Location-Based Service and Location-Contextualizing Service: Conceptualizing the Co-creation of Value with Location Information

Philipp zur Heiden
Paderborn University
philipp.zur.heiden@uni-paderborn.de

Jennifer Priefer
Paderborn University
jennifer.priefer@uni-paderborn.de

Daniel Beverungen
Paderborn University
daniel.beverungen@uni-paderborn.de

Abstract

Location-Based Service (LBS) is an established concept and enables providers and customers to co-create value-in-use, building on location information on humans or mobile objects. LBS, however, is not the only way to co-create value by using location information, as LBS does not target immovable objects, such as infrastructure. Informed by a literature review, we set out to conceptualize Location-Contextualizing Service (LCS) as a class of service complementing LBS. LCS focuses on improving existing service, based on enabling users with static positions to contextualize and analyze data on immovable objects. We describe the conceptual properties of LCS vis-á-vis LBS and outline why we see Geographic Information System (GIS) as a crucial class of systems to enable LCS. We discuss why LCS highlights new aspects and shifts research priorities that constitute the LBS and GIS fields today.

Keywords: Location Information, Location-based Service, Location-contextualizing Service, Geographic Information System

1. Introduction

Location-Based Service (LBS) utilizes location information to provide location-sensitive service (Xu et al., 2009) and has become increasingly popular since it enables co-creating personalized value-in-use, utilizing geospatial data of customers or mobile objects (Küpper, 2005; Raper et al., 2007). The data gathered—including an entity's or customer's position—are processed and analyzed by filtering, selecting, compiling, or creating valuable information (McKenna et al., 2014). Individual service consumption and the overall value of service are optimized for LBS (McKenna et al., 2014; Rao & Minakakis, 2003), which is documented by a range of IT artifacts—bundles of hardware, software, and technology—related to LBS. Common research foci of LBS include navigation service (Lehrer et al., 2011), location-based advertising (Molitor et al., 2019), and location-sensitive billing (Pei Chin & Siau, 2012).

Besides research on privacy (Xu et al., 2012) and user behavior (Molitor et al., 2020), IS research focuses on defining (Pei Chin & Siau, 2012) and designing LBS (Guo et al., 2018). However, there is a lack of research on service that is not location-specific by definition, but uses location information to augment value co-creation. In many of these cases, service might not utilize geospatial data referring to the position of mobile users, but rather referring to the locations and contextual embedding of immovable objects supplied by *Geographic Information System (GIS)*. Immovable objects can be any objects with a static geographic position of interest, e.g., hotels, technical equipment, and lots. For instance, when choosing a hotel online, customers can often select multiple criteria to filter for fitting hotels and find satisfactory results without exploring their current location. Further, when looking for houses online, customers are able to gain information about the surrounding of a house like the distance to public transport without using their current location. Still, most hotel booking or real estate websites (e.g., Zillow) allow for a geographic visualization of the filtered results with a browser-based GIS. We posit that utilizing a GIS for accessing location information of immovable objects can co-create superior value-in-use.

In this research endeavor, we take the perspective of service science—the study of service systems (Böhmann et al., 2014) and how value is created. Whereas a goods-dominant logic emphasizes value-in-exchange—depending on the value of the resources consumed during production—a service-dominant logic (Vargo & Lusch, 2004) as the core of service science assumes that service is the basis of all economic exchange and value creation, focusing on value-in-use. This logic implies a shift from a provider-centric to a customer-centric perspective on value (co-)creation (Vargo & Lusch, 2004). We analyze how value can be co-created in a service system featuring both mobile and immovable objects and their location information. Thus, we answer the following research question: *How can value be co-created utilizing location information?* This conceptual research is rooted in a literature review (Webster & Watson, 2002) to characterize and define LBS to further differentiate and conceptualize *Location-Contextualizing Service (LCS) as a class of analytics-based service* (Schüritz et al., 2017) that relies on analyzing geospatial data of immovable objects. We propose that LCS enables co-creating superior value-in-use compared to service not putting its entities in a spatial context. With our results, we contribute to service science by conceptualizing LCS as a class of service that differs from LBS. Introducing this class of service provides potential for enhancing existing service and creating superior value-in-use, especially in business-to-business contexts and overcoming privacy concerns known from LBS research. We aim to foster a new stream of research in service science and system science, based on designing software applications using location information, and in GIS-related research. We show how LCS as a class of service depends on GIS for value co-creation, bridging the gap between research on GIS and research on service science.

This paper is structured as follows. In Section 2, we review the core concepts constituting LBS and identify their value propositions in a literature review. Section 3 presents our method of conceptual research. In Section 4, we present our conceptualization of LCS as a class of service vis-à-vis LBS. Section 5 presents the theoretical research implications we draw from analyzing literature on LBS and conceptualizing LCS. Section 6 summarizes our findings and concludes the paper.

