Smart technologies in service provision and experience

Abstract

Service technologies have evolved rapidly in the last 20 years, concretely affecting service practices. The spread of smartphones, tablets, and smart objects has contributed to the exponential increase in connectivity. The growing number of connected smart devices configures complex ecosystems in which objects interact and communicate with each other through the exchange of data and access to a multiplicity of previously shared information. In this context, technologies open new horizons and scenarios that are not always imaginable, and also highlight the need to radically rethink service practices and methods of organizing service relations. This chapter addresses how smart technologies (e.g., artificial intelligence, wearables, chatbot, service/social robots, blockchain) can affect service practices by making service provision smart and fostering a smart service experience.

1. Introduction

Digital and cognitive technologies have evolved rapidly in the last 20 years. The spread of the Internet, smartphones, and smart objects has contributed to an exponential increase in connectivity. The growing number of connected smart devices configures complex systems in which objects and people interact and communicate with each other through the exchange of data and access to a multiplicity of information. The adoption of novel technologies (e.g., artificial intelligence [AI], chatbots, wearables, augmented reality, blockchain) promises to transform people's lives and society due to higher levels of connectedness, greater computational processing, and more complex decision-making involving extraordinary volumes of data (Huang & Rust 2018). Such features make it possible to define technologies as smart; that is, able to perform tasks and accomplish objectives that traditionally required human intelligence and capabilities.

The concept of smartness is relatively new in business studies. Rijsdijk and Hultink (2009) defined smartness as relating to a product's set of capabilities, including autonomy, adaptability, reactivity, multi-functionality, ability to cooperate to achieve a common goal, human-like interaction, and personality. The foundations of smartness have been studied in, for example, the context of AI and the Internet of Things/Everything (Langley et al. 2021), where smart objects, based on the input data, can sense, reason, and perform actions to reach a certain goal. In general, smart technologies are considered to impact service experience and engagement processes (Heller et al. 2021). Extant studies refer to an autonomous behaviour of smart technology, whereas other studies address the topic of smartness as a product's sum of capabilities (Rijsdijk & Hultink 2009) or a service system's ability to increase the frequency and intensity of value co-creation (Lim & Maglio 2018).
This chapter focuses on smart service technologies and how the smartness of technologies can make both service provision and service experience smarter. We argue that smart service provision deploys intelligent automation and augmentation to foster systems of insights. These processes initiate systems of engagement and enable smart service experiences wherein both hedonic and utilitarian value are co-created.

2. Smart service technology and smart services

In this chapter, we are interested in smart services, which are services delivered to or via smart technologies (Wünderlich et al. 2015). Such technologies offer new ways to design, deliver, and experience services. This can range from gathering and analysing data, to novel ways of sharing, learning, controlling, adapting, and acting. Smart services are not industry-specific; rather, they potentially extend to all industries, including energy, healthcare, transportation, domestic, and education. The implementation of smart services relates to critical outcomes in the value co-creating process, including cost and time saving, greater speed and control, reduced service supply costs and waiting times for service delivery, and higher perceived level of personalization. Recently, research has focused on the impact of smart technologies on both service providers and customers.

First, scholars have discussed the impact of smart service technologies on service provision. Most research on AI and robotics in value co-creation has focused on how these technologies support service providers (Kaartemo & Helkkula 2018). Scholars are also interested in how new technologies transform service provision, how firms should change their service strategies, and how companies should divide tasks between humans and machines (Huang & Rust 2018). Lam et al. (2017) explained how the capability of handling a greater volume of data, as well as faster analysis and use of versatile data, may improve service quality and reduce service costs. Automation and machine learning raise many questions about augmented intelligence enabling higher-skilled professionals to provide enhanced service compared to the lower-cost labour force.

A second research stream considers how customers perceive the use of smart services on the frontline (De Keyser et al. 2019; Marinova et al. 2017). Service researchers have considered how service quality and experience are impacted by robotic automation, machine learning, or deep learning technologies (Xiao & Kumar 2021). For instance, scholars are interested in understanding the service quality (Choi et al. 2020) and responsibility perceptions (Jörling et al. 2019) of human–robot interaction in various contexts. Mende et al. (2019) ran seven experiments that revealed how customers behave differently with frontline service robots compared with frontline humans. Interestingly, people are more willing to buy status goods and eat more when served by a humanoid service robot. However, it is worth noting that people may act differently depending on the type of smart technology (humanoid vs self-service robot) or the degree of automated social presence (McLeay et al. 2021). A wider set of studies on robot anthropomorphism (van Pinxteren et al. 2019) concentrates on the attribution of human characteristics, motivations, intentions, and emotions to non-human agents.

