application to 400 customers, we collect geospatial data to trace customer journeys on the high street. In a field experiment, we plan to identify, analyze, and quantify the effects of recommendations in this setting. Our results will provide new data-driven insights into the accuracy, acceptance, impact, and business implications of geospatial recommendations in high street ecosystems.

17.1 Introduction

For some hundred years, high streets used to be the primary channel for retail and service provision (Tauber, 1972). Due to the rise of online retail and emerging megatrends (e.g., digitalization, sharing economy) (Seeger and Bick, 2013), the economic importance of high street retail steadily declines, which is reflected in decreasing

numbers of visitors in many cities (Bollweg et al., 2018; IFH Köln, 2017). Eventually, a decreasing amount of visitors can impede the appearance and attractiveness of high streets since businesses that depend on an active stream of visitors may be forced to close down (Eichholz-Klein et al., 2015). On a general level, the unfolding digitalization profoundly impacts the high street ecosystem by changing the visiting intentions, shopping behavior, and overall habits of citizens, suburbanites, and other visitors (V. Kumar et al., 2017; Bollweg et al., 2018). Different from many large retail conglomerates that have launched online stores to implement omnichannel sales strategies (Brynjolfsson et al., 2013), family-owned small and medium-sized enterprise (SME) businesses — often constituting the majority of retail stores in high streets — are laggards regarding digitalizing their stores (Bollweg et al., 2016).

Multi-sided digital community platforms for high streets could be a viable means to make up for this deficiency since they can enable retailers and other service providers to combine their value propositions and offer digital service for improving customer experience on the level of an entire high street (Bartelheimer et al., 2018). These platforms provide a bi-directional digital channel between local customers and local businesses through which digital service is co-created (Barrett et al., 2015).

Inspired by the omnipresence of recommender systems in online retail — supporting customers' decision processes (Ricci et al., 2015) and providing business value for retailers (Lee and Hosanagar, 2014) — we propose that recommender systems are valuable for customers and retailers in high streets, too. Due to high streets' physical layout as decentralized marketplaces composed of multiple independent businesses, recommender systems have not been applied in high streets, yet. However, digital community platforms seem to provide a suitable technological and organizational foundation for giving recommendations that can influence customers' behavior and decision processes on the level of an entire high street.

Recommendations made in a high street can consider geospatial information such as the locations of businesses, and the customers' physical movements through the high street, which we refer to as trajectories. Thus, recommendations based on geospatial data (henceforth geo-recommendations) can capitalize on both the diversity of businesses on a high street as well as the customers' trajectories, current goals, and context to identify potentially attractive businesses, subject to the distance between customers and stores. If accepted by customers, geo-recommendations could

substantially impact customer journeys — time-logical sequences of the discrete service encounters customers have with other actors "along prepurchase, purchase and postpurchase situations" (Homburg et al., 2017, p. 384). The impact of geo-recommendations on customer journeys have neither been studied nor quantified in high streets before (Gavalas et al., 2014). The purpose of this research-in-progress paper is to outline a research process that will serve to identify and quantify *how geospatial recommendations impact customer journeys in a local high street*. Due to its novelty and unique layout, this endeavor can shed light on the acceptance, use, impact, value, and constraints of geo-recommendations in local high street ecosystems.

17.2 Theoretical Background

17.2.1 Recommender Systems

Recommender systems combine tools and techniques that "[produce] individualized recommendations as output or [have] the effect of guiding the user in a personalized way to interesting or useful objects in a large space of possible options" (Burke, 2002). Recommending products, restaurants or promising shopping locations is a long-known social process which has manifested in constructs such as word-of-mouth recommendations, reviews, and surveys and aims at supporting individuals lacking sufficient experience in selecting items deemed most suitable for them (Resnick and Varian, 1997). Digital recommender systems emerged as a class of information systems that provide suggestions for items such as products or points of interest (PoIs) (Ricci et al., 2015). The underlying decision processes can, among others, consider the properties of the items to recommend (content-based filtering), compare a user to other users (collaborative filtering), and reason upon a user's current situation (Adomavicius and Tuzhilin, 2015). The literature distinguishes different families of recommender systems such as product (e.g., Schafer et al., 1999), multimedia (e.g., Albanese et al., 2013; Hill et al., 1995; Gomez-Uribe and Hunt, 2016), news (e.g., Resnick et al., 1994; Billsus and Pazzani, 1999), and travel recommenders (e.g., Gavalas et al., 2014).

We focus on *geo-recommender systems*, which recommend items in relation to a user's past and current geographical positions (Liu and Wang, 2017). Related approaches

exist in the tourism industry, where geo-recommender systems help travelers finding PoIs such as sights or hotels (Gavalas et al., 2014). The IT artifacts presented there vary regarding the types of items recommended, additional services offered, and contextual criteria used to derive the recommendations. However, this research stream primarily focuses on technical aspects such as algorithms, system design, route planning, and maximizing recommendation accuracy (Gavalas et al., 2014; Gorgoglione et al., 2016; Liu and Wang, 2017). Previous studies suggest that the value of a recommender system is not only captured by its underlying algorithm's accuracy but also by the degree of perceived customer experience with regards to the fulfillment of the actual user's needs (Konstan and Riedl, 2012; Knijnenburg et al., 2012). From a socio-technical perspective, it remains unclear, how geo-recommendations impact users and the environment.

Marketing and Information Systems scholars primarily focus on the use of geo-recommender systems to optimize mobile advertising (Bauer and Strauss, 2016). Recent research uncovered the impact of customers' spatiotemporal contexts on mobile promotion redemption (Luo et al., 2014), found cannibalizing effects (Fong et al., 2015), showed the superiority of trajectory-based mobile recommendations for promotions (Ghose, Li, et al., 2019), and investigated the interplay of recommendation accuracy on customers' purchasing behavior and trust (Gorgoglione et al., 2016). While these studies can inform the design of a geo-recommendation service for local businesses, they are not exploring its impact on customer journeys in high streets due to their focus on maximizing advertising returns through mobile coupons. There is — to the best of our knowledge — no study on how recommendations of nearby businesses impact customer journeys.

17.2.2 Customer Experience and Customer Journeys in High Streets

To understand the impact of geo-recommendations on customers visiting a high street, we draw from the Service-dominant Logic of Marketing (S-D Logic) (Vargo and Lusch, 2016), customer journey theory (Voorhees et al., 2017), and customer experience theory (Verhoef et al., 2009). S-D Logic substitutes value that comes about through an exchange of goods and services for money (value-in-exchange)

with value-in-use that emerges in co-creation between a customer and other actors through the exchange of service — the application of knowledge and skills of a service provider for the benefit of a service customer (Vargo and Lusch, 2016). Customers who visit a high street may interact with service providers, such as retailers or service companies and other customers through various channels such as stores, advertisements, or digital media (Voorhees et al., 2017). The customer's perceived value-in-use of these encounters is reflected by the construct of *customer experience* (Verhoef et al., 2009), which is the "evolvement of a person's sensorial, affective, cognitive, relational and behavioral responses to a [service offering] by living through a journey of touchpoints [...] and continually judging this journey against response thresholds of co-occurring experiences in a person's related environment" (Homburg et al., 2017, p. 384). As for all service, the value-in-use of visiting a high street is "uniquely and phenomenologically determined" (Vargo and Lusch, 2017, p. 47) by the beneficiary, i.e., by the customer. Individual experiences and interactions with other high street actors impact the overall high street customer experience. Vice versa, the overall experience impacts the customer experience on an individual level (Tynan et al., 2014).

Recently, multi-sided digital community platforms for high streets have been proposed as a means to digitalize and foster the co-creation of customer experience in high streets (Bartelheimer et al., 2018). In particular, these platforms provide customers and retailers with a bi-directional digital channel, enabling service that is based on geospatial data of customers, service providers, and municipal entities. Service is co-created by networks of service providers in the same high street, since improving the potentials for customer experience benefits each constituent and leads to a self-reinforcing process that may strengthen the attractiveness and patronage of high streets. Since digital community platforms for high streets comprise data about local businesses and collect contextual data on customers, we suggest that they can be extended to provide customers with geo-recommendations on the businesses partaking on the platform.

17.3 Research Approach

We conduct a field experiment to study the impact of geo-recommendations on high street ecosystems (Recker, 2012). This approach corresponds with both recent

related work in the research stream (e.g., Ghose, Li, et al., 2019) and a recent call for field research by Gavalas et al. (2014), who identified a lack of formal field studies in their survey on mobile recommender systems. Therefore, we aim to study the phenomenon in its real-world context, i.e., the impact of geo-recommendations in a high street, which has not yet been subject to prior research.

The experiment takes place in the city center of Paderborn, which stands as a representative example of about forty cities in Germany. These cities have between 100.000–200.000 residents and feature similar high street structures, which are characterized by a large and diverse set of SME and branches of large retail chains. Thus, there is a sufficiently large number of businesses to give meaningful recommendations. Although the city acts as a regional center for nearby towns and rural areas, it lacks the vibrancy and attraction of metropolises such as Berlin or Cologne, which can hold their own against other shopping channels. So far vacancy rates remain low but local businesses face increasing competition with e-commerce (IFH Köln, 2017). In response, the SME businesses are looking for new value propositions for their customers and express a high degree of openness and cooperation regarding the study.

We split the endeavor into two phases: During the first phase, we equipped the high street with the necessary technology to record and trace individual customer journeys digitally, and thereby we advanced this high street into a physical and at the same time digital ecosystem. In the second phase, we will execute a randomized field experiment by providing a treatment group with geo-recommendations of nearby businesses. An experimental research method with a two-group design is selected to examine cause and effect relationships of geo-recommendations on participants behavior in and perception of the high street (Recker, 2012). Based on the data collected in the field, we will identify, analyze, and quantify the effects of geo-recommendations in the high street setting. The chosen approach enables both inductive data-driven identification of customer behavior as well as deductive research — e.g., hypotheses testing — through "the manipulation and measurement of clearly defined variables, but in a natural setting" (Benbasat et al., 1987, p. 370).

17.4 Geo-Recommendations in High Street Retail

17.4.1 Digitalization of the High Street Ecosystem

In the first research phase, we digitalized the high street ecosystem and instantiated a digital community platform as a means to collect digital traces of high street customer journeys. Sixty-six local businesses (retailers, restaurants, service providers) and about 400 customers participated in the two-month data collection period, which lasted from November 1st to December 31st, 2018. The sample of test customers consisted of first-year undergraduate students, including both locals with knowledge on the high street and new residents. We acknowledge the sample's limited representative power with regards to demographics and buying power. However, previous studies showed that younger people are more receptive to using digital services in brick and mortar retail in general (Betzing, Niemann, Barann, et al., 2019) and to mobile targeting in particular (Ghose, Li, et al., 2019) — rendering them a viable target group.

Customers use a smartphone application to record their high street customer journeys in the form of time-logical sequences of business sightings. We refrained from accessing the GPS sensor due to privacy concerns and limited indoor tracking capabilities. Instead, we equipped the partaking businesses with Bluetooth Low Energy (BLE) beacons that enable indoor and outdoor tracking scenarios (Betzing, 2018). Each business received at least two beacons — one at the entrance and one at the checkout — to track customers passing by and entering the venue. In particular, we record how long a participant remains in-store and whether the participant has bought something (Betzing, Niemann, and Berendes, 2019).

