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Digital service innovation in B2B markets

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Abstract

Purpose – Technology-enabled business-to-business (B2B) services contribute the largest share to GDP growth and are fundamental for an economy's value creation. This article aims to identify key service- and digital technology-driven B2B innovation modes and proposes a research agenda for further exploration.

Design/methodology/approach – This conceptual paper adopts a techno-demarcation view on service innovation, encompassing three core dimensions: service offering (the service product, or the "what"), service process (the "how") and service ecosystem (the "who/for whom"). It delineates the implications of three digital technologies – the internet-of-things (IoT), intelligent automation (IA) and digital platforms – for service innovation across these core dimensions in B2B markets.

Findings – Digital technology has immense potential ramifications for value creation by reshaping all three core dimensions of service innovation. Specifically, IoT can transform physical resources into reconfigurable service products, IA can augment and automate a rapidly expanding array of service processes, while digital platforms provide the technical and organizational infrastructure for the integration of resources and stakeholders within service ecosystems.

Originality/value – This study suggests an agenda with six themes for further research, each linked to one or more of the three service innovation dimensions. They are (1) new recurring revenue models, (2) service innovation in the metaverse, (3) scaling up service innovations, (4) ecosystem innovations, (5) power dependency and lock-in effects and (6) security and responsibility in digital domains.

Keywords B2B, Artificial intelligence, Innovation, Internet of things, Service ecosystem

Paper type Conceptual paper

Introduction

Service innovation powered by digital technologies is driving a transformative shift in business-to-business (B2B) industries. Digital services form part of a service revolution (Bornet *et al.*, 2021; Paluch *et al.*, 2022) similar to the one that transformed manufacturing starting in the late 18th century (Freeman and Louca, 2001; Rifkin, 2011). The growth of B2B services is particularly dynamic; between 1990 and 2020, global trade in goods expanded fivefold while B2B services multiplied elevenfold (Wolf, 2022). In large part, these new services are digital. They reflect the digital transformation connecting a growing share of physical and human resources to a global, almost ubiquitous information infrastructure. With global scale and exponential performance growth, digital technology has become the general-purpose technology for value creation and resource integration in many B2B markets.

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Despite these developments, studies on innovation in B2B markets often neglect service innovation and its potential. Digital services, in particular, have largely been ignored in the mainstream literature on service innovation (Opazo-Basáez *et al.*, 2021). Furthermore, even though many service innovations have originated in the B2B context, service research has primarily focused on how advances in technology influence consumer (B2C) markets, spanning from specific activities such as personalized advertising to wide-scale change for improved consumer well-being (e.g. Field *et al.*, 2021; Huang and Rust, 2021; Ostrom *et al.*, 2021). This narrow focus can be attributed to the conventional belief that services have a lower frequency of innovation (Baumol, 1967; Miozzo and Soete, 2001) and what Biemans and Griffin (2018) refer to as the innovation literature's strong bias toward physical products.

Research that specifically focuses on B2B mostly centers on manufacturing settings (Kowalkowski *et al.*, 2022; Raddats *et al.*, 2019), investigating topics such as new service development in product-centric firms (Burton *et al.*, 2017; Ettlie and Rosenthal, 2012), product-service innovation (Spring and Araujo, 2013; Chirumalla, 2016) and digital industrial services (Markfort *et al.*, 2021; Tronvoll *et al.*, 2020). The strong focus on manufacturing, however, limits a more comprehensive understanding of B2B service innovation. This becomes evident if we look at the tremendous growth of technology-enabled B2B services; knowledge-intensive business services such as consulting, information technology, logistics and operational services are the fastest-growing segments in the world economy (Wirtz *et al.*, 2015). These services may be provided either by pure service firms or by manufacturers (Kowalkowski and Ulaga, 2017), making the distinction increasingly less relevant if we want to understand service innovation. As digital technologies have the capacity to transform industries and blur traditional industry boundaries even further, we need a better understanding of how such technologies can drive change.

The service revolution in B2B markets becomes particularly apparent in the development of three key complementary signature technologies. They are (1) the internet-of-things (IoT), which transforms physical equipment, machinery and even fixed assets into services; (2) intelligent automation (IA), which uses digital technologies for service process innovation; and (3) digital platforms which constitute the organizational and technical architectures for service ecosystems. These technologies develop fast and are rapidly becoming more intelligent, powerful, smaller, lighter and cheaper (Wirtz *et al.*, 2018). They encompass both hardware and software and have the potential to reconfigure existing service systems and facilitate a diverse range of service innovations (Bornet *et al.*, 2021; Gregory *et al.*, 2021; Ng and Wakenshaw, 2017). In line with Opazo-Basáez *et al.* (2021), we argue that the disruptive potential of digital B2B services will alter the prevailing understanding of technological innovation in service.

In this paper, we seek to advance service innovation research by adopting a techno-demarcation view (Miles, 2016), holding that digital technologies have the genuine potential to unlock new services from resources and connect them across industry boundaries. We do this by drawing on Gustafsson *et al.*'s (2020) definition of service innovation as "a new process or offering that is put into practice and is adopted by and creates value for one or more stakeholders" (p. 112) in an ecosystem. Whereas most B2B service innovation research is limited to manufacturing settings, our study covers all types of B2B markets (i.e. manufacturing and professional service industries). It contributes to the service innovation literature by explicitly considering the general-purpose character (Arora *et al.*, 2004; Arora *et al.*, 2013) of these signature technologies that transcend existing business functions and industries and by identifying service-specific innovation characteristics apparent in the co-evolution of technologies and business models in service innovation.

In sum, the objectives of this article are twofold. First, we aim to outline how digital technologies influence the core dimensions of service innovation, that is, the "what" (the *offering*), "how" (the *process*) and "who/for whom" (the *ecosystem*) (see Figure 1). Second, we seek to identify priorities for research related to these dimensions and new technologies.

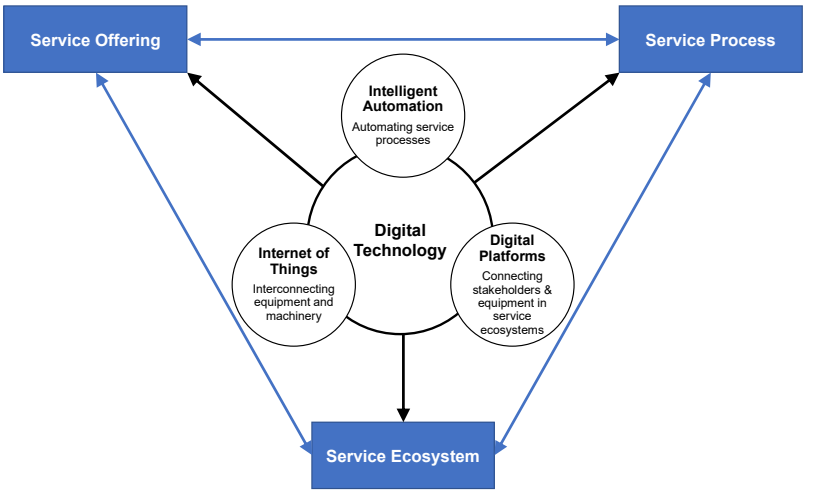

Figure 1.
Service innovation framework

Source(s): Figure by authors

These objectives are achieved by discussing the disruptive impact of three signature digital technologies (i.e. IoT, IA and digital platforms) on B2B markets.

In the next section, we review the service innovation literature, specifically focusing on the techno-demarcation perspective and the three service innovation dimensions. We then take stock of key digital technologies – IoT, IA and digital platforms – before discussing how these technologies drive service innovation along its three dimensions. Subsequently, we present a further research agenda with six themes. Finally, we discuss the theoretical and managerial implications.

Theoretical background

Techno-demarcation perspective

Service innovation is a multidimensional construct that can be understood from several perspectives. When delving into the realm of digital transformation, techno-demarcation emerges as a valuable perspective, emphasizing the pivotal role of technology. Moreover, it underlines the notion that service innovation is fundamentally different from product innovation (Miles, 2016). Barras' (1986) seminal work on the "reverse product cycle" is a case in point. According to conventional product innovation theory, during the initial stages of innovation, companies focus on developing new and unique products to explore emerging technology. As the technology matures and products become more standardized, the emphasis shifts to process innovation, as companies seek to improve manufacturing processes, supply chain management and other operational aspects to gain a competitive advantage (Utterback, 1994). However, Barras (1986) proposes an alternate trajectory for services. When new technology is introduced, it is first used to optimize existing service processes and improve service delivery efficiency. Technological applications are then used to enhance the quality of these services. Eventually, this leads to the creation of entirely new or significantly transformed service offerings. Hence, techno-demarcation implies that service innovation should not be treated as a special case of product innovation; the unique characteristics of services require innovation concepts, models and processes different from those in manufacturing (Hipp and Grupp, 2005; Song *et al.*, 2009).

While the techno-demarcation perspective has faced criticism for its exclusion of non-technological forms of innovation and its underestimation of the innovative intensity within service activities (Gallouj and Savona, 2009), it is worth remembering that this research reflects a time when manufacturing was considered the primary driver of the economy, with services often viewed as "innovation laggards". Therefore, studies on the role of technology in service innovation have often focused on the diffusion of innovations derived from the manufacturing sector (Pavitt, 1984). Today, however, we find ourselves in a distinctly different landscape where digital innovations have become general-purpose technologies (Arora *et al.*, 2004, 2013) for value creation, opening up previously unprecedented possibilities for service innovation. Consequently, techno-demarcation reflects the fundamental role of digital technology in connecting resources and service actors on an almost ubiquitous scale (Ehret and Wirtz, 2017; Vandermerwe and Erixon, 2023).

In light of this, we revisit the techno-demarcation perspective to outline how digital technologies profoundly influence the core dimensions of service innovation and to delineate research priorities. By adopting this perspective, we underscore the transformative potential of digital technologies in driving innovation across core service offerings, processes and the broader ecosystem. We recognize the distinctive attributes of services, including their intangibility, non-ownership nature and the central role of customer interaction (Lovelock and Gummesson, 2004). Consequently, our focus extends beyond mere novelty in tangible technological products, emphasizing the multi-faceted dimensions of innovation in services.