Recent studies have led to increasing empirical evidence on the impact of smart technology on service provision and experience. However, this evidence remains fragmented. Thus, it is not clear how the smartness of service technology impacts service practices. Below, we develop new frames for conceptualizing smart service provision and smart service experience.

3. Smartness of service technology for service practices

The service literature addresses how novel technologies promise broader applications for augmented human–machine interactions (Huang & Rust 2018; Wirtz et al. 2018), with specific focus on how to transform data into usable intelligence by incorporating digitally empowered systems (e.g., devices, new tools) that offer new opportunities to integrate resources and enable value creation and innovation.

Mele et al. (2020) proposed the concept of smart nudging as a way of using cognitive technologies to affect people's behaviour predictably, without limiting their options or altering their economic incentives. Several choice architectures and nudges affect value co-creation, by (1) widening resource accessibility, (2) extending engagement, or (3) augmenting human actors' agency. Cognitive technologies are unlikely to engender smart outcomes by themselves; instead, they enable designs of conditions and contexts that promote smart behaviours by amplifying capacities for self-understanding, control, and action.

Given such emerging opportunities, there is a need to frame how different service technologies and their smartness affect service practices. No studies have explicitly addressed the smartness of technologies in relation to service practices. We argue that the full potential of the smartness of novel technologies to affect service practices lies in the provision of smart-technology-enabled value propositions (i.e., smart service provision) and the experience of smart-technology-enabled solutions (i.e., smart service experience). Table 1 synthesizes the features of the smart technologies.

Table 1. Technologies futures

Technologies	Definition	Main features	Main references
Blockchain	Distributed digital ledger programmed to collect and certify data and information, which are recorded in an immutable way in a public register	Transparency, trust, safety, simplification, traceability, reliability, automation	Angelis & Ribeiro da Silva (2019); Chen (2018); Pilkington (2016),
Chatbot and intelligent conversational systems	Computer programs that interact with users using natural languages	Conversational capability, automatic response, emotionally intelligent, autonomous reasoning, trained ability	Kumar et al. (2016); Luo et al. (2019); Van Pinxteren (2020)
Smart wearables	Smart objects or processes designed to generate data and to communicate in an automatic way	Status diagnosis, interactions, data processing, connection	Gao & Luo (2015); Park (2020)
Service robot	System-based autonomous and adaptable interfaces that interact, communicate, and deliver service to customers	Autonomous decision capability, learning ability, adaptation, initiate tasks	Huang & Rust (2021); McLeay et al. (2021); Wirtz et al. (2018, 2021)
Social robots	Autonomous systems that can understand social cues through facial and voice recognition technology and interact with users in human-like manners	Human-like capabilities, communicating via natural language, reading and expressing emotions, social ability	Čaić et al. (2019); Wirtz et al. (2018)
Virtual/augmented reality	Intelligent image recognition technology based on the ability to correlate a series of data with a particular image, superimposing the data in a contextual manner on the frame	Immersive, mix of physical and digital elements, widening perceptions	Farah et al. (2019); Tredinnick (2018)

3.1. Smart Service Provision

Service provision concerns the deployment and offer of value propositions (i.e., different combinations of resources) to potential beneficiaries as input for their value-creation processes (Vargo & Lusch 2008). “Smart” features that utilize new technologies are transforming service provision. Smart service provision is an emerging concept referring to connected objects able to sense their condition and context, which "thus allows for real-time data collection, continuous communication and interactive feedback" (Wünderlich et al. 2015, p. 443). In other words, smart service provision enables interactive feedback, connectivity, and responsiveness (Huang & Rust 2018; Larivière et al. 2017).

To understand how the smartness of service provision is deployed, we consider the concepts of automation and augmentation. The former concerns routine or regular tasks, and the latter to non-routine or irregular tasks (Rouse & Spohrer 2018). Automation implies that machines take over human tasks, while augmentation means that humans collaborate closely with machines to perform a task (Raisch & Krakowski 2021).

