Reference Architectures Facilitating a Retailer's Dual Role on Digital Marketplaces: A Literature Review

Tobias Wulfert[a] and Jan Busch
Institute for Computer Science and Business Information Systems, University of Duisburg-Essen, Essen, Germany

Keywords: Electronic Commerce, Digital Marketplace, Dual Role, Reference Architecture, Literature Review.

Abstract: Electronic commerce and digital marketplaces (DMs) have proven to be successful business models compared with traditional brick-and-mortar retailing. Online sales and the simultaneous orchestration of participants from independent market sides on DMs (dual role) pose additional requirements for information systems. Reference architectures (RAs) can be used as blueprints for the implementation of information systems for DMs supporting a retailer's dual role. However, RAs in retail were mostly developed for brick-and-mortar environments. The peculiarities of electronic commerce and DMs require adaptations and enhancements. Thus, we conduct a literature review following vom Brocke et al. (2009) involving 1,357 research papers to identify RAs supporting a retailer's dual role on DMs. We identified seven DM-specific architecture requirements and analyzed RAs identified according to Angelov et al. (2012). Our analysis revealed 13 RAs with only limited support for a retailer's dual role on DMs.

1 INTRODUCTION

Platform-based business models are a successful way of conducting business with up to four times higher valuations than traditional companies and three times higher revenues on ecosystem-level including participating companies (Libert et al., 2014; Delteil et al., 2020). Besides other industries such as accommodation (e.g. AirBnB, Couchsurfing), mobility (e.g. uber, blablacar) or the music (e.g. Spotify, napster) (Evans and Schmalensee, 2016), platform business models have already conquered the retail sector with tremendous success (e.g. Amazon, eBay) (Wulfert et al., 2021). As the largest platform company in electronic commerce (e-commerce), Amazon generated USD 340 billion in revenue from product and service sales in 2020, with more than 60 percent of revenues resulting from commission fees for third-party sellers on its digital marketplace (DM) (Amazon, 2021). DMs employ a multi-sided market business model and monetize the orchestration of multiple market sides without gaining ownership on traded products (Hagiu, 2007). While electronic shops act as resellers in a single market, DMs connect previously independent markets with independent participants and enable transactions between them (Armstrong, 2006). DMs significantly reduce transaction costs in e-commerce environments for involved participants such as suppliers, logistic service providers, or market researchers by reducing the number of connections through intermediation (Böttcher et al., 2021; Hagiu and Wright, 2015b). They focus on the monetization of the matching between distinct participants instead of selling articles with higher margins (Evans and Schmalensee, 2016). The orchestration of DM participants results in indirect network effects that increase the attractiveness of a DM for participants (Shapiro and Varian, 1998). As DMs often form the first touchpoint for many customers and marketplace owners encapsulate manufacturers from customers, retailers need to establish their own DMs (McKinsey, 2020). Although the importance of platforms in retail seems to grow, literature so far only focuses on the adaption of business models and respective tools to model them (Evans and Schmalensee, 2016; Reillier and Reillier, 2017; Wulfert et al., 2021). Consequences for underlying information systems (IS) as infrastructure for e-commerce supporting the specifics of e-commerce and the intermediary business model of DMs are rarely considered (Aulkemeier et al., 2016a; Wulfert and Schütte, 2021). A retailer that transformed to a marketplace owner while competing with ecosystem participants selling own articles on the DM has a dual role that results in additional IS requirements (Wulfert and Schütte, 2021).

[a] https://orcid.org/0000-0002-5504-0718

Wulfert, T. and Busch, J.
Reference Architectures Facilitating a Retailer's Dual Role on Digital Marketplaces: A Literature Review.
DOI: 10.5220/0010997900003179
In *Proceedings of the 24th International Conference on Enterprise Information Systems (ICEIS 2022) - Volume 2*, pages 494-505
ISBN: 978-989-758-569-2; ISSN: 2184-4992

A reference architecture (RA) for DMs may help to identify gaps in existing IS and capabilities of a retailer required to be closed for a DM operation (Kotusev and Kurnia, 2020). Moreover, a RA can decrease setup time for IS supporting DMs and help to standardize processes and interfaces (Angelov et al., 2012). RAs serve as architectural templates for the design of company-specific architectures and have a prescriptive character for future IS implementations (Recker et al., 2021; Bass et al., 2003). The blueprints may also facilitate the introduction of new processes and technologies in e-commerce and ease the participation in a DM resulting in increased networks effects (Shapiro and Varian, 1998; Eaton et al., 2015). Although RAs for e-commerce do exist (Ecomod, 2006; Aulkemeier et al., 2016a; Vetter and Morasch, 2019), literature dealing with specific requirements of a retailer's dual role on DMs is sparse. These requirements involve bridging functions for e-commerce (Levy et al., 2019), a dedicated process for matching participants from multiple market sides (Reillier and Reillier, 2017), and additional innovation platform services coping with an increasing hybridization of products (Tiwana et al., 2010). Against this backdrop, our research question is as follows: *What RAs in e-commerce support a retailer's dual role on DMs?* To answer this research question, we conduct a literature review for (reference) architectures on an IS level in e-commerce (involving B2B and B2C business models) (Vom Brocke et al., 2009). As the architecture should have a reference characteristic, it needs to be reusable in several companies, technology- and vendor-independent, and cover (parts of) the IS architecture (Angelov et al., 2012). Additionally, we will analyze identified RAs concerning the fulfillment of additional requirements stemming from a retailer's dual role on DMs in a conceptual matrix (Webster and Watson, 2002).

The remainder of this article proceeds as follows. First, we derive characteristics of RAs and introduce architectural requirements (ARs) for DMs and the support of a retailer's dual role. Second, we sketch our research approach for the literature review. Third, we analyze 13 domain-specific RAs towards the facilitation of a retailer's dual role on DMs. We close with a discussion of our results and a brief conclusion.

2 REFERENCE ARCHITECTURE

RAs are reference models that serve as architectural templates for the design of company-specific architectures (Bass et al., 2003). An enterprise architecture reflects the fundamental organization of a system and its relationships to the environment (Keller, 2017). RAs aim to serve as templates for several companies that need to be instantiated by each company (Winter and Gericke, 2006). RAs can be distinguished primarily according to whether templates are provided for the entire company or for sub-architectures such as IS. Different architecture types such as business, application, and infrastructure architecture are formed for the individual components of the RA, that are developed using specific modeling languages. The structure of the architectures follows a layered approach, that usually reflects the proximity or distance from business problems to IS (business layer vs. infrastructure layer). As companies are increasingly permeated by technology, enterprise architecture management needs to consider IS at the application and infrastructure layer and their alignment with the corporate strategy and business model (Ahlemann, 2012; Pereira and Sousa, 2004; Winter and Fischer, 2006). IS research is mainly concerned with IS architectures, that take into account the business architecture, organizational structure, and process organization of a company. Furthermore, they comprise a "high-level sketch" of the system and application architecture of a company (Heinrich and Stelzer, 2009). In addition to IS architectures, there are more specific architectures for software, data, and the technical infrastructure that deal with the more technical details of IS. These sub-architectures can also be included in IS architectures (Heinrich and Stelzer, 2009). The different architecture types within an enterprise architecture can be structured thereby using architectural meta-models (Bass et al., 2003). The purpose of RAs for companies is to make the interaction of business requirements and information technology (business-IT alignment) transparent (Niemann, 2006). RAs are mostly developed by an independent institution (e.g., research institution or standardization institute) such as TOGAF (Angelov et al., 2012; Open Group, 2016). Thus, RAs are blueprints that form proven templates for companies to economically describe and design the increasingly complex business and IT architectures. RAs abstract from the peculiarities of a company and thus enable the reuse of the architecture.