With the technology in place, we can record and retrace individual customer trajectories and store visits in the high street — a valuable data source that in the past has been exclusively available to online shops in the form of click-stream data. During the data collection period, more than 2.000 customer journeys, comprising over 12.000 interactions with the businesses were recorded. The median duration of a high street visit was 62 minutes, which included a median amount of nine interactions with the local businesses.

17.4.2 Field Experiment with an Instantiated Geo-Recommendation System

In the second research phase, we will field an experiment by giving geo-recommendations to intervene in high street customer journeys. Subsequently, we explain how the geo-recommendation system works, give the experimental design, and sketch our plan to quantify the accuracy and business potential of geo-recommendations in the high street setting.

17.4.2.1 Recommender Design

We design and instantiate a state-of-the-art geo-recommendation system and train it with the previously collected customer journey data (see Figure 17.1, *Build Time*). Given an ongoing customer journey trajectory as input, the system's objective is to output geo-recommendations, i.e., to suggest businesses in the vicinity of the user, which are deemed relevant concerning the user's behavior (see Figure 17.1, *Run Time*).

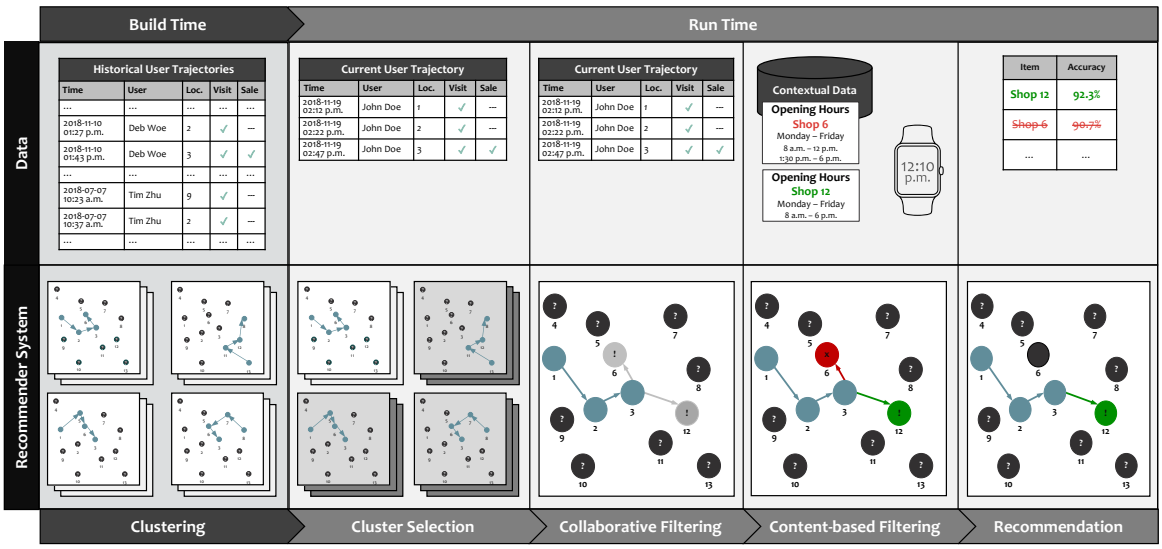


Figure 17.1: Simplified Recommender System Pipeline and Corresponding Data

The given trajectories $tr = (p_1, p_2, \ldots, p_n)$ consist of sequences of sampling points $p_i = \langle loc_i, t_i, \ldots \rangle$, which contain information such as the customer's location at/in a business loc_i, a timestamp t_i, and potential further information (e.g., if the user has bought something at the business) (Yuan et al., 2017). The envisioned system is

similar to the recent work of Ghose, Li, et al. (2019), who use graph-based clustering to identify groups of customers in a shopping mall that have similar movement patterns. As opposed to Ghose, Li, et al. (2019), we are not interested in the overall similarities between customers. Instead, we look at similarities between individual customer journeys, because the same customers might show various behaviors across individual journeys due to different goals when visiting the high street (Walters and Jamil, 2003). Therefore, our system clusters individual trajectories independently of the customers so that journeys within a cluster are similar to each other but dissimilar to the ones not in the group. Informed by Yuan et al. (2017) and Bian et al. (2018) assessments of trajectory-based clustering algorithms, we cluster the data using DBSCAN (density-based spatial clustering of applications with noise) with the longest common sub-sequences (LCSS) distance metric.

Based on the previously learned clusters, the system can categorize a customer's current journey as it commences. Subsequently, collaborative filtering is applied between the ongoing journey and the ones within the selected cluster to calculate a set of potentially relevant businesses (Adomavicius and Tuzhilin, 2015). The set of candidate recommendations is subject to content-based filtering to increase accuracy. As shown in Figure 17.1, opening hours and holiday indicators are used as filter criteria to prevent recommending businesses that are currently closed. Additional contextual information such as walking distances between the user and the businesses are taken into account as ranking criteria.

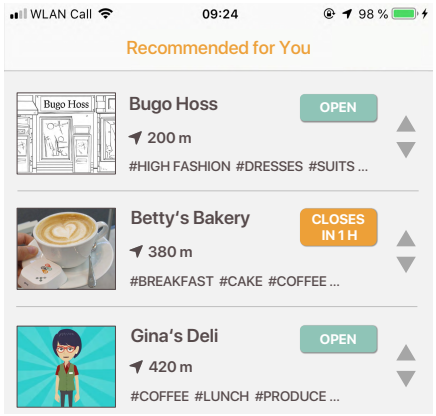
For implementing the geo-recommender system, we selected `LightFM`, which is an industrial grade hybrid recommendation system that has been proven to work well in similar contexts such as online fashion shopping (Kula, 2015). We learn the model using Bayesian Personalized Ranking (BPR) (Rendle et al., 2012), which can deal with missing labels such as customers not having visited a business before (i.e., not visiting a business is not taken as an indicator for disliking it). The overall recommender system pipeline will be incrementally optimized based on the results from the field experiment.

17.4.2.2 Experimental Design

We will again recruit about 400 participants with demographics comparable to the ones in the first phase and equip them with a mobile application. While the ap-

proach would apply to other demographic groups, it would require additional customer journey training data by these groups. Participants of the experiment will be randomly assigned to a control group or a treatment group. The former group is only able to record their trajectories, whereas the latter group will also receive individual geo-recommendations during their high street visits. Invisible to the users, the server-side component will continuously recalculate recommendations for all commencing customer journeys.

(a) Recommendation Push Notification



(b) Recommendations List

Figure 17.2: Mobile User Interfaces to the Geo-Recommendations

Two modes of treatment delivery take place: First, 20 minutes into the high street visit, the mobile application issues a push notification (see Figure 17.2a) that suggests the business currently ranked most relevant from the set of recommendations (Xu et al., 2011). If the participant is in an arbitrary store at the calculated delivery time, the notification is held back until he or she returns to public space. We chose this semi-fixed timing to control for any potential bias that could have been introduced by concurrent store visits or randomized timing. Participants leaving the high street within the first 20 minutes do not receive a geo-recommendation. For participants visiting the high street for extended periods of time, the application can issue up to two more push notifications at 30-minute intervals. We limit the number and frequency of notifications to prevent information overload and possibly associated adverse effects (Bauer and Strauss, 2016). Second, at any time during the high street visit, participants can access a pull-based (Xu et al., 2011) mobile recommendation interface that shows the three currently best-fitting businesses from the set of recommendations (see Figure 17.2b). Due to the novel high street setting, the accuracy of the geo-recommendations cannot be determined beforehand. Therefore, three recommendations instead of a single one are shown to increase the likelihood

of providing at least one relevant item (Adomavicius and Tuzhilin, 2015). Within the recommendation list, participants can give feedback by voting the recommendations as relevant or irrelevant (arrows in Figure 17.2b).

For both groups, we record the customer journeys, including their duration and the number of interactions with businesses. We combine the experiment with a brief post-test survey. After each high street visit, we quantitatively assess the participant's perception of the high street, the course of his or her customer journey, and their intentions to re-visit the high street. Participants who received the treatment will also be surveyed regarding their use of geo-recommendations. Additionally, timestamps of the interventions are logged, and their interactions with the recommendation interface will be recorded (i.e., clicking on recommendation push, notifications, clicking on recommended businesses). All collected measures directly relate to one or more hypotheses that we propose subsequently.

17.4.2.3 Quantifying the Accuracy of Geo-Recommendations

In line with other studies on recommender systems (Gavalas et al., 2014), we cater for internal validity by determining and quantifying the accuracy of the provided geo-recommendations based on the recorded behavioral data. Geo-recommendations can be understood as an additional touchpoint in the high street ecosystem, which can stimulate digital and personal interaction between the user and the businesses (Nüesch et al., 2015). Following the general aim of PoI recommendations to trigger behavioral responses (Gavalas et al., 2014), we expect customers to visit recommended businesses.

Arguably, recommending a business to a local resident might not provide the user with any *new* information, and, in contrast to Ghose, Li, et al.'s (2019) study on mobile coupons, might not increase the user's shopping efficiency. However, in contrast to recommendations for offers and coupons, which especially appeal to utilitarian users (Ghose, Li, et al., 2019), our geo-recommendations primarily aim at hedonistic users who prefer strolling the high street (Gavalas et al., 2014) and want to have a digital and at the same time physical high street customer experience (Betzing, Beverungen, and Becker, 2018). We maintain that even recommendations for known locations can give impulses to spontaneously re-visit them (Babin et al., 1994). Consequently, the system can recommend both businesses already visited

by the customer in a previous journey and those that are unknown, yet. We assess whether previous knowledge on the recommended business impacts the customers' behavioral response, i.e., if recommendations lead to discover unknown businesses and/or to re-visit known ones (Fleder and Hosanagar, 2007). Against this backdrop, we propose our first hypotheses:

H1a: *Geo-recommendations positively impact customers to visit previously unknown businesses.*

H1b: *Geo-recommendations positively impact customers to re-visit previously known businesses.*

Ghose et al. (2019) recently showed that trajectory-based mobile advertising could nudge users towards changing their shopping behavior. Similarly, we expect users to change their planned trajectories in the high street in order to visit the recommended businesses. They might even use this new trajectory to make other (previously unplanned) visits to businesses on the way. Intuitively, one may expect geo-recommendations to extend the duration of and distance traversed in a customer journey due to visiting the recommended businesses. However, recommendations are known to yield a functional value due to easing information search (Ricci et al., 2015). If a recommended business fulfills the customer's needs, he or she may even have efficiency gains since it eliminates the search process to find an adequate business (Ghose, Li, et al., 2019). Consequently, we cannot make assumptions on the direction of the effect. We state our second set of hypotheses as follows:

H2: *Geo-Recommendations impact the duration of high street customer journeys.*

H3: *Geo-Recommendations impact the number of businesses visited in high street customer journeys.*

17.4.2.4 Quantifying the Business Potential of Geo-Recommendations

Beyond quantifying the impact of geo-recommendations on customers' behavior, we also expect geo-recommendations to positively impact the customers' perception of the high street as a whole.

