Self-Efficacy Theory Perspective: Challenges and Improvement Strategies for Elderly People in Digital Healthcare Services

Wei Lin

Loughborough University, Epinal Way, Loughborough, Leicestershire, UK

linvvvvei@gmail.com

Abstract. As global population aging intensifies, the demand for healthcare services among the elderly is increasing. Digital healthcare services offer new possibilities for addressing the health management issues of the elderly; however, the acceptance and utilization of these digital tools by the elderly remain relatively low. Although previous research has emphasized the importance of understanding the elderly's needs and attitudes towards digital technologies, there is still a lack of in-depth explanation regarding the challenges faced by this group in using digital services and the underlying psychological factors. This paper, from the perspective of self-efficacy theory, explores how digital healthcare services can more effectively assist the elderly compared to traditional services. Based on this theoretical framework, the paper identifies that the elderly face a lack of self-efficacy when using digital services, manifested as difficulties in establishing personal achievement, a lack of substitute experience, poor effects of verbal persuasion, and biases and resistance towards technology. To address these issues, the paper proposes improvement strategies including enhancing technological adaptability, establishing peer support networks, increasing cooperation with family and community, and optimizing user experience. The paper emphasizes the value of focusing on the self-efficacy of the elderly in using digital healthcare services, providing new insights into the psychological and behavioral issues of elderly users, and offering practical suggestions for improving digital service design to help the elderly benefit more effectively from digital healthcare.

Keywords: Elderly, Digital Healthcare, Self-Efficacy Theory, Service Optimization

1 Introduction

Globally, population aging has become an undeniable social phenomenon. With advancements in medical technology and improvements in living standards, average life expectancy has increased, leading to a growing proportion of elderly individuals [1, 2]. However, the elderly generally face challenges in health management and medical services. They are more susceptible to chronic diseases, physical functional decline, and

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cognitive impairments, which has led to a rising demand for healthcare services [3]. In this context, the emergence of digital healthcare tools offers new possibilities for addressing health issues among the elderly. These products and services range from simple health monitoring applications to complex telemedicine systems, which can partially alleviate the problem of insufficient medical resources and provide more diverse and convenient health management options for the elderly [2, 4].

Nevertheless, the acceptance and usage rates of digital healthcare services among the elderly remain relatively low compared to traditional services [5, 6]. The rapid development of digital services presents a new challenge for the elderly, who often lack sufficient digital literacy to effectively use these tools [7, 8]. Existing studies suggest that many elderly individuals' confusion and helplessness towards new technologies may have affected their health management efficiency and could potentially exacerbate their health anxiety [4]. Whether digital healthcare services can truly provide more effective assistance compared to traditional services remains an open question. In other words, it is still worth exploring whether the proliferation of digital tools can play a positive role in improving elderly health management.

There has been considerable research on the prevalence, usage frequency, and user satisfaction of digital healthcare services. These studies generally acknowledge the convenience and accessibility of digital healthcare services, particularly their advantages in resource-limited areas [3]. At the same time, researchers are paying significant attention to the special needs and usage barriers of the elderly, with an increasing focus on designing products and services centered around elderly users [2]. However, existing research primarily focuses on the feasibility, usability, and user experience of digital services for the elderly, with less emphasis on self-efficacy among elderly users when using digital healthcare products [3, 7]. By studying the theory of self-efficacy in the elderly, we can gain a deeper understanding of how they build confidence in technology use and how they cope with challenges brought by new technologies. This perspective not only enriches the theoretical framework of elderly health management and technology acceptance but also provides practical guidance for the design and promotion of digital healthcare services, helping the elderly benefit more from these services.

This paper is divided into five sections. The second section will provide a literature review, exploring the development of digital healthcare services and their impact on the elderly. The third section will analyze in detail the issues faced by the elderly in medical consultations and health management. The fourth section will offer improvement suggestions from the perspective of self-efficacy theory. Finally, the fifth section will summarize the findings and propose directions for future research.