2. Literature on location-based service

In the quest for creating superior value-in-use with customers, location information can be used to enable new service systems. Location-Based Service (LBS) refers to location-sensitive service that utilizes location information (Xu et al., 2009). An LBS uses location information of mobile devices, combining them with information about service and products available within a defined physical proximity (Mathew et al., 2004). Also, it can utilize information on the physical surroundings of mobile users, e.g., shops and restaurants (Molitor et al., 2016). By definition, conceptual characteristics of LBS include *spatial proximity*—meaning that a service is only feasible if a customer is positioned relatively close to a service location (Bärsch et al., 2019)—and *locatability*—referring to the ability of a device to determine its current geographic position (Junglas et al., 2008). Further, LBS requires service customers to stay in physical proximity (Mathew et al., 2004; Molitor et al., 2016) and data provision in (near) real-time (Pei Chin & Siau, 2012). LBS can enable its clients to make better, informed real-time choices, increase the performance of individuals' tasks (Junglas, 2005), and enable businesses to build and maintain customer relationships to increase profit gain potential (Pei Chin & Siau, 2012). However, the cultural context of the LBS has been found to shape the way in which an LBS is used (Rao & Minakakis, 2004).

LBS has frequently been investigated in IS research and in system sciences. A focal point has been the design of IT artifacts targeting a variety of types of LBS and value propositions enabling LBS. To systematize different types of LBS, Lehrer et al., 2011 differentiate between static and dynamic LBS—depending on a customer's static position without movement or a dynamic position using an LBS while moving. Ibach et al., 2005 differentiate between static LBS (e.g., for buildings), general LBS (requiring information from a fixed point, i.e., locating nearby train stations), mobile LBS (where the location acts as a parameter of the behavior), and interdependent LBS (multiple actors with varying locations). Tan et al., 2014 identify push (delivered to the user by monitoring activities and locations) and pull (request initiated by the user) is channels to provide LBS. Further research suggests other types of LBS depending on specific examples (Junglas et al., 2008; Lehrer et al., 2011; Mathew et al., 2004; Pei Chin & Siau, 2012). However, research is lacking clear and comprehensive categories of value propositions that LBS can offer, as the existing classification schemes of LBS cannot be integrated. Thus, we reconsider existing knowledge on classifications of LBS and inductively utilize LBS to present a classification of LBS types (Table 2).

To map the literature on LBS, we performed a systematic literature review (Webster & Watson, 2002), offering a rigorous and traceable process to gather and review existing literature of particular interest (Vom Brocke et al., 2015). We used the search

Table 1: Results of the systematic literature review on LBS

Journal / Conference	Results	LBS & Definitions	LBS & Design	Data & Privacy	Relations & Attributes	n/a
European Journal of Information Systems (EJIS)	2	0	0	1	1	0
Information Systems Journal (ISJ)	1	0	0	1	0	0
Information Systems Research (ISR)	7	0	0	2	3	2
Journal of the Association for Information Systems (JAIS)	0	0	0	0	0	0
Journal of Information Technology (JIT)	0	0	0	0	0	0
Journal of Management Information Systems (JMIS)	10	1	2	0	3	4
Management Information Systems Quarterly (MISQ)	0	0	0	0	0	0
Decision Support Systems (DSS)	17	2	6	1	4	4
Communications of the Association for Information Systems (CAIS)	3	2	0	0	0	1
Telecommunications Policy	0	0	0	0	0	0
Socio-Economic Planning Sciences	4	0	0	0	0	4
Technological Forecasting & Social Change	6	0	2	0	2	2
International Conference on Information Systems (ICIS)	18	4	3	5	4	2
European Conference on Information Systems (ECIS)	12	1	3	2	5	1
Hawaii International Conference on System Sciences (HICSS)	45	2	5	13	11	14
Total	125	12	21	25	33	34

string "location-based" to scan the titles, abstracts, and keywords to identify papers targeting LBS or related concepts, considering the senior scholars' basket of journals and journals recommended by SIGGIS[1]. Additionally, we included ECIS and ICIS as the IS field's most popular conferences and HICSS as a conference with a special interest on location intelligence and GIS. We did not restrict our literature search to a specific time interval to be inclusive of all contributions, leading us to identify 125 papers, of which we identified 91 to be relevant for our analysis—i.e., targeting LBS.