Service innovation dimensions

Although the service innovation concept is widely used, few studies have explicitly defined it (Witell *et al.*, 2016). We build on the conceptualization by Gustafsson *et al.* (2020), which characterizes service innovation as a new *offering* and/or *process* that is adopted by stakeholders in an *ecosystem* and that creates value for them. This view of service innovation is particularly useful in understanding the role of digital technologies. First, it shifts the focus from the output delivered by the service provider to the value created for the beneficiary, consistent with new socio-technical processes accompanying digitization (Lusch and Nambisan, 2015). Second, it recognizes the beneficiary as an active participant in the innovation process, highlighting the pivotal role of digital technologies in facilitating connections among diverse stakeholders within an ecosystem (Smedlund, 2012). Gustafsson *et al.*'s (2020) conceptualization brings to the fore three distinct dimensions: service offering, service process and service ecosystem.

Service offering–focused research typically emphasizes measures tied to output, such as new service features and service products introduced, success rate, profitability or sales impact (Cooper and de Brentani, 1991; Hull, 2004; Wirtz *et al.*, 2021). It perceives service innovation primarily as an economic concept that should bring benefits to its developer (Toivonen and Tuominen, 2009).

Service process–focused research examines the dynamic nature of activity and time within service activities, influencing value creation. This approach involves changes in employees' and customers' roles, competencies, practices, norms and behaviors (Helkkula *et al.*, 2018). Recognizing the active involvement of customers, interdependence patterns and work divisions can vary considerably across different service processes (Larsson and Bowen, 1989). Process innovations can also impact customers' willingness to participate and their level of engagement (Chase and Apte, 2007).

Service ecosystem research focuses on the integration of resources among stakeholders, departing from the traditional emphasis on individual services (Rubalcaba *et al.*, 2012). It recognizes that individual firms cannot successfully launch a new offering or orchestrate the required networks without connecting to multiple stakeholders and resources in an

ecosystem (Helkkula *et al.*, 2018). Consequently, service innovation entails changes in institutional arrangements governing resource access and integration, enabling beneficiaries to create value by including new stakeholders, redefining roles and reframing resources within service ecosystems (Koskela-Huotari *et al.*, 2016).

Prior research examines types of innovation in isolation rather than in an integrated manner. In practice, service innovation opportunities and challenges can be better addressed by jointly drawing on offering, process and ecosystem dimensions. For instance, the maritime industry has traditionally been regarded as a laggard in terms of service innovation, with limited connectivity to vessels offshore and traditional, product-centric mindsets among ecosystem actors. However, this is changing as the following example from the Swiss-Swedish engineering group ABB illustrates. Its marine advisory system equips vessels and fleets with integrated marine solutions (software and sensors) for optimal reliability, flexibility and performance, providing customers with a wide range of service modules for energy efficiency and safer voyages (i.e. service offering). Using weather and loading data to plot the safest and most efficient route, ABB offers its customers smoother operation and better fleet control through a single interface. It enables fleet managers and ship officers to have better navigation with the support of 24/7 remote assistance from onshore operation centers (i.e. service process). Finally, through its technology platform, the firm orchestrates its global service network, digital operations centers, third-party cloud and activities of vessel owners and operators in what is a complex service ecosystem (Helkkula *et al.*, 2018). This case demonstrates how digital technologies like IoT, IA and digital platforms can provide novel, potentially disruptive service opportunities. Next, we discuss how such technologies foster service innovation in B2B markets.

Signature technologies for service innovation

Service value emerges when providers, clients, complementors and other stakeholders integrate resources to co-create value [1] (Spohrer *et al.*, 2022). Digital technologies facilitate and standardize the interaction and sharing of data and information in increasingly complex socio-technical systems. With the rise of integrated global information infrastructures and the concept of ubiquitous computing (Weiser, 1991), almost any service actor or resource can be connected on a global scale. Powered by artificial intelligence (AI) – the use of computational machinery to emulate a growing number of capabilities inherent in humans (Huang and Rust, 2021) – service stakeholders gain novel levers for configuring value propositions, operating service processes and directing service resources.

While technology opens new avenues for service innovation, it rarely does so in isolation. Effective service innovations reside in the reconfiguration of organizations and their business models to harness the technology potential (Breidbach and Maglio, 2016; Chesbrough, 2011). For example, Google was not the only company offering a search algorithm. Still, it was unique in identifying a pressing customer problem – the ambiguous effectiveness of media-embedded advertising – and providing a service-technology solution that offered real-time evidence of user interest through internet searches (Varian, 2010; Zuboff, 2019). Similarly, the German startup Celonis was not the first company capable of designing capable "process mining" software for monitoring business operations, but it was the first to identify C-level management as the decisive beneficiaries who suddenly gain unprecedented insights into their business, an issue overlooked by similar software providers (Economist, 2023).

On a general note, service innovations reside on complementing the potential offered by technology with the human dimension of service, apparent in user benefits and value, business models and institutions. This becomes apparent in three signature technologies of digital service innovation: (1) IoT transforming technical equipment into service facilities by embedding them in global information infrastructures; (2) IA breaking existing frontiers for

process design and operation by seamlessly integrating real-time data and intelligence and (3) platforms offering the technical and organizational architecture for integrating resources and stakeholders into service ecosystems for value co-creation. The relevance of these three technologies for service innovation is discussed next.

Internet-of-things technologies

IoT connects the global information infrastructure to a growing range of physical resources through sensors that offer real-time information on physical resources and environments, and actuators that allow global remote control of such resources (Ng and Wakenshaw, 2017). It has enabled novel business models through innovative services that leverage previously unconnected resources. For example, it facilitates mobility services by connecting vehicles, enables automated management of office facilities and enhances industrial services by equipping machines with sensors or actuators (Ehret and Wirtz, 2017).

As the world moves toward an era of IoT, Ng and Wakenshaw (2017) argue that the process of evolving physical goods into connected, transportable and dynamically reconfigurable service systems is disrupting at a Schumpeterian level that is just beginning. As a system, IoT consists of interconnected constituents that are uniquely identifiable and capable of virtual representation and virtual accessibility. This Internet-like structure enables the constituents' remote locating, sensing and operating. Real-time data and information flow between these constituents, empowering the system to be dynamically augmented, thereby broadening the range of outcomes in a dynamic and agile manner (Ng and Wakenshaw, 2017).

IoT technologies offer numerous opportunities for service innovation as they enable providers to connect equipment directly within end-user firms' premises, collect and analyze large sets of product usage and process data and remotely perform monitoring and control activities over customers' operations (Paiola and Gebauer, 2020). Key components of IoT, which are instrumental for delivering their advanced applications and envisaged benefits, are information protocols and middleware, sensors and actuators (i.e. components of automated systems that drive movement and change) and information technology-driven services such as big data analytics (Ehret and Wirtz, 2017). Thanks to cloud computing, massive amounts of data generated by relatively inexpensive sensors and actuators embedded in products can be easily stored, accessed and processed.

IoT facilitates market and customer information and opens new sources of innovation through the interaction between manufacturing assets and service markets. First, IoT enables new non-ownership services that transform negative uncertainty of asset ownership and operation for customers into opportunities for manufacturers or specialized service providers, who can remotely monitor and control assets in real time. A key characteristic that differentiates any service from goods businesses is the delivery of benefits without transferring ownership (Lovelock and Gummesson, 2004; Ehret and Wirtz, 2010). While services have always been part of human economic activity, digital technology has opened up previously unknown capabilities for specifying service benefits. Service contracts serve as an illustrative example. They play a central role in service businesses as each transaction needs to entail customer specifications for defining the promised service and related implications for service quality and fulfillment. Providers and clients had historically closed service agreements with analog communication, including handshakes and paper documents (Pine, 1993). With global infrastructures and technologies providing real-time data, providers and clients have unprecedented power to specify, negotiate, control and monitor service benefits, operations, performance and quality.

Second, firms can use IoT to unlock machine information and develop resources and capabilities to exploit data and gain intelligence and knowledge of business processes and

operations (Ehret and Wirtz, 2017). For example, John Deere can help farmers make more informed decisions by providing machine and crop data, and IBM Watson's AI system can help customers catalog and evaluate tens of thousands of suppliers. Since the value of information increases when aggregated and shared, firms aiming for IoT-based service innovation need digital systems for retrieving and analyzing data (Chesbrough, 2011).

The separation of information from a physical object, which allows information to be effortlessly transmitted and reconfigured in numerous ways, is called *liquification* (Normann, 2001). Liquification can enhance the abilities of digitized objects and mobilize the optimal combination of resources for a particular context. For example, it has allowed the separation of physical and information components of supply chains. Service innovations in supply chain management have resulted in new service offerings and processes through increased outsourcing and offshoring of information technology and transformed service ecosystems through the growth of information intermediaries (i.e. infomediaries; Hagel and Rayport, 1997). Liquification and subsequent processing and analyses to support decisions and actions are fundamental drivers of IoT (Ng and Wakenshaw, 2017). While the full potential of an IoT era has not yet materialized, integrating IoT with IA and other technologies holds the potential to unlock unparalleled levels of connectivity, efficiency and service innovation.

Intelligent automation

IA refers to the application of automation technologies to operate, optimize and expand service processes and tasks, helping organizations augment or automate service operations. Such technologies are used to improve efficiency and support the quality of contract fulfillment with real-time information and control of service operations (Bornet *et al.*, 2021). While many scholars and managers tend to view automation and augmentation as mutually excluding trade-offs (Raisch and Krakowski, 2021), IA aims to leverage automation in a way that enhances human capabilities (Bornet *et al.*, 2021; Spohrer *et al.*, 2022), thereby empowering people by either relieving them from certain activities or enabling them to perform novel services.

IA integrates several technologies, especially those related to vision (e.g. computer vision, character recognition and biometrics), language (e.g. natural language processing), thinking and learning (e.g. analytics and machine learning) and execution of tasks (e.g. robotic process automation, smart workflows and physical robots), aiming to design streamlined, simplified and scalable service processes (Bornet *et al.*, 2021). In particular, many information processing-type services (think of any service delivered over the phone, email, an app, or a website) and even entire service offerings (e.g. FinTechs and HealthTechs) can be end-to-end (E2E) automated with no human service employee involved. For example, Google serves billions of customers (including paying advertising clients such as SMEs) of which the vast majority will never interact with operational service employees. Google-type services are the exception today, but we expect such services to become mainstream and apply to many information-processing services globally. IA will enable firms to fully automate services and/or shift services to smart self-service solutions. Analyzing big data using methods such as machine learning, neural networks and deep learning can permit not only the automation of repetitive and routine tasks but also the processing of data to arrive at new conclusions or decisions (Huang and Rust, 2017).