3.1.1. Intelligent Automation

Intelligent automation combines technologies, tools, and methods to execute activities automatically and on behalf of knowledge workers. It is achieved "by mimicking the capabilities that knowledge workers use in the performing of work activities, i.e., language, vision, executing, thinking, learning" (Bornet et al. 2021: pag. 1), with benefits of increased speed, reduced cost, enhanced quality, and improved process resilience and reliability.

With the rapid development of robot technology, more robots have been introduced and applied, particularly in frontline services or in homes (Wirtz et al. 2018). Service robots take over many routine tasks with a range of potential benefits to organizations, including increased effectiveness, productivity gains, enhanced reliability, improved compliance, and stronger security (Huang & Rust 2018). They are capable of autonomous decision-making based on the data they collect via various sensors and other sources (Internet- and cloud-based systems), and they adapt to the different operative situations or frontline contexts (Huang & Rust 2021; McLeay et al. 2021). Hospitality and tourism provide many examples of robots successfully employed to deliver service tasks of varying complexity (Lu et al. 2021).

Service robots in the home context include robotic vacuum cleaners and lawnmowers. Equipped with a sensor and intelligent system, they have autonomous navigation, can be controlled via mobile phone, and can include multipurpose tasks. Increasingly, they are becoming part of domestic life, taking on some of the burden of dull, dirty, and dangerous jobs.

New technologies allow prompt and smooth service interactions. For example, chatbots are always available to foster information exchange and transfer (Castellano et al. 2018). Human–chatbot interactions provide information to consumers, while firms get information on consumers by tracking what they do and analysing the questions they ask (Luo et al. 2019; Van Pinxteren et al. 2020). The ability to access information from a wider knowledge base by using connected systems such as messaging or social platforms (e.g., Facebook) provides chatbots with computational capacities (Wilson-Nash et al. 2020) to go beyond repetitive behaviours. They can get closer to customers' real needs and habits and can anticipate future interactions and executions. In retail, intelligent agents can look for opportunities to go beyond the customers' expectations by identifying cross/up-selling opportunities that resonate with customers (Luo et al. 2019; Pantano & Pizzi 2020).

Unicorn Bay

Unicorn Bay Bot for Telegram helps users when they need information about the stock market and have no time to search for it online. This chatbot has information about all stock exchanges (and updates every 15 minutes).

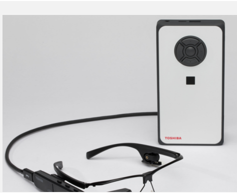
In a different setting, blockchain technologies promise to affect service organizations and processes beyond just creating new currencies (Chen 2018). Scholars have discussed the numerous distinctive features of blockchain (e.g., disintermediation, security) and their ability to make processes smoother. Blockchain provides automatic recording of information in an unchangeable way among different users who exchange "assets". The consensus mechanism is based on this innate immutability (Pilkington 2016). Service process operations are moving towards more coordinated and automated networks while being redesigned to reduce the need for intermediaries assuring more security and speed in information transmission. Smart contracts and tokens facilitate, execute, and enforce asset exchanges between multiple parties (Angelis & Ribeiro da Silva 2019; Chen 2018).

Dedit Education is a platform that allows schools and universities to notarize their students' certificates in a secure way. The fingerprint that will be inserted in the blockchain is generated for each file. The entity signs the transaction with its private key to give the original authorship of the certificate, facilitating a posteriori verification of authenticity by third parties. The student, universities, and companies can easily verify that the document is authentic and unmodified. The institution has its public key on its website. The hash value of the diploma is saved in the blockchain.

3.1.2. Intelligent Augmentation

New technologies enable wider access to resources (information, data, relations, interactions) otherwise unavailable to human beings, thereby augmenting actors' knowledge and capabilities (Mele et al. 2020). Intelligent augmentation enables new opportunities for human intelligence, knowledge, and capabilities. It provides adaptive aids for determining how humans can perform tasks: such intelligent tutoring assesses the availability of necessary knowledge and skills and determines the required training interventions (Rouse & Spohrer 2018).

