REVIEW ARTICLE

Digital transformation trends in service industries

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Abstract

This study examines the evolution of digital transformation (DT) in the service industry through real-world application cases and articles published in journals that are related to DT. This research collected 2,897,024 papers published in Scopus journals from 1991 to March 4, 2022. From this population of papers, 2,683 were reclassified and finally, 1831 were chosen for examination. Among these papers, 437 DT-related articles that focused on service fields were analyzed through word cloud analysis of keywords. This paper delineated evolutionary processes of DT in service sectors by reviewing and comparing both the commonalities and differences between the practice (actual cases) and research (published journal articles) of DT. In addition, this research explored the key contributors of DT in the three stages of DT evolution in the service sector. The results of this study provide theoretical and practical implications that offer strategic insights for planning and implementing DT in the service industry.

Keywords Digital transformation · DT research · Keyword analysis · Literature review · Real-world cases

1 Introduction

The World Economic Forum announced the Fourth Industrial Revolution as the emerging "cyber-physical systems" (Schwab 2016). Since then, digital transformation (DT) has rapidly spread in all types of organizations, including business

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enterprises, governments, and nonprofit institutions (Parviainen et al. 2017; Kapadia and Madhav 2020; Gebauer et al. 2021). Especially, digitally transformed services have positively affected customer experience satisfaction by utilizing advanced technologies such as artificial intelligence (AI), Internet of Things (IoT), virtual and augmented reality (VR/AR), cloud computing, and big data analytics (Tabrizi et al. 2019; Vial 2019; Lee and Lee 2020a). For instance, service providers have not only succeeded in boosting customer satisfaction but also making their business processes very transparent using IoT and blockchain technology (Chehri and Jeon 2019; Li et al. 2020a; Rosete et al. 2020). DT has not only changed the service industry but has also empowered consumers.

Today, customers can effectively search for information using digital devices, bringing numerous benefits such as convenience, diverse choices, and efficiency. Considering these benefits, service providers are offering various digital services to enable value co-creation with customers (Lee and Lee 2020c). DT has enabled service firms to create new business models that, in turn, transformed the value chain processes (Lee and Lim 2018). The current COVID-19 pandemic has greatly accelerated the pace of DT in the service industry (Priyono et al. 2020).

To provide new services and value to customers, it is imperative to apply advanced digital technologies (Lee and Lee 2020c; Li et al. 2020b; Rosete et al. 2020). DT encompasses transforming subjective information into objective data so that customer behavior or value added can be quantified (Chin and Lee 2022). Such digitalized objective data can help businesses introduce innovations for customer needs discovery and agile business operations (Parviainen et al. 2017). Thus, DT has become a strategic imperative for developing the firm's dynamic capabilities through agility, flexibility, and resilience to improve organizational performance (Kretschmer and Khashabi 2020).

Martin-Pena et al. (2018) stated that DT is revolutionizing existing business models, whereas Tronvoll et al. (2020) proposed that corporate DT must be based on operational strategies. According to Gobble (2018), DT facilitates effective applications of digital technologies to business process innovation. Rha and Lee's (2022) study, based on a keyword network analysis, showed that DT positively impacts operational processes for creating value in both manufacturing and service industries. Specifically, the implementation of DT requires new management procedures and practices that demand changes in organizational structures and culture (Pelletier and Cloutier 2019; Sklyar et al. 2019; Liu and Guo 2021; Endres et al. 2022). Rha and Lee (2022) analyzed a network map of research topics by analyzing keyword link relations in the service industry. Their study classified the various DT research fields into six clusters: "digitalization of services and new collaborative mechanisms, digital transformation of services, the acceleration of digital transformation, the development and application of new business models, the development and application of new business models, and digitalization of financial business." Despite these research results, the trends and change processes of DT are yet to be fully explored, and, to the best of our knowledge, there has not been a systematic study on the evolution of DT in the service industry. Therefore, it is important to understand the flow and research trends on how DT has integrated and revolutionized the service

industry. Studies are also needed to identify the influencing factors that either guide or enable DT in the service industry.

The purpose of this study is as follows. First, it delineates the various stages of DT development in the service industry by analyzing real cases in the service industry. Instead of adopting an academic approach, this study analyzes real cases of how DT has been implemented in the service industry (e.g., patterns or methods). Second, to examine the research trends in DT, we collected author keywords from DT-related journal articles published from 1991 to March 4, 2022 based on classification criteria specific to the service industry. Third, by comparing the results of the case analysis (part of the first objective) with the results of the research trend analysis (part of the second objective) we suggest the evolution stages of DT in the service industry. This study overcomes the limitations of the existing literature that has focused only on academic research. Fourth, based on the third research objective, this study identifies the determinants that impact DT implementation at various stages. The results of the study will shed valuable information in developing DT strategies for competitive advantage in the service industry.

The rest of this paper are structured as follows: Sect. 2 presents previous studies on DT and convergence of digital technologies. In particular, the development stage of DT is analyzed through actual cases in the service industry. In Sect. 3, we discuss the research design used to extract DT with service-related keywords through data collection and word cloud. Section 4 describes the results of the study on the stages of DT evolution and determinants. We conclude the study in Sect. 5 by presenting the conclusions, limitations of the study, and future research needs.