2 Literature Review

2.1 Healthcare Services and Digitalization

Healthcare refers to various services and activities aimed at maintaining or restoring health, preventing disease, and treating illnesses and injuries, with the goal of promoting individual and community health and well-being. Digital healthcare involves utilizing digital technology to transform these healthcare services into digital and networked

forms, enhancing various critical aspects of healthcare services to improve efficiency and accessibility [1, 3]. It encompasses four main areas: the collection, processing, analysis, storage, retrieval, sharing, exchange, and management of clinical information; patient medical consultations, prescriptions, rehabilitation, appointments, and referrals; access to health-related information and resources; and ancillary services such as medical education, clinical research, provider training, and administrative meetings [1, 3].

The development of digital health services has generally progressed through three distinct stages, each driven by advancements in technology:

In the 1980s and 1990s, with the widespread adoption of personal computers and local area networks, informatization began in various industries, including healthcare. On a global scale, the United States and Denmark were pioneers in public service informatization [9, 10]. In the 1980s, the U.S. Department of Veterans Affairs (VA) began developing its electronic health record system, which eventually evolved into a national electronic health record system, including hospital information systems (HIS), electronic medical records (EMR), and laboratory information management systems (LIMS) [9]. During the same period, Denmark accelerated its national informatization efforts and improved its national information and communication technology (ICT) infrastructure [9, 10]. In the healthcare sector, hospitals introduced ordering systems, appointment systems, and electronic health records (EHR). The 1990s saw significant advances, such as the "Amaya experiment," which facilitated the exchange of prescriptions between general practitioners and pharmacies via EDI messages, greatly simplifying referrals and prescription purchases. Meanwhile, a wave of "mandatory digitalization" emerged among the public, with online courses on electronic data related to public services becoming part of educational curricula for primary and secondary schools and the elderly [9]. Singapore's "National Computerization Plan" also began in 1980, with the Ministry of Health (MOH) establishing the National Medical Information Network (MediNet) in 1989 [9]. By the late 20th century and early 21st century, some developed and developing countries began to follow suit with informatization in public services. In 2001, the Japanese government decided to widely adopt IT across various sectors, including healthcare, and the Japan Association for Medical Informatics defined the electronic medical record (EMR) system for broader use [6]. China, impacted by the SARS outbreak in 2003, began to accelerate the establishment of systems to publicly disclose government policy information [9].

Entering the 21st century, the shift from 3G to 4G mobile digital networks and the development of internet technology brought new possibilities to the healthcare field. Digitalization began driving the gradual establishment of telemedicine services, such as online consultations and electronic prescriptions, which improved the accessibility and convenience of healthcare. In the early 2000s, the UK's National Health Service (NHS) started implementing electronic health records, allowing patients to access their health information online via computers; it also introduced the "Choose and Book" system, enabling patients to book hospital appointments online [9].

From 2006 to 2015, the period saw rapid development in internet-based healthcare, with significant advancements in technologies such as the internet, cloud computing, and big data across countries. In 2015, Zhejiang's informatization development index reached 95.89, second only to Beijing and Shanghai, with online appointment services,

internet consultations, and online drug purchases becoming widespread across provinces [9]. Concurrently, electronic health (eHealth) gradually evolved into mobile health (mHealth), driven by the proliferation of mobile devices and the development of various healthcare applications, such as health monitoring and medication reminders.

After 2016, with the advancement of digital technologies such as artificial intelligence, machine learning, big data, and the Internet of Things, digital health services have increasingly focused on improving service accessibility and refinement, as well as innovations and optimizations in convenience and information sharing. In terms of the proliferation of digital healthcare services, from 2015 to 2021, the frequency of smartphone use by Danes in consultations with general practitioners increased by 111%, and the use of health applications rose by 225% [10]. By 2017, electronic medical records (EMR) had been implemented in 93.6% of hospitals and 91.6% of clinics in South Korea [6]. Regarding information integration, Singapore's Integrated Health Information Systems (IHIS) standardized and integrated over 500 applications used across the three layers of Singapore's health system—SingHealth, the National Healthcare Group (NHG), and the National University Health System (NUHS)—on the healthcare cloud (H-Cloud) in 2016 [6]. In terms of healthcare service innovation, Japan developed the My ME-BYO Karte application, based on personal health record (PHR) data, for nationwide preventive healthcare, where "ME-BYO" is a Japanese term meaning "pre-disease" [6].

