

Utilizing Technological Innovations and Service Design to Foster Emotional Well-Being Among Individuals with Cognitive Disorders

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Abstract

This paper aims to explore the impact and challenges of technological innovation and service design on emotional health services for individuals with cognitive impairments. It begins by analyzing the relationship between cognitive impairments and emotional health, followed by a discussion on the application of technological innovation in emotional health services for individuals with cognitive impairments. Subsequently, it examines the influence of service design on emotional health for these individuals and the integration of technological innovation and service design. Finally, it discusses the future development direction and challenges of using technological innovation and service design to promote emotional health for individuals with cognitive impairments.

Keywords: technological innovation, service design, emotional health, cognitive impairments

1. Introduction

In recent years, cognitive impairments have increasingly drawn attention, highlighting the importance of emotional health services for individuals with cognitive impairments. This paper aims to explore the role of technological innovation and service design in promoting emotional health services for individuals with cognitive impairments, analyzing the application prospects of new technologies, the innovative direction of design concepts and methods, as well as the matching issues between service models and policy environments. Through the discussion of these key issues, it is hoped to provide valuable insights for the continuous development of emotional health services for individuals with cognitive impairments.

2. Analysis of the Relationship Between Cognitive Impairment and Emotional Health

2.1 Definition and Classification of Cognitive Impairment

Cognitive impairment is a condition that affects an individual's cognitive functions, including various types such as dementia, autism spectrum disorder (ASD), attention deficit hyperactivity disorder (ADHD), among others. Cognitive impairment, mainly manifested as a decline in memory or other cognitive functions, is the high-risk stage of the preclinical phase of senile dementia. These diseases have different clinical manifestations and symptoms, but all impact the individual's cognition and behavior. For instance, dementia primarily manifests as memory loss and declining cognitive abilities, ASD is characterized by social and communication difficulties, and ADHD presents symptoms like lack of focus and hyperactivity. (Tian, S., Chang, H., Li, P., et al., 2022) These characteristics lead to various challenges and difficulties for individuals with cognitive impairment in their daily lives.

Cognitive impairment can be classified based on different causes and symptoms. For example, it can be categorized into genetic cognitive impairment and acquired cognitive impairment based on the onset causes, and into subtypes such as memory impairment, thinking impairment, and perception impairment based on symptom manifestations. This classification aids clinicians in diagnosing and treating individuals with cognitive

impairment more accurately, facilitating the development of personalized rehabilitation plans and service designs. Moreover, different types of cognitive impairment may have variations in their pathological and physiological mechanisms, requiring further research and exploration.

Interventions and support measures need to be tailored according to the specific type of cognitive impairment. For instance, cognitive training and lifestyle adjustments can be implemented to slow down disease progression in patients with dementia. Social skills training and emotional support services are essential for individuals with ASD. Behavioral therapy and medication interventions may be necessary for individuals with ADHD. These targeted interventions help improve the quality of life and emotional health of individuals with cognitive impairment, enabling them to better integrate into society and family life.

2.2 The Importance of Emotional Health

Emotional health is crucial for individuals with cognitive impairment. It not only affects their psychological state and quality of life but also directly relates to the functioning of their cognition and the effectiveness of their rehabilitation. Individuals with cognitive impairment often experience emotional issues such as depression and anxiety, which not only intensify their suffering but also have a negative impact on their cognitive functioning and recovery process. Therefore, paying attention to and maintaining the emotional health of individuals with cognitive impairment is of paramount importance for their comprehensive rehabilitation.

Emotional health not only pertains to the psychological state of individuals with cognitive impairment but also directly influences their daily life and social interactions. Individuals with good emotional health are more likely to face difficulties and challenges in life positively and establish good interactive relationships with family and friends. On the contrary, individuals with severe emotional issues related to cognitive impairment may exhibit characteristics such as emotional instability and social avoidance, leading to a decrease in their quality of life and disconnection from society. Hence, effective emotional health interventions and support can help individuals with cognitive impairment adapt better to the social environment, enhance their quality of life, and improve their sense of well-being.