Generally, the positions of customers and entities in service can be either dynamic (moveable) or static (stationary, immovable). Following, we present result on different value propositions of LBS from our systematic literature review. First, *localized service provision* provides specific (information) service for customers when their current location is physically close to the location of an entity. These entities—e.g., stores for location-based advertising (Molitor et al., 2018) and points of interest for city guides (Lehrer et al., 2011)—are mostly immovable and can also be assigned to larger areas, e.g., cities or states. However, the position of the customer is dynamic, which allows tailoring an LBS to a customer's current position. Second, *locating service* serves to find and locate entities of interest. This value proposition can include recommendations, e.g., for restaurants, train stations, and points of interest (Lehrer et al., 2011). Here, customers and entities can be dynamic or static, but at least one entity must be able to move. Exemplary applications range from location-based recommendations to locating friends (Eldin & Wagenaar, 2004; Tewari et al., 2003). Third, *navigation service* extends locating service with functionality to navigate to an entity that has been located previously. In navigation service, customers are dynamic, as they want to navigate to an entity's static position by car, bike, or on foot. Fourth, *matching services* offer to connect users based on their (current or historical) geographic locations, e.g., in dating applications and location-based social networks (G. M. Lee et al., 2016). For this type of service to work, both users must have a dynamic position, as for example entering a new city will result in new matches. Fifth, *location analysis service* refers to documenting and analyzing previous movements of an entity and to predicting its future movements. When offering this value proposition, a customer's position in time of use is static, but the position of the entity is or has been dynamic, e.g., using fitness tracking applications or public transportation planners (Lehrer et al., 2011). Finally, *management and monitoring service* enables managing and monitoring the geographic position of multiple entities simultaneously. Again, a customer's position is static, whereas the positions of other entities are dynamic. Exemplary applications include traffic monitors (Lehrer et al., 2011) and inventory management systems (Mathew et al., 2004).

The value propositions and characteristics of the different types of LBS can be combined with each other for designing more sophisticated systems. Location-based social networks (Koohikamali et al., 2015), for instance, combine locating service and matching service to find friends in the area with localized service provision to show new contacts.

[1]https://aisnet.org/general/custom.asp?page=SeniorScholarBasket

Table 2: Types of LBS, systematized form exemplary applications

LBS Value Proposition	Position of Customer	Position of Entity	Exemplary Applications
Localized Service Provision	dynamic	static	Location-based advertising: Push notifications (e.g., Molitor et al., 2018), mobile coupons (e.g., Molitor et al., 2016), location retargeting (Molitor et al., 2019)
			Specific information for static locations in cities (Lehrer et al., 2011), on campus (Eldin & Wagenaar, 2004), and for coastal information (Ferreira Hipólito, 2007)
			Location-sensitive billing (Mathew et al., 2004; Pei Chin & Siau, 2012)
			Location-based web search (Choi, 2007)
			Location-based participation in policy-making processes (H. Lee et al., 2011)
Locating Service	dynamic	static	Location-based recommendations, e.g., for resource brokering (Tewari et al., 2003) and points of interests (Guo et al., 2018; Lin & Li, 2015)
			Point-of-interest finding in city guides (Guo et al., 2018; Lehrer et al., 2011)
			Locate-info (Mathew et al., 2004)
			Radar detector (Lehrer et al., 2011)
		dynamic	Locate-a-friend (Eldin & Wagenaar, 2004), fish finder (Rao & Minakakis, 2004)
	static		Product location tracking (Pei Chin & Siau, 2012)
Navigation Service	dynamic	static	Navigation in a car, by bike, and by foot (Lehrer et al., 2011)
			Route planning for individualized stops (Almobaideen et al., 2017)
Matching Service	dynamic	dynamic	Dating applications (Ryschka et al., 2014)
			Location-based social networks (G. M. Lee et al., 2016)
Location Analysis Service	static	dynamic	Fitness tracking applications, e.g., wearables (Lehrer et al., 2011)
			Vehicle analysis (Wagner et al., 2014)
			Golfing assistant (Rao & Minakakis, 2004)
			Public transportation planning applications (Lehrer et al., 2011)
Management and Monitoring Service	static	dynamic	Traffic monitors (Lehrer et al., 2011)
			Mobile inventory management (Mathew et al., 2004) and SCM (Rao & Minakakis, 2004)
			Analysis and prediction of carsharing routes (Wagner et al., 2014)

Location-based games (e.g., treasure hunts, Pokémon Go) utilize locating service and navigation service to find treasures and localized service provision to collect prizes near a treasure (Pei Chin & Siau, 2012). Emergency support systems are based on management and monitoring service to monitor the position of involved participants and navigation service for rescuing victims (Pei Chin & Siau, 2012). Support systems for user-based relocation in free-floating carsharing models (Wagner et al., 2014) can even combine all of the five value propositions: management and monitoring service to manage multiple cars and customers, location analysis service to analyze popular car routes and to predict the demand for cars, locating service and navigation service to identify and navigate to suitable parking spots, and localized service provision to identify a car closely located.

The different LBS types identified in the literature review (Table 2) can additionally be categorized as push and/or pull services (Tan et al., 2014). A pull LBS is initiated by the user, whereas a push LBS monitors the location of a user or an entity and is triggered based on certain requirements (Tan et al., 2014). Table 3 displays the different types of LBS categorized as (a) push and (b) pull LBS, including the differentiation between static and dynamic users and entities. Localized service provision can be either a push LBS (considering location-based advertising, e.g., Molitor et al., 2018), or a pull LBS (considering location-based web search, e.g., Choi, 2007). A locating service is in most cases triggered by the user, i.e., a pull LBS, but can also be a push LBS—e.g., notifications of an arriving package. A navigation service is usually initiated at the start by a user, however, the central part of providing real-time navigation advice places this LBS in the push category. Matching service can both be triggered by users or by their location, placing them in both categories. Most examples of location analysis service and management and monitoring service are initiated by user requests, thus, classified as pull LBS. However, users can also be notified by changing locations, e.g., cars and resulting congestion (Lehrer et al., 2011), which are also classified as pull LBS.