2 Literature review

2.1 Digital transformation

The rapid development of various digital technologies has enabled digital servitization, which in turn helped accelerate the growth of service industries through DT (Coreynen et al. 2020; Gebauer et al. 2021). Service organizations need to develop business models that can support operational innovations for digital servitization (Tronvoll et al. 2020). Digitization contributes to the development and implementation of innovative business models (Hokkanen et al. 2021). IoT, cloud computing, and big data analytics, which are considered fundamental technologies for digitization, provide service firms with capabilities to develop customer-oriented business models (Lee and Lim 2018; Frank et al. 2019; Paiola and Gebauer 2020). Even manufacturing firms are shifting their primary focus from the products they offer to an ecosystem that integrates products with services to maximize customer value (Coreynen et al. 2020).

Unlike digitization, which involves the application of digital technology, DT uses technologies to either create value for customers or support customers to create value themselves (Seyedghorban et al. 2020). Furthermore, DT encourages the trend to enhance customer participation in operation processes to expand their roles in pursuing shared goals (Lee and Lee 2020a). The recent trend is to develop the entire

world as a single competitive market with one platform. Thus, suppliers and buyers strive to gain a competitive advantage by offering more choices in the increasingly fierce market. Consequently, DT is a major strategic force that can enable innovations for creating customer value.

According to Kretschmer and Khashabi (2020), digital innovation has led to changes in organizational structure with the transformation of internal processes or core capabilities, which is referred to strategic renewal. As the process of DT in the era of service-oriented systems can bring strategic changes in the organizational structure, differentiated efforts are required at the various organizational level. For example, as DT can use similar technologies in related industries, sustainable business operations will be possible only when a company's unique core competencies are used to derive competitive advantage. In fact, DT is not only a technology-focused organizational change but also an essential factor for developing competitive advantage from an environmental perspective, particularly during the recent COVID-19 pandemic period (Kraus et al. 2021; Chin and Lee 2022). Therefore, DT helps business firms explore new opportunities to implement customer-oriented business models (Lee and Lim 2018; Frank et al. 2019; Paiola and Gebauer 2020).

2.2 Convergence innovation

An important innovation approach to value creation is inter-industry convergence. DT can empower the convergence of manufacturing and service industries. Convergence is the process of integrating and harmonizing technologies, products, and services to create new or additional value (Lee and Olson 2010). The sharing economy and subscription service business model, where critical value-creating resources can be accessed rather than owned, are representative examples of convergence innovation enabled by DT.

Servitization of products can be regarded as a part of industry convergence (Lee and Lim 2016). The term "servitization" was coined by Vandermerwe and Rada (1988) and defined as the transition from products or services to integrated product-service or service-service systems (Vandermerwe and Rada 1988; Lee and Lim 2016). Recently, with the support of advanced digital technologies, digital servitization has become a reality (Kohtamäki et al. 2021).

Digital servitization is defined as "the transition toward smart solutions (product-service-software systems) that enable value creation and capture through monitoring, control, optimization, and autonomous function" (Kohtamäki et al. 2021, p. 379). Kohtamäki et al. (2021, p. 393) suggested that "digital servitization emphasizes value creation through the interplay between products, services, and software." Martín-Peña et al. (2018) also argued that the companies that focus on service-enhancing services should first consider implementing digital technologies with convergence, such as digital servitization. These studies affirm that digital servitization helps develop competitive advantage for traditional manufacturing and service firms by creating value for all stakeholders.

DT has engendered a new market condition where customers shift their focus from a product-oriented transaction mode to a service-oriented one within the value

chain (Kamalaldin et al. 2020). With fast developing technologies, digital convergence of technologies and industries became possible for creating new services (Vandermerwe and Rada 1988; Lee and Lim 2016). This new era of convergence innovation, termed as "Convergenomics," has evolved through six stages of convergence (Lee and Olson 2010): components/products, functions, organizations, technologies, industries, and bio-artificial systems.

Components/products convergence includes the bundling of parts, products, services, and technologies. A good example is the smartphone, which is a device that combines a mobile phone, a camera, and an MP3 player.

Functional convergence seeks to maximize organizational performance through integrating various departments within an organization. For example, Netflix disrupted Blockbuster, which had a higher market share, by combining rental and collection functions using a vending machine during the early days of its business.

Organizational convergence aims to create a world-class value chain through collaboration of partner organizations that bring leading-edge core competencies. For instance, a sports kit that combines Nike shoes with iPod, a fusion product that created new value for the customers. This convergence is a representative example of how DT alters organizational boundaries.

Technology convergence involves integration of different technologies to create new value. For example, the convergence of medical science, ICT, biotechnology, and nanotechnology has created da Vinci surgical systems by Intuitive Surgical. Other examples include IBM's Watson, medical wearables, and individual gene analysis service (e.g., 23andMe).

Industry convergence involves integration of different industries to create new value. There are numerous examples such as music streaming service industry (convergence of MP3 and ICT), MOOCs in education, personal broadcasting service (e.g., YouTube, Afreeca TV, and WhatsApp), etc.