During the rehabilitation process of individuals with cognitive impairment, maintaining and promoting emotional health is also of significant importance. Emotional issues often impact the functioning of cognition and the effectiveness of cognitive rehabilitation, and they may even exacerbate the symptoms and progression of cognitive impairment. Therefore, considering individuals' emotional health comprehensively and emphasizing emotional support and psychological guidance in cognitive rehabilitation can enhance the effectiveness of rehabilitation, promote functional recovery, and improve the quality of life for individuals with cognitive impairment.

3. Application of Technological Innovation in Emotional Health of Individuals with Cognitive Impairment

3.1 Application of Virtual Reality Technology

3.1.1 Improvement of Cognitive Function with Virtual Reality Training

Virtual reality technology simulates human sensory experiences, creating a virtual environment where users can interact with and enjoy an immersive experience. (Li L., 2024) Virtual reality technology holds significant value in the rehabilitation of individuals with cognitive impairment. Through VR training, these individuals can undergo more intuitive and immersive cognitive training, which helps them focus attention, enhance memory, and improve cognitive flexibility. Utilizing VR technology for cognitive function training can significantly improve cognitive function in individuals with cognitive impairment, enhancing their ability for self-care and social adaptation.

The application of virtual reality technology in cognitive function training not only reflects in the enhancement of cognitive skills but also helps individuals with cognitive impairment better cope with challenges in daily life by simulating different situations and tasks. For instance, task training in virtual reality environments can boost attention and concentration in individuals with cognitive impairment, strengthen their problem-solving abilities, and enhance their skills in handling stress. This targeted training not only contributes to the improvement of cognitive function but also promotes the enhancement of emotional health by reducing depression, anxiety, and other emotional issues.

Moreover, virtual reality technology can provide personalized cognitive training programs, customized based on the specific conditions and rehabilitation needs of individuals. By conducting cognitive assessments and needs analysis for individuals with cognitive impairment and integrating the application of virtual reality technology, tailored training programs suitable for each patient's cognitive rehabilitation can be developed, thereby improving rehabilitation outcomes and individual satisfaction. Hence, virtual reality technology holds vast prospects and applications in the rehabilitation of individuals with cognitive impairment.

3.1.2 Impact of Virtual Reality Situational Simulation on Emotional Regulation

The rapid development of internet technology has profoundly empowered various aspects of medical care, and cognitive and psychological interventions for the elderly have entered the era of digital therapy. (Li Han & Li Xia, 2024) The application of virtual reality (VR) technology in emotional regulation among individuals with cognitive impairment has garnered significant attention. Through virtual reality situational simulation, individuals with cognitive impairment can experience various emotional scenes, such as relaxation, pleasure, challenge, etc., in a virtual environment, thereby promoting emotional regulation and mood management. Studies have shown that virtual reality situational simulation has a significantly positive impact on emotional regulation among individuals with cognitive impairment, helping to alleviate anxiety, depression, and other emotional issues, and enhance their emotional health levels.

Virtual reality situational simulation can not only simulate various emotional scenes but also be personalized based on individual emotional states and needs. Based on virtual reality technology and drawing from the content of traditional cognitive assessment scales, design a virtual reality game that integrates cognitive assessment and cognitive impairment rehabilitation training. (Wang, D., & Wang, D. J., 2023) For example, for individuals with heavy anxiety, virtual scenes designed for relaxation and pleasure, such as beaches or gardens, can be created. Through visual and auditory stimuli and interactive experiences, patients can relax physically and mentally and regulate their emotions. For individuals with severe expression, scenes with stronger challenges, such as climbing mountains or solving difficult problems, can be designed to stimulate their initiative and self-confidence, promoting emotional regulation and self-awareness.

Moreover, virtual reality situational simulation can play a positive role in emotional support and psychological therapy. By interacting with virtual characters, participating in emotional scene training, etc., the emotional expression ability and emotional communication skills of individuals with cognitive impairment can be enhanced, improving their social interaction ability and emotional connection. This comprehensive application of emotional support and psychological therapy helps promote a comprehensive improvement in emotional health among individuals with cognitive impairment, enhancing their quality of life and social adaptation skills. Therefore, the application of virtual reality situational simulation in emotional regulation among individuals with cognitive impairment holds significant importance and vast prospects.