To determine the reusability of RAs in e-commerce in section 5, we applied six dimensions describing RAs (Angelov et al., 2012; Barbosa et al., 2019; Giachetti, 2010). We describe RAs according to their specificity, layers, coverage, level of detail, degree of formalization, and purpose. **Specificity** determines the applicability and re-usability of a RA and serves to distinguish architectures for a particular context from more holistic ones (Angelov et al., 2012). The differentiation of RAs for

IS based on the characteristics of specificity serves to distinguish architectures for a particular context from more holistic ones. Industry-specific architectures (e.g., Y-CIM-model, H-model) can be directly applied in but are limited to only one industry such as manufacturing or retail (Becker and Schütte, 2004). Technology-specific RAs focus on a particular technology or technology area. Vendor-specific architectures focus on system components of a software manufacturer and describe their architectural understanding (Giachetti, 2010). Unspecific architectures can be used as domain-independent architectures in different industries (Giachetti, 2010). They abstract from the specifics of individual software manufacturers and are usually oriented towards the processes within a company or industry. Unspecific architectures represent templates that need to be further specified for concrete applications in companies. These architectures include ARIS, the Zachmann framework, and TOGAF (Heinrich and Stelzer, 2009). According to layered models of IS, the following architectural **layers** are usually distinguished, depending on the proximity to information technology (Ahlemann, 2012; Winter and Fischer, 2006; Barbosa et al., 2019; Heinrich and Stelzer, 2009): motivation, business, application, and infrastructure layer. These layers are also considered in widely used architectural modeling approaches (e.g., ArchiMate) (Open Group, 2019). Following Angelov et al. (Angelov et al., 2009), the architecture **coverage** describes the content of the architecture. Components represent concrete software modules and interfaces describe the connections between the individual modules. Protocols define the communication formats between the components. Guidelines are closely connected with procedure models and contain recommendations for action for the implementation of the RA. With regards to the **level of detail**, a distinction is made between detailed, semi-detailed and aggregated specifications (Angelov et al., 2012; Greefhorst et al., 2006). The level of detail is differentiated by the number of elements and connections within the architecture and the number of aggregation levels. According to Angelov et al. (Angelov et al., 2012), architectures with many elements and more than two levels of aggregation have a detailed specification, whereas architectures with an aggregated specification are characterized by few elements and no levels of aggregation.

The **degree of formalization** describes the type of representation of the RA (Barbosa et al., 2019). Informal architectures are represented in textual form. Semi-formal architectures use non-standardized notations to describe the architecture. Formal architectures are implemented in standardized notations (e.g., UML, ArchiMate) (Angelov et al., 2012; Open Group, 2019).

The **purpose** of a RA is either a subsequent abstraction of existing systems to standardize IS (standardization) or sets an ex-ante requirement facilitating new IS (facilitation) (Greefhorst et al., 2006). While standardization architectures are based on (parts of) IS that have already been tested in practice, facilitation architectures are developed as templates (Angelov et al., 2012). Standardization architectures have a descriptive character (Galster and Avgeriou, 2011). Developing a facilitation architecture based on existing research has a prescriptive character and allows for “a futuristic view of a class of systems” (Galster and Avgeriou, 2011, p. 154). Facilitation architectures integrate innovative architectural patterns and aim to convince software and enterprise architectures of the qualities and benefits of the new RA (Angelov et al., 2008).

3 DIGITAL MARKETPLACES AND ARCHITECTURAL REQUIREMENTS

Retail transactions are executed using electronic means and digital technologies in e-commerce (Laudon and Traver, 2019). The degree, to which the transaction of the physical or digital product is executed digitally, is not further specified and can vary from electronic information retrieval in a pre-purchase phase to a completely digital transaction involving a digital product (e.g., music download) (Timmers, 1998; Laudon and Traver, 2019). In this regard, DMs establish a virtual environment for buyers and sellers to conduct transactions (Turban et al., 2017), exploit network effects (Park et al., 2004), and implement asymmetric pricing mechanisms (Chen, 2014; Rochet and Tirole, 2003). DMs apply the concept of two-sided markets (Armstrong, 2006; Hagiu and Wright, 2015a; Rochet and Tirole, 2003). They match two or more previously distinct markets and exploit direct and indirect network effects (Armstrong, 2006). These effects are exploited to further propel the DM (e.g., subsidization of a particular participant type) (Rochet and Tirole, 2003; Armstrong and Wright, 2007). DMs offer a digital representation of the diverse assortment of products offered by sellers (Teller and Elms, 2010). The DM can be represented as virtual location in an architecture model (e.g., ArchiMate) (Wulfert and Schütte, 2021). From a customer point-of-view, DMs “resemble retail agglomerations” (Hänninen, 2018, p. 155) integrating the range of articles of participating suppliers, retailers, and wholesalers through a single digital channel (Teller and Elms, 2010). DMs also reduce the number of intermediaries and provide uniform boundary resources (Eaton et al., 2015). Besides taking a neutral role by merely facilitating the matchmaking between participants, the marketplace owner can also behave competitively to supply-side participants offering its own articles to demand-side participants (Wulfert and Schütte, 2021; Wulfert et al., 2021). The focus of this research paper is on the retailer's dual role as simultaneous marketplace owner and reseller behaving competitive to other supply-side participants as introduced by Wulfert and Schütte (Wulfert and Schütte, 2021). DMs can be established on the basis of an existing offline business in brick-and-mortar stores or electronic shops as additional sales or procurement channel (Kawa and Wałęsiak, 2019). Thus, a retailer's IS need to facilitate the intermediation and orchestration of previously independent sides and traditional retail functions with related tasks (Levy et al., 2019; Reillier and Reillier, 2017). Establishing a DM and taking on a dual role poses additional requirements for IS (Schmid, 1997; Smolander and Rossi, 2008; Wulfert and Schütte, 2021). For the analysis of the identified RAs in section 5 we refer to the criteria introduced by Wulfert and Schütte (Wulfert and Schütte, 2021). These criteria are augmented by an additional AR on boundary resources (AR7).