The highest level of convergence is bio-artificial convergence, where biological and artificial systems are integrated to create new value. Good examples include the brain wave-controlled wheelchair and metaverse.

The development of convergence innovation has been enabled and accelerated by digital technologies. Thus, digital technology is the driving force behind the convergence revolution. Digital convergence offers new value-creating opportunities for organizations, customers, and external stakeholders. Therefore, the DT-based service innovation can be explored through real-world cases of convergence innovation in the service industry.

2.3 Development of DT-based services

Digital technologies are being applied extensively in the service sector, as new technologies have always been at the forefront of digital industrialization. For example, media publishing services have evolved based on digital technologies, such as audiobooks, electronic documents, and e-books (e.g., Kindle), thus creating online bookstores and electronic subscription service models (Kulesz 2011). In video services, Netflix's videotape vending machine service has evolved into a streaming service.

In accommodation and hospitality services, the application of mobile phones, the Internet, and mobile applications have revolutionized the reservation system (António and Rita 2021). Bank payment services have evolved from telephone transfer services to automated teller machine (ATM) account transfers, PayPal, internet banking, and mobile banking (Flood et al. 2013). As for education services, TV content for video lectures and MOOCs have become widely available. In the medical services industry, video and remote treatment services have emerged (e.g., teladoc health) (Lee and Lee 2021).

Digital-based business models are constantly evolving while inducing consumer participation (Lee and Lee 2021). Customers directly or indirectly participate in value creation activities, expanding the diversity of the service contents and facilitating the development of new business models. Today, customized digital services for customers are proliferating through activities such as customer (user) experience monitoring that collects real-time data on customer behavior. Based on these cases, the development of digital-based services can be divided into three stages.

The first stage is the technology-based service stage (digital trial), which has been developed by combining technologies with services or applying them to products. The second stage is the web-based service stage (digital convergence), which has been developed through the convergence of digital technology and network technology. The third stage is an app-based service stage (DT), which has been developed as many customers use and participate in applications on mobile devices. The characteristics of each phase are as follows:

2.3.1 Technology-based services

In the first stage, newly emerged digital technologies are applied to change the way products or services are delivered. This is the first phase of digitizing tangible products or transforming them into digital signals that can be processed on the computer. For example, compact disks (CDs) and MiniDisks that store digital music files, digital players, digital video cassette recorders (VCRs), automated teller machine (ATM) account transfer, and automatic response system (ARS) services are attempts to deploy new technologies into services. This new service delivery method creates new customer value, and DT can accelerate this process. As shown in Table 1, in the initial stage of DT, some of traditional in-person encounters can be changed to non-face-to-face services.

2.3.2 Web-based services

The second stage is where web-based services are developed and offered to customers through the integration of digital technologies and online services. At this stage, services can be delivered in real-time as data are collected and shared in real-time. In this stage, a service model is developed by integrating contents and industry characteristics. Some examples in this stage are: iTunes in the music industry, PayPal's payment service to support e-commerce, and Expedia and Hotels.com for online reservations and orders in the travel and hospitality sectors. Video contents were

Table 1 Stages of service development based on digital transformation

DT service	Technology-based service (Digital trial)	Web-based service (Digital convergence)	App-based service (Digital transformation)
Press publishing service	Books, Audiobooks	Kindle, E-book	Electronic subscription service
Music service	Cassette Tape, CD, MD	MP3 distribution	iTunes
Video service	Videotape, VCR, Netflix bending machine	YouTube	Netflix
Accommodation reservation	Telephone reservation ARS	Website reservation	Airbnb APP, Yogiotte, Yanolja
Fintech service (bank service)	Account transfer, ATM	PayPal, Internet banking	Mobile banking
Healthcare service, legal services, Transportation service	Characteristics of DT in the professional service field are: 1. Specific laws exist (financial law/medical law/lawyer law/education law, etc.) 2. Service sectors grow with the development of related technologies		

distributed through YouTube, and online personal broadcasting became reality. In the food and beverage industry, Mr. Pizza expanded the food ordering system from telephone to online, greatly improving the service quality and efficiency. In the web-based service stage, DT empowered web-oriented business models.

2.3.3 App-based services

In the third stage, app-based services emerged. Many innovative app-based services spread rapidly in the lodging, fintech, video streaming, gaming, and music sectors. The pace of DT in the service industry has greatly accelerated during the COVID-19 pandemic crisis (Priyono et al. 2020; Lee and Lee 2021). As a matter of fact, a paradigm shift occurred in service deliveries across the industry (Priyono et al. 2020; Liu and Guo 2021). Customers have become quite hesitant about physical proximity or face-to-face encounters with service workers. Service providers also valued contact-free service deliveries to prevent the spread of infection (Lee and Lee 2020c).