Geo-recommendations can support customers in learning about the latest trends (Tauber, 1972), explore new and unknown stores on the high street (Jarboe and McDaniel, 1987), and conduct "adventure shopping" (Arnold and Reynolds, 2003), all of which are known to yield a positive value-in-use (Arnold and Reynolds, 2003). In particular, a feeling of joy from making a serendipitous discovery can create hedonic value-in-use (Bellotti et al., 2008; Babin et al., 1994), which may then affect the perceived value-in-use of the high street (visit) as a whole (Tynan et al., 2014). High street businesses often are geographically dispersed, and customers may walk by relevant businesses without recognizing them. Geo-recommendations may increase customers' awareness of what the high street has to offer, and thus, may increase the perceived attractiveness of the high street (Um et al., 2006). Further, as users tend to evaluate their current experience in relation to previous experiences (Betzing, Beverungen, and Becker, 2018), value-in-use and attractiveness perceived during the current high street visit may affect future behavior. Perceived value-in-use and perceived attractiveness are known concepts to explain customers' re-visit intentions of a high street (Um et al., 2006). Additionally, positive customer experience is known to impact "satisfaction, trust, [and] re-visit intention" (McLean et al., 2018, p. 326). To go beyond educated assumptions, we sketch a third set of hypotheses that will allow a thorough empirical evaluation of the above-stated premises:

H4: *Geo-recommendations positively impact customers' perceived value-in-use of a high street.*

H5: *Geo-recommendations positively impact customers' perceived attractiveness of a high street.*

H6a: *A higher perceived value-in-use of a high street positively impacts customers' re-visit intentions.*

H6b: *A higher perceived attractiveness of a high street positively impacts customers' re-visit intentions.*

However, deriving business potentials of geo-recommendations for high streets as a whole is hardly possible without taking multiple consumer moderators from customer experience theory into account (Verhoef et al., 2009): (1) The type of shopping trip respectively the customer journey goal drives the customer's need for recommendations (Walters and Jamil, 2003). Utilitarian customers that have a clear goal such as buying a particular product (Ghose, Li, et al., 2019) may not respond in the

same way to geo-recommendations than a hedonistically motivated customer who wants to window shop in his or her leisure time (Homburg et al., 2017). (2) The social environment that is made by the persons who accompany the customer during his or her trip may constrain the relevance of recommendations (Verhoef et al., 2009). (3) Socio-demographic factors such as age, gender, and technology affinity may further impact the use of a geo-recommendation system (Gavalas et al., 2014). Data on all moderators will be collected during the field experiment, which allows us to control for them.

17.5 Conclusion

Against the backdrop of diminishing customer frequencies in many high streets, we set out to identify and quantify the impact of digital geo-recommendations on a high street ecosystem. We digitalized a German high street and collected real-world customer journey data — an asset that allows us to build and train a geo-recommendation system. In a field experiment in the same high street, we will intervene in customer journeys by giving geo-recommendations and record customers' responses. The paper provides sets of hypotheses regarding the quantitative impact of geo-recommendations on customer behavior and the perceived value-in-use of the high street as a whole. These hypotheses can only be tested in situ, which has not been done before. We gain novel insights by identifying the applicability, limitations, and effects of geo-recommendations for high streets and even quantify them with collected data. Thereby, we contribute to the research streams on recommender systems, high street retail, and customer experience.

We are confident that augmenting customer journeys in high streets with geo-recommendations generates a value-in-use for both customers and businesses, and that providing a geo-recommendation service might eventually contribute towards strengthening the high street's competitive position in channel selection.

18 One Plug at a Time — Designing a Peer-to-Peer Sharing Service for Charging Electric Vehicles

Fact sheet of publication *P.12*

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One Plug at a Time — Designing a Peer-to-Peer Sharing Service for Charging Electric Vehicles

Abstract. The widespread diffusion of electric vehicles (EVs) suffers from the lack of a well-developed public charging infrastructure, which currently is uneconomical to develop for investors. Many owners of EVs have private charging stations at their premises, which yield unlockable potential due to high idling times. In line with sharing platforms for other goods like accommodations and cars, we present the design, prototypical implementation, and evaluation setting of CrowdStrom, a peer-to-peer sharing service for charging EVs that networks individuals, their charging stations, and charging service customers.

18.1 Infrastructures for Electric Vehicle Charging

Clean, carbon-neutral transportation, fueled by electricity generated from renewable sources has been on governments' agendas for years. Central to these ambitious development plans is the potentially widespread diffusion of electric vehicles (EVs) (Rezvani et al., 2015). While the German government, which is pursuing a target of one million registered EVs in Germany by 2020 (Nationale Plattform Elektromobilität, 2016), provides financial incentives for EV-buyers, registrations remain low with little more than 50,000 EVs registered by the end of 2015 (Nationale Plattform Elektromobilität, 2016). In a circular pattern, customer adoption of EVs has been hampered by the lack of a well- developed public charging infrastructure (Rezvani et al., 2015), and the resulting limited demand for EVs deters investors from developing these infrastructures. Many owners of EVs have private charging stations at

their premises, which yield unlockable potential due to high idling times. Peer-to-peer (P2P) sharing has been proposed as way to increase the availability and use of existing resources by granting public access to individually owned resources (Belk, 2014). P2P sharing facilitates IT-enabled economic transactions between individuals, where only temporary access to a physical resource is granted by a resource owner to others who need it in exchange for a monetary consideration (Matzner et al., 2016). The shift in consumer attitude from preferring ownership of a resource to preferring access to it has fueled the rise of IT-enabled P2P sharing services in domains such as transportation (e.g. BlaBlaCar) and accommodation (e.g. Airbnb) (Belk, 2014). The central component of such services is a web platform that brings together peer-providers and peer-consumers and that provides a framework for handling business transactions (Andersson et al., 2013). Against this background, we adopt the P2P sharing paradigm to enable individuals and businesses to share their private charging stations with other EV-drivers. The remainder of the paper is structured as follows: section two sketches the research approach and the activities conducted in the course of the CrowdStrom project. Section three introduces the business model and the CrowdStrom platform, while the fourth section closes with the discussion of a comprehensive evaluation setting.

18.2 Research Approach

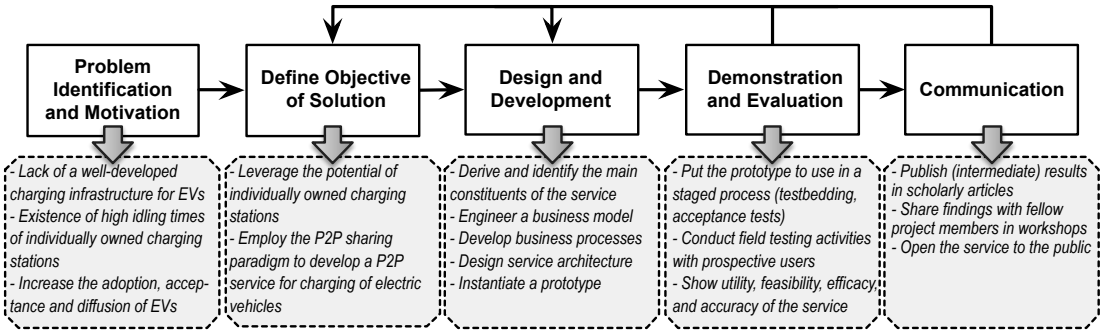

Figure 18.1: Overview of the DSR Phases Adopted for the CrowdStrom Project

We adopt the Design Science Research (DSR) paradigm (Peffers et al., 2006) to develop a business model and an instantiation of a P2P service for sharing EV-charging stations within a joint industry-and-academia consortium. In line with research guidelines on DSR (Peffers et al., 2006), our work follows the cyclic process of the DSR Methodology (Figure 18.1).

After identifying the mentioned societal problem, we further developed and communicated the project's objectives in multiple design cycles (Matzner, Chasin, Todenhöfer, et al., 2015). During the design and development phase, we addressed different issues of the EV-charging challenge ranging from customer-related (acceptance, willingness-to-pay), provider-related (incentives, organizational development), and legal aspects (energy provision, taxation) to service design (procedural/technical design principles) (Matzner et al., 2016). We will subsequently conduct a comprehensive evaluation to advance the prototype into a mature solution.

18.3 The CrowdStrom Business Model and Prototype

The CrowdStrom service networks individuals and businesses that provide charging stations (peer-providers), and EV-drivers that require charging (peer-customers). Additionally, a service operator acts as intermediary that runs the central web platform, handles transactions, and provides support services in return for a share of the revenue. The roles of the peer-provider and peer-customer are not mutually exclusive, i.e., users may both provide charging stations and use the ones of other users. Peer-providers connect their charging stations to the platform and define hourly prices according to location and power output. While the service is not intended to generate large revenue for peer-providers, it reduces the total cost of ownership of their already existing and individually bought charging stations. Furthermore, we identified a strong solidarity within EV-drivers and societal aspects to positive influence peers to become providers (Matzner, Chasin, Todenhöfer, et al., 2015). Peer-customers register at the service and then use the Web platform to search for and possibly reserve charging stations nearby. Additional filters for distance, price, charge rates [kW/h], plug types, green power, and customer ratings may also be applied to the search process. Peer-customers authenticate themselves at the charging station by means of RFID cards, text messages or the Web front-end. Charging sessions are recorded and fed back to the platform, so both providers and customers can have dashboards that transparently reflect their service usage (charging sessions, total energy transferred, current balance, invoices) and to facilitate an automated billing process that settles balances monthly.

Figure 18.2 depicts the implemented solution design of the prototypical CrowdStrom platform. We leverage state-of-the-art open-source technologies (e.g. *Angu-*

Figure 18.2: CrowdStrom Platform Components and Service Architecture

larJS, Materialize) for the responsive web front-end and the server back-end (e.g. *Java EE, MySQL*). The charging station controller handles communication between charging stations and the platform, using the de facto standard *OCPP* (OCPP Steering Group, 2012). We rely on third-party providers for geocoding, cartographic material, and SMS handling. A central security service manages user authentication and authorization based on privileges and roles. Depending on the user's role, a range of functions and services is offered.

18.4 Evaluation and Outlook

Venable et al. (2016) define four evaluation strategies for DSR projects, from which we selected the *Human Risk & Effectiveness* strategy, as it focusses on socio-technical aspects of the service and on its real-world application. In earlier design cycles, we iteratively improved CrowdStrom's business model, processes, and service delivery mechanisms by conducting artificial formative evaluations in form of expert interviews, simulated experiments, and workshops with domain experts and technicians from our partnering local utility. For the final evaluation, we will conduct a naturalistic summative evaluation (Venable et al., 2016) in which we rigorously evaluate the validity and effectiveness of the prototype and its underlying design to ensure their utility in the real-world environment they were designed for. We will conduct two field tests for which we invite potential users to become peer-providers or peer-customers to gain insights regarding both roles.

For the first field test, we provide participants with a charging station to set up at their premises and connect to CrowdStrom in order to experience being a peer-provider for one day. During the course of the test, project members will mimic

customers and perform charging sessions. Afterwards, we conduct semi-structured interviews with the participants to understand their experiences regarding the setup process, functionalities of the prototype, financial prospects, and interaction with test customers.

For the second field test, we scheduled 30 participants to perform a one-hour long test drive in an EV that entails comprehensive use of the CrowdStrom platform, i.e., search for a charging station, reserve it, visit it, and conduct a charging session. To assess the perceived ease-of-use of the solution, participants will answer semi-structured interviews. In addition, their interaction with the prototype will be screen-captured and monitored. Since both field tests will be very resource intensive (fleet of EVs, charging stations, personnel) the number of participants, especially on the provider side, will be rather small. Nevertheless, by closely monitoring and surveying the participants, we are sure to receive fruitful evaluation results that will help to improve CrowdStrom, reduce uncertainties about social and use issues, validate the ability of the design to solve the initially identified problems, and inform the launch of the platform.