Suppliers and customers as essential participants in e-commerce and brick-and-mortar environments are augmented by advertising partners, logistical service providers, opinion research firms, and others as additional market sides connected by DMs (Böttcher et al., 2021). To support the innovation platform perspective, we consider third-party developers and infrastructure providers as potential participants of DMs (Tiwana et al., 2010). Thus, a DM usually orchestrates multiple market sides (Hagiu, 2009). Retailers and suppliers can either interact with a DM as a supplier or demand products from other supply-side participants (Wulfert et al., 2021). As a result, the various DM participants must be effectively represented in terms of master data, and records must be maintained to guarantee that interactions between them can be traced in order to improve future matchmaking (**AR1**).

According to Hagiu and Wright (Hagiu and Wright, 2015b), participants in a DM must constantly have some sort of affiliation to it. In the offline environment, brick-and-mortar retailers aim to establish relationships with their customers by providing loyalty cards or shopping companion apps (Wulfert et al., 2019). The manner in which DM participants affiliate is not clearly defined and can be interpreted in a variety of ways (e.g. contract, membership, cookies) (Wulfert et al., 2021). Because it requires information on the participants, affiliation is necessary to increase the likelihood and quality of the matching among participants (**AR2**) (Evans and Schmalensee, 2016; Reillier and Reillier, 2017).

The key value proposition of a DM is the orchestration of previously independent market sides (Armstrong, 2006; Evans and Schmalensee, 2016; Rochet and Tirole, 2003). This entails matching single participants from the various sides of the DM (Moazed and Johnson, 2016). Reillier and Reillier (Reillier and Reillier, 2017) describe matching as a process of attracting, matching, and connecting DM participants in order to facilitate (retail) transactions (**AR3**).

The type, extent, and coverage of services offered by the DM owner varies depending on maturity and business model specification (Wulfert et al., 2021). The degree of additional services provided by a DM ranges from passive matching (e.g., eBay classifieds) to full-service offerings (e.g., Amazon) that include sales processing, logistic services, and training (Wang and Archer, 2007; Wulfert et al., 2021; Wulfert and Schütte, 2021). Depending on the degree of centralization of the DM (Wang and Archer, 2007), a significant portion of the bridging activities may be performed by other DM participants or the marketplace owner (Levy et al., 2019; Wulfert and Schütte, 2021). Because DMs often mature by adding new offerings for participants such as payment or logistics services (Reillier and Reillier, 2017), a retailer's IS should be adaptable to accommodate the integration of new services provided by the DM (**AR4**) (Wulfert and Schütte, 2021). This requires a flexible and modular architecture with the possibility to integrate new functions and services (pluggability) (Aulkemeier et al., 2016b; Wulfert et al., 2021).

Apart from retail-related services, DMs can provide DM participants with innovation platform services like access to sales or smart product-related data, as well as development services unrelated to the core retail business (**AR5**) (Tiwana et al., 2010). Innovation services are technical capabilities that enable participating developers to create new solutions (services or software extensions) and foster a DMs generativity (Asadullah et al., 2018; Wulfert and Schütte, 2021). The potential of innovation platforms to catalyze reconfigurability of technical and organizational components to accelerate generativity and value creation is based on their architectural modularity (Baldwin and Clark, 2000; Tiwana et al., 2010).

DMs aggregate digital representations of suppliers' assortments (Wulfert and Schütte, 2021). E-commerce in general, as well as the aggregation of distinct supply-side participants' individual assortments, necessitates a digital representation of the articles (**AR6**) (Turban et al., 2017). Articles and services can take many different forms, each with its own set of attributes that must be reflected in the article master data. The assortment supplied by external participants can be described as the periphery of DM, whereas the core is the DM itself, which provides (core) services to its participants (Staykova and Damsgaard, 2015). As a result, DMs lower transaction costs for participants by allowing a variety of articles to be sold or acquired through a single touchpoint with a consistent user experience (Wulfert and Schütte, 2021).

The establishment of a DM involves the provision of dedicated boundary resources so that participants from different market sides can connect (**AR7**). Designing boundary resources requires considering a variety of different applications. While supply-side participants need an interface to upload their assortment to the marketplace, service providers need interfaces for offering additional (product-related) services. External application developers use a development environment, standard system architecture, or interface descriptions (Dal Bianco et al., 2014). Thus, the marketplace owner needs to open its IS for other participants (Eisenmann et al., 2009). Even though boundary resources allow access to core modules of the DM, they also act as a control mechanism allowing marketplace owners to manage the infrastructure based on the strategy pursued, which increases the chances of achieving market leadership (Eaton et al., 2015; Ghazawneh and Henfridsson, 2013). Boundary resources represent a dimension of governance, defining the boundaries between the marketplace owner and the community of external participants, thus facilitating the realization of strategically relevant decisions about ownership, entry into new markets or community building (Dal Bianco et al., 2014; Hein et al., 2020; Foerderer et al., 2019). Dal Bianco et al. (Dal Bianco et al., 2014) differentiate application, development, and social boundary resources. Social boundary resources are used for knowledge transfer, development boundary resources for supporting application development, and application boundary resources for enabling interaction with platforms. For this research, we focus on technical boundary resources (i.e., application and development boundary resources) (Dal Bianco et al., 2014). While the former (APIs, libraries, etc.) are defined as the minimum required for a platform ecosystem to be viable, the latter increase the attractiveness of the ecosystem from the developers' perspective (Dal Bianco et al., 2014).

4 SCIENTIFIC APPROACH

To adequately address our research question, existing RAs and conceptual models in e-commerce are identified and analyzed for the support of DMs in a scoping approach (Paré et al., 2015). For this purpose, we conducted a literature review following vom Brocke et al. (Vom Brocke et al., 2009) in combination with Webster and Watson (Webster and Watson, 2002) to identify RAs that facilitate a retailer's dual role on DMs (Wulfert and Schütte, 2021). A literature review based on a clearly defined process and additional quality criteria ensures traceability, systematicity, and reproducibility of the results (Cram et al., 2020). As an initial narrow search for RAs on DMs does not provide sufficient results, we broadened our literature search to the context of e-commerce. According to Cooper (Cooper, 1988), our literature review can be described as follows: we searched for RAs in e-commerce as research outcomes. Our goal was to synthesize the literature on RAs facilitating a retailer's dual role on DMs. We neutrally represented our findings from our exhaustive literature review. The organization of our literature review is conceptual. The foundation of our research is the conceptualization of RAs as objects of consideration in e-commerce in general and for DMs in particular. The left-hand side of Figure 1 depicts the generalized search query, which was adapted to the syntax of each search engine. A search across relevant journals and conference papers was conducted using SCOPUS, Web of Science (WoS), IEEE Xplore (IEEE), AIS electronic library (AISeL), and ACM as scientific databases on 2021-09-28. As keywords, we used RA and e-commerce with related synonyms resulting in a set of 1,357 preliminary articles. To ensure an appropriate level of quality we focus on scientific literature and added additional quality criteria to the search (Randolph, 2009). We excluded non-English and non-German articles, panels, and commentaries. Identified papers have to comply with the context of e-commerce. For the e-commerce focus, we excluded architectures that do not cover the whole shopping process in e-commerce, are vendor- or technology-specific, and architectures only concerned with actors on the business layer (Angelov et al., 2012). In line with our search for RAs in IS consisting of information on business, application, and infrastructure layer, we also excluded articles that only focus on the infrastructure layer (i.e., articles that focus exclusively on infrastructure and application aspects without applying them in an e-commerce context) and articles with a focus on the business layer only (e.g., articles that focus exclusively on e-commerce or sub-types without the inclusion of additional technical layers). Considering these quality criteria in the title, abstract, and full-text subsequently, we identified 53 potentially relevant publications, leaving 39 after the exclusion of duplicates (Bandara et al., 2015). Then,