In this stage, a new service model that combines services and apps emerged such as Airbnb. The developments of DT-enabled services in three stages have been possible because of innovations and rapid advances in digital technologies. With the development of various service platforms, customers around the globe now have opportunities to participate in the service operation process. The three stages of DT-based service development show a trend that is quite similar to the evolution of convergence innovation, from technology convergence to product/service convergence, business convergence, and industry convergence (Sims Bainbridge and Roco 2016). Table 1 summarizes the development stages of DT-enabled services.

Based on Table 1, the various trends of DT will be analyzed by examining both commonalities and differences based on actual cases and the published papers in academic journals. Rha and Lee (2022) reported interesting results, showing that most academic research on DT-based services has been focused on "fintech and healthcare services." The result of their analysis clearly reveals that the rapid spread of DT has been in parallel with advances in digital technologies. However, as shown in Table 1, it is difficult to find real-world cases even in the fintech and healthcare areas.

This may be due to differences in industry characteristics that affect the application of advanced technologies. In addition, DT adoption in knowledge-intensive professional service industries, such as healthcare, education, transportation, law, and consultancy, may be rather complex due to the rules or regulations imposed by the related professional associations. Furthermore, there appears to be divergent trends between academic studies (e.g., research scope and countries/cultures where the research was conducted) and practical examples (e.g., real application cases) due to differences in economic, social, and regulatory conditions (Brunetti et al. 2020).

3 Research design and methodology

3.1 Analysis process

To analyze the DT trends in the service industry, this paper examined actual cases in digital service sectors and articles published in business-related journals. The word cloud was generated through keyword analysis, and DT was divided into stages by matching service-related keywords and industry classification criteria. Figure 1 presents the research procedure used in this study.

Step 1: The study data were collected from service-related articles published in technology, digital, and business Scopus journals. The research period spanned from 1991, the year the first study on digital technologies was published, to March 4, 2022.

Step 2: Word cloud was extracted from author keywords through keyword analysis.

Step 3: The keyword data from word clouds are analyzed based on the service industry classification criteria.

Step 4: Journal articles on DT-based services are listed in the chronological order based on the service industry classification criteria.

Step 5: A comparative analysis is undertaken between real-world service cases and research trends shown by journal articles, for DT evolution stages in the service industry.

Step 6: The determinants of DT evolution are analyzed.

To verify the "inter-coders reliability", as suggested by Thomé et al. (2016), research data were selected through consensus among researchers in all decisions regarding analysis and inclusion/exclusion at every stage of the research.

The data collection procedure started by identifying Scopus journal articles in the service field from 1991 to March 2022. A total of 2,897,024 articles were found with

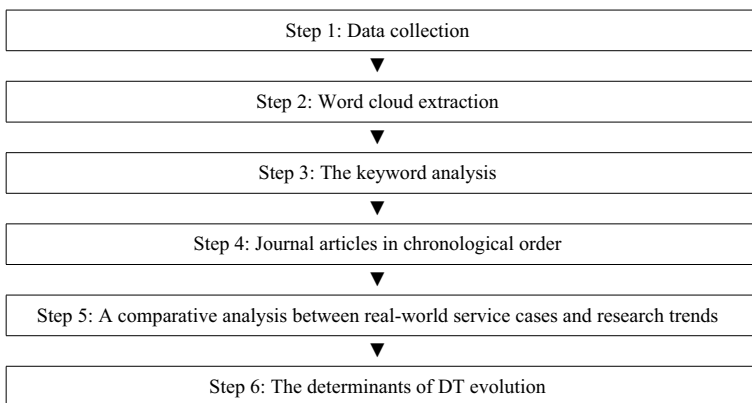| Step 1: Data collection |
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| Step 2: Word cloud extraction |
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| Step 3: The keyword analysis |
| ▼ |
| Step 4: Journal articles in chronological order |
| ▼ |
| Step 5: A comparative analysis between real-world service cases and research trends |
| ▼ |
| Step 6: The determinants of DT evolution |

Fig. 1 Research procedure

Table 2 Data collection procedure

Scope	Services > technology > digital > business journal	Published papers
Steps	Data collection (search period: 1991–March 4, 2022)	Results
Step 1	Scopus: service search	2,897,024 cases
Step 2	Scopus: service > technology search	104,422 cases
Step 3	Scopus: service > technology > digital search	23,142 cases
Step 4	Scopus: services > technology > digital > business journal select	2683 cases
Extraction step	Keyword analysis: service > technology > digital > business journal > word cloud	1831 cases
Analysis step	Industry analysis: service industry classification index > three-stage DT service evolution	437 cases

relevant pieces of information (e.g., information such as title, author name, journal, and author keywords). The collected data were processed through filtering steps of Services > Technology > Digital > Business Journal. After processing, 1831 articles passed the service industry classification index. Finally, 437 DT-related studies in the service field were selected for this study. The data collection procedure are summarized in Table 2.

3.2 Methods for extracting service-related words

The word cloud generated by keyword analysis contained various keywords. Since the purpose of this study is about examining DT trends in the service industry, keywords that were related to general technology were excluded. Most of the duplicate keywords were related to IT or other technical fields. Thus, keywords needed to be filtered for the service industry. Subsequently, the journal articles data was further classified by categories in the service industry (based on the International Standard Industrial Classification recommended by the United Nations) (Korea National Statistical Office 2021) and by the year of publication to ascertain the research trends. The data collection procedure used was as follows.