Summarizing the literature on LBS and its different types, we propose a revised definition. *Location-based service (LBS) is a class of service utilizing location information of identified, proximal, and locatable entities and/or users, aiming to provide personalized, up-to-date information for better and informed real-time decisions* (Junglas et al., 2008; Lehrer et al., 2011; Mathew et al., 2004; Pei Chin & Siau, 2012; Tilson et al., 2004).

Table 3: Classification of the different types of LBS as push or pull channels

(a) Classification of location-based push service

Entity \ User	Static	Dynamic
Static		localized service provision, navigation service
Dynamic	locating service, location analysis service, management and monitoring service	matching service

(b) Classification of location-based pull service

Entity \ User	Static	Dynamic
Static		localized service provision, locating service
Dynamic	locating service, location analysis service, management and monitoring service	locating service, matching service

3. Method

To conceptualize LCS as a class of service, we turn to *conceptual research* as a non-empirical research method, as it has been successfully applied in service research (Jaakkola, 2020), most notably in the conceptualization of the service-dominant logic (Vargo & Lusch, 2004). Conceptual research aims to provide the conceptual design of new artifacts, i.e., constructs, frameworks, methods, and systems. In comparison to empirical research, conceptual research builds on arguments derived from combining and assimilating evidence in the form of established theories and concepts (Hirschheim, 2008; Jaakkola, 2020). Thus, a conceptual research paper must not necessarily provide data in the sense of empirical research papers. Instead, conceptual research starts with a focal phenomenon not accurately addressed in existing research or with theory that is argued to be incomplete (Jaakkola, 2020).

According to Mora et al., 2008, conceptual research can be divided into conceptual behavioral research and conceptual design research. Conceptual behavioral research targets research on entities that stand in relation to real things, whereas conceptual design research deals with the explorative design of artifacts (Mora et al., 2008). Conceptual research papers can result in different types of contributions—theory synthesis, theory adaptation, typology, or model—determined by the approach used to structure arguments and develop the results (Jaakkola, 2020). Theory synthesis integrates multiple theories or literature streams to enhance insights into phenomena and theories Jaakkola, 2020. Similarly, theory adaptation extends an established theory by considering and integrating other theories (Jaakkola, 2020). A typology paper identifies conceptual variants of a construct, framework, method, or system and declares them as distinctive types, thus contributing through differentiation (Jaakkola, 2020). A model paper identifies and predicts relationships between concepts, building a theoretical framework (Jaakkola, 2020).

This paper aims to conceptualize LCS as a class of service, building on geospatial data of immovable objects to co-create value. We adhere to the guidelines of conceptual behavioral research for typology development, as we identified service that utilizes location information but does not fit the definition of an LBS. Thus, we start with service utilizing location information on immovable objects as a previously not analyzed phenomenon. We build on the results of the systematic literature review presented in Section 2—contributing insights on the properties and different examples of LBS in theory and practice—to distinguish the concepts of LBS and LCS, on the road to conceptualizing LCS as a class of service using real-world examples. This goal combined with the tradition of IS being cautious in declaring research results a theory classifies our paper as a typology paper.

4. Location-contextualizing service as a class of service

When analyzing the classification of LBS regarding the position of users, position of entities, and the differentiation between push and pull service in Table 3, both push and pull have an empty cell in the table. This top left cell in both cases characterizes service with a user and an entity that have static locations, but still utilize location information. Although some definitions would still consider this an LBS (Xu et al., 2009), most established definitions and our revised definition do not include such service as it lacks spatial proximity and locatability (Bärsch et al., 2019; Junglas et al., 2008)—the main characteristics that constitute an LBS. While location information is optional in this type of service, they can still enhance the service's value proposition and might help to co-create superior value-in-use.

In industry and society, multiple instances of such type of service can be observed. For instance, web-based hotel selection service provides customers with available accommodation options that refer to a particular city at a specific time. While the service can be delivered without location information, enhancing and contextualizing it with the geographic positions of hotels enables customers to search hotels by their locations in a specified area and to visualize their search results in a GIS. Unlike with LBS, hotel selection websites do not require the current location of a customer to provide service. Further, both the customer and the entity can have a static position, i.e., entities might be immovable. This conceptualization stands in stark contrast to the value propositions of LBS we identified. For those, either customers, entities, or both must have dynamic positions. Other examples for service that uses location information but is not an LBS include real estate platforms (e.g., Zillow), job offering portals (e.g., Indeed and Monster) and risk assessment services (e.g., portal of the German federal office for radiation protection).