The rapid pace of technological innovation, exemplified by machine learning and innovations such as distributed ledger technologies, points to a central role for technology in future B2B service innovation. For instance, the mining and shipping industries are shifting toward more autonomous service systems and operations, forming new industrial ecosystems with software and hardware experts, systems integrators, manufacturers, telecommunications providers and other specialized firms. These autonomous systems largely operate without

human intervention. In light of these developments, Breidbach *et al.* (2018) provide a valuable distinction between traditional and autonomous systems based on their handling of variability. Specifically, traditional systems aim to reduce variability, often exemplified by user interfaces with limited options. Conversely, autonomous systems embrace variability, evident in practices like AI-based financial services autonomously making investment decisions. This distinction carries implications for digital service innovation, including how to design cost-effective processes across organizations. We believe future digital service innovations will accelerate such decision-making capabilities across companies.

Sophisticated algorithms, software, robotics, processing power and sensor technology breakthroughs enable increased autonomy across industrial and service applications. IA is particularly vital for B2B firms, given their more industrialized service processes (Hofmeister *et al.*, 2023). By using industrial robots equipped with software, sensors, algorithms and cameras, companies like ABB provide paint process automation services to automotive clients. This enhances accuracy, quality, workplace safety and productivity while optimizing space utilization.

We also see that IA will have further disruptive power for B2B industries and markets. Service firms will not produce much of the technology required for IA (e.g. chatbot solutions, digital agents, smart SST and service robots) in-house. Rather, they will procure IA technologies from leading, globally operating vendors specializing in digital agents, warehouse solutions and airport solutions for information counters, and so on (Bornet *et al.*, 2021; Paluch *et al.*, 2022). This is akin to banks not building ATMs but procuring them from specialist equipment providers. It seems likely that such technologies will be increasingly sourced from global vendors that have cutting-edge R&D capabilities and the scale required to deliver high-quality and cost-effective solutions (cf., Ehret and Wirtz, 2017). Examples may include vendors of AI-powered self-service technology (SST), retail solutions based on service robots (e.g. SoftBank's Pepper), embedded speech recognition (e.g. Nuance's conversational AI solutions), customizable platforms for digital agents (e.g. ANZ Bank's digital agent Jaime was developed by Soul Machines, a vendor of "digital people") and chatbots (e.g. IBM's Watson Assistant, a leading provider of conversational AI technology) that can be tailored to the specific needs of client firms (Paluch *et al.*, 2022). Vast new markets are likely to emerge for B2B players. However, to seize such opportunities, firms must engage in market-shaping, which means considering a larger ecosystem of relevant stakeholders, understanding the institutional arrangements governing their behaviors and fostering new resource linkages across the ecosystem (Nenonen *et al.*, 2019).

Digital platforms

Digital platforms bring together "individuals and organizations so they can innovate or interact in ways not otherwise possible, with potential for nonlinear increases in utility and value" (Cusumano *et al.*, 2019, p. 13). Platforms can hence enhance the scale and scope of service innovations, thereby enlarging service markets using digital infrastructures.

Today, the largest service firms in terms of market capitalization are essentially digital platform businesses (e.g. Apple, Microsoft, Alphabet, Amazon, Meta, Alibaba and Tencent), and "by now, nearly every executive has navigated at least one discussion about whether his or her organization should strive to become a platform" (Brown, 2016, p. 2). However, most platforms fail, with only 3% of platform strategies succeeding (Yoffie *et al.*, 2019). Furthermore, this failure rate seems particularly high in B2B contexts as firms tend to be more reluctant about being locked into another firm's platform ecosystem than consumers. As such, while platforms offer exciting service innovation opportunities, it is important to understand better what platforms are and what it means for platform businesses to operate in B2B markets (Perks *et al.*, 2017).

Digital platforms are explicitly designed to use digital technologies to enable business interactions among authorized members, fostering novel ecosystems and influencing the institutional arrangements governing the practices of its members (Rangaswamy *et al.*, 2020; Wirtz *et al.*, 2019). For over two decades, disruptive platform-based business models have accelerated service growth in B2B markets. Consider the example of Salesforce.com; more than twenty years ago, the company's founder, Chairman and CEO, Marc Benioff, became an early proponent of the *software-as-a-service (SaaS)* model in an industry dominated by software sales and licensing. Salesforce.com today relies on a comprehensive platform and ecosystem of partners that serve as a powerful competitive advantage in its sector (Ulaga and Kowalkowski, 2022).

However, different types of digital platforms exist, and Rangaswamy *et al.* (2020) make an important distinction between *business* and *technology platforms*. There is a wide range of business platforms, including transaction platforms (e.g. Amazon Business and Shopify), service platforms (e.g. Vixxo), payment platforms (e.g. Visa and its Authorize.net gateway) and two-sided technology platforms (e.g. Apple's App Store). In all these business platforms (1) the core matchmaking functions (i.e. linking one user to another on the platform) are executed digitally, (2) the platform promotes direct communications and business transactions among its users and (3) platform members are independent parties who retain residual ownership rights. On the other hand, pure technology platforms such as Salesforce.com play no or minimal role in matching buyers with sellers. Technology platforms are generally one-sided because the service offering comes from the platform company itself.

Furthermore, it is crucial to recognize the distinctive characteristics and considerations that set apart B2B markets from B2C environments when evaluating the requirements and prerequisites for successful platform implementation. First, B2B markets are generally more heterogeneous and complex, and platform members, which are legal entities, are more reluctant to share proprietary data with a platform company (Hein *et al.*, 2019). Second, in contrast to B2C markets where the winner-takes-all or winner-take-most approach often prevails (Cusumano *et al.*, 2019), the high switching cost of industrial assets as well as the generally narrower platform scope and size may encourage platform coopetition rather than platform competition (Jovanovic *et al.*, 2022). This means that traditional direct and indirect network effects (i.e. the platform's value increases with each new actor on the same or the other side of the platform; Rangaswamy *et al.*, 2020) do not necessarily apply. Instead, data network effects may be more vital for B2B platforms; the more the platform learns from the data it collects, the more valuable the platform becomes to its members (Gregory *et al.*, 2021).

Common for all digital platforms, however, is that they are based not only a technical architecture and other tangible resources (as in the case of traditional, firm-centric and product-centric platforms) but also on intangible resources. These form an "architecture of participation": a set of organizational norms, rules and activities that its connected members use to coordinate and co-align their actions (Lusch and Nambisan, 2015; Nambisan and Sawhney, 2011).

Additionally, regardless of platform, the degree of openness is a key issue influencing the overall service experience. If a platform is too closed, it will prevent the leverage of innovations by third parties and the number of members may become too small to generate network effects. On the other hand, too much openness might bring value-destroying effects, such as poor-quality interactions and congestion, which cause members to defect (Rangaswamy *et al.*, 2020). Overall, platforms can drive service innovation by enabling novel offerings, processes and knowledge not previously accessible to individual members or the broader service ecosystem.

Digital service innovation opportunities

Considering our three signature service technologies, we are now in the position to explore key innovation opportunities in B2B markets. In practice, service innovation opportunities

and challenges can be best addressed by drawing on all three service innovation dimensions: service offering, service process and service ecosystem. Even if the emphasis in a specific service innovation project may be on one particular dimension, to various degrees, it most likely also influences the other dimensions (Helkkula *et al.*, 2018). As such, we advance that for B2B firms to harness the benefits of digital service opportunities, they should focus on all three dimensions. For example, the launch of a data-driven service in the transportation industry (i.e. service offering) also impacts how activities like monitoring, maintenance and repair are done (i.e. service process), and is likely to require data sharing and coordination with new parties (i.e. service ecosystem). In line with our techno-demarcation view, we specifically discuss how the digital technologies reviewed drive innovation along the three dimensions (see Table 1), acknowledging that different sets of services may be demarked by the specific types of technology they employ.

Service offering innovation

The growth of services in B2B sectors is primarily driven by new digitized offerings that can be supplied virtually (Wolf, 2022), presenting opportunities for more effective outcomes due to the scalable and fungible nature of digital resources (Adner *et al.*, 2019). The advent of the IoT facilitates continuous connectivity and data flows, giving rise to a range of non-

Digital technology	Key dimensions of service innovation Service offering	Service process	Service ecosystem
Internet-of-things (IoT)	• Embedding service capabilities into physical assets • Transforming large-volume data from physical assets into actionable service intelligence	• Real-time equipment control for enhanced efficiency and service quality • Customizing touchpoints and optimizing customer journeys with data insights	• Connecting prospective ecosystem actors and enabling ecosystem formation • Orchestrating physical and digital ecosystem resources for service quality and performance
Intelligent automation (IA)	• Developing scalable and cost-effective services through increasingly autonomous solutions • Translating human needs into enhanced service value through technology	• Empowering human capabilities through augmentation and automation of tasks and decision-making • Using IA to handle the variability of complex services	• Coordinating external human and technology resources • Leveraging process automation and augmentation for activities performed by service partners and complementors
Digital platforms	• Pooling and exploiting data for continuous value creation • Expanding services with third-party developers and providers	• Facilitating stakeholder collaboration and knowledge sharing • Streamlining intra-organizational processes through platform-mediated resource integration	• Orchestrating the resource integration of customers, providers and complementors for service co-creation • Opening access to complementary resources and empowering ecosystem actors to engage in service innovation

Source(s): Table by authors

Table 1. Technology-driven service innovation opportunities in B2B markets

ownership services and anything-as-a-service (XaaS) business models. Examples include remote advisory services, data management and integration, cloud infrastructure optimization and the "SaaS-ification" of software licenses into subscriptions. Additionally, IoT enables providers to monitor and control assets remotely, transforming uncertainty downsides for customers into opportunities (Ulaga and Kowalkowski, 2022). Hence, traditionally product-centric firms like Caterpillar are augmenting their existing portfolio of offerings with a host of adjacent, connected services.

Advancements in sophisticated algorithms, software, robotics, processing power and sensor technology are further driving the development of increasingly autonomous solutions across services and industries. This IA trend is expected to accelerate decision-making capabilities across companies further. For instance, the subscription model, which has gained traction in consumer markets, is now increasingly adopted in B2B. Examples include predictive analytics of vast datasets, intelligent document processing, automated human resources and talent management and end-to-end supply chain automation solutions that include traceability and smart contracts.