3.2.1 Step 1: procedure for extracting related words

Figure 2 shows the results of the word cloud analysis of keywords after extracting all the related words. DT-related services were observed in the periphery area as compared to technical keywords. First, these results indicate that the initial research works focused mostly on technology and digital infrastructure; therefore, DT-related keywords in the service industry have a relatively low frequency. Second, as we analyzed DT papers that dealt with issues only in service fields, there was no centrality of keywords and the words with high frequency of occurrence would indicate their importance, all shown visually (Heimerl et al. 2014). The results of the word cloud analysis, shown in Fig. 2, revealed only a small number of keywords due to the diverse service fields.

3.2.2 Step 2: identifying the first journal article published

Considering the characteristics of various service industries, service-related keywords with low significance were excluded from the word cloud analysis. Digital-related service keywords were applied based on the industry classification criteria. All journal articles were organized by matching with author keywords. Finally, the relevance of the service industry was reviewed based on the first journal that published the relevant research.

Table 3 presents the trends of DT-related research based on the chronological order of first journal articles published on the various service topics. The first research paper was published in 1995, which focused on home banking-related financial services. Subsequently, the number of papers published in academic journals increased in the following order of topics: e-commerce, e-learning, travel accommodation, healthcare, accounting, video media, music distribution, transportation, and gaming services.

3.2.3 Step 3: trend analysis of DT research

The results of the research trend analysis based on published journal articles in the service industry can be summarized as follows: First, the digital technology-related research has been growing in the service industry. Second, research related to digital services is expanding to various industry sectors. While the digital service research has been growing continuously since DT-related journal article was first published in 1995, the published papers during the past five years account for more than 70% of the total.

Table 4 presents the DT research trends based on published journal articles published in the three digital stages: trial, convergence, and transformation. The DT development is classified into three stages after examining the

Fig. 2 Word cloud analysis of keywords

temporal characteristics of DT research. With the accelerating research trend, DT has expanded into various sectors of the service industry.

Adoption of digital technologies accelerated in manufacturing industries after the introduction of the Fourth Industrial Revolution (Lee and Lee 2020a; Li et al. 2020b). A similar trend was observed about DT research in the service industry, as shown in Table 4. With the advent of advanced digital technologies, service research is exploding in both breadth and depth, especially since 2016. Moreover, a trend of applying innovative new business models in several service fields emerged. The current COVID-19 pandemic provided a new stimulus for the rapid implementation of DT in almost every sector of the service industry (Priyono et al. 2020; Lee and Lee 2021). Therefore, in this study, the research trend analysis period in DT was divided into the initial trial stage (1995–2007), convergence stage (2008–2016), and transformation stage (2017-present).

In the initial trial stage (1995–2007), research in digital-related services examined new ideas or experiments by leveraging ICTs. During this period, academic research explored ideas to improve organizational performance, opportunities in the digital economy, service quality, customer services, supply chains, and operational efficiency in the fields of payment services, e-commerce education, hospitality/hotel industry, and healthcare. However, only 17 journal articles were published between 1995 and 2007.

In the convergence stage (2008–2016), digital technologies exploded in both technical research and real-world applications. This stage was the rapid growth period of DT-based service ecosystems in music, video media, accounting, physical fitness, games and sports, and food and beverage services. With the success of digital technology applications in various industrial fields, rigorous DT service research began to emerge in specialized fields. For example, new business models were being developed with the application of digital technologies in healthcare, finance, distribution of videos/music, transportation, online games, sports marketing, m-commerce, and food and beverage services. During this period, convergence innovations began to emerge in various industries, as shown by 85 studies on this topic, an increase of 500% over the period prior to 2008. During this period, many journal articles were published in the following service industries: e-commerce (66), healthcare (57), banking services (57), fintech (39), educational services (37), and travel and accommodation services (33).

After 2017, during the transformation stage (2017-present), research on DT expanded across various industrial fields. Accordingly, the keywords regarding each service industry sector began to emerge, starting research trends in such areas as offline, online, and mobile services. With the introduction of Industry 4.0, the digital trend expanded to professional services, and convergence is observed between diverse industrial fields. During the transformation stage, 335 digital service-related studies were published in journals, and DT has been recognized as an important factor for obtaining a sustainable competitive advantage in the service industry.