Research areas and search string

Reference architecture	Electronic commerce
("Reference Architecture" OR "IT-Architecture" OR "Software Architecture" OR "Information System Architecture") AND ("Electronic Commerce" OR "Electronic Trade" OR "Online Shopping" OR "Online Commerce" OR "E-Commerce" OR "Ecommerce" OR "Electronic Marketplace" OR "Transaction Platform")	

Literature screening and selection

Databases	Scopus	WoS	IEEE	AISeL
Preliminary set	393	215	81	668
Title check	121	79	41	11
Abstract check	46	27	28	4
Full-text check	23	16	12	2
Duplicate check	38			
RA check	8			
For-/Backward	5			
Final set	13			

Figure 1: Search String and Literature Review Results.

we applied the method for RA analysis by Angelov et al. (Angelov et al., 2012). As analysis criteria we considered the presented RA dimensions (section 2) and ARs (section 3) subsequently. The application of RA dimensions and ARs was conducted by two researchers independently. Diverging criteria were discussed in online meetings after each phase. The analysis regarding RA dimensions (i.e., RA check) was applied to assess the reusability of architectures in different organizational contexts. Applying these criteria to our initial set resulted in eight papers. After the application of the RA dimensions, we conducted a one-way back- and forward search and identified five additional papers (Figure 1). We determined AR fulfillment based on a qualitative analysis of the final set of papers and analyzed the textual descriptions and graphical representations of the ARs. While fulfillment means that they match our textual description, partial fulfillment is indicated when not all aspects are fulfilled (e.g., platform boundary but no development boundary included). As the final set of 13 papers needs to support the retailer's role in brick-and-mortar and e-commerce with its related bridging functions (Levy et al., 2019), we applied the seven ARs. The orchestration of the formerly independent markets sides (Rochet and Tirole, 2003) and additional innovation services (Tiwana et al., 2010) pose additional requirements for a retailer's IS that need to be reflected in RAs for e-commerce (Wulfert and Schütte, 2021). We further analyze them regarding the fulfillment of the ARs posed by the marketplace operator role and the provision of innovation services (i.e., dual role) (Armstrong, 2006; Tiwana et al., 2010). In the following section we present the analysis of the 13 RAs identified in a conceptual matrix (Table 1).

5 REFERENCE ARCHITECTURE FOR RETAIL INFORMATION SYSTEMS

The industry-specific RAs for IS in the context of e-commerce offer a high-level view on architecture components and business functions (Bass et al., 2003; Becker and Schütte, 2004). The 13 RAs identified cover a period from 2004 until 2019. The RA analysis is summarized in Table 1 in chronological order of the RA release in its latest version (AR fulfilled: X; AR partially fulfilled: (X); AR not fulfilled: (-).

The **Global Electronic Market Stands (GEMS)** is a RA for e-commerce that incorporates a manufacturer, retailer, and consumer perspective on the business layer (Albers et al., 2004). It provides an aggregated specification in textual form and was developed to facilitate the interactions on DMs. The architecture describes the affiliation of diverse actors with the DM required for the entrance control module and defines the matching as a core task. The authors describes data records needed for a sufficient matching of supply and demand sides (Albers et al., 2004).

The **H-model** was developed for brick-and-mortar retail and wholesale and consists of eleven main trading functions and detailed process models (Becker and Schütte, 2004). The process models are formally described with event-driven process chains and the data models are depicted in entity-relationship models. Additionally, the architecture specifies components, interfaces, protocols, and guidelines for architecture and system implementation. As it is derived from several system implementations and the specification of the industry solution for SAP's enterprise resource planning system, it is an attempt to standardize retail processes and supporting information technology. The H-model focuses on the reseller mode, purchasing articles from manufacturers and selling them to customers (Hagiu and Wright, 2015a). The affiliation of manufacturers and customers with the retailer is partially modeled in business partner master data. It covers retail-related services (e.g. logistics, procurement). As it has a brick-and-mortar focus, it does not consider innovative platform services.

ECOMOD was presented in 2006 and consists of reference processes and strategies for e-commerce subsumed under a structuring RA (Ecomod, 2006). The reference processes mainly describe business layer components and the descriptions are considered semi-detailed. The authors developed an individual notation for the depiction of the RA and related processes. As the research project is based on the input from various companies, the architecture is introduced to standardize the processes and information

Table 1: Conceptual Matrix of Reference Architectures Supporting a Retailer's Dual Role on Digital Marketplaces.

Reference Architecture (Reference) | **Architectural Requirement**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
GEMS (Albers et al., 2004)	-	x	x	-	-	-	-
H-Model (Becker and Schütte, 2004)	-	(x)	-	x	-	-	-
ECOMOD (Ecomod, 2006)	-	(x)	-	(x)	-	-	-
Platform Architecture (Lan et al., 2008)	-	(x)	-	(x)	(x)	-	x
Model of e-Marketplaces (Matook and Vessey, 2008)	-	-	x	x	-	x	(x)
e-ZOCO Architecture (Castro-Schez et al., 2010)	-	(x)	(x)	x	-	x	(x)
EC-SCP(Chi et al., 2010)	x	x	x	-	-	-	-
Shell model (Schütte, 2011)	-	x	-	x	-	-	(x)
E-commerce Reference Architecture (Aulkemeier et al., 2016b)	-	(x)	-	x	-	-	-
Pluggable Service Platform (Aulkemeier et al., 2016a)	x	(x)	-	x	x	-	x
ARTS (OMG, 2019)	-	(x)	-	x	-	-	-
Integrated Architecture (Vetter and Morasch, 2019)	x	(x)	-	x	x	x	-
NGECP (Huang et al., 2019)	x	x	(x)	x	-	x	-

technology in e-commerce. It focuses on purchasing and selling activities with suppliers and customers under consideration. Affiliations to the intermediary are only considered for the consumer side. The orchestration of market sides is not reflected within this RA. Retail-specific services are only integrated partially (Frank, 2004). Articles are represented digitally and enriched with unstructured data (e.g. photos, videos) but the agglomeration of manufacturers' and retailers' assortments is not intended (Frank, 2001).