Finally, digital platforms enable the provision of novel services that were previously unavailable to individual members. Consequently, platforms are replacing traditional pipeline businesses and enable the management of subscriptions and other service contracts (Rangaswamy *et al.*, 2020). For example, security company Axis Communications leverages machine learning and deep learning in its video surveillance systems to enhance real-time analysis, making its AI-enabled technology platform essential for scalable and cost-effective service innovation. Axis generates and integrates complementary assets by attracting third-party developers through its software development kit (SDK). Such digital interfaces provide standards and facilitate interactions in increasingly digital ecosystems (Hein *et al.*, 2019). Overall, the abundance of generated data and the ability to analyze, curate and use large data sets open avenues for new services that emphasize continuous value creation over time through access- or performance-based contracts (Ulaga and Kowalkowski, 2022).

Service process innovation

Service process innovation refers to any change in the service creation process that influences the value created, including shifts in the roles, competencies, skills, practices, or behaviors of providers, customers and other stakeholders involved (Helkkula *et al.*, 2018). Rather than the common belief that digitalization "changes everything," Furr *et al.* (2022) point out that many firms innovate to improve their service processes rather than change their core offerings. A case in point was container shipper Maersk's attempt to use blockchain "to do what it did before blockchain, namely to ship more efficiently around the globe" (p. 596). Blockchain makes it possible to create a digital ledger of transactions with information on their ownership, hence providing a higher level of trust than other shared databases (Bousquette, 2022).

IoT technologies enable real-time monitoring of equipment and service resources, allowing firms to develop, customize and integrate digital touchpoints to improve service processes and systems (Lundin and Kindström, 2023). Examples include apps, online systems and self-service abilities, which bring about operational improvements, better control, consistent service quality and cost and time savings. Companies can get closer to their customers and partners by designing and managing new digital touchpoints. For example, the digital agriculture enterprise Climate analyzes weather, soil and field data to assist farmers in optimizing resource usage and enhancing overall productivity by identifying potential factors that could limit crop yields within their fields.

Digital empowerment of human capabilities through IA further enhances service processes by making provider and customer employees more informed and capable of performing tasks. The augmentation and automation of tasks and decision-making

contribute to an enhanced service experience and reduce the likelihood of errors and mismatches. Digitization allows services to be dynamically reconfigured, increasing service variability and adaptability. However, companies can also strategically leverage digital technologies to deliberately reduce variability, particularly for complex and costly B2B services (Wirtz and Kowalkowski, 2023). Applying an operations management approach, organizations can boost efficiency by reducing customer-induced variability through measures such as separating front-office and back-office operations, modularizing services and deploying self-service technologies, robots and AI. These steps build on one another, facilitating smooth implementation (Wirtz and Zeithaml, 2018; Wirtz *et al.*, 2023a).

In addition, platforms play a crucial role in connecting providers, customers and complementors, forging digital linkages among geographically dispersed actors. This shift from intra-organizational processes (e.g. low-contact systems; Chase and Tansik, 1983) to inter-organizational processes involving multiple actors is driven by the digitization of data and services. By integrating resources and processes on a single platform, B2B firms can streamline workflows, eliminate redundancies and optimize the overall service delivery process. Platform-mediated resource integration also allows for real-time feedback and iterative improvements based on customer interactions and insights, leading to ongoing enhancement of service processes.

Service ecosystem innovation

Finally, digital technologies play a pivotal role in shaping innovation within service ecosystems where multiple stakeholders collaborate to enhance user experiences and improve the overall value-creating potential of the ecosystem (Helkkula *et al.*, 2018). These technologies enable connecting people and things, data collection and processing and autonomous learning and decision-making, ultimately automating value creation (Beverungen *et al.*, 2019; Breidbach *et al.*, 2018). Service ecosystem innovation requires the collaboration of several actors who contribute a wide range of resources (Poeppelbuss *et al.*, 2022). However, it also introduces greater uncertainty, both technologically and relationally (Ramirez Hernandez and Kreye, 2021).

Many B2B firms rely on external parties to perform various service activities across the customer journey, such as information provision, systems integration, training and field service provision (Witell *et al.*, 2020). Understanding how digital technologies impact these activities, the evolving role of service partners and the response required for service innovation is therefore crucial. However, digitizing service processes may involve significant upfront investments for partners, impeding the pace of digital service innovation in many companies. Walmart's challenge in onboarding farmers to their digital inventory software system serves as an example, highlighting the hurdles faced in this regard.

Ecosystem reconfiguration is often necessary for the successful implementation of new services. For instance, Michelin uses tire sensors, vehicle boxes and antennas to capture and transmit IoT data. However, the firm faced several technological and relational challenges with its service network when moving from selling truck tires to fleet solutions (Renault *et al.*, 2010). The firm could not integrate and automate back-office processes and fully support its dealers until it implemented a new IT system that connected its network members.

Digital platforms empower firms to orchestrate the collaboration of customers, providers and complementors in the co-creation of services (Perks *et al.*, 2017; Rangaswamy *et al.*, 2020; Wirtz *et al.*, 2019). By leveraging standardized tools like application programming interfaces (APIs) and SDKs, firms can integrate complementary assets on the platform, fostering liquidity and increasing resource density within the platform-enabled service ecosystem (Hein *et al.*, 2019).

In the B2B realm, the tolerance for failure among customers is typically low, underscoring the criticality of selecting pilot customers and effectively scaling pilot initiatives. Moreover,

ensuring the economic viability of service innovation within the ecosystem can be challenging, especially when engaging diverse stakeholders with varying priorities. This challenge is exemplified by the use of blockchain technology in transformative projects like asset tracking in complex supply chains. For example, in collaboration with IBM, Danish shipper Maersk launched its hyped TradeLens blockchain platform to digitize container shipping. Still, the platform encountered complexities and difficulties in enlisting participation from numerous companies (including other carriers) and nations, leading to its closure (Bousquette, 2022).

Research agenda

Our conceptual discussion reveals substantial research opportunities at the intersection of service innovation and technology management. Specifically, we explore the potential synergies of digital technologies and their potential for new configurations of service offerings, processes and ecosystems. Particular emphasis is placed on new levels of value creation and impact. We organized these opportunities into six themes for further research, as detailed in the following sections and Table 2.

Theme 1: new recurring revenue models

Digital technology lays the foundation for novel recurring revenue models (Ehret and Wirtz, 2017; Varian, 2010). For example, subscription businesses have outperformed the S&P 500 index in the last decade and maintained growth throughout the pandemic (Zuora, 2022). In B2B, subscriptions span from software and connected equipment to various product-as-a-service offerings. With the power to monitor and control physical assets in real time through IoT technologies, industrial equipment providers also find lower thresholds for revenue models such as outcome-based contracts and innovative rental and leasing offerings (Ehret and Wirtz, 2017). These connectivity-based service offerings are generally enabled and mediated by digital platforms.

Overall, digital technologies and the associated data flows allow new services with a stronger focus on continuous value creation over time, requiring new service activities and processes. However, B2B and service research are just beginning to understand the profit implications of these recurring revenue models (Queiroz *et al.*, 2020; Worm *et al.*, 2017). Hence, there is limited guidance on how to build and deploy such service innovations. Managers and researchers have yet to agree on the structure, responsibilities, costs and liabilities associated with these revenue streams and the implications for order-to-cash cycle management. Thus, there are opportunities for future research to elucidate the financial architecture of these innovations.

Theme 2: service innovation in the metaverse

The metaverse is the latest chapter in the digital service revolution which will allow exciting innovation opportunities at the intersection between IA, IoT, digital twins and the metaverse. For example, equipment repair can be deskilled and improved through superimposed tags, explanations and analyses that allow for better, faster and cheaper repairs (Dwivedi *et al.*, 2023). Deskilling may even facilitate self-service, allowing firms to bring repairs and maintenance in-house.

Digital twins are the cornerstones of the enterprise metaverse, being virtual representations of physical assets, systems or processes. They are increasingly used to detect, prevent, predict and optimize outcomes through data curation and real-time analytics (Rantala *et al.*, 2023). This presents unique opportunities for innovating service offerings and processes, and for fostering novel virtual ecosystems. While most firms are in the early stages

Research themes	Research questions
Theme 1: new recurring revenue models	• What are the key factors that contribute to the adaptation and value creation of recurring revenue models in B2B markets? • What digital technologies and capabilities are required to build a profitable recurring revenue stream? • What are the structural and financial considerations involved in building and deploying service innovations based on recurring revenue models? • How can digitization enable new innovations in service contracting?
Theme 2: service innovation in the metaverse	• How can the metaverse be effectively utilized to innovate service offerings and processes? • What are the potential impacts of emerging technologies such as mirror worlds, augmented reality and entirely virtual worlds on service innovation? • How can firms leverage digital twins to develop its enterprise metaverse and unlock service value? • What are the most effective approaches for establishing platforms around interconnected digital-twin networks, and what are the implications for service innovation?
Theme 3: scaling up service innovations	• How can firms turn service concept pilots into scalable offerings? • How can firms onboard a critical mass of ecosystem actors for service innovation? • What are the conditions under which a firm may achieve first-scaler advantage? • How can incumbent firms strengthen their competitive advantage vis-à-vis digital entrants through service innovation?
Theme 4: ecosystem innovations	• How can firms effectively orchestrate the dynamics of service ecosystems to drive service innovation? • How do interdependencies between technologies and collaborators in service ecosystems influence future service innovations? • How can institutions and governance mechanisms in service ecosystems address the challenges of balancing contradictory or paradoxical requirements in service innovation? • How can actors of a service ecosystem allocate rights and responsibilities for effective value co-creation? • How can constitutive rules support the interplay between social and technological dimensions in ecosystem innovations?
Theme 5: power dependency and lock-in effects	• What are the challenges and implications of firms relying on external specialists for service innovation? How can these relationships be managed to ensure a balanced and mutually beneficial partnership? • What strategies and approaches can firms employ to mitigate the risks associated with lock-in situations in service ecosystems?
Theme 6: security and responsibility in digital domains	• How can tools, technologies and the sharing of digital governance protocols and practices enable more resilient services and mitigate digital vulnerabilities and cyber security risks? • How should firms best take corporate digital responsibility (CDR) into account when innovating? • How can firms work effectively with partners to develop and implement technologies in line with CDR principles? • What governance procedures are most effective in enhancing CDR compliance?

Source(s): Table by authors

Table 2.
Service innovation research agenda

focusing mainly on the internal benefits of single twins, we see that the metaverse offers opportunities to establish multi-sided platforms around interconnected digital-twin networks. Research is therefore needed to explore the optimal use, implementation and implications of the metaverse within B2B contexts.