Table 3 The service industry classification criteria for the first published paper in Scopus journals

Industry sector	Digital service keyword	First research	Keyword	Publication journal name
Financial and insurance activities	Banking	1995	Home-banking and shopping	Information and management
		2000	Retail banking	Accounting, management and information technologies
Wholesale and retail trade	Fintech	2017	Fintech, financial services industry	Contemporary economics
	Commerce	2001	E-commerce	Information society
Education	Education	2002	Education	Journal of services marketing
	Learning	2004	E-learning	Information and management
	Teacher	2018	Technology and teacher education	World journal on educational technology
Accommodation and food service activities	Hotel	2005	Hotels	International journal of contemporary hospitality management
	Tourism	2008	Tourism	Asia Pacific journal of marketing and logistics
	Food	2013	Fast foods (kiosk)	Journal of hospitality and tourism technology
Transportation and storage	Trade	2006	Cyber-trader	International journal of technology management
	Delivery	2009	Delivery service providers	Information and management
	Uber	2017	Uber's global expansion	Technology in society
	Store	2018	Fashion retail store	Journal of global fashion Marketing
Human health and social work activities	Health	2007	Health services	Supply chain management
Information and communication	Video	2008	Video games	Journal of network and systems management
	Music	2009	Music retrieval	ACM transactions on information systems
	Music	2010	Music download	Journal of internet commerce
	Radio	2010	Internet radio, live audio, multimedia, service models	International journal of business data communications and networking
	Game	2012	Olympic games	Information systems research

Table 3 (continued)

Industry sector	Digital service keyword	First research	Keyword	Publication journal name
Professional, scientific, and technical activities	Accounting	2008	Accounting information, Data collection	Social responsibility journal
	Tax	2019	Digital tax	National tax journal
	Law	2020	LawTech	Computer law and security Review
Arts, entertainment, and recreation	Sport	2012	Sport marketing	Sport, business, and management: an international journal
Real estate activities	Space, real estate	2018	Co-working space, corporate real estate management	Journal of corporate real estate
	Home	2020	Home-sharing, Airbnb	International journal of hospitality management

Table 4 Research trend analysis of digital transformation

Three stages of digital transformation evolution

Keyword	Industry sector	Digital trial									Digital convergence									Digital transformation						Total
		1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
Legal tech	Legal service	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	4	1	–	6
Game	Game service	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	3	3	2	9
Travel	Travel service	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	2	6	–	9
Teacher	Education	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	3	2	5	3	16
Fintech	Finance	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	8	3	7	16	2	39
Uber	Transportation	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	2	–	3	1	8
Food	Food & beverage	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	3	1	9	2	17
Sport	Sports	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1	1	–	–	4	2	1	10
Finance	Finance	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	1	2	2	3	6	–	16
Order	Order service	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	1	2	2	3	1	11
Delivery	Transportation	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	1	–	2	2	1	2	2	8	1	21
Music	Audio service	–	–	–	–	–	–	–	–	–	–	1	1	1	1	1	–	–	1	1	–	1	–	–	–	8
Video	Video service	–	–	–	–	–	–	–	–	–	1	–	–	2	1	–	–	–	–	1	1	–	3	2	–	11

Table 4 (continued)

Three stages of digital transformation evolution

Keyword	Industry sector	Digital trial									Digital convergence									Digital transformaton						Total
		1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
Accounting	Accounting	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	1	–	–	2	1	–	–	6
Health	Health care service	–	–	–	–	–	–	–	–	1	–	1	–	–	4	–	2	5	1	1	4	8	7	21	2	57
Hotel	Accommodation	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1	–	1	1	1	4	11	9	4	33
Education	Education	–	–	–	1	–	–	–	–	–	–	–	1	2	3	1	–	–	–	3	6	6	4	7	3	37
Commerce	Commerce	–	–	2	1	2	1	2	1	2	5	4	1	2	2	4	1	4	4	4	3	3	10	7	1	66
Bank	Banking service	1	1	–	–	–	1	–	–	–	–	–	1	–	2	1	3	2	–	7	6	6	11	12	3	57
Sub total(A)		1	1	2	2	2	2	3	1	3	7	7	4	8	14	10	10	14	11	26	36	50	77	120	26	437
Total		17									85									335						437
Journal counts for word cloud analysis (B)		3	7	8	11	14	15	12	16	15	25	25	29	33	45	39	36	64	70	121	147	224	321	454	97	1831
(A/B) * 100		33%	14%	25%	18%	14%	13%	25%	6%	20%	28%	28%	14%	24%	31%	26%	28%	22%	16%	21%	24%	22%	24%	26%	27%	24%

4 Results

4.1 Three stages of DT evolution

Comparing the actual cases of DT implementation in the service industry (see Table 1) with the related research trend (see Table 4), the two trajectories were quite similar. DT has evolved gradually over time, some unevenly, in each service field and is now expanding throughout the industry. Like the trend of real-world application cases, the research trend in DT has extended to various service fields such as payments, e-commerce, travel and accommodation, music, videos, transportation, healthcare, and law. Table 5 shows the three-stage evolutionary process of DT based on the results reported in Tables 1 and 4.

In Table 5, the three stages of DT evolution (trial, convergence, and transformation) are presented with their associated characteristics. The first stage when digital technology appeared can be considered the DT trial stage for service support and service quality improvement. In the DT trial stage, DT was applied primarily to internal processes for improving the production efficiency and quality of products/ services. In the digital convergence stage, the application of network technologies emerged (Lee and Lim 2018). During this period, mobile services expanded worldwide with the exploding use of smartphones, and related research became popular. In the third stage, DT brought a complete overhaul of the value chain where customer participation became another source of innovation (Kimberling 2020; Li et al. 2020b).