Despite significant progress in digital healthcare, there are still many areas requiring broader efforts, such as data security and privacy protection, closer government collaboration and support in terms of policy and funding, and the cultivation of interdisciplinary talents across the service spectrum. Among these, the issue of equality in digital healthcare services is the most concerning [9]. Undoubtedly, digital development allows elderly patients, those with physical disabilities, and patients in remote areas to benefit from electronic healthcare. However, the gap in benefits between "vulnerable groups" and "non-vulnerable groups" in terms of technology access and experience is widening. For instance, technology access or unequal enjoyment of technology, such as the fact that Singapore's H-cloud currently supports only some public hospitals, specialist centers, and general clinics, means that more peripheral areas may not benefit from digital healthcare conveniences [6]; some elderly individuals and disabled persons who are less engaged in society may be excluded from certain digital services; and electronic healthcare might exacerbate the disparity between the "rich" and the "poor" [10]. Additionally, in terms of technology experience, issues related to digital health literacy have created efficiency gaps in learning and using services among different groups [8, 10]. This indicates that there is still much room for discussion on how digital service models can improve patient or public engagement and enhance education on digital health literacy.

2.2 The Impact of Digital Healthcare Services on the Elderly

In recent years, the impact of digital healthcare services on the elderly has become a research hotspot. Relevant studies have increasingly shifted from focusing on doctors or institutions to examining the user groups, such as the elderly, who are the end users

of these services [7]. These studies cover a wide range of scenarios, including: purely online services using mobile health programs or platforms, such as remote consultations, psychological therapy, and health knowledge learning; scenarios involving the integration of online platforms with offline devices or Internet of Things (IoT) services, such as health monitoring and medication management; and preliminary or auxiliary online services that support offline processes, such as medical consultations and companion care [4, 11]. This broad range of application scenarios indicates that digital health services are gradually integrating into the daily lives of the elderly, aiming to improve their health management and quality of life through technological means.

In the research on mobile health applications or platforms, many studies focus on how to design mobile health applications suitable for the elderly to promote their health and well-being. By improving user interfaces and enhancing ease of use, these services can somewhat overcome the operational barriers faced by the elderly when using digital tools [2]. However, despite the significant potential of these applications to improve the quality of life for the elderly, existing research often remains limited to evaluating experimental effects [3]. Elderly users generally have high expectations and acceptance of these applications, but the obstacles they may face during long-term use due to a lack of technical experience have not been fully revealed.

The development of IoT and sensor technologies has provided new tools for managing the health of the elderly, such as activity recognition, fitness assistance, vital signs monitoring, daily diet tracking, and sleep monitoring [11]. At the same time, digital auxiliary services such as online hospitals, online appointment booking, pre-consultations, and examination scheduling have expanded the choices available to the elderly in healthcare. These services not only bring convenience to the elderly but also create new possibilities for personalized and customized healthcare solutions. Although there is a significant amount of research on specific technical implementations, unresolved issues in these studies often revolve around technical capabilities, with little discussion on how to integrate these technologies into the traditional lifestyles of the elderly. The successful application of these technologies depends on the elderly's technical literacy and social support, particularly in populations with low technical skills or lacking support networks. How to assist these individuals in effectively using these technologies remains an important research direction [7].

2.3 Self-Efficacy Theory

Self-efficacy theory, proposed by Albert Bandura, is a theoretical framework for explaining individual behavior and motivation, emphasizing one's confidence and capability to complete specific tasks [12, 13]. Self-efficacy stems from four primary sources of information: personal achievements, vicarious experiences, verbal persuasion, and physiological states [12]. Personal success can enhance self-efficacy, while failures may undermine it. Vicarious experiences refer to the idea that observing others' successes can lead individuals to believe they can accomplish similar tasks. Verbal persuasion, especially from credible sources, can help boost an individual's confidence. Physiological states affect self-efficacy by influencing emotions and anxiety levels [14, 15].

Initially, Bandura applied this theory to systematic desensitization for patients with fear of snakes, and it has since been widely used in fields such as education, self-directed learning, and internet use [12]. In various domains, self-efficacy impacts individuals' choices of action, goal setting, effort levels, persistence, resilience in adversity, and the achievements they attain [13, 16].