To fill this gap, we conceptualize a *class of service: Location-Contextualizing Service (LCS)*. LCS utilizes location information of entities with a static position to co-create superior value-in-use and, ultimately, support customer decision-making by spatial contextualization. While geospatial data are not constitutive for this class of service, they can enhance the value co-created by service customers and service providers. The spatial context includes not only the geospatial data of the entities, but also environmental data which can be spatially related to the positions of the immovable objects. We position LCS as analytics-based service. As a subtype of digital service, this service utilizes data and analytics to improve and innovate existing service offerings (Demirkan et al., 2015; Schüritz et al., 2017). Analytic-based service extends digital service to provide critical information for decision-making (Schüritz et al., 2017). As an LCS is based on data—particularly geospatial data—and provides analytics service especially as decision support service, LCS provides a new type of analytics-based service. To further clarify the conceptual properties of LCS in contrast to LBS, we explain their differences with a set of criteria, stemming from both the literature on LBS and a conceptual comparison of existing LBS and LCS instances (Table 4).

Spatial proximity is an essential aspect of LBS because LBS requires a customer to be close to a service location (Bärsch et al., 2019). In contrast, LCS does not pre-suppose that a service customer is in spatial proximity to a service provider, since LCS is independent of the customer's location. In a similar vein, *locatability* is a crucial characteristic of LBS, describing that devices connected in a service system need to be capable of identifying their geographic position (Junglas et al., 2008). Locatability directly relates to spatial proximity, since information on the spatial context of service components is essential for the system's operation. However, LCS does not require a locatability of movable objects, but uses static coordinates of service components to operate.

Concerning the *co-creation of value*, LBS are a type of innovative service that would not be possible without location information, as either the customer, the entity, or both have a dynamic position that must be tracked (Xu et al., 2009). As such, the location information of the customer and/or the entity serve as resources—intangible, dynamic, infinite (Constantin & Lusch, 1994; Vargo & Lusch, 2004). The value of an LBS is created by integrating locations of customers and entities, thus, the provider and customer integrate their resources to co-create value. In LCS, this co-creation of value is possible without considering and integrating location information. The basic service integrates different resources of customers and providers, but the integration of location information of immobile objects can enhance the value co-created.

LBS systems use *geospatial entities* in the form of devices, products, service, and places (Mathew et al., 2004). The devices need to be locatable and the service customer using the devices must be close to products, service, and places to co-create service. As identified in our literature review, entities in LBS can have a static or dynamic position, depending on their value proposition. However, LCS mainly depends on immovable entities, e.g., a dispersed infrastructure or places. The *position of the customer* in LBS and LCS can also differ. LBS is used by mobile users (Lehrer et al., 2011; Molitor et al., 2016) who use their mobile devices to receive data, information, or service through their current position, or by customers with a static position who use management and monitoring service. In contrast, LCS is only used by customers with a static position, since neither the current position of customers nor their movements are relevant for them. For example, hotel booking sites do not change their service based on the position of the customer, and even if customers change their position this has no effect on the service.

Another key characteristic for LBS concerning the *type of data* is to use (near) real-time location and context data enabling the service (Pei Chin & Siau, 2012). Devices determine a user's location and transmit

Table 4: Conceptual comparison of LBS and LCS

Criteria	Location-Based Service (LBS)	Location-Contextualizing Service (LCS)
Spatial proximity	Customer has to be close to the service location (Bärsch et al., 2019)	Not required, service is independent of the location of the customer
Locatability	Devices need to be capable of determining their geospatial position (Junglas et al., 2008)	Not needed, relies on static positions with fixed coordinates
Co-creation of value	Innovative service is not feasible without location information	Enhanced value of a service through location information
Geospatial entities	Devices, products, service, places	Immovable objects and places
Customer's position	Dynamic or static (Lehrer et al., 2011)	Static (e.g., back office)
Data type	Real-time location and context data (e.g., service hours), enabling the service	Historical location data enhancing (not enabling) the original service
Enabling technology	GPS, Bluetooth, mobile devices, GIS	GIS
Knowledge contribution	Invention, improvement	Improvement

it to the backend in real-time, and vice versa, data are provided in the opposite direction in real-time, too. LCS work with considerably longer time periods, focusing on historical data because the objects' positions are static, enhancing the original service, but not enabling it. Further, the *enabling technology* for LBS is the ability to acquire geospatial data, e.g., through the global positioning system (GPS), Bluetooth, or mobile devices. Since LCS is used by customers with static positions and does not utilize mobile devices, it depends on the storage, analysis, and visualization of geospatial data to generate value-in-use. Therefore, within an LCS system, GIS constitute the basis for data analytics and exploration.

GIS—a class of information system that include geospatial data as a substantial element—enable the analysis of location information used by both LBS and LCS. GIS allow users to acquire and represent geographic phenomena (Chrisman, 1999) and provide a diverse set of methods to work with geospatial data. Thus, GIS provide the capability to integrate location as part of an information system (Farkas et al., 2016).