Internet connection options have radically changed due to smart objects (e.g., smart glass, smart watch, smart shirts, smart lens, and smart bangles). Specifically, wearables enable continuous data exchange and deliver actionable information to help actors understand information in ways that reveal new insights and enable their decision-making (Park 2020). Wearables support actors with ongoing feedback, alerts, and recommendations appropriate to each actor's choice and use contexts. A main application of this technology is in the healthcare ecosystem (Wang & Hajli 2017). Notable examples are wearables that monitor parameters of wellness, such as sleep and calories, and medical devices for elderly or vulnerable people or those with chronic diseases (Gao & Luo 2015). These tools assist doctors and professionals to capture health data whenever required by increasing their work efficiency.



Smart glasses are glasses with an integrated camera. Their lenses act as screens on which different types of information are shown. They provide surgeons with additional information and visual guidance during surgical procedures.

Apart from routine automated tasks, service robots can perform tasks that require high cognitive and analytical skills by analysing large volumes of data, integrating internal and external information, and recognizing patterns and relating them to customer profiles (Wirtz et al. 2021). For example, service robots in healthcare can help doctors analyse large quantities of data in a cost- and time-efficient way by identifying possible diagnoses, proposing best solutions, and making recommendations (Wirtz, 2021). Recent developments demonstrate that robots are increasingly capable of more sophisticated physical and cognitive activities, including detecting worsening dementia, identifying hazards like spills on a shop floor, and offering wealth-management advice. In a different context, social assistive robots are powerful tools that provide services to fragile or elderly people (Čaić et al. 2019; Odekerken-Schröder et al. 2020; Van Doorn et al. 2017).

The MARIO project addresses the difficult challenges of loneliness, isolation, and dementia in older people through innovations and multifaceted inventions offered by service robots. MARIO is based on the robot Kompai R&D, by Robosoft, which can assist the elderly and people with disabilities by speaking, understanding language, and moving independently.

3.2. Smart Service Experience

Service experience refers to "a customer's individual and subjective response to any direct or indirect contact with the provider" (Jaakkola et al. 2015 p, 12). Such experience can be physical or digital, lived, observed, or imagined, and can relate to a single event, a set of events, or a process (Helkkula 2011). As a subjective response, it is always context-specific and is co-created when actors engage with the service offering (Patrício et al. 2011) and integrate resources with other actors (Vargo & Lusch 2008). It relates not only to the shopping or consumption phase but to the whole customer journey by enacting the customer's cognitive, emotional, and behavioural responses (Verhoef et al. 2009).

Recent contributions have addressed the role of intelligent technology in making experiences smart for customers. Kabadyi et al. (2019) argued that "the advancements in smart technologies hold key potential to enhance their experiences overall by transforming conventional service experiences into smart service experiences" (p. 334). In other words, a technology-mediated experience is one where a service is delivered through smart devices with the possibility of real-time interactions alongside capacities of autonomy, visibility, accessibility, monitoring, sensing, and communication (Gonçalves et al. 2020). Conversely, perceived risk and privacy and safety concerns can worsen the experience.

To understand how experience with smart services arises, we consider utilitarian and hedonic value. Utilitarian value concerns task compilations and is extrinsic: the experience helps a customer to achieve a specific objective (Hong et al. 2017). Hedonic value relates to fun and enjoyment (Ryu et al. 2010) and is intrinsic: the experience is enjoyed for its own sake (Hong et al. 2017).

3.2.1. Utilitarian Value

Digital and cognitive technologies foster the acquisition of products, services, or information efficiently, reflecting a more task-oriented, cognitive shopping outcome (Babin et al. 1994). Utilitarian value is provided via fulfilment of functional needs. This dimension includes items including more information, convenience, quick service, decision effectiveness, goal orientation, and saved money.

Studies on wearable devices advocate their greater potential for self-awareness or self-control interaction capabilities deployed through remote control systems, as well as their data-processing capabilities (Gao & Luo 2015). Studies regarding healthcare have addressed how wearables provide actors with actionable insights so that they can establish commitment and consistency, thereby enhancing the decision-making process. By focusing on pertinent information, these solutions widen opportunities for actors, thus reducing their sense of risk and cognitive efforts, and personalizing treatment (Wang & Hajli 2017).