Acknowledgments

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[56] Homepage *CrowdStrom*: `www.crowdstrom.de`

19 Customer Participation in Virtual Communities for Local High Streets

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Customer Participation in Virtual Communities for Local High Streets

Abstract. Customers increasingly substitute personal interaction that formerly took high streets with digital participation in retail-related virtual communities (VC) and social shopping sites. This work investigates the potential adoption of a VC to the high street to strengthen its competitive position. We assess customers' motives for participating in such a VC and its effect on customers' intention to visit the high street. We field an online survey with 402 participants that builds upon uses and gratifications theory. Our results suggest that receiving and sharing information are the most influential drivers of high street VC participation, which, in turn, leads to favorable behavioral responses.

19.1 Introduction

For centuries, customers came together on high streets to find, buy, discuss, and enjoy products and services with like-minded peers (Tauber, 1972). These high streets are agglomerations of retail, business, and cultural activity and comprise the focal shopping district of a town or city, often in the forms of a historic city center, market place or downtown area (Niemeier et al., 2013). Since the turn of the millennium, retail has gradually transformed to focus on digital offerings that are unbound from high streets (Hänninen et al., 2019).

In particular, social commerce offerings and retail-related virtual communities (VCs) (Hajli et al., 2015; Zhang and Benyoucef, 2016) have become increasingly popular means by which to explore products and interact with other customers (Cheung et al., 2015). Social commerce manifests in different forms, such as group-buying, peer-to-peer sales, social shopping communities, and shopping through social networking sites (Zhang and Benyoucef, 2016). All forms encompass "exchange-related ac-

tivities that occur in, or are influenced by, an individual's social network in computer-mediated social environments, where activities correspond to the need recognition, pre-purchase, purchase, and post-purchase stages of a focal exchange" (Yadav et al., 2013, p. 312). These VCs are powered by digital platforms, where groups of like-minded peers come together to "interact around a shared interest" (C. E. Porter, 2006), such as fashion or bargains. Social mechanisms like posting, voting, and commenting encourage members to exchange their opinions, advise each other, and learn about new products (Olbrich and Holsing, 2011). A popular kind of VC is the "deal community" in which customers post about special offers, bargains, and price glitches that they have spotted in e-commerce (Bergmeier et al., 2016). Deal communities share traits with traditional word-of-mouth marketing that reaches potentially large audiences (Bergmeier et al., 2016). For example, *Pepper Media*, who runs eleven deal communities worldwide, reports 500 million page views and 67,500 deals created per month in 2018 (Pepper.com, 2018).

Marketing and information systems research on social commerce and virtual retail communities, inter alia, assessed their marketing potentials (Yadav et al., 2013), consumer purchasing behavior (Olbrich and Holsing, 2011; Pappas, 2018; Zhang and Benyoucef, 2016), consumer-to-brand interaction (Azar et al., 2016), consumer-to-consumer interaction and word of mouth (Mikalef et al., 2017; Cheung et al., 2015; Mikalef et al., 2013), and motives for initial adoption (Akman and Mishra, 2017; Ifinedo, 2016) and continuous use (Hajli et al., 2015). However, these works always assume social commerce offerings as being location-independent. As such, these platforms tend to benefit e-commerce and omnichannel retailers (von Briel, 2018). At the same time, many city centers face declining numbers of visitors (Becker et al., 2019). This trend is particularly hard on the independent small and medium-sized enterprise (SME) retail stores that often remain invisible in the digital realm (Bollweg et al., 2018).

In this context, recent literature suggests that local SMEs businesses cooperate in the digital transformation in order to maintain the social and economic relevance of the high street (V. Kumar et al., 2017; Becker et al., 2019). They suggest using digital platforms and VCs as a means by which to meet customers' digital demands (Hänninen et al., 2018). Research on virtual but local shopping communities is sparse, except for Bartelheimer et al. (2018), who present an information systems design theory and an exemplary design for a "community platform" for high streets. The platform meant to network local businesses with local customers digitally. Although the label

"community" suggests social interaction, their platform lacks the mechanisms for user-generated content that VCs have, such as creating posts and commenting on them. Further, they do not investigate whether individual customers would take part in such a VC.

Against this backdrop, we now transfer the concepts of user-generated content and social interaction to the high street and investigate the prospects of a local VC. Hence, the goal of the present work is to assess *customers' motives to participate in virtual communities for local high street retail*. We also assess the relationship between participation in a local VC and customers' behavioral intentions to visit and re-visit the SME shops in the high street. To reach these objectives, we built upon previous work by Bartelheimer et al. (2018), Betzing (2018), and Betzing, Bartelheimer, et al. (2019) and designed a VC application for local high streets in the form of mockups. We fielded an online survey with 402 participants to assess customer participation in that VC service through the lens of uses and gratifications theory (UGT) (West and Turner, 2017). We adapt previously validated UGT constructs to the novel high street setting to reveal customers' perceptions of and motives to participate in VCs for local high streets. From a theoretical point of view, this study contributes novel insights into customer participation in VCs. Practitioners can build on the presented design and the study's insights to implement local VCs for their shopping districts that can contribute to strengthening the competitive position of local retail SMEs.

The remainder of this paper is structured as follows: Section 19.2 establishes the research background, derives hypotheses, and proposes the research model for this study. Section 19.3 details the study setting, measures, and data collection. Section 19.4 presents the resulting measurement model and structural model, whereas Section 19.5 discusses theoretical contributions, managerial implications, limitations, and future research directions. We conclude in Section 19.6.

19.2 Research Background and Hypotheses

19.2.1 Virtual Communities in Retail

VCs are "aggregation[s] of individuals or business partners who interact around a shared interest, where interaction is at least partially supported and/or mediated

by technology and guided by some protocols or norms" (C. E. Porter, 2006). As a form of a digital platform, VCs facilitate information-sharing on topics of mutual interest between members using "strong social relationships [...], community-specific organizational structure, a shared history, community rituals, continuity of communication, and a common on-line meeting space" (Stanoevska-Slabeva, 2002, p.71). Brand communities (Muniz and O'Guinn, 2001), social shopping communities (Cheung et al., 2015), group-buying communities (Lim, 2014), and deal communities (Bergmeier et al., 2016) are retail-related VCs (Peters and Bodkin, 2018), which also are a subset of social commerce. They all break down the geographical boundaries of brick and mortar retail and are location-independent (Teller, 2008; Flavián and Guinalíu, 2005). From the customers' perspective, VCs have figured out how to provide many of the benefits that once only traditional high street marketplaces provided (Tauber, 1972): Customers share information, engage in social interaction, support each other in product searches and buying decisions, and communicate with businesses and brands (Cheung et al., 2015). In effect, the utilitarian and hedonic shopping functions that were provided by brick and mortar retail in the last century are now provided digitally (Babin et al., 1994; Arnold and Reynolds, 2003). This development has had particularly strong effects on SME high street retailers, which are often owner-operated, independent stores with no large retail corporation in the background (Bollweg et al., 2018). These actors make up the majority of tenants in many city centers but rarely have the time, knowledge, or financial means to partake actively in VCs (Bartelheimer et al., 2018). Additionally, local businesses without an online shop are irrelevant for the geographically dispersed members of VCs. In consequence, local retailers miss the significant economic benefits that VCs can have as an additional digital channel on which to advertise and sell products (Olbrich and Holsing, 2011).

However, we maintain that the advantages of VCs could be exploited in the scope of local high streets. Recent IS research explains the merits of local platforms that digitally complement physical retail settings at the level of whole high streets or city centers (e.g., Hänninen et al., 2019; Betzing, Bartelheimer, et al., 2019; Betzing, 2018; Bartelheimer et al., 2018). We also see local platforms emerging that act as information media or mutual online shops, but the lack means for social interaction and user-generated content (Bärsch et al., 2019; Bollweg et al., 2018). These platforms could provide the technological and organizational foundation for a VC. Nevertheless, the idea of VCs for local high streets remains purely academic. Putting local

VCs into geographical boundaries could diminish the number of potential users to such an extent that no critical mass for a vibrant community would come together (Evans and Schmalensee, 2010). However, VCs hold the prospect of relieving local retailers from having to create digital marketing content themselves. From the retailers' point of view, VC members provide digital word-of-mouth (Nisar et al., 2019). Customers can help each other to find the "hidden gems" on their high street and also learn about bargains and relevant offers that are just around the corner. Improving digital marketing and having social commerce on the level of the high street might benefit both the individual SME and the high street as a whole. Nevertheless, it remains open whether customers would be interested in such a local VC and — if so — what would motivate them to participate in it.

19.2.2 Participation in Virtual Communities

A VC can be understood as a medium that supports its users in fulfilling particular goals. We draw from UGT to investigate the motives for participation in media (Flanagin and Metzger, 2001; McQuail, 1987). UGT focuses on the goal-driven individual, who has psychological needs and consequently selects from a set of competing media resources an appropriate medium that gratifies one's goals (Mikalef et al., 2017; West and Turner, 2017). The VC competes with other media resources, such as print, online shops, and interpersonal communication, to satisfy the users' needs (Cheung et al., 2015). In the context of this study, these needs can be, for example, information search and decision support regarding shopping. UGT has previously been applied to explore customers' motives for using the Internet (Stafford et al., 2004), and for using social media (Park et al., 2009). Central motives can be cognitive (i.e., rational decision making) or affective (i.e., emotions) (Pappas et al., 2016; Krishnamurthy and Dou, 2008) and relate to information seeking, social interaction, self-expression, and entertainment (Shao, 2009; Park et al., 2009).

Dholakia et al. (2004) were the first to apply UGT to VCs. They constructed five gratifications that individuals may pursue in participating in a VC and thereby choosing the VC over other media forms. They found that the use of a VC can relate to a *purposive value (PV), self-discovery (SD), maintaining interpersonal interconnectivity (MII), social enhancement (SE), and an entertainment value (EV)*. Table 19.1 provides definitions for all constructs, and the subsequent section will hypothesize their applicability for local VCs.