Furthermore, once services are scalable and incremental service costs are low, one might expect that today's fragmented B2B service markets may become more concentrated and many small and medium-sized B2B firms will be pushed out of business. In many markets, "born digital" new entrants may be the disrupters. Questions such as how mirror worlds, augmented reality and entirely virtual worlds will change B2B service innovation, delivery and markets are largely missing but seems to offer exciting opportunities for service scholars.

Theme 3: scaling up service innovations

A general challenge for many B2B firms, especially those rooted in a product-centric engineering culture, is the ability to ramp up their service innovations. Often, it comes to a stall when firms want to launch and roll out the service offering (Kowalkowski and Ulaga, 2017). Despite digital opportunities, especially those facilitated by IA and platforms, scalability is still a major challenge for service processes and many digital service offerings are developed very individually as firms struggle to mobilize the wider ecosystem (Poeppelbuss *et al.*, 2022). Platforms support scalability, yet the TradeLens example illustrates the difficulties for a platform owner (in this case, Maersk and IBM) in onboarding a critical mass of key ecosystem actors. While technologies like blockchain continue with proof-of-concept initiatives attract widespread attention, Jensen *et al.* (2019) note that very few of those initiatives have moved to real-world operating solutions.

Further, compared to incumbent firms, many digital firms are specialized rather than diversified, which Giustiziero *et al.* (2021) explain by hyperscaling and hyperspecialization. The ability to scale quickly at low costs in the digital world overwhelms the typical efficiencies from integration. So, when hypergrowth is possible, spending resources on anything other than the core business is a distraction. Such "first-scaler advantage" accrues not to the first firm that enters a market but to the first firm that serves that market at scale. Once a scale-up occupies the high ground in its service ecosystem, the network around it recognizes its leadership and attracts further talent and capital (Levie and London, 2018). We hence need to understand how incumbent service providers can better defend their market position through service offerings and platforms, offset the advantages of their digital challengers and examine the role incumbents' deep domain expertise and high-touch service capabilities can play.

Theme 4: ecosystem innovations

There is a growing interest in service research that examines the interplay between technology and institutions, as well as the role of institutions and governance in organizing service ecosystems. Digitally enabled innovations bring about benefits that often have externalities for most ecosystem actors, even those not directly involved in the initial adoption or implementation of the service (Agrawal *et al.*, 2022; Spohrer *et al.*, 2022). Actors may face the challenge of balancing seemingly contradictory or paradoxical requirements, such as sharing access and resources, safeguarding unique capabilities, balancing automation and augmentation and making investments for collective benefits (*cf.*, Ostrom, 2015). Drawing on our insights, we argue that many technologies have dual properties. For example, IA can be used to both empower humans through close collaboration with machines and shift human tasks to machines. Such interdependencies across time and space create paradoxical tensions (Raisch and Krakowski, 2021). However, research has only recently begun to explore these tensions and their impact on service innovation efforts at an ecosystem level (Tóth *et al.*, 2022).

On a broader scale, digital service innovations disrupt social systems and present opportunities to stimulate social action. Hence, unlocking the action potential of digital service innovation requires a deeper understanding of its social dimension. However, our understanding of the interaction between technology and the social dimension of service is still in its early stages, both among information systems and service scholars. Here, soft systems design approaches have begun to explore the concept of constitutive rules in information systems, which are based on the collective intentions of communities regarding the use and meaning of technology (Lowe *et al.*, 2020). Another promising avenue for exploration is the process of establishing constitutive rules that human actors agree upon when adopting digital technologies for service innovation. For instance, the concept of cryptocurrencies as a replacement for traditional monetary institutions is still in the process of gaining broader acceptance in society (Taleb, 2021).

Theme 5: power dependency and lock-in effects

Today, we are witnessing the emergence of increasingly intricate and dynamic ecosystems comprising technologies and collaborators. When it comes to service innovation, numerous firms, including global market leaders, rely on software and hardware companies to obtain essential resources and capabilities for data management, cloud services, cybersecurity, algorithms, AI and more. These include big tech companies like Amazon, Cisco, Microsoft and Nvidia, as well as various specialized local firms. As competition in the realm of services intensifies within the digital sphere, the dynamics of the industry are evolving, leading many B2B firms to become more reliant on these ecosystem actors and their platforms and IoT and IA technologies for new service offerings and process innovations. Consequently, the control over technologies within ever-evolving service ecosystems is gradually shifting away from individual firms while complexity becomes intricately interwoven with the interplay between technology and people. This necessitates the imperative of orchestration (Breidbach *et al.*, 2018). Research should thus explore how lead firms can drive extensive change and coordinate activities across organizational boundaries by effectively orchestrating and governing the ecosystem's infrastructure, technologies and human resources.

Moreover, incumbent firms often encounter challenges when it comes to scaling up (Theme 3) and navigating the complexities of digital infrastructure. As a result, they may rely on external digital innovators or systems integrators for service innovation, even resorting to utilizing these firms' white-label services that can be effectively reused on a larger scale (Poeppelbuss *et al.*, 2022). However, such practices raise concerns regarding the potential asymmetry in the relationship, possible competition and issues of forward integration.

Additionally, the presence of platforms and other digital infrastructure often leads to lock-in situations, which may explain the failure of certain B2B platforms. Customers tend to prefer open standards and APIs, avoiding being tied to a proprietary supplier platform. Anecdotal evidence suggests that apprehension regarding dependence on TradeLens, with intellectual property jointly owned by IBM and Maersk, made many actors reluctant to participate as they sought an industry platform with broader governance (Hill, 2018). Further research should seek to examine how firms can mitigate such risks and identify approaches by which a platform can attract customers and other relevant stakeholders.

Theme 6: security and responsibility in digital domains

More research is needed to understand potential vulnerabilities in digital domains and how tools, technologies and governance mechanisms could be integrated into firms' service offerings to reduce such vulnerabilities (Ng and Wakenshaw, 2017). The increasing connectivity facilitated by IoT technologies, cloud computing and the interdependence of actors relying on digital technologies for sensitive data and mission-critical equipment and

processes heightens the importance of cybersecurity. Moreover, as IA accelerates and firms' data accounts become more intricate, cybersecurity problems become increasingly difficult to predict. Effective management and mitigation of such risks have emerged as a differentiator for B2B firms and a source of opportunities for service innovation. For example, ABB offers cybersecurity services, working closely with shipowners, yards and classification societies to enhance the cyber resilience of ships and ensure compliance with international and state-specific regulations (Tronvoll *et al.*, 2020). Research in this area should also delve into the sharing of digital governance protocols and practices among ecosystem partners to enable the development and adoption of new, more resilient services.

Furthermore, digital and AI innovations carry serious ethical, privacy and fairness risks for end users. A recent stream of research on corporate digital responsibility (CDR) explores these risks (e.g. Lobschat *et al.*, 2021), especially in digital service ecosystems with their vast flows of money, service, data, insights and technologies between business partners (Wirtz *et al.*, 2023b). Plenty of pressing research questions relate to CDR in B2B digital innovation. For instance, new vendors arise that deliver customer-facing digital technologies and their design and development of customer-interfacing technologies often determine how service firms interact with their customers. Consequently, CDR risks need to be mitigated between B2B vendors and their clients. For example, should biometric customer identification be a design feature of a particular service offering or process? We need to understand better how B2B suppliers can work effectively with technology partners and their clients to develop and implement new technologies that follow good CDR principles, what governance procedures are most effective in enhancing CDR compliance, and what role contractual agreements can play (e.g. penalty clauses and shifting the liability of CDR failures).

Conclusions and implications

Digital technology has become a key driving force behind service-driven business transformation. With advancements in ubiquitous computing, nearly every resource and service actor can now be globally interconnected, unlocking unprecedented potential for value creation among multiple stakeholders. To fully harness the potential of digital technology, both scholars and practitioners must recognize the distinct characteristics of service innovation, which differ from those of product innovation. Crucially, effective service innovation encompasses all three core dimensions of service – that is, the offering, process and ecosystem. By examining three signature technologies – internet-of-things, IA and digital platforms – we identify six key themes for service research and management. In this section, we highlight the key implications of our research.

Theoretical implications

Digital service innovation has profound implications for virtually all B2B firms, including technology- and engineering-oriented companies that focus on hardware and software development. While it is recognized that service innovations encompass non-technological aspects (e.g. organizational and business model dimensions), digital technologies offer new pathways for service design, innovation and performance. In addition to a research agenda, we provide the following contributions pertaining to the role of digital technologies in B2B service innovation.

First, this article explores how three signature technologies provide key opportunities for service offering, process and ecosystem innovation. Despite the dominant and growing role of technology-enabled services and service innovation, the innovation literature remains strongly biased toward products (Biemans and Griffin, 2018), which is demonstrated by extant research on digital product innovation (e.g. Wang *et al.*, 2022; Lyytinen *et al.*, 2016). As

digital technologies are transforming traditional industries and blurring industry boundaries, digital services are becoming pivotal to the competitive advantage of B2B firms, regardless of whether their origin is service or manufacturing (Biemans and Griffin, 2018; Kowalkowski and Ulaga, 2017). Yet, we still lack a comprehensive understanding of digital service innovation in B2B as prior research tends to focus either on the idiosyncrasies of manufacturing (e.g. Paiola and Gebauer, 2020; Tian *et al.*, 2022) or on various non-technological aspects of innovation (e.g. O'Cass and Sok, 2013; Salunke *et al.*, 2011).

Second, we adopt a techno-demarcation perspective on service innovation to emphasize the transformative potential of digital technologies in driving innovation across core service offerings, service processes and the broader ecosystem. While traditional approaches to technological service innovation (e.g. Barras, 1986) have faced criticism for their reductionism (Gallouj and Savona, 2009), digital technologies now serve as the foundational architecture and infrastructure for service innovation systems. It is also worth noting that while early work emphasized digital technology's importance in service innovation, the extent of recent digital innovation in the realm of service could scarcely be predicted (Barrett *et al.*, 2015). Rather than trying to synthesize a wide range of technological and non-technological perspectives, which often leads to overly broad and abstract research (Witell *et al.*, 2016), we have intentionally drawn on techno-demarcation to reflect this significant shift. In doing so, we bring forward a systems perspective on service innovation.