Lan et al. (Lan et al., 2008) present a **platform architecture** with e-commerce patterns following the service-oriented paradigm. Existing standards such as service data objects or service component architecture are adapted for use in e-commerce. The architecture formally presents components in UML and XML notation. While the overall transactions are modeled in an aggregated manner in use case diagrams, a purchase order is exemplary detailed using XML. The RA is developed to facilitate transactions in the e-commerce environment. The affiliation of the actors with the platform is implicitly mentioned in the authentication portal. The authors define several documents and signals (e.g., order, acknowledge signal) as boundary objects for information exchange between actors. Besides transaction-related services, the authors opt for integrating additional offerings by adding additional (micro) services. They can be developed using development tools from the development tool layer. However, the authors do not intend a use by external developers.

The domain-specific **Model of e-Marketplaces** covers the business, application, and infrastructure layer with components and interfaces in an aggregated manner (Matook and Vessey, 2008). It is developed to support different types of DMs and standardize their information systems with semi-formal and additional textual descriptions. Matook and Vessey consider a retailer's dual role as owner of a DM and simultaneous seller of articles in their textual description (Matook and Vessey, 2008). However, the authors only mention customers and sellers as potential participants and do not describe affiliation vehicles. The matching of participants is described as a value-adding activity and marketplaces can also offer additional retail services such as contract, financial, or logistics services besides an aggregated representation of the various assortments. The authors do not consider any innovation platform service or related development boundary resources. Application boundary resources are described as part of the infrastructure layer.

The **e-ZOCO** architecture includes aggregated specifications for components and guidelines for business, application, and infrastructure layer (Castro-Schez et al., 2010). The architecture is presented in a semi-formal way by using non-standardized illustrations supplemented by describing texts. It is developed to facilitate DMs by overcoming "the limitations of centralized architecture" (Castro-Schez et al., 2010, p. 272). The architecture requires affiliation to the DM for the authentication of participants. The matching process is addressed by sophisticated recommendation and search engines that are described in detail. e-ZOCO comprises a product catalog as a pivotal component for managing the aggregated assortment of the manufacturers and retailers. Additional services to facilitate the orchestration of the different actors are considered such as messaging and forum subsystems. The authors integrate a middleware for the communications of the different (internal) subsystems but do not mention any specific boundary objects for the communication with other actors.

The **Generic E-Commerce Service Composition Platform (EC-SCP)** is introduced to facilitate various business models in e-commerce (Chi et al., 2010). It is concerned with components and interfaces on the business and application layer. The aggregated specification is presented semi-formal with non-standardized forms and supplementing textual descriptions. The core of the architecture is formed by a matchmaking component and an orchestration plan generator. The authors introduced service providers as additional participants besides manufacturers and consumers. Affiliations are represented in the access component managing participant identities and access rights.

The **shell model** as proposed by Schütte is a task-oriented redesign of the H-model (Schütte, 2011). It consists of four architectures covering the whole value chain across manufacturer, wholesaler, retailer, and consumer and implicitly mentions data forwarding along the value chain. The retail architecture consists of five shells for the main retail tasks (master data, technical tasks, economic operative tasks, administrative tasks, and decision-oriented tasks) of each actor and the retailer in particular (Schütte, 2017). Each shell consists of a series of tasks that form the components of the architecture. The aggregated specification of the architecture is presented semi-formal with non-standardized circles and rings supplemented by textual descriptions. As it is based on the H-model and integrating IS along a retail value chain, it is a means for standardization. The affiliation is highlighted by specific architectures for the participants. It considers the digital representation of the articles, but not the aggregation of diverse assortments on a single DM.

Aulkemeier et al. (Aulkemeier et al., 2016a) develop a **reference architecture for electronic commerce** and offer an additional view on application and technological architectural layers besides the business processes. The architecture presents components, interfaces, and guidelines for the business, application, and infrastructure layers. The aggregated specification is depicted formally using ArchiMate. It is derived from a literature review and facilitates various business models in e-commerce. However, the RA focuses on the reselling of articles in electronic shops. Because of the reseller focus, the affiliation is only integrated for customers. With the mentioned focus, retail-specific services are considered but no additional innovation platform services.

Furthermore, Aulkemeier et al. (Aulkemeier et al., 2016b) suggest an additional RA for a **pluggable service platform** focusing on the development and integration of retail-related and external services. The architecture provides an aggregated specification of components, interfaces, and guidelines depicted formally in ArchiMate. In contrast to their aforementioned architecture, the authors focus on the business and application layer. The architecture should facilitate the integration of additional services and enables the development of (innovative) services by third-party developers. It introduces services providers, that provide IT or business services to the retailer, and a platform provider responsible for the intermediation between the retailer and service providers or developers as additional participants. The affiliation of these participants is indicated by connecting arrows. A retailer can integrate various external services using defined boundary resources for files, applications, and web services.

The **Association for Retail Technology Standards (ARTS)** introduces a RA for its Business Process Retail Models for the brick-and-mortar environment with a focus on the business layer components (OMG, 2019). ARTS is updated by the Object Management Group that provides open standards for several industries and ARTS is the RA for retail. The components can be characterized as aggregated specification and the architecture is modeled with a non-standardized notation. The components are detailed in the Business Process Model and Notation language. It only focuses on consumer and suppliers as participants but partially integrates the affiliation with the retailer. The orchestration of independent markets is not addressed i.e. by matching. Retail-specific services are provided as a main focus. As it introduces online ordering and pick-up in store, it needs to include a digital representation of the assortment with unstructured data but no aggregation of the assortment of diverse actors.

Vetter and Morasch (Vetter and Morasch, 2019) develop a RA involving the components of an **integrated platform** for the brick-and-mortar and e-commerce environment. In addition, the authors provide a mapping for their architecture components to specific SAP software modules that are not considered for further analysis. The RA includes components on the business and application layer. The authors use a non-standardized notation for depicting their aggregated specification of the architecture. As the RA rests on the SAP enterprise resource planning system, it is an attempt to standardize the architecture in retail. The authors implicitly mention further participants such as employees. The affiliation is also only monitored for the customer side and only retail-specific services are included. Although the authors do not mention external access to their application and infrastructure layer, the components map to the introduced innovative platform services.

Huang et al. (Huang et al., 2019) introduce an **architecture for a portal-based next-generation e-commerce platform (NGECP)**. The NGECP provides an aggregated specification for the actor, business, and application layer components and interfaces. It is described in a non-standardized notation supplemented by textual descriptions. The architecture is developed to facilitate a portal-based e-commerce solution. The authors represent several additional participants such as logistics service providers or reference raw material suppliers and represent their affiliation as matchmaking between the participants is seen as the core value proposition. Nevertheless, the authors do not further specify data records required for a proper matching. Besides, retail-specific services are offered and the dual role is supported. However, innovation platform services are not mentioned.