4. The Impact of Service Design on the Emotional Well-Being of Individuals with Cognitive Disabilities

4.1 Importance of Personalized Service Design

4.1.1 Development and Implementation of Personalized Rehabilitation Plans

The importance of personalized service design for individuals with cognitive impairments cannot be overstated. By developing and implementing personalized rehabilitation plans, it becomes possible to better meet the diverse needs and characteristics of different individuals, thus enhancing rehabilitation outcomes and individual satisfaction. Research has shown that personalized service design can effectively improve the rehabilitation process and quality of life for individuals with cognitive impairments, making it a key factor in driving development in the rehabilitation field.

The development of personalized rehabilitation plans requires assessment and analysis based on the specific conditions and needs of individuals with cognitive impairments. For instance, in the case of patients with dementia, cognitive and functional assessments can be conducted to understand the extent of cognitive impairment and their ability for daily living, thereby establishing realistic rehabilitation goals and plans tailored to their actual situation. For individuals with autism spectrum disorder, specific social skills training and emotional support services need to be designed based on their social communication barriers and behavioral characteristics. Through the development of personalized rehabilitation plans, rehabilitation work can be more precisely guided, leading to improved outcomes and individual engagement.

The implementation of personalized rehabilitation plans is a crucial aspect of personalized service design. It involves thorough communication and consultation with individuals with cognitive impairments and their family members to devise rehabilitation schemes that align with their needs and preferences, providing personalized rehabilitation services and support. For example, incorporating virtual reality technology for personalized cognitive training allows for adjustments in training content and difficulty levels based on individuals' emotional states and cognitive levels, thereby enhancing training effectiveness and individual engagement. Additionally, through community-based service networks and volunteer services, continuous emotional support and rehabilitation guidance can be provided to individuals with cognitive impairments, promoting their rehabilitation progress and social integration. Therefore, personalized service design holds significant importance and practical value in the rehabilitation of individuals with cognitive impairments.

4.1.2 Provision of Personalized Emotional Support Services

Personalized service design plays a crucial role in the rehabilitation of individuals with cognitive impairments. The provision of personalized emotional support services can be precisely analyzed and customized based on the

individual's emotional state and needs, effectively promoting the emotional health and rehabilitation progress of individuals with cognitive impairments. By gaining in-depth understanding and assessment of an individual's emotional characteristics and rehabilitation needs, personalized rehabilitation plans tailored to their needs can be developed, providing more effective emotional support services and enhancing rehabilitation outcomes.

The importance of personalized service design is also reflected in the comprehensive attention given to the emotional health of individuals with cognitive impairments. Various forms of emotional support services can be adopted based on different individuals' emotional characteristics and rehabilitation needs, such as psychological counseling, emotional guidance, and emotional cognitive training. These services not only help individuals with cognitive impairments better understand and manage their emotions but also improve their emotional expression and communication skills, promote social interaction and emotional connection, thereby enhancing their quality of life and social adaptation.

Furthermore, the provision of personalized emotional support services can also play a positive role in cognitive rehabilitation. Through collaboration with professional medical personnel and social support groups, more comprehensive and integrated emotional support services can be provided to individuals with cognitive impairments, including life guidance, social skills training, community participation, etc., providing them with more considerate and thoughtful rehabilitation care. The implementation of personalized service design not only promotes the emotional health and rehabilitation outcomes of individuals with cognitive impairments but also enhances their satisfaction and engagement in rehabilitation services, driving continuous progress and innovative development in rehabilitation work.

4.2 Building a Community-Based Service Network

4.2.1 Construction and Operation of Community Rehabilitation Centers

The construction of a community-based service network is of paramount importance for the rehabilitation and social integration of individuals with cognitive impairments. The establishment of community rehabilitation centers is the core of this network. By providing specialized rehabilitation services and support to individuals with cognitive impairments, these centers can effectively enhance their quality of life and social adaptability. Community rehabilitation centers not only offer rehabilitation techniques and therapeutic methods but also provide comprehensive services such as psychological support and social skills training, aiding individuals in better integrating into community life.