In healthcare, beyond research focused on healthcare professionals and systems, self-efficacy theory is also widely applied to assessing elderly individuals' self-care, exercise motivation, and predicting service usage outcomes. For example, [15] discusses the mediating role of self-efficacy between social support and self-care behaviors among elderly patients with chronic pain, identifying that mutual enhancement of social support and self-efficacy can promote more sustained self-care behaviors. [16] suggests that the use of digital coaches may boost the confidence of younger elderly individuals in independently engaging in physical activities when they are uncertain about improving their health, thereby enhancing their self-efficacy. [17] explores how self-efficacy affects the well-being of elderly people in Spain through their mental health status, introducing social support and optimism as moderating variables. It was found that when elderly individuals have moderate to high levels of social support and optimism, the positive impact of self-efficacy on well-being is more pronounced. Self-efficacy beliefs have been shown to be a significant predictor of individual behavior and persistence. The applicability of this theory spans across various age groups, regions, cultural structures, and levels of mobility, making it highly relevant in different contexts. Therefore, analyzing the self-efficacy of elderly individuals in using digital healthcare services can further elucidate how digital services positively or negatively impact them.

3 Inadequate Self-Efficacy among the Elderly in Using Digital Health Products

Despite the increased likelihood of elderly individuals using digital services today, due to varying factors such as age, living area, educational level, health status, and healthcare needs, existing literature still reports that awareness and utilization of various digital health services among the elderly remain relatively low [8, 18]. The elderly often struggle to develop a belief in their ability to effectively use digital products and services, leading to a series of behavioral and psychological reactions such as avoiding new technologies, resisting or lacking self-learning motivation, difficulty completing tasks independently, sensitivity to negative feedback, and lack of expectations regarding the effectiveness of these services [3, 7]. This paper will explore the underlying reasons for these issues from the perspective of self-efficacy theory. Overall, inadequate self-efficacy among elderly users when using digital health products manifests in several key areas, including difficulty establishing personal achievements, lack of effective vicarious experiences, poor effectiveness of verbal persuasion, and entrenched technological biases and exclusion. The following sections will discuss these aspects in detail.

3.1 Difficulty in Establishing Personal Achievements

The most significant factor contributing to inadequate self-efficacy is the lack of successful direct experiences. The technical complexity of digital services presents substantial challenges for the elderly in accumulating successful experiences. Using digital services and developing e-health literacy requires elderly individuals to have both health awareness and the ability to use electronic products or the internet [1, 4]. Compared to using traditional non-digital products (e.g., reading books, using a frying pan for cooking), elderly individuals who have learned to use complex machinery (e.g., blenders, cameras) are more likely to learn how to use smart devices (e.g., smartphones, wearable monitors). Those who use non-health-related digital services (e.g., video calls) are more likely to transfer their experiences to digital healthcare services (e.g., online consultations). However, on one hand, physical and cognitive decline hinders the learning of digital services: for example, reduced vision may prevent the use of voice commands for screen operations, and declining memory may make it difficult to remember lengthy service processes or repeatedly forget them [4, 18]. On the other hand, significant differences in the difficulty and usage processes of health services provided by different vendors and for different diseases exacerbate the challenges and frustration experienced by the elderly in transferring their experiences [19]. This means that difficulties in using complex digital services (even with assistance) can make it challenging to develop positive beliefs when later facing simpler services.

3.2 Lack of Effective Vicarious Experiences

There is evidence that social support and community are effective means of building self-efficacy in using digital healthcare services, with peer experiences being particularly beneficial for empathy and understanding [1]. However, obtaining effective peer experiences is very challenging. On one hand, elderly individuals lack effective demonstration experiences. The low proportion of elderly individuals using digital products means that they have difficulty finding successful role models among their peers and often rely on younger family members for help. Due to differences in technological proficiency and physical capabilities, even when younger individuals demonstrate the feasibility of technology, the elderly may still struggle to gain confidence. On the other hand, it is difficult for the elderly to share successful experiences with digital products. The technical complexity of digital products, combined with the cumbersome process of using digital platforms and disseminating content, creates significant barriers for technologically inexperienced elderly individuals participating in these platforms. These barriers not only hinder effective communication among the elderly but also place them in a relatively isolated position within the digital network, making it difficult for genuine experiences with digital products to be widely shared and discussed, further diminishing their opportunities to gain vicarious experiences.