FIT iscapable of monitoring vital signs, including electrocardiography, body temperature, and movement, using complex signal-processing technology, ultra-low-power electronics, and low-power wireless microcontrollers.

Trust-enabling technologies and a security-first mindset are key to utilitarian value (Angelis & Ribeiro da Silva 2019). Blockchain ensures trusted transactions, data security, and transparent auditability, which help create informed and engaged actors. Blockchain is founded on a chain of custody, ensuring complete traceability (past and present) of the various operators' actions and behaviours. The validated blocks of transactions, linked to a time chain, act as a decentralized and immutable network that facilitates information exchange so that all participants have access to a transparent and shared database. As contracts and documentation are managed digitally, actors experience enhanced trust and security (see Authentico).

Authentico has created, through blockchain technologies, an innovative system to protect consumers by supporting the fight against the foreign imitation of Italian agri-food products

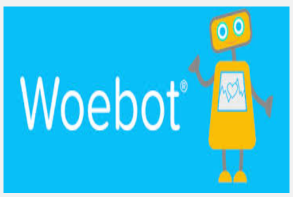
The blockchain used by Authentico is Quadrans, a public blockchain that allows the notarization of relevant documents to verify the authenticity of a product. The blockchain document-notarization system supports the company in certifying quality documentation to be shared with the consumer.

3.2.2. Hedonic Value

People often use novel technologies for fun, playfulness, joy, and excitement (Ryu et al. 2010). These hedonic dimensions of value refer to social, emotional, and epistemic aspects of service experience. The behaviour is guided by affective motivations, such as entertainment and emotions, and by socially satisfying interactions.

By learning from previous conversations and using their learning to continuously adapt their actions (Wilson-Nash et al. 2020), chatbot technologies influence decision-making by using emotional associations, social effects, and behavioural signals (Murray & Häubl 2009) (see Woebot ilustration). Social robots can detect emotional states, such as happiness or sadness, read mood, intuit customer needs, and respond in contextually and emotionally appropriate ways.

Socially assistive robotics play the role of trainers that monitor the progress of the treatment given, so that it can be modified if necessary. Some can activate and maintain social interaction, typical of toy robots, which are able to assume facial expressions and gestural movements, even imitating the expressions and movements of the user. Furthermore, playing with pet robots facilitates personal attachment and can be therapeutic for lonely elderly people or those suffering from dementia. Living with a pet robot keeps elderly people in better psychological condition, wards off depression, and contributes to general well-being (see Paro illustration).

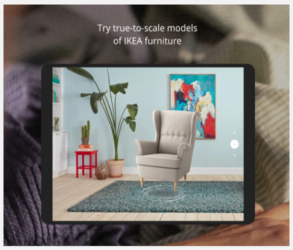


Woebot is a digital assistant with which users can interact either by typing text, or by sending images of their faces, voice messages, or videos. The system recognizes the user's emotions and transmits the results to the conversation service, which can then record the emotional peaks. Through the dialogues, users' psychic problems are monitored and analysed. Subsequently, the service generates natural language to suggest solutions that improve the mood, adopting emergency measures where necessary.

Paro is a seal pet, 55 centimetres long and weighing just over 2.5 kilos. It can move its eyes, head, and fins, and it has numerous sensors that make it sensitive to light and touch all over its body, including its moustache. Among its characteristics, it can recognize the patient's voice and learn information, such as the patient's personal and behavioural habits.

Virtual and augmented realities modify the service context to offer a novel experience by increasing the opportunities for enjoyment, fantasy, and happiness (Farah et al. 2019; Tredinnick 2018). The virtual solutions exploit the "wow" effect capable of capturing attention through surprise and virtual magic. The immersive and fantasy experience overcomes time and space, requires emotional involvement and mental efforts (Bridges & Florsheim 2008), and guarantees the augmented experience. The addition of detailed information helps to improve the user's perception by offering support (in case of need) or suggestions (in case of choice) (Farah et al. 2019)(see Ikea Place illustration). In physical stores, virtual dressing rooms enable customers to try on various clothes and accessories, and to take pictures and share them on social media.

Similarly, in the beauty sector, make-up virtual try-on allows customers to virtually try nail polish, lipstick, and eye shadow, and to see the results in a "magic mirror". Make-up artists can suggest looks to the client for make-up tests.