6 DISCUSSION AND FUTURE RESEARCH

We have identified 13 architectures for e-commerce that are characterized as RAs and have analyzed them for the fulfillment of seven additional ARs stemming from the marketplace operator role and the simultaneous sales on the DM in a reseller role (i.e., dual role). Our analysis shows that none of the 13 RAs fully supports the requirements resulting from a retailer's dual role on DMs. More specifically, architectures dealing with DMs in particular (Huang et al., 2019; Albers et al., 2004; Castro-Schez et al., 2010), neither mention the marketplace owner as an additional ecosystem participant providing own products nor refer to additional innovation platform services enabling integration of third-party developers. Not explicitly mentioning a retailer's dual role in a RA may be caused by the reason that an actor can take on several roles within a single ecosystem (Corallo, 2007). However, a dual role as a reseller on the DM and marketplace owner involves information advantages such as the concentration on fast-moving products and more profitable customers (Wulfert and Schütte, 2021). These advantages have led to antitrust law consideration in the past involving recommendation of own products to customers or adjusting prices and commission fees accordingly (Euorpäische Kommission, 2020). The implementation of sophisticated boundary resources and the attraction of third-party developers can positively influence the attractiveness of a DM for other ecosystem participants. Third-party developers can implement additional modules for the DM, such as shop themes, interfaces with other digital platforms, or feature add-ins. The best fit for the the seven ARs is the RA presented by Huang et al. (Huang et al., 2019) that focuses on the orchestration of different types of participants (Table 1). As none of the analyzed RAs fulfills the requirements resulting from a retailer's dual role, future research may develop a RA supporting a retailer's dual role on DMs. The reseller mode is already fully covered by many brick-and-mortar (Becker and Schütte, 2004; Schütte, 2011) and e-commerce (Ecomod, 2006; Chi et al., 2010; Aulkemeier et al., 2016a) architectures under consideration. Research on conceptual modeling from the past fifty years led to a focus on existing business models and creating domain-specific description languages (Recker et al., 2021). The brick-and-mortar and e-commerce RAs as well as domain-specific description languages may form the foundation for an architecture supporting a retailer's dual role. The innovation platform services are also considered in some RAs (Aulkemeier et al., 2016b; Vetter and Morasch, 2019; Lan et al., 2008). Seven of the identified RAs were developed by researchers and research institutes to facilitate the development of new IS and the integration of new concepts and technologies. Standardizing IS in e-commerce was the focus of five RAs. In this regard, generic architectures (e.g., TOGAF, Zachman Framework) might also be used for standardization in e-commerce. However, we do not include such architectures in our literature sample, as they are too generic and abstract to be directly applied in e-commerce and hence will not discuss or support a retailer's dual role. Most of the RAs applicable in e-commerce are inspired by a brick-and-mortar background or are initially developed for an offline environment. Although the RAs are vendor and technology independent and are designed for longevity and as well as reusability, they do not always represent state-of-the-art processes or retail tasks developed 15 years ago. Despite IS researchers having early on propagated reference models as crucial vehicles for IS development and implementation, in an era of agile development, they have not prevailed in many industries including retail and their value for developers, companies, and researchers has been questioned (Saghafi and Wand, 2014). Nevertheless, recent research claimed that reference models remain important (Recker et al., 2021). Although we have focused within our literature review on RAs for e-commerce, our back- and forward search led to the integration of architectures originating from a brick-and-mortar context. These architectures support a retailer's bridging functions that are also relevant in e-commerce (Schütte, 2017). However, they do not take into account the specifics of the retailer's dual role such as innovation platform services (AR5), a digitally aggregated assortment (AR6), or boundary resources for all types of ecosystem participants (AR7) (Table 1). Additionally, our review addressed scientific databases potentially excluding company-specific RAs and those proposed by industrial associations. While the former would be considered too specific during the analysis, the latter can be reused and potentially facilitate a retailer's dual role. Thus, future research may also analyze practice-based RAs for the fulfillment of the introduced ARs. Moreover, our set of applied ARs was limited to seven (Wulfert and Schütte, 2021). Although this set is neither complete nor comprehensive, it includes the main requirements resulting from a retailer's dual role on DMs. The ARs address the retailer's dual role with the marketplace owner as an ecosystem participant behaving competitively to other resellers (Kawa and Wałęsiak, 2019) with the major requirements matching process as core value proposition (AR3) (Reillier and Reillier, 2017) and additional innovation platform services (AR5) (Tiwana et al., 2010). Thus, future research can derive additional ARs from practitioner interviews and company documentations. Another important avenue for future research will be the enhancement of a RA to support the specifics of a retailer's dual role on DMs (i.e., matching and innovation-related services). The enhanced RA should especially support the necessary activities for orchestrating participants (matching functions) and integrate innovation-related services to develop new services and modules (infrastructure layer).

7 CONCLUSION

A retailer operating a DM while simultaneously selling products on this marketplace in a reseller role takes on a dual role in this DM ecosystem. This dual role involves the bridging functions from the reseller mode, the matching processes relevant for the marketplace, and additional innovation platform services for attracting third-party developers to the marketplace. Our analysis revealed 38 architectures in the context of e-commerce that are described with six RA-related dimensions and analyzed using seven DM-specific ARs. We identified thirteen RAs that address some of the ARs resulting from a retailer's dual role on DMs. However, none of them fully supports the requirements of DMs. The NGECP fulfills five of the ARs resulting from a retailer's dual role on DMs (Huang et al., 2019). A retailer's dual role was not fully addressed by any of the analyzed RAs. The matching process requirement (five architectures), the innovation platform services requirement (three architectures), and the aggregated assortment requirement (four architectures) were also underrepresented in our literature sample. Hence, we call for initiatives developing dedicated RAs supporting a retailer's dual role on DMs.

REFERENCES

Ahlemann, F. (2012). *No Strategic enterprise architecture management: Challenges, best practices, and future developments. Management for professionals*. Springer, Berlin [u.a.].

Albers, M., Jonker, C. M., Karami, M., and Treur, J. (2004). Agent Models and Different User Ontologies for an Electronic Market Place. *Knowledge and Information Systems*, 6(1):1–41.

Amazon (2021). Amazon Annual Report 2020.

Angelov, S., Grefen, P., and Greefhorst, D. (2009). A classification of software reference architectures: Analyzing their success and effectiveness. In *WICSA-ECSA2009 Proceedings*, pages 141–150. IEEE.

Angelov, S., Grefen, P., and Greefhorst, D. (2012). A framework for analysis and design of software reference architectures. *Information and Software Technology*, 54(4):417–431.

Angelov, S., Trienekens, J. J. M., and Grefen, P. (2008). Towards a method for the evaluation of reference architectures: Experiences from a case. In Morrison, R., Balasubramaniam, D., and Falkner, K., editors, *ECSA2008 Proceedings*, pages 225–240. Springer.

Armstrong, M. (2006). Competition in two-sided markets. *RAND Journal of Economics*, 37(3):668–691.

Armstrong, M. and Wright, J. (2007). Two-sided Markets, Competitive Bottlenecks and Exclusive Contracts. *Economic Theory*, 32(2):353–380.