The operation of community rehabilitation centers is a crucial aspect of the community-based service network. Through proper planning and effective management, these centers can offer continuous and stable rehabilitation services to individuals with cognitive impairments. In the operation of community rehabilitation centers, emphasis should be placed on human-centered care and personalized services. It is advocated for rehabilitation professionals to interact and engage collaboratively with individuals with cognitive impairments, creating a warm and harmonious rehabilitation environment to enhance rehabilitation outcomes and user experience. Additionally, community rehabilitation centers should strengthen collaboration with other community institutions, establishing a diversified network of rehabilitation services to provide more comprehensive and integrated rehabilitation support to individuals with cognitive impairments.

Rehabilitation medicine plays an important role in community medical services. However, there are still issues in the current development of community rehabilitation, such as supply and demand, personnel, funding, and mechanisms. It is necessary to increase investment in community rehabilitation, strengthen the construction of talent teams, enhance medical insurance support, promote institutional integration, expand network platform construction, and ensure the healthy and orderly development of community rehabilitation medicine. (Tang J, Tao YP & Feng H., 2016)

4.2.2 The Role of Community Volunteer Services in Cognitive Impairments

Within the construction of a community-based service network, community volunteer services play a significant role in addressing cognitive impairments. Volunteer services can provide more personalized and attentive rehabilitation support to individuals with cognitive impairments, effectively enhancing their rehabilitation outcomes and quality of life. Volunteers can establish close emotional connections with individuals through companionship, assisting with daily activities, and organizing rehabilitation activities, thereby increasing their sense of social integration and confidence. Research indicates that volunteer services can effectively alleviate depression and loneliness in individuals with cognitive impairments, enhancing their sense of happiness and social belonging.

The construction of a community-based service network also requires attention to the standardization and professionalization of volunteer services. Through systematic training and guidance for volunteers, their understanding of individuals with cognitive impairments and rehabilitation skills can be enhanced, enabling them to fulfill their service responsibilities more effectively. Volunteers can also act as an extension of

community rehabilitation centers, collaborating with professional rehabilitation personnel to provide comprehensive rehabilitation support to individuals with cognitive impairments. Furthermore, communities should encourage more compassionate and responsible volunteers to participate, collectively providing more thoughtful and meticulous rehabilitation services to individuals with cognitive impairments, thereby advancing the development and improvement of community-based service networks.

5. Integration of Technological Innovation and Service Design

5.1 Advantages and Challenges of Cross-Industry Collaboration

The cross-industry collaboration model is a significant pathway to promote innovation in emotional health services for individuals with cognitive impairments. Collaboration among technology enterprises, medical institutions, and social organizations can leverage the strengths of each party, achieving resource sharing and collaborative innovation. Technology enterprises bring advanced technological research and innovation, providing more intelligent and convenient rehabilitation solutions for individuals with cognitive impairments. Medical institutions contribute with professional medical teams and clinical experience, offering specialized support and supervision for rehabilitation services. Social organizations play a vital role in promoting community-based outreach and implementation of rehabilitation services, facilitating comprehensive coverage and effective operation of services.

However, the cross-industry collaboration model also faces challenges. Firstly, there are issues regarding the coordination of interests among partners. Different organizations have their own interests and development goals. Finding consensus and achieving a balance of interests in collaboration is a key issue to address. Secondly, there is a balance to be struck between information sharing and privacy protection. Cross-industry collaboration involves a significant amount of information exchange and sharing, and ensuring individual privacy and information security is an important consideration in the design of collaboration models. Therefore, in the construction of cross-industry collaboration models, it is necessary to fully consider the interests of all parties, establish collaboration mechanisms and norms, strengthen information security and privacy protection measures, and promote the steady development and continuous innovation of cross-industry collaboration models.