Table 19.1: Construct Definitions

Construct	Definition	References
Purposive Value	The utilitarian and informational value gained from fulfilling an instrumental purpose through virtual community participation.	(Cheung et al., 2015; De Vries and Carlson, 2014; Cheung et al., 2011; Shao, 2009; To et al., 2007; Dholakia et al., 2004; Stafford et al., 2004)
Self-Discovery	"Working on one's own identity and reflecting on one's own personality" (Trepte, 2005, p. 170) through virtual community participation.	(Ifinedo, 2016; Pai and Arnott, 2013; Dholakia et al., 2004)
Maintaining Interpersonal Interconnectivity	The social value gained from interacting and communicating with other members in the virtual community.	(De Vries and Carlson, 2014; Shin, 2013; Shao, 2009; To et al., 2007; Dholakia et al., 2004)
Social Enhancement	"The value that a participant derives from gaining acceptance and approval of other members, and the enhancement of one's social status within the community on account of one's contributions to it." (Dholakia et al., 2004, p. 244)	(Mikalef et al., 2017; Wang et al., 2016; De Vries and Carlson, 2014; X. Zheng et al., 2013; Alexandrov et al., 2013; Cheung et al., 2011; Shao, 2009)
Entertainment Value	"The fun and enjoyment an individual derives from interacting with others" (Ifinedo, 2016, p. 195) through virtual community participation.	(Akman and Mishra, 2017; Mikalef et al., 2013; Pai and Arnott, 2013; Shao, 2009; Stafford et al., 2004; Dholakia et al., 2004)
Participation	The users' behavioral intention to adopt the virtual community and engage with other users.	(Akman and Mishra, 2017; Mikalef et al., 2017; Zhang and Benyoucef, 2016; Hajli et al., 2015)
Visit Intention	The users' behavioral intention to patronize retailers on the high street.	(Badrinarayanan and Becerra, 2018; Cheung and Lee, 2009; Baker et al., 2002)

Since Dholakia et al.'s (2004) seminal work, their constructs have been widely adopted to study user participation in social networking sites (e.g., Ifinedo, 2016; Pai and Arnott, 2013; Cheung et al., 2011) and VCs (e.g., Hajli et al., 2015; Cheung and Lee, 2009; H. Kim et al., 2008). However, as Peters and Bodkin (2018) show, VC research primarily focuses on communities that revolve around a focal brand or retail chain and not on local digital communities. Given their methodological rigor and widespread adoption of the constructs, we apply Dholakia et al.'s (2004) constructs to the high street retail setting, in which many individual businesses are featured in the same VC. Such a local VC is a network-based "specialized, ~~geographically dispersed~~ community based on a structured, relatively sparse, and dynamic network of relationships among participants sharing a common focus" (Dholakia et al., 2004, p.248, emphasis added). Our setting is unique for three reasons: The community is not just *virtual* but fosters real-world interactions between customers and local businesses, the VC is not geographically dispersed but is limited to a geographical region, and this real-world anchoring allows the VC to become a location-based service interfaced through mobile devices during the customer journey.

19.2.3 Research Model and Hypotheses

The Internet has served an instrumental purpose since its inception, and informative value has been a major gratification for Internet use (Stafford et al., 2004). Consequently, the exchange of information is a central theme in VC research (Cheung et al., 2015; Shao, 2009; H. Kim et al., 2008; Dholakia et al., 2004). Members participate in VCs to learn, solve problems, generate new ideas, and make informed decisions based on the wisdom of the community (De Vries and Carlson, 2014; Cheung et al., 2011). The literature found an informative value of online deal communities that focus on e-commerce (Bergmeier et al., 2016). It also highlighted that members of these VCs are supporting each other reciprocally and are willing to share information with others (Libai et al., 2010). The primary value proposition of a VC for local deals is information exchange. It provides the organizational and technological basis for local customers to create deals and learn about worthwhile buys in the vicinity. The available information on the VC can comprise a utilitarian value (De Vries and Carlson, 2014) when users have efficiency gains in their product search and alternatives evaluation phases of the customer journey (To et al., 2007; Blackwell et al., 2005). Moreover, community members do not have to rely on firm-generated advertising but can exchange deal-related information directly with each other. This type of user-generated information is perceived as more credible than firm-generated marketing communications (Cheung et al., 2014; Krishnamurthy and Dou, 2008). In short, we expect the utilitarian and informational value of such a local deal VC to be a central motive for choosing this medium over other forms of information on the high street. Hence, we present the following hypothesis:

H1: *Purposive value has a positive influence on participation in VC for local high streets.*

Social interaction helps people in forming their individual preferences and values (McKenna and Bargh, 1999; Ifinedo, 2016). A local VC presents deals belonging to various product categories, and thus, gives a cross-section on what the high street has to offer. Customers can draw inspiration from these posts and discover new trends (Mikalef et al., 2013; To et al., 2007). Also, they can gain useful thoughts from the discussion with other community members (Pai and Arnott, 2013). Consequently, VC participation may help to discover one's traits (McKenna and Bargh, 1999). Following Dholakia et al. (2004), we expect VC participation to have a self-referential component (Trepte, 2005), where the VC can aid users in reflecting on their preferences. Therefore:

H2: *Self-discovery has a positive influence on participation in VCs for local high streets.*

Vice versa, the VC is an outlet for customers that need to communicate and voice their opinion (X. Zheng et al., 2013; Shao, 2009). VCs and social commerce offerings provide opportunities to exchange and socialize with groups of like-minded individuals (Mikalef et al., 2017; De Vries and Carlson, 2014), and allow to make new friends (Shu and Chuang, 2011; Cheung and Lee, 2009).

Personal interactions in a local VC may share traits with the interactions taking place in the physical retail store (To et al., 2007). The act of shopping is a popular leisure activity that often is conducted together with friends that provide social support and gratification (Shao, 2009; Dholakia et al., 2004). Acquaintances and other shoppers in the store can influence one's behavior directly and indirectly. For example, friends may give their direct feedback and recommendations to a picked-up product. Furthermore, the behavior of other customers (e.g., selecting particular products) can influence one's product selection. We suggest that members of a local VC can influence each other in the same vein, both directly through suggestions, and indirectly through the public discussion of deals. Digital socializing is known to influence customers' purchase behavior (Mikalef et al., 2017; Mikalef et al., 2013), and we expect that the need for socializing and interpersonal interconnectivity drives users' participation behavior (Dholakia et al., 2004). Furthermore, since the VC under consideration connects nearby customers, we imagine that some users seek to make new friends digitally with whom to meet in the physical world subsequently. We hypothesize as follows:

H3: *Maintaining interpersonal interconnectivity has a positive influence on participation in VCs for local high streets.*

Besides the gratification from the social exchange, the VC may give its users a feeling of social belonging and yield a relational value (Alexandrov et al., 2013). Research has shown that VC members share social norms and tend to project the community's attributes onto themselves (Kang et al., 2014). Consequently, users might seek to enhance their social identity by becoming part of the community and gain acceptance from other members (Dholakia et al., 2004). Further, the perceived enhancement of one's social status through content creation may result from one of two underlying needs (Alexandrov et al., 2013). On the one hand, users post content and help other members out of altruism (Wang et al., 2016). They have the intrinsic motivation to share their experiences with others to support their product search and decision-making activities (Mikalef et al., 2017). On the other hand, some users

want to satisfy their needs for self-affirmation and appreciation (Azar et al., 2016) by becoming opinion leaders (X. Zheng et al., 2013). We expect that these behaviors also apply to a local VC. We expect that users participate to receive gratification from other community members, and thus, hypothesize:

H4: *Social enhancement has a positive influence on participation in VCs for local high streets.*

VC and social commerce research have identified hedonic gratifications from using these media forms (Mikalef et al., 2013). Hedonically motivated users may turn to VCs to gain a feeling of enjoyment and entertainment (Akman and Mishra, 2017) or to "kill time" (Cheung et al., 2011; Azar et al., 2016). VC participation has also been associated with enthusiasm for a shared interest or hobby, making VC use a relaxing pastime (Ifinedo, 2016; McKenna and Bargh, 1999). Traditionally, the customer journey is understood to have a hedonic component (Lemon and Verhoef, 2016). In effect, some customers draw more value from the shopping process than from the purchased product and its use (Akman and Mishra, 2017; Mikalef et al., 2013). We expect that customers seek entertainment during the shopping process and use the VC as a medium to gratify this need. We suggest the following hypothesis:

H5: *Entertainment value has a positive influence on participation in VCs for local high streets.*

Community participation yields economic value for the local high street only if it triggers behavioral responses. While digital word-of-mouth is known to affect e-commerce revenue (Bergmeier et al., 2016; Libai et al., 2010), the digital VC has to trigger *physical* responses in the real world. While the threshold for visiting the high street can be higher than it is for accessing an online shop, a local VC can generate awareness of what the high street has to offer and help potential customers discover new businesses and re-discover known ones. In effect, VC participation may change users' shopping habits and customer journeys (Bartelheimer et al., 2018; Berendes et al., 2018). As a result, users may visit more businesses in a high street visit, which prolongs the customer journey and may increase spending in the high street, strengthening the local economy. We expect users' behavioral intentions to visit the high street and its local businesses to be positively influenced by VC participation.

H6: *Participation in VCs for local high street has a positive influence on customers' behavioral intention to visit businesses in the high street.*

Lastly, demographics such as age and gender may influence users' intentions to participate in a local VC. It can be suspected that a local VC, which is interfaced through smartphones, particularly appeals to a younger audience. In support, the literature shows that age can have a negative effect on the adoption of digital service in retail due to technology anxiety (Dean, 2008; Meuter et al., 2003). Furthermore, the literature shows that female users have higher gratification from supporting peers through writing reviews than men have (Yoo and Gretzel, 2008). Women also are more likely to engaging in social practices (Lin and Lu, 2011), and thus may have a stronger interest in participating in local VCs. Consequently, we test whether age and gender have moderating influences on any hypothesis.

In short, Figure 19.1 provides our research model. The five motives by Dholakia et al. (2004) (gratifications) influence community participation (use), which itself affects users' behavioral intention to visit the high street's businesses.