Each stage of DT evolution has its own characteristics as follows: In the trial stage (1995 to 2007), research on digital technology appeared gradually, while most studies were focused more on general IT than on digital services (Agarwal et al. 2010). During the 1995–2007 period, digital technologies were advancing rapidly. Thus, digital trials in service firms were led by a small team of technical professionals and were applied to improving products and services. This is the period when many new innovations were introduced, including new ordering methods and e-commerce (e.g., home shopping, home banking, online payment, etc.).

During the digital convergence period (2008 to 2016), many convergence innovations began to emerge such as technology and products, interindustry, joint venture partnerships. (Agarwal et al. 2010; Lee and Olson 2010; Lee and Lim 2018). The global spread of smartphone usage created an environment where DT can flourish and engage more users in services through new business models. During this period, academic research took the momentum of rapid growth as many studies began to appear in journals (Heilig et al. 2017; Vial 2019).

During the DT stage (2017 to present), it became feasible to integrate service models and technologies for value chain innovations in service organizations (Vial 2019). DT became the battle cry for organizational innovation (Heilig et al. 2017; Vial 2019; Kretschmer and Khashabi 2020). Accordingly, various DT-related studies were conducted in service fields (Rha and Lee 2022). Some of the early DT-related publications were on digital healthcare, legal tech, and fintech (Rha and Lee 2022).

Table 5 DT evolution 3 stages

	Stage 1: digital trial	Stage 2: digital convergence	Stage 3: digital transformation
Characteristics	Partial digitization attempts	Convergence of products, technologies, and industries	Combining service models and technologies
Period	1995–2008	2008–2016	2017–2022
Driving force	Digital technology	Convergence innovation	4th industrial revolution related technology
Results	Small technical teams	New business models Spread of smartphones	Digital service industry
Term	Digitization	Digitalization	Digital transformation
Research	Early research emerged	Expansion of research diversity	Explosive increase in research

In summary, research in the trial stage was mostly focused on applying digital technologies to products and services. During the digital convergence stage, products and services were converged with digital technologies, and new business models were introduced. A large number of convergence-related studies in various service fields began to appear in journals. Table 5 summarizes the characteristics, period, driving force, and results of each stage.

4.2 Key contributors to DT evolution

The goal of DT in service organizations is to create new or additional value through the application of advanced digital technologies throughout operation processes. Some of the early real-world DT cases examined in this study indicate that core technologies that contribute to developing new business models were the main driving force for DT evolution. In addition to core technologies, factors that contribute to dynamic capabilities supported DT (Chin and Lee 2022). For example, product flexibility, favorable legal and economic policies, and progressive labor market all contribute to rapid DT. For example, for music distribution and video media services during the early stage, digital development was based on product flexibility for changing the product form to the contents. Evolution of DT is especially noteworthy in music and video service areas. The digital music distribution business became an important service industry because of new digital technologies that enabled the distribution of music via MP3 technology, which is protected by copyright law and the author's rights. Video streaming service, which became possible because of video streaming and network optimization technologies, has evolved into the online subscription service.

The subscription economy and sharing economy are representative DT business models in the service industry. iTunes, Netflix, Google app service, and Microsoft Windows service have been converted into subscription-based service models (Zhang and Seidmann 2010; Bray et al. 2021). The sharing economy models include Airbnb and Uber, which are representative business models where service functionalities and advanced digital technologies are converged (Xie and Mao 2017). However, both Airbnb and Uber have encountered legal and local labor groups' resistance as they have expanded their operations globally (Watanabe et al. 2017). IKEA has been very successful in providing integrated on-offline experiences to customers through DT (Mixson 2021).

In healthcare industry, DT has brought major changes to the way healthcare is provided to the patients (Lee and Lee 2020b). The convergence of medical science and digital technologies has enabled remote healthcare, non-face-to-face prescription delivery, and robotics-supported diagnosis and surgery (Minor and Bevins 2020). Today, digital healthcare is providing core service values. However, digital healthcare services are still constrained by technological, medical, social, legal, and economic conditions of each country (Lee and Lee 2021).

Fintech provide payment services as a core value, enabled by DT with such technologies as AI, cloud computing, and robotics. Although fintech has received much attention as an innovative financial service, its wide availability has been somewhat restricted due to the emergence of the International financial reporting standards (IFRS)

and different accounting standards of countries (Nguyen et al. 2020). In addition to financial laws (e.g., accounting standards), there are other industry-related regulations such as the Banking Act, Securities Act, Insurance Act, and Personal Information Protection Act (FDIC 2021).

Legal tech services are attracting much attention as they provide a core value of legal advice. With the development of sophisticated technologies, such as natural language processing and text mining, DT in the legal field has enabled the legal advisory service model through the convergence of robotics (chatbot), legal documents, and AI-supported data science (Park and Noe 2018). However, DT in legal services involve the divergent interests of bar associations, law firms, and legal tech operators. Thus, there are obstacles and barriers to widespread adoption of DT-supported legal tech services (Boustany 2021; Rathore et al. 2022).