3.3 Poor Effectiveness of Verbal Persuasion

One significant reason for the inadequate self-efficacy of elderly individuals using digital products is the poor effectiveness of verbal persuasion. Elderly individuals generally exhibit higher levels of caution regarding health-related issues, and the continually evolving healthcare services and diverse sources of information further complicate their ability to acquire, evaluate, and make decisions about information [19, 20]. Information from the internet and digital platforms is often complex and lacks transparency, making it harder for elderly individuals to develop a sense of reliability and trust compared to advice from doctors, family members, or close friends [14, 20]. Moreover, even if the persuader has earned sufficient trust, a lack of expertise in technology or inappropriate explanation methods can weaken the effectiveness of the persuasion. Examples include using technical jargon that is difficult for the elderly to understand, employing non-targeted persuasion methods, oversimplifying or overcomplicating issues, and showing impatience or lack of repetition. Furthermore, due to the lack of personal successful experiences or similar success stories among their peers, mere verbal persuasion appears relatively ineffective in enhancing their self-efficacy. Without practical experience, elderly individuals find it challenging to assess the feasibility of digital products based solely on the complex and variable external persuasion.

3.4 Persistent Technological Bias and Exclusion

Technological bias and exclusion directly affect the self-efficacy of elderly individuals regarding digital healthcare services. When faced with complex or advanced medical technologies, elderly individuals often experience feelings of apprehension [3]. Due to their lack of understanding of these new technologies and the rapid technological advancements that exceed their adaptation capacity, elderly individuals may perceive these technologies as too complex, difficult to master, or unsuitable for their actual needs [1]. Particularly when these technologies could directly impact their health, elderly individuals may adopt a more cautious and wary attitude. These technologies may require more steps, more detailed checks, or higher costs, leading elderly individuals to feel unnecessary burdens and even question whether these steps are designed by relevant institutions to generate profit [4, 19]. Such doubts and misunderstandings further exacerbate their psychological resistance to new technologies, fostering a general aversion to using digital healthcare services [3]. Ultimately, this technological bias and exclusion further weaken elderly individuals' self-efficacy and hinder their ability to effectively utilize digital healthcare services.

4 Product Recommendations

Based on the analysis and discussion above, we have identified the problems elderly individuals encounter when using digital healthcare products and the various factors affecting their self-efficacy. To enhance the success rate and experience of elderly individuals in performing related tasks, we propose the following product recommendations and future development directions.

4.1 Establish Effective Strategies for Adapting to New Technologies

To address the issue of low self-efficacy among elderly individuals when faced with digital healthcare services, service providers can adopt a gradual approach to help them establish effective strategies for adapting to new technologies. This includes increasing alternative experiences and reducing the complexity of technology use. Firstly, by breaking down goals and task steps, elderly individuals can be encouraged to learn and use new technologies in stages. For example, starting with simpler applications such as appointment scheduling or checking health records, and then gradually transitioning to more complex functions like online consultations or remote health monitoring. Setting small goals, such as successfully completing a certain operation or consistently using a feature for a period of time, helps elderly individuals gradually adapt to and master new technologies. Additionally, integrating different digital scenarios and linking the required technological skills conceptually can be beneficial, such as transitioning from using transportation codes and payment codes to digital medical insurance codes, thereby connecting their experiences in various contexts. Simultaneously, learning strategies to address common issues, such as how to reset devices or solve network connection problems, is crucial. When elderly individuals cannot resolve issues on their own, they should be encouraged to seek technical support through printed guides, video tutorials, or hotline services. By employing these strategies, feelings of helplessness and frustration when operating new technologies can be reduced, helping elderly individuals build stronger self-efficacy and increasing their willingness to use digital healthcare services.

4.2 Establish Peer Communication Networks

Creating peer support groups among elderly individuals can encourage them to share their successful experiences and challenges with digital healthcare services. Through regular offline communication activities, elderly individuals can engage in face-to-face consultations, discussions, learning, and imitation, thereby increasing their understanding and confidence in new technologies. The benefits of peer communication activities include not only strengthening social connections among elderly individuals and reducing feelings of loneliness but also helping them learn and master digital services more intuitively through hands-on experience and personal demonstrations. For example, promoting typical cases of elderly individuals successfully using digital healthcare services in these activities can make “experienced elderly users” role models for others. By providing demonstrations, fears of new technologies can be reduced, and operational experience can be referenced. Additionally, to increase the attention and enthusiasm of the elderly population, practical gifts such as daily necessities can be included before or after the activities, thereby bridging the gap between digital services and daily life. As a continuation and supplement to offline activities, online groups can be organized to reduce geographical limitations through group chats, further consolidating the achievements of offline communication and providing ongoing support and interactive platforms for elderly individuals, gradually improving their internet utilization, electronic health literacy, and information evaluation skills.