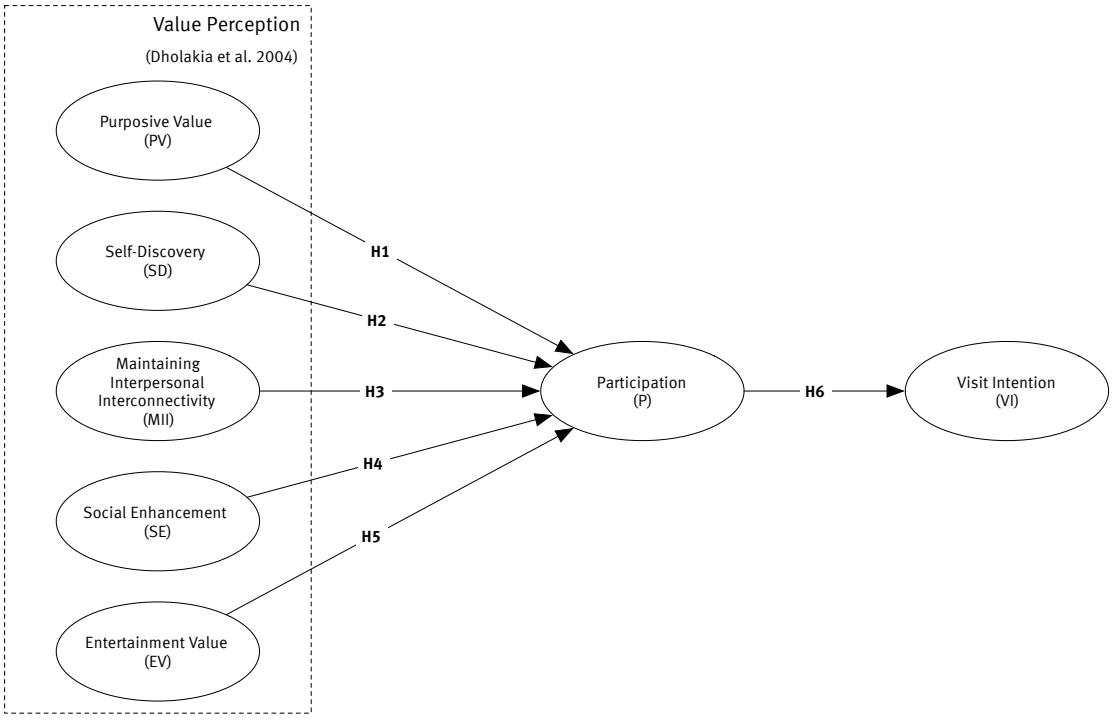


Figure 19.1: Research Model

19.3 Research Method

19.3.1 Virtual Community Setting

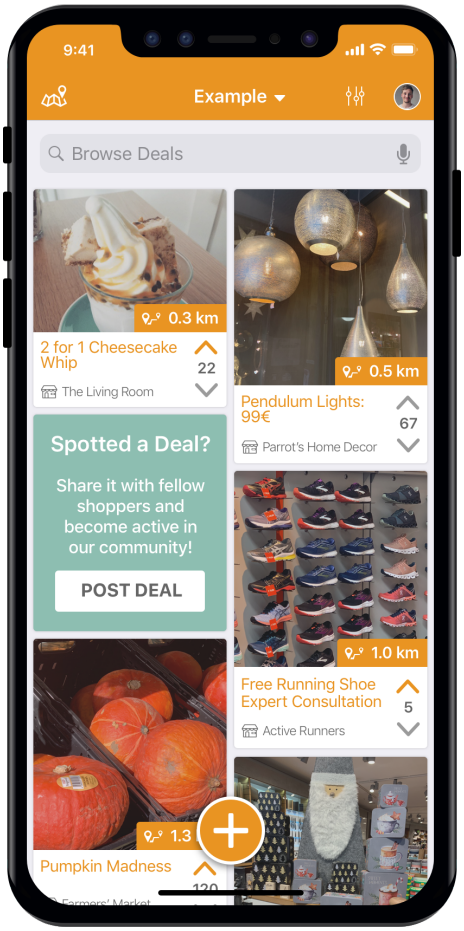
We conducted an online survey to assess customer participation in VCs for local high street retail. As the survey material, we designed a fictitious VC service that manifests as a mobile app. We created mockups, which were framed in a virtual phone border (Figure 19.2). The design builds upon Bartelheimer et al.'s (2018) work, which presents a mobile platform for local high streets. In contrast to their work, our service only includes customer-to-customer communication, which means that it does not feature firm-generated information by retailers but only deals that are created by customers. A platform operator makes the community available for a specific geographical area so that local users can generate content and socialize. The mockup design is also informed by the five motives for participation (Dholakia et al., 2004), so we included functional (PV, SD), interactive/social (MII, SE), and entertainment (EV) aspects in the design. Overall, the study design fosters ecological validity by resembling both a real-world use case and a realistic user interface that follows the human interface guidelines for Apple iOS[57].

Participants first received a brief introduction to the study and the high street setting. Then, they saw the mockups as depicted in Figure 19.2, received brief explanations to what they could do with the app, and were asked to imagine using it.

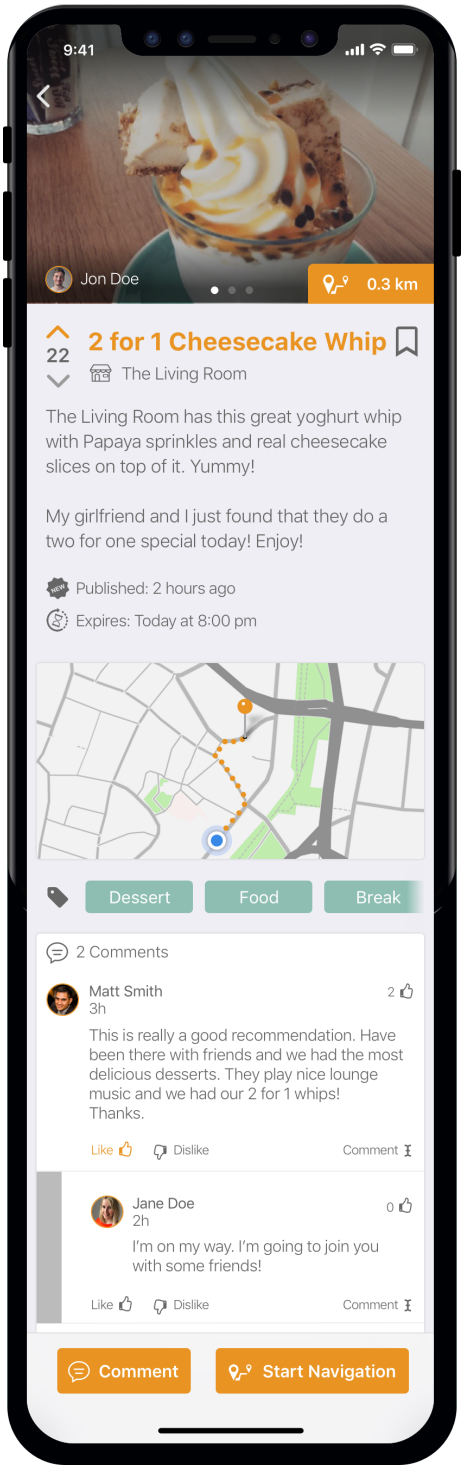
The VC has a central feed (Figure 19.2a) that displays offers and deals offered in the user's vicinity. Search and filter interfaces ease browsing, whereas buttons to vote and to add content allow users to engage in deal creation. The upper right buttons lead to further interfaces to create, search, and follow specific keywords as well as the own member profile page[58]. The deal-detail view (Figure 19.2b) shows information on the offer and its creator and allows the user to vote, comment, and navigate to the business. We based the overall range and depth of functions loosely on two market-leading deal communities from Western Europe.

[57] `https://developer.apple.com/design/human-interface-guidelines` for Apple iOS 12, last accessed 16th October, 2019.

[58] While we showed additional mockups to the participants, we omit them here for the sake of brevity.



(a) Main Feed



(b) Deal Detail View

Figure 19.2: Mobile User Interfaces to the Virtual High Street Community

19.3.2 Measures and Questionnaire

After being introduced to the virtual high street community, participants answered a questionnaire (see Table 19.5 in the Appendix), which we pretested with twenty participants. Since our study builds on Dholakia et al.'s (2004) model, we adopted the latent variables PV, SD, MII, SE, and EV from their model but modified item SD2 to fit the study's context. Informed by other studies that measure users' behavioral intention (Akman and Mishra, 2017; Badrinarayanan and Becerra, 2018; Cheung and Lee, 2009; Baker et al., 2002), we included constructs to capture the users' intentions to adopt the VC and engage with other users (P), and to patronize the high street (VI). The constructs were developed and validated in a comprehensive pre-test. All indicators use 5-point Likert scales. At the end of the questionnaire, participants gave personal and demographic information and received a short debriefing.

19.3.3 Sample and Data Collection

The minimum number of required responses — ninety — is estimated by calculating ten times the maximum numbers of indicators per variable (here: PV) (Chin, 1998). We also consulted Soper's (2019) a-priori sample-size calculator. For an anticipated medium effect size, a statistical power of 0.95, and an α-level of 0.05, the recommended minimum sample size is 247. Under the assumption that the respondents have diverse opinions about VCs for local high streets, we sought to acquire a larger sample.

We recruited participants on January 9-11, 2019, from the online subject pool of Oxford University spin-off *Prolific Academic* (Palan and Schitter, 2018). Their platform allows researchers to pre-screen for appropriate participants and also attempts to balance participants evenly with regard to age and gender. Previous studies highlight the appropriateness of online recruiting platforms with regard to random-sample populations who behave similar to participants in traditional laboratory experiments (Berinsky et al., 2012; Mason and Suri, 2012). We limited the scope of eligible participants to regular users of Apple devices to prevent unfamiliarity effects with the mockups, which are designed to mimic the look and feel of Apple's mobile operating system, iOS. Given that high streets and the underlying phenomenon of their declining importance exists in both North America and Europe (Townsend et al., 2017), we limited the eligible participants to be residents of the Western World.

Thereby, we account for different regional perceptions of high streets and brick and mortar.

Participants received a compensation of £1 for participation. In total, 437 participants took part in the survey. After filtering out incomplete data records and records from inattentive users who did not pass an attention-check question (Oppenheimer et al., 2009), a final sample of 402 responses remained.

Table 19.2: Respondent Demographics

Gender		Age		Country of Residence			
Female	198 (49.25%)	<= 20	58 (14.42%)	Austria	6	Poland	16
Male	203 (50.50%)	21-29	172 (42.79%)	Denmark	2	Portugal	31
Other	1 (0.25%)	30-39	103 (25.62%)	Finland	3	Spain	12
		40-49	41 (10.20%)	France	3	Sweden	5
		50-59	18 (4.48%)	Germany	8	Switzerland	2
		>= 60	10 (2.49%)	Ireland	3	United Kingdom	237
				Italy	18	United States	56

Table 19.2 provides the demographics of the sample. Most participants are between 21–29 years old, and genders were evenly represented. The average completion time for the survey was 5 minutes and 34 seconds. About 85% of respondents are frequent or very frequent social media users (never: 2, rarely: 20, occasionally: 40, frequently: 130, very frequently: 210), and nearly half of the respondents visit their high street once (84) or less than once a month (106). In contrast, 72 respondents frequent the high street every week, and 81 (59) respondents at least two (three) times a month.

19.3.4 Common Method Variance

Since data on the exogenous and endogenous variables are collected from a single source (Podsakoff and Organ, 1986), common method variance (CMV) could affect the results (Fuller et al., 2016). This bias was controlled ex-ante by pre-testing the survey for comprehensibility and unbiased wording, using different scale formats (5-point Likert scale and drop-down scale), and by reminding participants to give their honest opinion (Podsakoff et al., 2003). We included a theoretically unrelated item on the relevance of cash money in the survey, which allowed us to apply Lindell and Whitney's (2001) marker variable test ex-post.

As shown in Table 19.3, the correlations between the latent variables in the model and the marker variable are lower than the threshold of 0.3 (Lindell and Whitney, 2001). In addition, the maximum shared variance with the marker variable is low at 4 percent ($corr(PV, marker) = 0.2$), and none of the other correlations approaches the 0.9 threshold (Pavlou et al., 2007). Moreover, Harman's single-factor test revealed that the first factor accounts for only 25.267 percent of the variance (Podsakoff et al., 2003). Consequently, we have no evidence of CMV.

19.4 Results

19.4.1 Measurement Model

We assessed the measurement model for reliability and validity (Hair et al., 2016). Table 19.3 provides the Cronbach's alpha (α), composite reliability (CR), and the average variance extracted (AVE).

Table 19.3: Psychometric Properties

	Cronbach's Alpha	Composite Reliability	AVE	PV	SD	MII	SE	EV	P	VI
PV (old)	0.680	0.758	0.275	0.524						
PV (new)	0.684	0.827	0.619	0.787						
SD	0.299	0.740	0.588	0.371	0.767					
MII	0.573	0.824	0.700	0.379	0.476	0.837				
SE	0.815	0.915	0.843	0.418	0.325	0.353	0.918			
EV	0.765	0.850	0.588	0.286	0.361	0.402	0.359	0.767		
P	0.773	0.854	0.596	0.393	0.360	0.355	0.306	0.231	0.772	
VI	0.770	0.855	0.599	-0.043	0.163	0.200	0.066	0.187	0.037	0.774
Marker	—	—	—	0.200	0.167	0.181	0.107	0.109	0.065	-0.045
				Square-root AVE (on diagonal) and correlation coefficients						

Except for PV (old), all constructs pass the validity and reliability tests. SD and MII have α-values below the threshold of 0.7 (Nunnally, 1978). However, Cronbach's α can underestimate the reliability for small numbers of items (Revelle and Zinbarg, 2009). It has been previously criticized for having limited accuracy for two-item scales (Eisinga et al., 2013), which both constructs under consideration use. By assessing the other indicators, we find that both constructs indicate CR scores greater than the lower bound of 0.7 (Hair et al., 2016) and AVE scores greater than the lower bound of 0.5 (Fornell and Larcker, 1981).Therefore, the lower α is unlikely to point out issues related to internal consistency.