The effective implementation of DT in financial, healthcare, and legal services should always consider social, cultural, and legal conditions (e.g., stakeholder groups such as civic societies, associations, local regulations, and community influencers). Thus, the key contributors to DT adoption in professional service fields include core values, technologies, and social and legal systems. Table 6 presents a brief summary of key contributors of DT evolution.

5 Discussion and conclusions

This study classified the development stages of DT in the service industry by comparing real-world DT cases and academic research trends. The research trends of published studies in Scopus journals from 1991 to March 2022 were analyzed, and the general trends of DT research were compared to real-world application cases in the industry.

The results of this study can be summarized as follows: First, the three stages of DT development based on real-world implementation cases in the service industry were the technology-based service stage, web-based service stage, and app-based service stage (see Table 1). Specifically, DT has evolved from a stage where digital devices are developed and applied to analyze accumulated data, to a stage where web services are expanded through online networks, and to a stage where more personalized mobile services become feasible with the advent of smartphones.

Second, this study analyzed research trends based on DT-related articles published in journals (see Table 4). Since 2016, research has become more diverse, spreading into different service sectors. In the fields of finance, healthcare, and e-commerce, there has been a trend of improved offline services, the emergence of new online services, and a shift to mobile services.

Third, based on the results presented in Tables 1 and 4, DT evolution has been divided into three stages: Digital trial, digital convergence, and digital transformation (see Table 5). Although academic research began to appear after real-world DT cases were reported, the development stages of DT between actual implementation cases and academic research are quite similar. In the digital trial stage, DT was explored for new opportunities to improve the quality of products/

Table 6 Key contributors of DT evolution

DT service	Core service value	Core technology	Legal system
Digital healthcare service	Medical service	Imaging & video call technology, genetic technology	Medical law
Digital music service	Music distribution	MP3	Copyright law
Fintech service	Payment service	Computational and computing skills	Financial law
Legal tech service	Legal advisory service	Text mining, natural language processing, chatbot technology	Attorney law
Video streaming service	Video media	MP4, video streaming technology	Copyright law, portrait rights

services and the efficiency of the supply chain. In the digital convergence stage, new innovations were introduced through convergence that transcends organizational functions and boundaries through the application of network technology and mobile devices. In the DT stage, service models were developed to create new value by engaging customers in operational processes.

Fourth, this paper examined the major contributors to DT evolution in the service industry, as summarized in Table 6. The core service values of business, advanced technologies, and legal/social/cultural systems were identified as the key contributors of DT's evolution in the service industry. The development and application of core technologies for each service field have propelled the emergence of DT-based services. For example, the DT-based subscription model replaced traditional music distribution and video media services. In addition, the evolution of DT-based services has been defined and constrained by the legal environment of each country. For example, DT flourished in the service sector when the existing legal system was conducive to the development of core values and technologies in medical services, payment services, and legal advisory services. The study results indicate that service industry is diverse and sustained innovation is imperative to provide new and improved customer experience and satisfaction.

5.1 Implications of the study results

This study makes contributions to the service business literature and practice of DT as it examined DT applications based on academic research trends and real-world application cases. First, in terms of theoretical contributions, the study presented a DT transition trend in the service industry by comparing DT-based practical applications with the findings of academic research. Second, the study classified the stages of DT evolution, which can be utilized as a theoretical basis to explore future developments in DT-based services. Third, as this study examined the DT evolution trends by comparing actual cases with academic research, the same basic approach can be applied to research in other fields from a methodological perspective.

With the emergence of new technologies, business firms have been applying new business models to meet customer needs. Thus, this research has the following practical values. First, it can be used as basic data to review factors that enhance competitiveness when DT is implemented in different service sectors. In the future, it can be used as the base data to expand the scope of DT-based services and to explore new ways to strengthen user participation through digital platforms and app services. Second, in the service fields where legal reviews are required (e.g., healthcare and legal services), this study can be a valuable reference for finding solutions to the problem of strengthening organizational competitiveness by introducing DT. Third, as DT is a major strategic goal of almost every organization, the findings of this study can be a valuable source of information managers contemplate DT, which is congruent with the characteristics of the firm.

5.2 Limitations and future research

To examine DT trends in the service industry, this study collected data based on keyword analysis of real-world cases and published articles in Scopus journals. However, the study has some limitations. First, it may be difficult to generalize the results of this research because of the limited scope as it did not include all general services. Second, another limitation of the study is due to the time difference between the implementation of real-world cases and the publication of academic research, considering the rapid pace of technological advances. Some of the recent advances in digital technologies in Industry 4.0 era are not fully reflected in some of the published studies and thus the data used in this study may have some bias. Since relevant research is insufficient in terms of examining new technologies that emerged after Industry 4.0, changes in ICT led by Industry 4.0 were not fully reflected in this study.

Directions for future research are recommended as follows: Future research should investigate how big data analytics, AI-based technology, IoT, and cloud computing can induce users to participate more fully in their respective service field and how operational processes should be improved through DT. When future studies perform a longitudinal research on the trends of such innovative technologies, significant new findings may be found. Third, since DT is subdivided by service sectors, no statistical significance was found for the centrality of keyword network analysis for the collected data. Therefore, future studies should expand the scope of research to alleviate these limitations.

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