4.3 Enhance Collaboration with Family, Community, and Healthcare Professionals

Providing a professional, proactive, and patient support environment for elderly individuals using digital healthcare services is crucial. Firstly, to better support elderly users in operating relevant products, devices, instruments, and platforms should include features for sharing and synchronizing information with family members. This allows family members to detect and assist with any issues that arise during the elderly person's use of the product. Secondly, in terms of product promotion, service providers should expand their outreach efforts by targeting communities, transportation hubs, landmarks, and commercial areas, and establish product experience stations with dedicated staff for on-site guidance. This approach will help identify and cultivate seed users, thereby increasing elderly users' trust and familiarity with the product through hands-on experience. Finally, to enhance product credibility, service providers should actively seek collaborations with healthcare and eldercare institutions. Endorsements and evaluations from these institutions and professionals can increase the product's professionalism and persuasiveness, thereby strengthening elderly users' trust and reliance on the product.

4.4 Improve User Experience and Product Design Details

In the design process of digital healthcare products, addressing the needs of elderly users is crucial. The product and interface operation processes should be as simple, readable, and user-friendly as possible. Special attention should be given to information delivery, operation input, and feedback, with auxiliary features provided for users with various operational difficulties. For instance, even for operating systems designed for all age groups, it is important to ensure that elderly users can easily find and use accessibility features such as text enlargement, voice prompts, or simplified navigation options. Additionally, products should have a clear guidance system for different operational purposes, such as step-by-step tutorials for online appointment scheduling and diagnostic record queries. Given the lower technological familiarity of some elderly users, guidance for basic operations should be more explicit to avoid confusion from incorrect operations. In terms of display, increasing the contrast between primary and secondary information, and reducing unnecessary information and functional distractions is important. For operations, guiding users on how to return to previous pages, close pop-ups or overlays, and restore device settings can reduce discomfort during use. Furthermore, establishing a simple user feedback mechanism to monitor and analyze repetitive operations can help identify potential difficulties and lead to continuous optimization.

5 Conclusion

Digital healthcare services present numerous challenges in application despite offering more possibilities compared to traditional services for the elderly. This analysis highlights that elderly individuals often struggle to establish effective self-efficacy when

using digital healthcare services, which not only affects their health management outcomes but also exacerbates their resistance to new technologies. According to self-efficacy theory, personal achievement, alternative experiences, verbal persuasion, and technological biases are the primary factors influencing elderly users' self-efficacy when using digital tools. This paper proposes several improvements: enhancing strategies for dealing with new technologies, establishing peer communication networks, increasing collaboration with family, community, and healthcare professionals, and optimizing user experience and product design.

The theoretical significance of this study is evident in several aspects: by exploring elderly individuals' self-efficacy in digital healthcare services, it bridges multiple fields such as psychology, health management, and service design, expanding a richer theoretical framework. Additionally, through the lens of self-efficacy theory, this study examines how elderly individuals cope with technological challenges in digital healthcare services, which not only explains issues of individual technological adaptability but also reveals the psynochological factors influencing this adaptation process. Furthermore, this research provides practical recommendations for actual products. By proposing strategies to enhance elderly users' self-efficacy, it offers practical guidance for policymakers and product designers to assist elderly populations in more smoothly accepting and using digital healthcare services.

Despite its contributions, this study has certain limitations that future research could address. Firstly, the analysis is primarily based on theoretical perspectives and user experiences, lacking more objective data support, such as behavioral scales, to improve assessment accuracy. Secondly, the study focuses on elderly users with limited internet knowledge and technical experience in certain regions of China, resulting in a lack of sample diversity. Lastly, while the study addresses the general efficacy of using digital healthcare services, it does not explore case-specific details. Future research could be more specific, investigating elderly users' self-efficacy and usage behaviors in different digital service cases.

In summary, although this study provides insights into the barriers elderly users face in digital healthcare services from the perspective of self-efficacy theory, further research is needed to better assist elderly individuals in benefiting from digital services.

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