We assessed discriminant validity using the Fornell-Larcker criterion, which suggests that the square root of the AVE of each construct should be larger than its highest correlation with any other construct in the model (Fornell and Larcker, 1981). The criterion is fulfilled for all constructs except PV (old). PV7 also displayed poor cross loading. Finally, we assessed the standardized factor loadings for all measurement items (see Table 19.5). Following Hair et al. (2016), every latent variable should explain at least 50 percent of the variance of its indicators (i.e., a threshold of 0.708). Indicators PV1, PV2, PV5, PV6, PV7, PV8, PV9, EV4, P3, and VI4 have bad loadings. Removing the last three indicators from the model does not increase the respective CR values, and their constructs' AVE values are already within the valid range, so they remained in the model. In conclusion, the construct *purposive value* (PV old) is invalid for this study (although it was valid in Dholakia et al.'s (2004) study). After eliminating PV1, PV2, PV3, PV6, PV7, PV8, and PV9 from the measurement model (see PV (new) in Table 19.3), the measurement model is appropriate with regard to reliability, convergent validity, and discriminant validity.

19.4.2 Structural Model

We ran SmartPLS version 3.2.8 to evaluate the Structural Equation Modeling (SEM) using the Partial Least Squares (PLS) algorithm. Bootstrapping with 5,000 re-samples yielded the path coefficients β, their p values, the effect sizes f^2, the predictive relevance Q^2, and the coefficients of determination R^2 (Ringle et al., 2015). We also calculated the variance inflation factor (VIF) for all paths and found no indication of multicollinearity because all VIF values are below the threshold of 5 (Hair et al., 2016). Statistical results are given in Table 19.4 and Figure 19.3.

Table 19.4: Hypotheses Testing and Structural Model Results

Hyp.	Path	β	t-Statistic	f^2	q^2	VIF	Outcome
H1	PV ⇒ P	0.376***	7.465	0.185^{oo}	0.082^{oo}	1.240	**Supported**
H2	SD ⇒ P	0.192***	3.759	0.040^{o}	0.016	1.476	**Supported**
H3	MII ⇒ P	0.124*	2.491	0.017	0.005	1.514	**Supported**
H4	SE ⇒ P	-0.032	0.719	0.001	-0.001	1.249	Not supported
H5	EV ⇒ P	0.167***	3.482	0.033^{o}	0.014	1.352	**Supported**
H6	P ⇒ VI	0.633***	15.711	0.668^{ooo}	—	1.000	**Supported**

β = path coefficient; f^2 = effect size; q^2 = predictive relevance; VIF = variance inflation factor; ***: $p \leq 0.001$;
**: $p \leq 0.01$; *: $p \leq 0.05$; ^{o}: $0.02 \leq f^2/q^2 < 0.15$ (small); ^{oo}: $0.15 \leq f^2/q^2 < 0.35$ (moderate); ^{ooo}: $f^2/q^2 \geq 0.35$ (large)

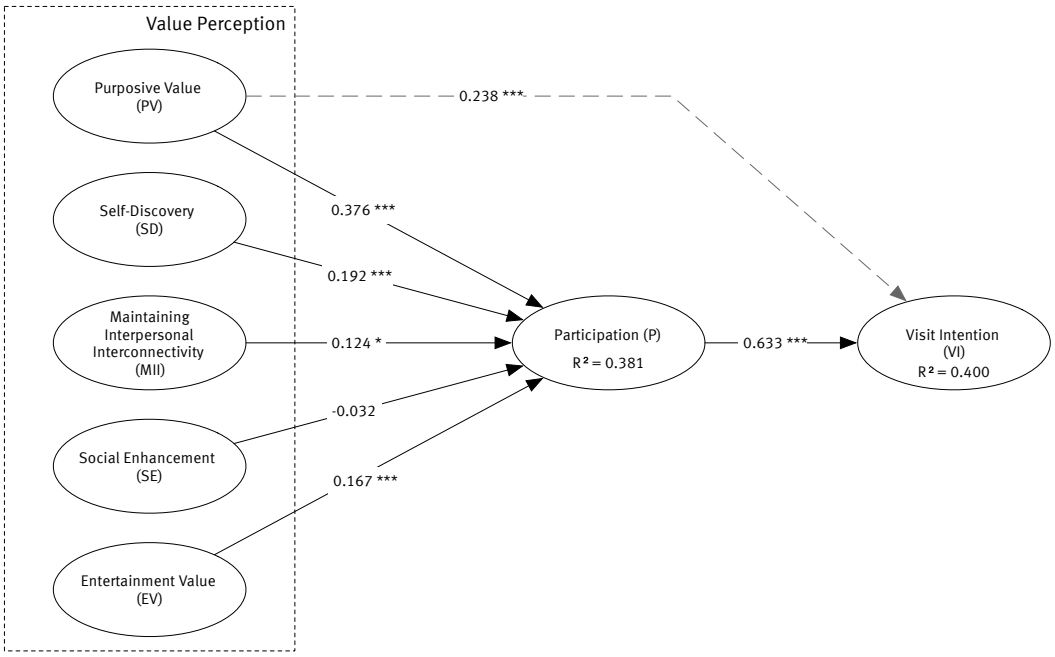


Figure 19.3: Results Model

The coefficient of determination measures the model's predictive power. The model has moderate explanatory power, as it accounts for 38.1 percent of the variance in users' participation in VCs in local high streets, and 40 percent of the variance in visiting shops on the high street. Stone-Geisser's Q^2 confirms the model's ability to predict the endogenous variables (P: $Q^2 = 0.208$; VI: $Q^2 = 0.224$) (Stone, 1974; Geisser, 1974).

Hypothesis 1 proposes that PV has a positive influence on participating in VCs for local high street retail. Table 19.4 shows that H1 is supported ($\beta = 0.376; p \leq 0.001$) with a medium effect size ($f^2 = 0.185$) and small predictive relevance ($q^2 = 0.082$) (Cohen, 1988). SD has a significant influence on VC participation (H2: $\beta = 0.192; p \leq 0.001$) with a small effect size ($f^2 = 0.040$). MII has a significant influence on participation (H3: $\beta = 0.124; p \leq 0.05$), but the construct shows neither a significant effect size nor predictive relevance. SE has no significant influence on VC participation ($\beta = -0.032; p = 0.480$). Therefore, H4 is not supported. However, H5 is supported, as EV has a significant influence on participation ($\beta = 0.167; p \leq 0.001$), with a small effect size ($f^2 = 0.033$). H6, which states that community participation has a positive effect on customers' behavioral intentions to visit shops in the high street, is supported ($\beta = 0.633; p \leq 0.01$), with a large effect size ($f^2 = 0.668$). Besides the direct effects of exogenous variables on the endogenous variables, PV has an indirect effect

on behavioral intentions to visit local shops ($\beta = 0.238; p \leq 0.01$). Finally, we found no moderating influences of gender or age group on customers' VC participation and high street patronage intentions.

19.5 Discussion

The goal of this study was to assess individual customers' motivations to participate in virtual deal communities for local high streets, and their behavioral intentions to visit these high streets upon using the VC. Building on the extant research on UGT (West and Turner, 2017; Flanagin and Metzger, 2001) in the context of social networks (Ifinedo, 2016), social commerce sites (Zhang and Benyoucef, 2016), and VCs (Dholakia et al., 2004), we derived hypotheses, executed an online survey, and tested our research model using PLS-SEM. The model presented in Figure 19.3 suggests the relevance of various value perceptions regarding users' decision to participate.

We find that customers have both utilitarian and hedonic motives (Babin et al., 1994). They value cognitive factors such as efficient information retrieval and affective factors such as drawing enjoyment from VC use (Pappas et al., 2016). Similar effects have been reported for social media usage in retail contexts (Mikalef et al., 2013; Lin and Lu, 2011). On the rational level, customers expect to improve the efficiency of their shopping processes through learning from the expertise and opinion of other users in the community before making decisions (PV). This result supports previous research that identifies information retrieval and information sharing as central motives for using network-based VC (Dholakia et al., 2004; Lin and Lu, 2011; H. Kim et al., 2008).

On the emotional level, users expect entertainment value from participating in the VC. Social networking sites are known to be used for bridging waiting time (Ifinedo, 2016; Cheung et al., 2011). We find the same effect for the use of local VCs. In effect, while taking a break during the shopping trip, users pick up their smartphones and interact with the community. This behavior confirms the findings of previous studies on Internet and social network use (Azar et al., 2016; Shu and Chuang, 2011; Ifinedo, 2016).

The prospect of increasing one's social status is a known antecedent to community participation, which allows one to create a favorable self-identity and to exchange with like-minded peers (Azar et al., 2016; Alexandrov et al., 2013). However, we find that users in local deal communities do not seek social enhancement or feelings of importance from the community. Likewise, Dholakia et al. (2004) did not find evidence that social enhancement influences VC participation. Conversely, in the related brand communities, users perceive a social value from associating themselves with a specific brand (Chu and Sung, 2015; Muniz and O'Guinn, 2001). The local deal community does not cater to a specific brand or a single category like fashion but instead to high street shopping in general. Hence, the setting might lack the appeal to function as a social status symbol. However, customers might perceive value from supporting the local SME businesses and the local economy ("doing a good thing"), which in turn, could motivate VC participation. We already find support for altruistic behavior, since respondents report a general willingness to post information to support others. Nevertheless, future studies are needed to illuminate how altruistic and principlistic motives (Cheung and Lee, 2012) drive participation in local VCs.

While our study confirms that bolstering one's ego through social interaction has no statistical relevance to participation in local VCs, the value of relational ties from interacting with others (MII) does. Interactions with acquaintances in virtual environments have a strong influence on customers (Shin, 2013), and also other shoppers in the high street are known to affect customers' decisions (Verhoef et al., 2009). Under the premise that the relevance of the community is geographically limited and that it brings together *local* customers, this sense of belonging in a social environment can be introduced more easily than it can in geographically dispersed VCs that have no real-world anchoring (Dholakia et al., 2004).

The local VC is a tool for customers to apply during their decision processes. As Faulds et al. (2018) show, this process and the act of shopping have transformed from discrete activities to continuous tasks. Because of the ubiquity of mobile devices and shopping opportunities, customers are permanently exposed to information that influences their decision processes. Participating in a local deal community is one influence that supports pre-purchase activities such as need recognition, product search, and alternatives evaluation (Blackwell et al., 2005). In the post-purchase phase, customers can use the VC to exchange with others that have bought the same product or that are planning their purchase.