Design science research is a research paradigm (Gregor & Hevner, 2013) that enables the design of IT artifacts as part of service systems engineering (Beverungen et al., 2018; Böhmann et al., 2014). To frame *contributions* of design science research, Gregor and Hevner, 2013 propose a 2x2 matrix that is constituted by application domain maturity (low or high) and solution maturity (low or high). We posit that LBS are often inventions that address low application domain maturity and low solution maturity. Thus, LBS can enable entirely new value propositions that build on geospatial data. LCS, however, seems to be focused on extending and improving solutions for known problems and, in most cases, will likely be subject to high application domain maturity, such that they classify as improvements. Compared to LBS that need to demonstrate that they can work to co-create value-in-use, papers on LCS need to focus on conceptualizing and quantifying the added value offered vis-à-vis service that does not use geospatial data.

5. Research implications

Reinforcing the service science perspective, a service system enables service customers and service providers to co-create value based on a service-for-service exchange. Value co-creation can only function if both sides are willing to share and access the other actor's knowledge and skills. If a service system includes information and communication technology as well as data collection, preprocessing, and analytics tools (Schüritz et al., 2019), it is either a data-driven or an analytics-based service. Thus, LCS should be classified as analytics-based service, co-creating value by integrating and contextualizing the location of immovable objects in addition to the resources that are already integrated.

Boundary objects are a key element of service systems, describing artifacts located at the interfaces between research fields or communities, enabling the transfer of cross-border information and knowledge (Becker et al., 2013). A useful boundary object offers concrete means for service customers and providers to specify and learn about their differences and dependencies across a particular boundary (Carlile, 2002). In LBS scenarios, GIS can serve as boundary objects between service customers and service providers. GIS are already being used in multiple LBS of different types, mainly focusing on the acquisition of the position data of users or objects as well as the presentation of the analyses results on a map—mostly in real-time. GIS provide tools and functions to analyze geospatial data, enabling service customers (e.g., through visualizing geospatial objects) and service providers (e.g., through analyzing spatial patterns of customers) to co-create value.

GIS can also be applied to constitute an LCS as they enable processing, analyzing, and visualizing geospatial data. Still, service customers can interpret the data visualized by GIS, allowing them to co-create superior value-in-use compared to a service not contextualizing location information. When improving an existing service with location information and turning it into an LCS, there is a need to integrate a GIS or at least GIS functionalities into the existing service. The focus of the GIS within an LCS is on managing existing location data of immovable objects and to analyze these data. For example, the geospatial data of hotels can be used to analyze profitable areas in which many hotels are booked or reveal spatial correlations with traffic conditions or proximity to events. Thus, for example, the identification of new hotel sites becomes possible.

Another stream of research for LBS in service science is usage intention—describing the behavioral intention to participate in a service (Jang & Lee, 2018). Research in this area highlights security, performance, and presentation as the main drivers to use LBS (Deng & Chang, 2013; Yun et al., 2013). This observation suggests that LBS is frequently examined from a consumer perspective. We posit that LCS will be (and already are) implemented in B2B and B2C contexts, e.g., for hotel selection and job offering portals. Though LCS can also be applied in a private context—consider the hotel booking example—LCS usage intention de-emphasizes designing appealing user interfaces and real-time maps that focus on hedonic user experience, but focus on designing solid and predictable applications that can promote business value by enabling new business models or processes.

Since LCS offers possibilities for designing service systems and introduces a new angle on existing service, we posit that LCS also leave their mark on concepts and theories that have been investigated in LBS research, resulting in a need to re-think and update some of them for LCS research. For example, location privacy is a core topic in LBS research (Padmanaban, 2013), since customers' locations are considered to be personal data that must be protected for legal and ethical reasons. For LCS on the other hand, the most sensitive data are the locations of immovable objects. Thus, LCS de-emphasizes the use of personal data on humans, while emphasizing data on immovable objects. This is, however, relevant for critical public infrastructure, e.g., considering distribution grids, where geospatial data are particularly worth protecting since, once they become public, their location will always be known to all (friendly or hostile) outsiders. Instead of imitating the focus of LBS on privacy, research on LCS must focus on security issues to prevent cyber-attacks on public infrastructures and other critical, immovable objects.

6. Conclusion and outlook

In this paper, we conceptualize LCS as a class of service that builds on location information, but differs from current conceptualizations of LBS. We portray the differences between both types through a literature review on common characteristics and examples of LBS. Against this backdrop, we conceptualize a set of properties and research implications that refer to LCS as a class of service.

We use service science as a theoretical lens to analyze services related to location information. Thus, this paper does not focus on technologies that enable LCS, but rather identifies further use cases for using location information in service science. Although we conceptualize LCS, we have yet to design LCS-based service systems to evaluate and quantify the utility and added value of the concept. Still, we posit that in building on location information, LCS can add a valuable perspective to service science, system science, and IS research. Concerning our structured literature review, we acknowledge that the selection of journals and conferences we made is not complete and future research could include OR, MS, or GIScience journals to enhance the search. However, we thoroughly anchored our research in service science literature.

We argue that our conceptualization of LCS can enable further research to explore and quantify to what extent augmenting service systems as LCS might enable service providers and service customers to co-create superior value-in-use. In this way, designing and evaluating LCS will enable the research community to develop new insights into the value-in-use realized with geospatial data, an area of research that is still driven by other disciplines (Bin et al., 2020) than IS research. We call on further research to explore if strategies to design LBS (Tilson et al., 2004) can be used or adapted for designing LCS. Further research might also complement the conceptual comparison of LBS and LCS to point at similarities and differences.