Finally, our study highlights the multidimensional nature of service innovation as it discusses the influence of technology on the "what" (the *offering*), "how" (the *process*) and "who/for whom" (the *ecosystem*). While any signature technology may primarily impact a specific dimension, we discuss the interdependence between them. For example, a digital platform can enable new interconnected and layered services based on fundamentally different service processes, linking data previously not combinable. It may further allow complementors to enter the ecosystem and build their own service innovations to make the overall customer value proposition even more compelling. Furthermore, to realize the potential of such service innovation, IoT and IA technologies may be pivotal. Overall, this research taps into the literature stream that treats the service innovation construct as multidimensional (e.g. Helkkula *et al.*, 2018; den Hertog *et al.*, 2010; Rubalcaba *et al.*, 2012), although we specifically delineate the principal role of digital technologies.

Managerial implications

In addition to the theoretical implications of our research, there is also practical relevance. Today, service innovation has become a major growth engine for all types of B2B firms. Digital technology is the key driver enabling this growth. At the same time, research shows that in comparison to B2B firms primarily focused on products, services-focused firms tend to exhibit a lower degree of sophistication in their innovation practices. They often lack explicit management frameworks for innovation, maintain reduced expectations regarding innovation outcomes and display a preference for incremental innovation (Biemans and Griffin, 2018). By elucidating how signature technologies drive service innovation in B2B markets, we provide managers with valuable insights to enhance their capacity for identifying and capitalizing on opportunities in an era where such innovations represent a pivotal determinant of success.

The most imminent managerial implication lies in recognizing the paramount importance of business model design in harnessing the potential of service technologies. Simply integrating a sensor into a machine does not create a substantial impact on its own; instead, its significance lies in its role as a component of a performance-based or subscription-based business model. While there are often bold assertions in the public and in the management literature regarding the substitutive power of technology, the key determinant for success lies

in aligning beneficiaries, business models and governance structures. Effective service implementation involves technologies that enhance and automate human capabilities rather than merely replacing them (Raisch and Krakowski, 2021).

Furthermore, managers should approach service innovation opportunities and challenges by considering all three dimensions of service innovation: that is, the service offering, service process and service ecosystem. While a given service innovation project might primarily prioritize one dimension, it is important to recognize that it will inevitably have varying impacts on the other dimensions (Helkkula *et al.*, 2018). The same principle applies to the facilitating technologies. As a result, we recommend that innovation managers and business developers aiming to leverage the advantages of digital service opportunities should direct their attention to all three dimensions and consider the synergistic role of multiple signature technologies. This comprehensive approach ensures a more holistic and effective strategy for capitalizing on the potential of digital services.

Note

1. In line with Grönroos and Voima (2013), value creation is seen as "the customer's creation of value-in-use" (p. 137) during the usage of resources and processes. Consequently, value co-creation occurs when the provider directly and actively engages in the customer's value-creation process.

References

Adner, R., Puranam, P. and Zhu, F. (2019), "What is different about digital strategy? From quantitative to qualitative change", *Strategy Science*, Vol. 4 No. 4, pp. 253-261, doi: 10.1287/stsc.2019.0099.

Agrawal, A., Gans, J. and Goldfarb, A. (2022), *Power and Prediction: the Disruptive Economics of Artificial Intelligence*, Harvard Business Review Press, Boston, MA.

Arora, A., Fosfuri, A. and Gambardella, A. (2004), *Markets for Technology: the Economics of Innovation and Corporate Strategy*, MIT Press, Cambridge, MA.

Arora, A., Fosfuri, A. and Rønde, T. (2013), "Managing licensing in a market for technology", *Management Science*, Vol. 59 No. 5, pp. 1092-1106, doi: 10.1287/mnsc.1120.1628.

Barras, R. (1986), "Toward a theory of innovation in services", *Research Policy*, Vol. 15 No. 4, pp. 161-173, doi: 10.1016/0048-7333(86)90012-0.

Barrett, M., Davidson, E., Prabhu, J. and Vargo, S.L. (2015), "Service innovation in the digital age", *MIS Quarterly*, Vol. 39 No. 1, pp. 135-154, doi: 10.25300/misq/2015/39:1.03.

Baumol, W.J. (1967), "Macroeconomics of unbalanced growth: the anatomy of an urban crisis", *American Economic Review*, Vol. 57 No. 3, pp. 415-426.

Beverungen, D., Müller, O., Matzner, M., Mendling, J. and vom Brocke, J. (2019), "Conceptualizing smart service systems", *Electronic Markets*, Vol. 29 No. 1, pp. 7-18, doi: 10.1007/s12525-017-0270-5.

Biemans, W. and Griffin, A. (2018), "Innovation practices of B2B manufacturers and service providers: are they really different?", *Industrial Marketing Management*, Vol. 75, pp. 112-124, doi: 10.1016/j.indmarman.2018.04.008.

Bornet, P., Barkin, I. and Wirtz, J. (2021), *Intelligent Automation: Learn How to Harness Artificial Intelligence to Boost Business & Make Our World More Human*, World Scientific Books, Singapore.

Bousquette, I. (2022), "Blockchain fizzles in shipping", *Wall Street Journal*, December 16, 2022, print edition.

Breidbach, C.F. and Maglio, P.P. (2016), "Technology-enabled value co-creation: an empirical analysis of actors, resources, and practices", *Industrial Marketing Management*, Vol. 56, pp. 73-85, doi: 10.1016/j.indmarman.2016.03.011.

Breidbach, C., Choi, S., Ellway, B., Keating, B.W., Kormusheva, K., Kowalkowski, C., Lim, C. and Maglio, P. (2018), "Operating without operations: how is technology changing the role of the firm?", *Journal of Service Management*, Vol. 29 No. 5, pp. 809-833, doi: 10.1108/josm-05-2018-0127.

Brown, C. (2016), "3 Questions to ask before adopting a platform business model", *Harvard* Business Review, HBR Online, April 5.

Burton, J., Story, V.M., Raddats, C. and Zolkiewski, J. (2017), "Overcoming the challenges that hinder new service development by manufacturers with diverse services strategies", *International Journal of Production Economics*, Vol. 192, pp. 29-39, doi: 10.1016/j.ijpe.2017.01.013.

Chase, R.B. and Apte, U.M. (2007), "A history of research in service operations: what's the big idea?", *Journal of Operations Management*, Vol. 25 No. 2, pp. 375-386, doi: 10.1016/j.jom.2006.11.002.

Chase, R.B. and Tansik, D.A. (1983), "The customer contact model for organization design", *Management Science*, Vol. 29 No. 9, pp. 1037-1050, doi: 10.1287/mnsc.29.9.1037.

Chesbrough, H.W. (2011), *Open Services Innovation: Rethinking Your Business to Grow and Compete in a New Era*, Jossey-Bass, San Francisco, CA.

Chirumalla, K. (2016), "Organizing lessons learned practice for product–service innovation", *Journal of Business Research*, Vol. 69 No. 11, pp. 4986-4991, doi: 10.1016/j.jbusres.2016.04.065.

Cooper, R.G. and De Brentani, U. (1991), "New industrial financial services: what distinguishes the winners", *Journal of Product Innovation Management*, Vol. 8 No. 2, pp. 75-90, doi: 10.1111/1540-5885.820075.

Cusumano, M.A., Gawer, A. and Yoffie, D.B. (2019), *The Business of Platforms: Strategy in the Age of Digital Competition, Innovation, and Power*, Harper CollinsPublishers, New York.

den Hertog, P., Van der Aa, W. and De Jong, M.W. (2010), "Capabilities for managing service innovation: towards a conceptual framework", *Journal of Service Management*, Vol. 21 No. 4, pp. 490-514, doi: 10.1108/09564231011066123.

Dwivedi, Y.K., Hughes, L., Wang, Y., Alalwan, A.A., Ahn, S.J., Balakrishnan, J., Barta, S., Belk, R., Buhalis, D., Dutot, V., Felix, R., Filieri, R., Flavián, C., Gustafsson, A., Hinsch, C., Hollensen, S., Jain, V., Kim, J., Krishen, A.S., ... Wirtz, J. (2023), "Metaverse marketing: how the metaverse will shape the future of consumer research and practice", *Psychology and Marketing*, Vol. 1, p. 27.

Economist (2023), "The real next big thing in business automation: process mining will help automate business long before chatbots do", March 23, 2023, available at: www.economist.com/business/2023/03/23/the-real-next-big-thing-in-business-automation (accessed 22 May 2023).

Ehret, M. and Wirtz, J. (2010), "Division of labor between firms: business services, non-ownership-value and the rise of the service economy", *Service Science*, Vol. 3 No. 2, pp. 136-145, doi: 10.1287/serv.2.3.136.

Ehret, M. and Wirtz, J. (2017), "Unlocking value from machines: business models and the industrial internet of things", *Journal of Marketing Management*, Vol. 33 Nos 1-2, pp. 111-130, doi: 10.1080/0267257x.2016.1248041.

Ettlie, J.E. and Rosenthal, S.R. (2012), "Service innovation in manufacturing", *Journal of Service Management*, Vol. 23 No. 3, pp. 440-454, doi: 10.1108/09564231211248499.

Field, J.M., Fotheringham, D., Subramony, M., Gustafsson, A., Ostrom, A.L., Lemon, K.N., Huang, M.H. and McColl-Kennedy, J.R. (2021), "Service research priorities: designing sustainable service ecosystems", *Journal of Service Research*, Vol. 24 No. 4, pp. 462-479, doi: 10.1177/10946705211031302.

Freeman, C. and Louca, F. (2001), *As Time Goes by: from the Industrial Revolutions to the Information Revolution*, Oxford University Press, New York.

Furr, N., Ozcan, P. and Eisenhardt, K.M. (2022), "What is digital transformation? Core tensions facing established companies on the global stage", *Global Strategy Journal*, Vol. 12 No. 4, pp. 595-618, doi: 10.1002/gsj.1442.

Gallouj, F. and Savona, M. (2009), "Innovation in services: a review of the debate and a research agenda", *Journal of Evolutionary Economics*, Vol. 19, September, pp. 149-172, doi: 10.1007/s00191-008-0126-4.

Giustiziero, G., Kretschmer, T., Somaya, D. and Wu, B. (2021), "Hyperspecialization and hyperscaling: a resource-based theory of the digital firm", *Strategic Management Journal*, Vol. 44 No. 6, pp. 1391-1424, doi: 10.1002/smj.3365.

Gregory, R.W., Henfridsson, O., Kaganer, E. and Kyriakou, H. (2021), "The role of artificial intelligence and data network effects for creating user value", *Academy of Management Review*, Vol. 46 No. 3, pp. 534-551, doi: 10.5465/amr.2019.0178.