Central to the customer decision process (a.k.a. the customer journey) is the customer experience construct (Verhoef et al., 2009), which comprises the "evolvement of a person's sensorial, affective, cognitive, relational and behavioral responses to a firm or brand" (Homburg et al., 2017, p. 384) and to high street shopping as a whole (Berendes et al., 2018). Both, cognitive and affective aspects stimulate VC use. We maintain that using a local VC caters to multiple facets of the customer experience construct and provides both hedonic and utilitarian value (Lemon and Verhoef, 2016; Arnold and Reynolds, 2003; Babin et al., 1994). Besides the previously established rational and emotional gratifications from interacting with the VC, redeeming posted offers and visiting the high street can yield positive experiences. For example, price-conscious users can be affected positively by the feeling of getting a bargain. Hedonistically motivated customers who engage in "adventure shopping" can have a positive experience from making serendipitous discoveries (Arnold and Reynolds, 2003). Lastly, the literature shows that value co-created through interacting with others during the customer journey may even be weighted more importantly by some customers than the value inherent to the purchased good (Mikalef et al., 2013), and therefore, can be a substantial gratification for VC use.

Our study contributes to the literature by advancing knowledge about VC participation, and by providing evidence of UGT's applicability to understanding what motivates individual users to participate in a VC in the novel context of local high street retail. In effect, local community participation becomes a function of different goals and their degree of fulfillment. Participation explains 38 percent of the variance, which is comparable to and consistent with previous studies on community adoption (e.g., Ifinedo, 2016; Hajli et al., 2015).

19.5.1 Managerial Implications

A local VC appeals to customers primarily as a medium for receiving and reciprocally sharing information. During their journeys, customers can access recommendations for local deals given by other shoppers in their vicinity. Customers get decision support and discover new interests and businesses that match them. The study suggests that a local VC can impact the physical customer journeys on local high streets (Berendes et al., 2018; Voorhees et al., 2017) in two ways. On the one hand, more than ninety percent of the surveyed customers are motivated to visit the newly discovered shops, which adds diversity to the journey. On the other hand,

about half of the participants report behavioral intentions also to visit known shops more often due to VC use. Consequently, the number of businesses visited, and thus, the duration of the high street visit can be extended by use of the VC. Although the present study did not assess the long-term effects of a VC on customer behavior, a positive marketing impact on local high streets and their businesses is likely.

The VC presented in this study is conceptualized as an additional service to extend existing local retail platforms (Bartelheimer et al., 2018; Bärsch et al., 2019), and smart city platforms (H. Kumar et al., 2018) that lack customer-to-customer communication. We suggest potential platform operators refrain from launching a stand-alone VC for a high street since these platforms rely on direct network effects from users. Only when a critical mass of users is reached does the platform provide value to its users (Evans and Schmalensee, 2010). The literature on multi-sided platforms names various strategies to overcome the initial cold-start problem (i.e., lack of user-generated content results in a lack of users and vice versa) (de Reuver et al., 2018). By adding a VC feature to an existing platform, a potentially large group of users becomes available at launch. Furthermore, the high street retailers could issue special offers for VC members as an initial investment to attract and register users (de Reuver et al., 2018).

The VC's design and mechanisms must cater to fulfilling the cognitive and affective gratifications, which themselves can support both positive customer experiences and the associated goal of ongoing VC participation (Dholakia et al., 2004; Verhoef et al., 2009). Since purposive value has a significant impact on local VC participation, VC designers should give special consideration to supporting users in content creation, information retrieval, and decision-making. Our VC design features search, filter, tagging, voting, and comment mechanisms. The user's current location is used as a contextual parameter for sorting and displaying directions to the businesses. The decision-support literature suggests applying recommender systems to display relevant deals that the user has not previously interacted with (Betzing, Bartelheimer, et al., 2019; Gorgoglione et al., 2016).

From a strategic point of view, high street stakeholders who are thinking of launching a local VC should consider not only direct network effects but also indirect ones. The value created by users' participating in the VC for retailers and the high street depends on the number of users that actively create their content (Katz and Shapiro, 1985; Akar and Mardikyan, 2018). Eighty-three percent of participants would try the

presented VC service and could imagine using the community to gather information. However, they are less committed to creating content themselves. Our analysis of users' behavioral intention to participate suggests a 5:1 ratio of content consumers to content generators. Therefore, extrinsic incentives such as competitions, monetary rewards, and material rewards might be instrumented to convert information consumers to content generators (Garnefeld et al., 2012). Kraut and Resnick (2012) provide design advice on how to encourage users to become engaged contributors to the community.

We expect that VCs for local high streets will emerge in practice in the next few years. To clarify how local VCs can be instantiated and succeed in the real world, we call for contributions from design science and action design research (Sein et al., 2011). Future research can build upon this study and its mockups to implement and evaluate a local deal community. By intervening in a local high street ecosystem, customer participation could be quantitatively and qualitatively assessed to yield essential information for design and action. In combination with survey research, longitudinal analyses of use logs or the network topology could reveal how motives for community participation evolve. These analyses can also shed light on users' participatory roles (e.g., content consumers and content creators), and their development over time. Different intrinsic and extrinsic motivators could be tested to yield design principles for *lively and active* local VCs, and the economic impact of a VC on local SME shops could be quantified.

19.5.2 Limitations and Future Research Directions

As with any empirical research, our study is subject to several limitations. First, the study might suffer from a subject-expectancy effect. Although study participants were asked to give their honest opinion, they may have assumed the role of "good subjects" by giving positive responses. Self-reported behavioral intentions, in particular, might be skewed. Second, digital platforms for local high streets and shopping districts are a recent phenomenon that is still in its infancy (Bartelheimer et al., 2018). Established platforms tend to focus on providing retailer-curated information, mediating transactions, and mediating fulfillment (Bärsch et al., 2019). They lack the mechanisms for user-generated information from VCs (Figure 19.2). Therefore, we used a laboratory setting with a fictitious VC and surveyed a thought experiment. This setup leaves three related limitations: First, the study has limited

external validity, as no real-world behavior could be surveyed. Although the customers' self-reported behavioral intentions suggest a widespread potential adoption of the VC service, it likely overestimates *actual* participatory behavior. Second, since we do not have real usage data with which to triangulate the survey data, our analysis was executed using data from a single source. However, no CMV is evident. Third, participants were recruited from several Western countries. Despite introducing the setting at the beginning of the survey, they may have various mental models of the concept "high street" (e.g., historic towns in Europe vs. main streets in the US). These perceptions can influence participants' evaluations of the presented VC.

The model only explains 38% of the variance of VC participation, which calls for further research to understand the motivational antecedents and moderators of the construct. A recent literature review by Zhang and Benyoucef (2016) on consumer behavior in the related social commerce sites, among others, names further hedonic, social and utilitarian value perceptions (Mikalef et al., 2013; To et al., 2007), personal traits (Kang et al., 2014), and aspects from technology acceptance research (Venkatesh et al., 2012) as potential antecedents and moderators. Given the nature of deal communities, the explicit influence of expected financial benefits could also be investigated.

Furthermore, Pappas (2018) suggests fuzzy-set qualitative comparative analysis (fsQCA) as an advancement over linear approaches like the employed symmetric PLS-SEM analysis for behavioral customer analyses. The underlying reasoning is that the presence or absence of an antecedent usually does not explain an outcome condition, such as VC participation in full (Pappas et al., 2016). That is, a variable can be a predictor in some cases, while it does not apply in other cases with the same outcome. The fsQCA method allows identifying configurations of variables that achieve an outcome (Woodside, 2013). Future research on VC participation can apply fsQCA to unveil these solutions, which, in turn, may be used to identify archetypal customer groups.

19.6 Conclusion

Many SME high street retailers stand in the digital shadows of large omnichannel and online retailers, as these SMEs lack the time and resources to appear in the

digital realm (Bollweg et al., 2018; Bartelheimer et al., 2018). This paper broadens the scope of VCs for user-generated marketing to high street retail by suggesting that a VC for local high streets, where customers create content about local offers and make suggestions, can help keep local businesses from residing in digital blind spots. We conducted an online survey with 402 participants to assess customers' motives for participating in local VCs, and their behavioral intention to visit local SME shops because of the information received on those VCs.

From a managerial point of view, our study reveals that local VCs can stimulate digital customer interaction in the high street, thereby increasing visitor traffic to local shops. Of course, the VC does not release retailers from the obligation to offer attractive value propositions to potential customers and to actively manage the customer experience throughout the customer journey (Lemon and Verhoef, 2016). The mockups we provide can mark a starting point for groups of high street retailers to establish a local VC service as part of an existing digital platform in order to enhance the competitive position of local brick and mortar retail.

From a theoretical point of view, our study contributes novel insights to customer participation in local VCs, and points out the need for further research at the intersection between retail and VCs research in the information systems and marketing disciplines.

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19.A Appendix

Table 19.5: Survey Instrument

Construct	Item	Operationalization	Mean	SD	Loading	t-Statistic
Purposive Value (PV)		*I would use the provided app...*				
	PV1	to get information	4.309	0.619	0.556	10.034
	PV2	to learn how to do things	2.811	1.038	0.489	7.621
	PV3	to provide others with information	3.644	0.913	0.736	19.558
	PV4	to contribute to a pool of information	3.657	0.916	0.703	18.226
	PV5	to generate ideas	3.226	1.029	0.589	11.345
	PV6	to negotiate or to bargain	2.953	1.135	0.285	3.591
	PV7	to get someone to do something for me	2.301	0.989	0.311	3.712
	PV8	to solve problems	2.995	1.014	0.430	7.074
	PV9	to make decisions	3.960	0.779	0.421	6.018
Self-Discovery (SD)		*I would use the provided app...*				
	SD1	to learn about myself and others	2.843	1.042	0.792	16.629
	SD2	to discover new areas of interest	4.236	0.707	0.740	12.390
Maintaining Interpersonal Interconnectivity (MII)		*I would use the provided app...*				
	MII1	to have something to do with others	3.401	1.067	0.849	26.922
	MII2	to stay in touch	2.774	1.092	0.825	25.408
Social Enhancement (SE)		*I would use the provided app...*				
	SE1	to impress	2.199	0.991	0.925	54.872
	SE2	to feel important	1.955	0.870	0.912	46.986
Entertainment Value (EV)		*I would use the provided app...*				
	EV1	to be entertained	3.309	1.035	0.767	21.056
	EV2	to play	2.647	1.047	0.782	23.991
	EV3	to relax	3.075	1.040	0.813	31.799
	EV4	to pass the time away when bored	3.328	1.090	0.699	17.192
Participation (P)	P1	I would download the virtual community app for my high street	4.020	0.844	0.818	37.927
		I would use the app...				
	P2	to consume information	4.022	0.725	0.800	30.765
	P3	to create content myself	2.684	0.997	0.683	20.827
	P4	to participate actively in the community	3.077	1.039	0.777	33.348
Visit Intention (VI)		*The app would motivate me...*				
	VI1	to discover new shops on the high street	4.226	0.738	0.822	34.008
	VI2	to visit these discovered shops	4.129	0.683	0.837	34.313
	VI3	to visit shops I already know more often	3.391	0.944	0.612	13.607
	VI4	to visit more shops on the high street	3.826	0.844	0.804	34.343

PV, SD, MII, SE, EV are adopted from Dholakia et al. (2004, p.252). Grey-colored measurement items within the PV construct turned out to be invalid with regard to their outer loadings and were eliminated from the model calculations (see results section).

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