Asadullah, A., Faik, I., and Kankanhalli, A. (2018). Digital Platforms: A Review and Future Directions. In *PACIS Proceedings*, pages 1–14.

Aulkemeier, F., Paramartha, M. A., Iacob, M. E., and van Hillegersberg, J. (2016a). A pluggable service platform architecture for e-commerce. *Information Systems and e-Business Management*, 14(3):469–489.

Aulkemeier, F., Paramartha, M. A., Iacob, M. E., and van Hillegersberg, J. (2016b). A pluggable service platform architecture for e-commerce. *Information Systems and e-Business Management*, 14(3):469–489.

Baldwin, C. Y. and Clark, K. B. (2000). *Design Rules: The Power of Modularity*. MIT Press, Cambridge.

Bandara, W., Furtmueller, E., Gorbacheva, E., Miskon, S., and Beekhuyzen, J. (2015). Achieving rigor in literature reviews: Insights from qualitative data analysis and tool-support. *Communications of the Association for Information Systems*, 37:154–204.

Barbosa, A. O., Santana, A., Hacks, S., and Von Stein, N. (2019). A taxonomy for enterprise architecture analysis research. In *ICEIS2019 Proceedings*, volume 2, pages 493–504.

Bass, L., Clements, P., and Kazman, R. (2003). *Software architecture in practice*. Addison-Wesley Professional, Boston.

Becker, J. and Schütte, R. (2004). *Handelsinformationssysteme: domänenorientierte Einführung in die Wirtschaftsinformatik*. Redline Wirtschaft, Frankfurt am Main, 2., vollst edition.

Böttcher, T., Rickling, L., Gmelch, K., Weking, J., and Krcmar, H. (2021). Towards the Digital Self-Renewal of Retail: The Generic Ecosystem of the Retail Industry. In *WI2021 Proceedings*, pages 1–9.

Castro-Schez, J. J., Miguel, R., Vallejo, D., and Herrera, V. (2010). A multi-agent architecture to support B2C e-Marketplaces: The e-ZOCO case study. *Internet Research*, 20(3):255–275.

Chen, J. (2014). Pricing strategies in the electronic marketplace. In *Handbook of Strategic e-Business Management*, pages 489–522. Springer, Berlin [u.a.].

Chi, J., Yin, C., Song, M., Song, J., and Zhan, X. (2010). Generic service composition platform for pervasive E-Commerce. *Wireless Communications and Mobile Computing*, 10:1366–1377.

Cooper, H. M. (1988). Organizing Knowledge Synthesis: A Taxonomy of Literature Reviews. *Knowledge in Society*, 1(1):104–126.

Corallo, A. (2007). The business ecosystem as a multiple dynamic network. In Corallo, A., Passiante, G., and Prencipe, A., editors, *The Digital Business Ecosystem*, pages 11–32. Edward Elgar Publishing, Cheltenham, UK.

Cram, W. A., Templier, M., and Paré, G. (2020). (Re)considering the concept of literature review reproducibility. *Journal of the Association for Information Systems*, 21(5):1103–1114.

Dal Bianco, V., Myllärniemi, V., Komssi, M., and Raatikainen, M. (2014). The Role of Platform Boundary Resources in Software Ecosystems: A Case Study. In *WICSA22014 Proceedings*.

Delteil, B., Le, A., and Miller, M. (2020). Six golden rules for ecosystem players to win in Vietnam.

Eaton, B., Elaluf-Calderwood, S., Sorensen, C., and Yoo, Y. (2015). Distributed tuning of boundary resources: the case of Apple's iOS service system. *MIS Quarterly*, 39(1):217–243.

Ecomod (2006). Referenzgeschäftsprozesse und Strategien im E-Commerce.

Eisenmann, T., Parker, G., and Van Alstyne, M. (2009). Opening Platforms: How, When and Why? In Gawer, A., editor, *Platforms, Markets and Innovation*, pages 131–162. Edward Elgar, Cheltenham LB - Eisenmann2009.

Euorpäische Kommission (2020). Kartellrecht: Kommission richtet Mitteilung der Beschwerdepunkte an Amazon wegen Nutzung nichtöffentlicher Daten unabhängiger Verkäufer und leitet zweite Untersuchung der E-Commerce-Geschäftspraxis des Unternehmens ein.

Evans, D. S. and Schmalensee, R. (2016). *Matchmakers. The New Economics of Multisided Platforms*. Harvard Business Review Press, Boston.

Foerderer, J., Kude, T., Schuetz, S. W., and Heinzl, A. (2019). Knowledge boundaries in enterprise software platform development: Antecedents and consequences for platform governance. *Information Systems Journal*, 29(1):119–144.

Frank, L. (2004). Architecture for integration of distributed ERP systems and e-commerce systems. *Industrial Management and Data Systems*, 104(5):418–429.

Frank, U. (2001). A Conceptual Foundation for Versatile E-Commerce Platforms. *Journal of Electronic Commerce Research*, 2(2):48–57.

Galster, M. and Avgeriou, P. (2011). Empirically-grounded reference architectures: a proposal. In *ISARCS2011 Proceedings*, pages 153–158.

Ghazawneh, A. and Henfridsson, O. (2013). Balancing platform control and external contribution in third-party development: the boundary resources model. *Information systems journal*, 23(2):173–192.

Giachetti, R. E. (2010). *Design of enterprise systems: theory, architecture, and methods*. CRC Press, Boca Raton.

Greefhorst, D., Koning, H., and Van Vliet, H. (2006). The many faces of architectural descriptions. *Information Systems Frontiers*, 8(2):103–113.

Hagiu, A. (2007). Merchant or two-sided platform? *Review of Network Economics*, 6(2):115–133.

Hagiu, A. (2009). Multi-sided platforms: From microfoundations to design and expansion strategies. *Harvard Business School Strategy Unit Working Paper*, (09-115).

Hagiu, A. and Wright, J. (2015a). Marketplace or reseller? *Management Science*, 61(1):184–203.

Hagiu, A. and Wright, J. (2015b). Multi-sided platforms. *International Journal of Industrial Organization*, 43:162–174.

Hänninen, M. (2018). Has digital retail won?: The effect of multi-sided platforms on the retail industry. *Strategic Direction*, 34(3):4–6.

Hein, A., Schreieck, M., Riasanow, T., Setzke, D. S., Wiesche, M., Böhm, M., and Krcmar, H. (2020). Digital platform ecosystems. *Electronic Markets*, 30(1):87–98.

Heinrich, L. and Stelzer, D. (2009). *Informationsmanagement: Grundlagen, Aufgaben, Methoden*. Oldenbourg Wissenschaftsverlag, München.

Huang, Y., Chai, Y., Liu, Y., and Shen, J. (2019). Architecture of next-generation e-commerce platform. *Tsinghua Science and Technology*, 24(1):18–29.

Kawa, A. and Wałęsiak, M. (2019). Marketplace as a key actor in e-commerce value networks. *Logforum*, 15(4):521–529.