Grönroos, C. and Voima, P. (2013), "Critical service logic: making sense of value creation and co-creation", *Journal of the Academy of Marketing Science*, Vol. 41 No. 2, pp. 133-150, doi: 10.1007/s11747-012-0308-3.

Gustafsson, A., Snyder, H. and Witell, L. (2020), "Service innovation: a new conceptualization and path forward", *Journal of Service Research*, Vol. 23 No. 2, pp. 111-115, doi: 10.1177/1094670520908929.

Hagel, J. III and Rayport, J.F. (1997), "The coming battle for customer information", *McKinsey Quarterly*, No. 3, p. 64.

Hein, A., Weking, J., Schreieck, M., Wiesche, M., Böhm, M. and Krcmar, H. (2019), "Value co-creation practices in business-to-business platform ecosystems", *Electronic Markets*, Vol. 29 No. 3, pp. 503-518, doi: 10.1007/s12525-019-00337-y.

Helkkula, A., Kowalkowski, C. and Tronvoll, B. (2018), "Archetypes of service innovation: implications for value cocreation", *Journal of Service Research*, Vol. 21 No. 3, pp. 284-301, doi: 10.1177/1094670517746776.

Hill, R. (2018), "IBM struggles to sign up shipping carriers to blockchain supply chain platform – reports", The Register, available at: www.theregister.com/2018/10/30/ibm_struggles_to_sign_up_shipping_carriers_to_blockchain_supply_chain_platform_reports/ (accessed 9 September 2023).

Hipp, C. and Grupp, H. (2005), "Innovation in the service sector: the demand for service-specific innovation measurement concepts and typologies", *Research Policy*, Vol. 34 No. 4, pp. 4517-4535, doi: 10.1016/j.respol.2005.03.002.

Hofmeister, J., Kanbach, D.K. and Hogreve, J. (2023), "Measuring and managing service productivity: a meta-analysis", *Review of Managerial Science*, pp. 1-37, doi: 10.1007/s11846-023-00620-5.

Huang, M.-H. and Rust, R.T. (2017), "Technology-driven service strategy", *Journal of the Academy of Marketing Science*, Vol. 45 No. 6, pp. 906-924, doi: 10.1007/s11747-017-0545-6.

Huang, M.-H. and Rust, R.T. (2021), "A strategic framework for artificial intelligence in marketing", *Journal of the Academy of Marketing Science*, Vol. 49 No. 1, pp. 30-50, doi: 10.1007/s11747-020-00749-9.

Hull, F.M. (2004), "Innovation strategy and the impact of a composite model of service product development on performance", *Journal of Service Research*, Vol. 7 No. 2, pp. 167-180, doi: 10.1177/1094670504268452.

Jensen, T., Hedman, J. and Henningsson, S. (2019), "How TradeLens delivers business value with blockchain technology", *MIS Quarterly Executive*, Vol. 18 No. 4, pp. 221-243, doi: 10.17705/2msqe.00018.

Jovanovic, M., Sjödin, D. and Parida, V. (2022), "Co-evolution of platform architecture, platform services, and platform governance: expanding the platform value of industrial digital platforms", *Technovation*, Vol. 118, 102218, doi: 10.1016/j.technovation.2020.102218.

Koskela-Huotari, K., Edvardsson, B., Jonas, J.M., Sörhammar, D. and Witell, L. (2016), "Innovation in service ecosystems: breaking, making, and maintaining institutionalized rules of resource integration", *Journal of Business Research*, Vol. 69 No. 8, pp. 2964-2971, doi: 10.1016/j.jbusres.2016.02.029.

Kowalkowski, C. and Ulaga, W. (2017), *Service Strategy in Action: A Practical Guide for Growing Your B2B Service and Solution Business*, Service Strategy Press, Scottsdale: AZ.

Kowalkowski, C., Bigdeli, A.Z. and Baines, T. (2022), "Guest editorial: the future of servitization in a digital era", *Journal of Service Management*, Vol. 33 No. 1, pp. 59-69, doi: 10.1108/josm-01-2022-450.

Larsson, R. and Bowen, D.E. (1989), "Organization and customer: managing design and coordination of services", *Academy of Management Review*, Vol. 14 No. 2, pp. 213-233, doi: 10.5465/amr.1989.4282099.

Levie, A. and London, S. (2018), *From Start-Up to Scale: A Conversation with Box CEO Aaron Levie*, McKinsey Podcast, New York City.

Lobschat, L., Mueller, B., Eggers, F., Brandimarte, L., Diefenbach, S., Kroschke, M. and Wirtz, J. (2021), "Corporate digital responsibility", *Journal of Business Research*, Vol. 122, pp. 875-888, doi: 10.1016/j.jbusres.2019.10.006.

Lovelock, C. and Gummesson, E. (2004), "Whither services marketing? In search of a new paradigm and fresh perspectives", *Journal of Service Research*, Vol. 7 No. 1, pp. 20-41, doi: 10.1177/1094670504266131.

Lowe, D., Espinosa, A. and Yearworth, M. (2020), "Constitutive rules for guiding the use of the viable system model: reflections on practice", *European Journal of Operational Research*, Vol. 287 No. 3, pp. 1014-1035, doi: 10.1016/j.ejor.2020.05.030.

Lundin, L. and Kindström, D. (2023), "Digitalizing customer journeys in B2B markets", *Journal of Business Research*, Vol. 157, 113639, doi: 10.1016/j.jbusres.2022.113639.

Lusch, R.F. and Nambisan, S. (2015), "Service innovation: a service-dominant logic perspective", *MIS Quarterly*, Vol. 39 No. 1, pp. 155-175, doi: 10.25300/misq/2015/39.1.07.

Lyytinen, K., Yoo, Y. and Boland, R.J. Jr (2016), "Digital product innovation within four classes of innovation networks", *Information Systems Journal*, Vol. 26 No. 1, pp. 47-75, doi: 10.1111/isj.12093.

Markfort, L., Arzt, A., Kögler, P., Jung, S., Gebauer, H., Haugk, S., Leyh, C. and Wortmann, F. (2021), "Patterns of business model innovation for advancing IoT platforms", *Journal of Service Management*, Vol. 33 No. 1, pp. 70-96, doi: 10.1108/josm-11-2020-0429.

Miles, I. (2016), "Twenty years of service innovation research", in Toivonen, M. (Ed.), *Service Innovation: Novel Ways of Creating Value in Actor Systems*, Springer (Translational Systems Sciences, New York, Vol. 6, pp. 3-34.

Miozzo, M. and Soete, L. (2001), "Internationalization of services: a technological perspective", *Technological Forecasting and Social Change*, Vol. 67 No. 2, pp. 159-185, doi: 10.1016/s0040-1625(00)00091-3.

Nambisan, S. and Sawhney, M. (2011), "Orchestration processes in network-centric innovation: evidence from the field", *Academy of Management Perspectives*, Vol. 25 No. 3, pp. 40-57, doi: 10.5465/amp.25.3.zol40.

Nenonen, S., Storbacka, K. and Windahl, C. (2019), "Capabilities for market-shaping: triggering and facilitating increased value creation", *Journal of the Academy of Marketing Science*, Vol. 47 No. 4, pp. 617-639, doi: 10.1007/s11747-019-00643-z.

Ng, I.C. and Wakenshaw, S.Y. (2017), "The Internet-of-Things: review and research directions", *International Journal of Research in Marketing*, Vol. 34 No. 1, pp. 3-21, doi: 10.1016/j.ijresmar.2016.11.003.

Normann, R. (2001), *Reframing Business - when the Map Changes the Landscape*, John Wiley & Sons, Hoboken, New Jersey.

Ostrom, E. (2015), *Governing the Commons: the Evolution of Institutions for Collective Action*, Cambridge University Press, Cambridge.

Ostrom, A.L., Field, J.M., Fotheringham, D., Subramony, M., Gustafsson, A., Lemon, K.N., Huang, M.H. and McColl-Kennedy, J.R. (2021), "Service research priorities: managing and delivering service

in turbulent times", *Journal of Service Research*, Vol. 24 No. 3, pp. 329-353, doi: 10.1177/10946705211021915.

O'Cass, A. and Sok, P. (2013), "Exploring innovation driven value creation in B2B service firms: the roles of the manager, employees, and customers in value creation", *Journal of Business Research*, Vol. 66 No. 8, pp. 1074-1084, doi: 10.1016/j.jbusres.2012.03.004.

Opazo-Basáez, M., Vendrell-Herrero, F. and Bustinza, O.F. (2021), "Digital service innovation: a paradigm shift in technological innovation", *Journal of Service Management*, Vol. 33 No. 1, pp. 97-120, doi: 10.1108/josm-11-2020-0427.

Paiola, M. and Gebauer, H. (2020), "Internet of things technologies, digital servitization and business model innovation in BtoB manufacturing firms", *Industrial Marketing Management*, Vol. 89, pp. 245-264, doi: 10.1016/j.indmarman.2020.03.009.

Paluch, S., Wirtz, J. and Werner, H. (2022), "The service robot revolution", in Davis, M.M. (Ed.), *Research Handbook on Services Management*, Edward Elgar Publishing, pp. 296-308.

Pavitt, K. (1984), "Sectoral patterns of technical change: towards a taxonomy and a theory", *Research Policy*, Vol. 13 No. 6, pp. 343-373, doi: 10.1016/0048-7333(84)90018-0.

Perks, H., Kowalkowski, C., Witell, L. and Gustafsson, A. (2017), "Network orchestration for value platform development", *Industrial Marketing Management*, Vol. 67, pp. 106-121, doi: 10.1016/j.indmarman.2017.08.002.

Pine, B.J. (1993), *Mass Customization: the New Frontier in Business Competition*, Harvard Business School Press, Boston, MA.

Poeppelbuss, J., Ebel, M. and Anke, J. (2022), "Iterative uncertainty reduction in multi-actor smart service innovation", *Electronic Markets*, Vol. 32 No. 2, pp. 599-627, doi: 10.1007/s12525-021-00500-4.

Queiroz, S.A.B., Mendes, G.H.S., Silva, J.H.O., Ganga, G.M.D., Cauchick Miguel, P.A. and Oliveira, M.G. (2020), "Servitization and performance: impacts on small and medium enterprises", *Journal of Business and Industrial Marketing*, Vol. 35 No. 7, pp. 1237-1249, doi: 10.1108/jbim-06-2019-0277.

Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J. and Gebauer, H. (2019), "Servitization: a contemporary thematic review of four major research streams", *Industrial Marketing Management*, Vol. 83, pp. 207-223.

Raisch, S. and Krakowski, S. (2021), "Artificial intelligence and management: the automation–augmentation paradox", *Academy of Management Review*, Vol. 46 No. 1, pp. 192-210, doi: 10.5465/amr.2018.0072.

Ramirez Hernandez, T. and Kreye, M.E. (2021), "Uncertainty profiles in engineering-service development: exploring supplier co-creation", *Journal of Service Management*, Vol. 32 No. 3, pp. 407-437, doi: 10.1108/josm-08-2019-0270.

Rangaswamy, A., Moch, N., Felten, C., van Bruggen, G., Wieringa, J.E. and Wirtz, J. (2020), "The role of marketing in digital business platforms", *Journal of Interactive Marketing*, Vol. 51, pp. 72-90, doi: 10.1016/j.intmar.2020.04.006.

Rantala, T., Ukko, J., Nasiri, M. and Saunila, M. (2023), "Shifting focus of value creation through industrial digital twins—from internal application to ecosystem-level utilization", *Technovation*, Vol. 125, 102795, doi: 10.1016/j.technovation.2023.102795.

Renault, C., Dalsace, F. and Ulaga, W. (2010), *Michelin Fleet Solutions: from Selling Tires to Selling Kilometers*, ECCH Case Study.

Rifkin, J. (2011), *The Third Industrial Revolution. How Lateral Power Is Transforming Energy, the Economy, and the World*, Palgrave MacMillan, London.

Rubalcaba, L., Michel, S., Sundbo, J., Brown, S.W. and Reynoso, J. (2012), "Shaping, organizing, and rethinking service innovation: a multidimensional framework", *Journal of Service Management*, Vol. 23 No. 5, pp. 696-715, doi: 10.1108/09564231211269847.

Salunke, S., Weerawardena, J. and McColl-Kennedy, J.R. (2011), "Towards a model of dynamic capabilities in innovation-based competitive strategy: insights from project-oriented service firms", *Industrial Marketing Management*, Vol. 40 No. 8, pp. 1251-1263, doi: 10.1016/j.indmarman.2011.10.009.

Smedlund, A. (2012), "Value cocreation in service platform business models", *Service Science*, Vol. 4 No. 1, pp. 79-88, doi: 10.1287/serv.1110.0001.

Song, L.Z., Song, M. and Di Benedetto, C.A. (2009), "A staged service innovation model", *Decision Sciences*, Vol. 40 No. 3, pp. 571-599, doi: 10.1111/j.1540-5915.2009.00240.x.

Spohrer, J., Maglio, P.P., Vargo, S.L. and Warg, M. (2022), *Service in the AI Era: Science, Logic, and Architecture Perspectives*, Business Expert Press, New York.

Spring, M. and Araujo, L. (2013), "Beyond the service factory: service innovation in manufacturing supply networks", *Industrial Marketing Management*, Vol. 42 No. 1, pp. 59-70, doi: 10.1016/j.indmarman.2012.11.006.

Taleb, N.N. (2021), "Bitcoin, currencies, and fragility", *Quantitative Finance*, Vol. 21 No. 8, pp. 1249-1255, doi: 10.1080/14697688.2021.1952702.

Tian, J., Coreynen, W., Matthyssens, P. and Shen, L. (2022), "Platform-based servitization and business model adaptation by established manufacturers", *Technovation*, Vol. 118, 102222, doi: 10.1016/j.technovation.2021.102222.

Toivonen, M. and Tuominen, T. (2009), "Emergence of innovations in services", *Service Industries Journal*, Vol. 29 No. 7, pp. 887-902, doi: 10.1080/02642060902749492.

Tóth, Z., Sklyar, A., Kowalkowski, C., Sörhammar, D., Tronvoll, B. and Wirths, O. (2022), "Tensions in digital servitization through a paradox lens", *Industrial Marketing Management*, Vol. 102, pp. 438-450, doi: 10.1016/j.indmarman.2022.02.010.

Tronvoll, B., Sklyar, A., Sörhammar, D. and Kowalkowski, C. (2020), "Transformational shifts through digital servitization", *Industrial Marketing Management*, Vol. 89, pp. 293-305, doi: 10.1016/j.indmarman.2020.02.005.

Ulaga, W. and Kowalkowski, C. (2022), "Servitization: a state-of-the-art overview and future directions", in Edvardsson, B. and Tronvoll, B. (Eds), *The Palgrave Handbook of Service Management*, Palgrave Macmillan, pp. 169-200.

Utterback, J.M. (1994), *Mastering the Dynamics of Innovation*, Harvard Business School Press, Boston, MA.

Vandermerwe, S. and Erixon, D. (2023), "Servitization of business updated: now, new, next", *European Management Journal*, Vol. 41 No. 4, pp. 479-487, doi: 10.1016/j.emj.2023.07.007.

Varian, H.R. (2010), "Computer mediated transactions", *American Economic Review*, Vol. 100 No. 2, pp. 1-10, doi: 10.1257/aer.100.2.1.

Wang, G., Henfridsson, O., Nandhakumar, J. and Yoo, Y. (2022), "Product meaning in digital product innovation", *MIS Quarterly*, Vol. 46 No. 2, pp. 947-976, doi: 10.25300/misq/2022/15252.

Weiser, M. (1991), "The computer for the 21st century", *Scientific American*, Vol. 265 No. 3, pp. 94-104, doi: 10.1038/scientificamerican0991-94.

Wirtz, J. and Kowalkowski, C. (2023), "Putting the 'service' into B2B marketing: key developments in service research and their relevance for B2B", *Journal of Business and Industrial Marketing*, Vol. 28 No. 2, pp. 272-289, doi: 10.1108/jbim-02-2022-0085.

Wirtz, J. and Zeithaml, V. (2018), "Cost-effective service excellence", *Journal of the Academy of Marketing Science*, Vol. 46 No. 1, pp. 59-80, doi: 10.1007/s11747-017-0560-7.

Wirtz, J., Tuzovic, S. and Ehret, M. (2015), "Global business services: increasing specialization and integration of the world economy as drivers of economic growth", *Journal of Service Management*, Vol. 26 No. 4, pp. 565-587, doi: 10.1108/josm-01-2015-0024.

Wirtz, J., Patterson, P.G., Kunz, W.H., Gruber, T., Lu, V.N., Paluch, S. and Martins, A. (2018), "Brave new world: service robots in the frontline", *Journal of Service Management*, Vol. 29 No. 5, pp. 907-931, doi: 10.1108/josm-04-2018-0119.

Wirtz, J., So, K.K.F., Mody, M.A., Liu, S.Q. and Chun, H.H. (2019), "Platforms in the peer-to-peer sharing economy", *Journal of Service Management*, Vol. 30 No. 4, pp. 452-483, doi: 10.1108/josm-11-2018-0369.

Wirtz, J., Fritze, M.P., Jaakkola, E., Gelbrich, K. and Hartley, N. (2021), "Service products and productization", *Journal of Business Research*, Vol. 137 December, pp. 411-421, doi: 10.1016/j.jbusres.2021.08.033.

Wirtz, J., Hofmeister, J., Chew, P.Y.P. and Ding, X.D. (2023a), "Digital service technologies, service robots, AI, and the strategic pathways to cost-effective service excellence", *Service Industries Journal*, Vol. 43 Nos 15-16, pp. 1173-1196, online first, doi: 10.1080/02642069.2023.2226596.

Wirtz, J., Kunz, W.H., Hartley, N. and Tarbit, J. (2023b), "Corporate digital responsibility in service firms and their ecosystems", *Journal of Service Research*, Vol. 26 No. 2, pp. 173-190, doi: 10.1177/10946705221130467.

Witell, L., Snyder, H., Gustafsson, A., Fombelle, P. and Kristensson, P. (2016), "Defining service innovation: a review and synthesis", *Journal of Business Research*, Vol. 69 No. 8, pp. 2863-2872, doi: 10.1016/j.jbusres.2015.12.055.

Witell, L., Kowalkowski, C., Perks, H., Raddats, C., Schwabe, M., Benedettini, O. and Burton, J. (2020), "Characterizing customer experience management in business markets", *Journal of Business Research*, Vol. 116, pp. 420-430, doi: 10.1016/j.jbusres.2019.08.050.

Wolf, M. (2022), "Globalisation is not dying, it's changing", *Financial Times*, Vol. 13, p. 2022, September, available at: www.ft.com/content/f6fe91ab-39f9-44b0-bff6-505ff6c665a1

Worm, S., Bharadwaj, S., Ulaga, W. and Reinartz, W. (2017), "When and why do customer solutions pay off in business markets?", *Journal of the Academy of Marketing Science*, Vol. 45 No. 4, pp. 490-512, doi: 10.1007/s11747-017-0529-6.

Yoffie, D.B., Gawer, A. and Cusumano, M.A. (2019), "A study of more than 250 platforms a reveal why most fail", Harvard Business Review, HBR Online, May 29.

Zuboff, S. (2019), "Surveillance capitalism and the challenge of collective action", *New Labor Forum*, Vol. 28 No. 1, pp. 10-29, Los Angeles, doi: 10.1177/1095796018819461.

Zuora (2022), *The Subscription Economy Index*, Subscribed Institute, February 2022.

Further reading

Coombs, R. and Miles, I. (2000), "Innovation, measurement and services: the new problematique", in Metcalfe, J.S. and Miles, I. (Eds), *Innovation Systems in the Service Economy, Measurement and Case Study Analysis*, Kluwer Academic Boston, MA, pp. 85-103.

Gallouj, F. and Weinstein, O. (1997), "Innovation in services", *Research Policy*, Vol. 26 Nos 4-5, pp. 537-556, doi: 10.1016/s0048-7333(97)00030-9.

Kuo, Y.K., Kuo, T.H. and Ho, L.A. (2014), "Enabling innovative ability: knowledge sharing as a mediator", *Industrial Management and Data Systems*, Vol. 114 No. 5, pp. 696-710, doi: 10.1108/imds-10-2013-0434.

Tilson, D., Lyytinen, K. and Sørensen, C. (2010), "Research commentary—digital infrastructures: the missing IS research agenda", *Information Systems Research*, Vol. 21 No. 4, pp. 748-759, doi: 10.1287/isre.1100.0318.

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