7. Acknowledgements

This paper was developed in the research project FLEMING, which is funded by the German Federal Ministry for Economic Affairs and Climate Action (BMWK), promotion sign 03E16012F.

References

Almobaideen, W., Krayshan, R., Allan, M., & Saadeh, M. (2017). Internet of things: Geographical routing based on healthcare centers vicinity for mobile smart tourism destination. *Technological Forecasting and Social Change*, *123*, 342–350.

Bärsch, S., Bollweg, L., Lackes, R., Siepermann, M., Weber, P., & Wulfhorst, V. (2019). Local shopping platforms–harnessing locational advantages for the digital transformation of local retail outlets: A content analysis. *Proceedings of the WI 2019, Siegen, Germany*.

Becker, J., Beverungen, D., Knackstedt, R., Matzner, M., Müller, O., & Pöppelbuß, J. (2013). Bridging the gap between manufacturing and service through it-based boundary objects. *IEEE Transactions on Engineering Management*, *60*(3), 468–482.

Beverungen, D., Lüttenberg, H., & Wolf, V. (2018). Recombinant service systems engineering. *BISE*, *60*(5), 377–391.

Bin, J., Gardiner, B., Li, E., & Liu, Z. (2020). Multi-source urban data fusion for property value assessment: A case study in philadelphia. *Neurocomputing*, *404*, 70–83.

Böhmann, T., Leimeister, J. M., & Möslein, K. (2014). Service systems engineering. *BISE*, *6*(2), 73–79.

Carlile, P. R. (2002). A pragmatic view of knowledge and boundaries: Boundary objects in new product development. *Organization science*, *13*(4), 442–455.

Choi, D.-Y. (2007). Personalized local internet in the location-based mobile web search. *DSS*, *43*(1), 31–45.

Chrisman, N. R. (1999). What does 'gis'mean? *Transactions in GIS*, *3*(2), 175–186.

Constantin, J. A., & Lusch, R. F. (1994). *Understanding resource management: How to deploy your people, products, and processes for maximum productivity*. Planning Forum.

Demirkan, H., Bess, C., Spohrer, J., Rayes, A., Allen, D., & Moghaddam, Y. (2015). Innovations with smart service systems: Analytics, big data, cognitive assistance, and the internet of everything. *Comm. of the AIS*, *37*.

Deng, Y., & Chang, K. (2013). Information visualization and location-based services on mobile devices. *AMCIS Proceedings*.

Eldin, A. A., & Wagenaar, R. (2004). A fuzzy logic based approach to support users self control of their private contextual data retrieval. *Proceedings of the 13th ECIS*.

Farkas, D., Hilton, B., Pick, J., Ramakrishna, H., Sarkar, A., & Shin, N. (2016). A tutorial on geographic information systems: A ten-year update. *Comm. of the AIS*, *38*(1), 190–234.

Ferreira Hipólito, J. (2007). Multimedia mobile services with applications in environment. *Technological Forecasting and Social Change*, *74*(6), 854–865.

Gregor, S., & Hevner, A. R. (2013). Positioning and presenting design science research for maximum impact. *MISQ*, *37*(2), 337–355.

Guo, J., Zhang, W., Fan, W., & Li, W. (2018). Combining geographical and social influences with deep learning for personalized point-of-interest recommendation. *JMIS*, *35*(4), 1121–1153.

Hirschheim, R. (2008). Some guidelines for the critical reviewing of conceptual papers. *JAIS*, *9*(8), 432–441.

Ibach, P., Tamm, G., & Horbank, M. (2005). Dynamic Value Webs in Mobile Environments Using Adaptive Location-Based Services. *Proceedings of the 38th HICSS*.

Jaakkola, E. (2020). Designing conceptual articles: Four approaches. *AMS Review*, *10*(1-2), 18–26.

Jang, S. H., & Lee, C. W. (2018). The impact of location-based service factors on usage intentions for technology acceptance: The moderating effect of innovativeness. *Sustainability*, *10*(6), 1876.

Junglas, I. (2005). An Experimental Investigation of Location-Based Services. *Proceedings of the 38th HICSS*.

Junglas, I., Abraham, C., & Watson, R. T. (2008). Task-technology fit for mobile locatable information systems. *DSS*, *45*(4), 1046–1057.

Koohikamali, M., Gerhart, N., & Mousavizadeh, M. (2015). Location disclosure on lb-snas: The role of incentives on sharing behavior. *DSS*, *71*, 78–87.

Küpper, A. (2005). *Location-based services. fundamentals and operation*. John Wiley & Sons, Ltd.

Lee, G. M., Qiu, L., & Whinston, A. B. (2016). Strategic Network Formation in a Location-Based Social Network: A Topic Modeling Approach. *Proceedings of the 49th HICSS*, 5249–5258.