Keller, W. (2017). *IT-Unternehmensarchitektur. Von der Geschäftsstrategie zur optimalen IT-Unterstützung*. dpunkt.verlag, Heidelberg, 3 edition.

Kotusev, S. and Kurnia, S. (2020). The theoretical basis of enterprise architecture: A critical review and taxonomy of relevant theories. *Journal of Information Technology*, 35(4):1–41.

Lan, J., Liu, Y., and Chai, Y. (2008). A solution model for service-oriented architecture. *WCICA2008 Proceedings*, pages 4184–4189.

Laudon, K. C. and Traver, C. G. (2019). *E-Commerce 2018: business. technology. society*, volume 14. Pearson Education, Boston.

Levy, M., Weitz, B. A., and Grewal, D. (2019). *Retailing management*. McGraw-Hill Education, New York, NY, tenth edit edition.

Libert, B., Wind, Y., and Fenley, M. (2014). What Airbnb, Uber, and Alibaba have in common. *Harvard business review*, 11(1):1–9.

Matook, S. and Vessey, I. (2008). Types of Business-to-Business E-Marketplaces: The Role of a Theory-Based, Domain-Specific Model. *Journal of Electronic Commerce Research*, 9(4):260.

McKinsey (2020). The conflicted Continent: Ten charts show how COVID-19 is affecting consumers.

Moazed, A. and Johnson, L. N. (2016). *Modern Monopolies. What It Takes to Dominate the 21st-Century Economy*. St. Martin's Press, New York.

Niemann, K. D. (2006). *From Enterprise Architecture to IT Governance. Elements of Effective IT Management*. Vieweg, Wiesbaden.

OMG (2019). ARTS Business Process Model for Retail.

Open Group (2016). TOGAF Worldwide.

Open Group (2019). ArchiMate 3.1 Specification.

Paré, G., Trudel, M. C., Jaana, M., and Kitsiou, S. (2015). Synthesizing information systems knowledge: A typology of literature reviews. *Information and Management*, 52(2):183–199.

Park, N. K., Mezias, J. M., and Song, J. (2004). A resource-based view of strategic alliances and firm value in the electronic marketplace. *Journal of Management*, 30(1):7–27.

Pereira, C. M. and Sousa, P. (2004). A method to define an enterprise architecture using the zachman framework. *SIGAPP2004 Proceedings*, 2:1366–1371.

Randolph, J. J. (2009). A guide to writing the dissertation literature review. *Practical Assessment, Research and Evaluation*, 14(13):1–13.

Recker, J., Lukyanenko, R., Samuel, B. M., and Castellanos, A. (2021). From Representation to Mediation: A New Agenda for Conceptual Modeling Research in a Digital World. *MIS Quarterly*, 45(1):269–300.

Reillier, L. C. and Reillier, B. (2017). *Platform Strategy. How to Unlock the Power of Communities and Networks to Grow Your Business*. Routledge, London.

Rochet, J. and Tirole, J. (2003). Platform competition in two-sided markets. *Journal of the European Economic Association*, 1(4):990–1029.

Saghafi, A. and Wand, Y. (2014). Do ontological guidelines improve understandability of conceptual models? A meta-analysis of empirical work. In *HICSS2014 Proceedings*, pages 4609–4618, Waikoloa, Hawaii. IEEE.

Schmid, B. (1997). Requirements For Electronic Markets Architecture. *Electronic Markets*, 7(1):3–6.

Schütte, R. (2011). *Modellierung von Handelsinformationssystemen. Kumulative Habilitationsschrift*. Westfälische Wilhelms-Universität Münster, Münster.

Schütte, R. (2017). Information systems for retail companies. In Dubois, E. and Pohl, K., editors, *International Conference on Advanced Information Systems Engineering*, pages 13–25, Essen, Deutschland. Springer.

Shapiro, C. and Varian, H. R. L. B. S. (1998). *Information rules: a strategic guide to the network economy*. Harvard Business Press, Boston, Mass.

Smolander, K. and Rossi, M. (2008). Conflicts, compromises, and political decisions: Methodological challenges of enterprise-wide e-business architecture creation. *Journal of Database Management*, 19(1):19–40.

Staykova, K. S. and Damsgaard, J. (2015). A Typology of Multi-sided Platforms: The Core and the Periphery. In *ECIS2015 Proceedings*.

Teller, C. and Elms, J. (2010). Managing the attractiveness of evolved and created retail agglomerations formats. *Marketing Intelligence & Planning*, 28(1):25–45.

Timmers, P. (1998). Business models for electronic markets. *Electronic markets*, 8(2):3–8.

Tiwana, A., Konsynski, B., and Bush, A. A. (2010). Platform Evolution: Coevolution of Platform Architecture, governance, and Environmental Dynamics. *Information Systems Research*, 21(4):675–687.

Turban, E., Whiteside, J., King, D., and Outland, J. (2017). *Introduction to Electronic Commerce and Social Commerce*. Springer Texts in Business and Economics. Springer International Publishing, Cham, 4 edition.

Vetter, T. and Morasch, R. (2019). Integrierte Plattformen im Handel. In Heinemann, G., Gehrckens, H. M., Täuber, M., and GmbH, A., editors, *Handel mit Mehrwert*, pages 321–343. Springer, Heidelberg.

Vom Brocke, J., Simons, A., Niehaves, B., Riemer, K., Plattfaut, R., Cleven, A., Brocke, J. V., and Reimer, K. (2009). Reconstructing the Giant: On the Importance of Rigour in Documenting the Literature Search Process. In *ECIS2017 Proceedings*, volume 9, page 2206–2217, Verona, Italy.

Wang, S. and Archer, N. P. (2007). Electronic marketplace definition and classification: literature review and clarifications. *Enterprise Information Systems*, 1(1):89–112.

Webster, J. and Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, 26(2):xiii – xxiii.

Winter, R. and Fischer, R. (2006). Essential layers, artifacts, and dependencies of enterprise architecture. In *EDOCW2006 Proceedings*, pages 30–38.

Winter, R. and Gericke, A. (2006). Teradata University Network - Ein Portal zur Unterstützung der Lehre in den Bereichen Business Intelligence, Data Warehousing und Datenbanken. *Wirtschaftsinformatik*, 48(4):276–281.

Wulfert, T., Betzing, J. H., and Becker, J. (2019). Eliciting Customer Preferences for Shopping Companion Apps: A Service Quality Approach. In *WI2019 Proceedings*, pages 1220–1234.

Wulfert, T. and Schütte, R. (2021). Retailer's Dual Role in Digital Marketplaces: Towards Architectural Patterns for Retail Information Systems. In *ICEIS2021 Proceedings*, pages 601–612.

Wulfert, T., Seufert, S., and Leyens, C. (2021). Developing Multi-Sided Markets in Dynamic Electronic Commerce Ecosystems - Towards a Taxonomy of Digital Marketplaces. In *HICSS2021 Proceedings*, pages 6133–6142.