IKEA, the Swedish furniture multinational, has found an effective way to meet customer needs: IKEA Place, an app that uses augmented reality technology to facilitate both online and in-store shopping. By using the camera, customers can view products from the IKEA catalogue in 3D as if they were standing in front of them. By scanning the free floor, choosing an item, moving, rotating, and placing it, customers can, with just a few clicks, buy the product and share it on social networks with their friends.

4. A Virtuous Cycle Between Systems of Insights and Systems of Engagement

The wider adoption of smartsmart service provision enhances smart service experience (Figure 1). The systems of insight and the systems of engagement are not stand-alone; there is a dynamic interplay between them, with the development of one integrated structure. Smart technologies support providers to capture insights that not only are relevant to customers to the execution of each specific stage or encounter, but also become pivotal to improve the customer experience along the entire journey. At each interaction with customers (through whatever touchpoint or channel), providers foster customer engagement from a data-driven perspective by matching data from the blended digital/physical context and translating them into a call to action. In turn, this rich engagement provides a close connection with customers, allowing yet more data to be collected, which reinforces the systems of insight

Figure 1. Smart service practices

Through technologies, smart service provision can sense a customer's condition and his/her surroundings, thereby enabling continuous interactive feedback to fulfil customers' needs at specific times and/or in specific contexts. Moreover, the "always on" connection and maintenance of smart products allows service providers to establish and cultivate close ties with their customers (Gonçalves et al.2020), enabling the use of customer behaviour data that will translate to better information about customer needs (Wünderlich et al., 2015). In this way systems of insights work to spur intelligent automation and augmentation actions. The systems of insights provide rich and updated knowledge about customers through the collection and analysis of data and social feeds (social media, service interactions, web clickstream data, and geospatial and time information). Providers can predict actors' behaviours and preferences, identify needs and correlations, and determine the design of automated actions. In addition, by leveraging behaviour-driven insights, the providers can apply advanced analytics to operational contexts at the point at which they generate customer interaction data, support actors in making better decisions based on massive data and multiple interactive responses, and augment actors' capabilities (Huang & Rust 2021; Mele et al. 2020).

By prompting intelligent automation and augmentation, systems of insights foster systems of engagement for a smart service experience. From wearables to social robots, technologies can both capture and leverage data insights to provide the elements of connected experiences where the consumer not only experiences the product or brand, but also becomes part of the complete experience (Kabadayi et al. 2019). Utilitarian and hedonic values are the levers of the systems of engagement, which is about engaging customers on the basis of their specific needs and contextual conditions to improve experience. The systems of engagement allow interactions leading customers towards goal attainment and the desired experience. Cognitive, emotional, sensorial, and social elements most readily encompass the broad spectrum of interactions that form a comprehensive service experience (Gonçalves et al. 2020).

In summary, the smartness of service technology does not lie in the wider use of a more advanced technology. Rather, it enhances the smart service provision related to the development of systems of insights that fosters systems of engagement to improve the smart service experience.

5. Conclusions

In this chapter, we have conceptualized smart service provision and smart service experience. Smart service provision relates to the use of smart technologies in service delivery. Rather than arguing that there is a clear division between "smart" and "unintelligent" technologies, we maintain that technologies enable different levels of intelligent automation and augmentation along a continuum. Intelligent automation refers to processes that enable automated actions in regular tasks, including automated social presence. Intelligent augmentation refers to a technology's support in non-routine or irregular tasks, such as adaptive aiding. Smart service provision deploys intelligent automation and augmentation to foster systems of insights. Both intelligent automation and intelligent augmentation can support systems of engagement that promise to enact a smart service experience with utilitarian and hedonic value.

This raises several new questions for scholars and practitioners. For instance, we need more empirical research to understand how the addition of intelligent automation and augmentation influences the smart service experience. It would be important to understand when service providers benefit more from intelligent automation and when from increasing intelligent augmentation. This would help companies design and implement new strategies for service provision in different industries. Moreover, we need more empirical research on how smart technologies mediate service experiences, and the perception of utilitarian and hedonic value. We encourage future research to tackle the role of smart service on both sides of the coin: provision and experience.

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