Lee, H., Sajjad, F., Al-Yafi, K., & Irani, Z. (2011). A workflow model to support location based participation to policy making processes. *Proceedings of the 19th ECIS*.

Lehrer, C., Constantiou, I., & Hess, T. (2011). A cognitive processes analysis of individuals' use of location-based services. *Proceedings of the 19th ECIS 2011*.

Lin, L.-F., & Li, Y.-M. (2015). Social appraisal support for point-of-interest visiting decision-making. *Proceedings of the 23rd ECIS*.

Mathew, J., Sarker, S., & Varshney, U. (2004). M-commerce services: Promises and challenges. *Comm. of the AIS*, *14*(1).

McKenna, B., Tuunanen, T., & Gardner, L. A. (2014). Exploration of location-based services adoption. *International Journal of E-Services and Mobile Applications*, *6*(1), 1–22.

Molitor, D., Reichhart, P., & Spann, M. (2016). Location-based advertising and contextual mobile targeting. *Proceedings of the 37th ICIS*.

Molitor, D., Spann, M., Ghose, A., & Reichhart, P. (2018). Measuring the effectiveness of location-based mobile push vs. pull targeting. *Proceedings of the 39th ICIS*.

Molitor, D., Spann, M., Ghose, A., & Reichhart, P. (2020). Effectiveness of location-based advertising and the impact of interface design. *JMIS*, *37*(2), 431–456.

Molitor, D., Zubcsek, P. P., Spann, M., & Reichhart, P. (2019). The interplay of retargeting and location revisits in location-based advertising. *Proceedings of the 40th ICIS*.

Mora, M., Gelman, O., Paradice, D., & Cervantes, F. (2008). The case of conceptual research in information systems. *CONF-IRM 2008 Proceedings*, *52*.

Padmanaban, R. (2013). Location privacy in location based services: Unsolved problem and challenge. *Int. J. Adv. Remote Sens. GIS*, *2*(1), 398–404.

Pei Chin, N. J., & Siau, K. (2012). Critical success factors of location-based services. *Proceedings of the 33rd ICIS*.

Rao, B., & Minakakis, L. (2004). Assessing the business impact of location based services. *Proceedings of the 37th HICSS*.

Rao, B., & Minakakis, L. (2003). Evolution of mobile location-based services. *Communications of the ACM*, *46*(12), 61–65.

Raper, J., Gartner, G., Karimi, H., & Rizos, C. (2007). A critical evaluation of location based services and their potential. *Journal of Location Based Services*, *1*(1), 5–45.

Ryschka, S., Tonn, J., Kyung-Hun Ha, & Bick, M. (2014). Investigating Location-Based Services from a Business Model Perspective. *Proceedings of the 47th HICSS*, 1173–1182.

Schüritz, R., Farrell, K., Wixom, B. W., & Satzger, G. (2019). Value co-creation in data-driven services: Towards a deeper understanding of the joint sphere. *Proceedings of the 40th ICIS*.

Schüritz, R., Seebacher, S., Satzger, G., & Schwarz, L. (2017). Datatization as the next frontier of servitization–understanding the challenges for transforming organizations. *Proceedings of the 38th ICIS*.

Tan, A. Z. Y., Wen Yong Chua, & Chang, K. T. T. (2014). Location Based Services and Information Privacy Concerns among Literate and Semi-literate Users. *Proceedings of the 47th HICSS*, 3198–3206.

Tewari, G., Youll, J., & Maes, P. (2003). Personalized location-based brokering using an agent-based intermediary architecture. *DSS*, *34*(2), 127–137.

Tilson, D., Lyytinen, K., & Baxter, R. (2004). A framework for selecting a location based service (LBS) strategy and service portfolio. *Proceedings of the 37th HICSS*.

Vargo, S. L., & Lusch, R. F. (2004). Evolving to a new dominant logic for marketing. *Journal of Marketing*, *68*(1), 1–17.

Vom Brocke, J., Simons, A., Riemer, K., Niehaves, B., Plattfaut, R., & Cleven, A. (2015). Standing on the shoulders of giants: Challenges and recommendations of literature search in information systems research. *Comm. of the AIS*, *37*.

Wagner, S., Brandt, T., Kleinknecht, M., & Neumann, D. (2014). In free-float: How decision analytics paves the way for the carsharing revolution. *Proceedings of the 35th ICIS*.

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MISQ*, *26*(2), 13–23.

Xu, H., Teo, H.-H., Tan, B. C. Y., & Agarwal, R. (2009). The role of push–pull technology in privacy calculus: The case of location-based services. *JMIS*, *26*(3), 135–173.

Xu, H., Teo, H.-H., Tan, B. C. Y., & Agarwal, R. (2012). Effects of individual self-protection, industry self-regulation, and government regulation on privacy concerns: A study of location-based services. *ISR*, *23*(4), 1342–1363.

Yun, H., Han, D., & Lee, C. C. (2013). Understanding the use of location-based service applications: Do privacy concerns matter? *Journal of Electronic Commerce Research*, *14*(3), 215.