6. Directions and Challenges for the Future

6.1 Future Development Trends and Challenges in Technological Innovation and Service Design

6.1.1 Prospects of New Technology Applications

Technological innovation and service design play a crucial role in promoting the emotional well-being of individuals with cognitive impairments. The application of new technologies brings vast prospects for development in the field of emotional health. Virtual reality (VR) technology, as an emerging technology, has shown tremendous potential in the emotional health domain of individuals with cognitive impairments. Through VR technology, these individuals can undergo more intuitive and immersive emotional regulation training, helping them better understand and manage their emotional states, alleviate negative emotions such as depression and anxiety, and enhance their emotional well-being.

The application of artificial intelligence (AI) technology also offers new possibilities for the emotional well-being of individuals with cognitive impairments. Through intelligent algorithms and data analysis, AI can achieve real-time monitoring and analysis of individual emotional states, providing data support and guidance for personalized emotional support and rehabilitation programs. AI can also combine with big data technology to extract patterns and trends in emotional health from massive data, providing scientific basis and direction for optimizing and improving emotional health services.

In addition to VR technology and AI technology, gene editing technology has also demonstrated potential in the field of emotional health. Gene editing technology can influence an individual's emotional regulation mechanism by adjusting the expression of specific genes, promoting the development of emotional well-being at the genetic level. Although gene editing technology still faces technical and ethical challenges in application, with continuous progress and standardization, its prospects for application in the emotional health field remain vast.

As a technology that directly converts brain signals into computer-readable commands, Brain-Computer Interface (BCI) is very effective in helping individuals with cognitive impairments improve their emotional health. When the BCI system detects that the emotional state of individuals with cognitive impairments is poor, it can provide relaxing, soothing information or stimuli through audio, video, or vibration to monitor their emotional status. Moreover, specialized cognitive training programs can be designed to adjust the difficulty and mode of training based on the feedback of individual brain signals, helping individuals with cognitive impairments improve attention, memory, and cognitive functions. BCI technology can also assist in communication and interaction by capturing brain signals and converting them into text, speech, or images, facilitating more accurate expression of emotional needs for individuals with cognitive impairments.

Furthermore, personalized rehabilitation training tasks and programs can be designed based on individual brain signal patterns and specific needs. Combining with electroencephalogram (EEG) signal analysis technology, BCI can monitor sleep stages and quality in real-time, timely detecting and intervening in sleep disorders. For patients with long-term bedridden or limited mobility, BCI provides a new interactive approach, enabling them to control household appliances, entertainment devices, and even social networks through thoughts, thereby enhancing their independence and sense of well-being. BCI can be used in biofeedback therapy, allowing patients to learn how to adjust brain activity patterns through self-awareness to alleviate symptoms. By capturing patients' intent signals, external devices (such as robotic arms or electronic wheelchairs) can be driven to help patients rebuild lost motor functions, or through virtual reality environment simulation training, accelerate muscle memory and neural reshaping processes.

With technological advancements, BCI is also expected to be applied to deeper levels of emotion regulation, such as intervening in specific neural activity patterns through technical means to alleviate or eliminate negative emotions, or enhance positive emotional experiences, further enhancing individuals' emotional health and social adaptability.

6.1.2 Innovative Directions in Design Concepts and Methods

Technological innovation and service design play a crucial role in promoting the emotional well-being development of individuals with cognitive impairments. The innovative directions in design concepts and methods are vital for driving the trend of emotional health services. With the rapid development of information technology, personalized service design based on big data and artificial intelligence has become a new research direction. This design concept integrates individual emotional characteristics and rehabilitation needs with big data analysis to achieve more precise and personalized rehabilitation services, enhancing emotional well-being.

The widespread application of virtual reality (VR) technology has also brought innovative methods to emotional health services. VR technology simulates situations and tasks to help individuals with cognitive impairments better cope with emotional challenges in daily life. For example, through simulating relaxing and enjoyable emotional scenarios in virtual reality environments, it helps individuals with emotional regulation and management, alleviating negative emotions such as anxiety and depression, and improving emotional well-being.

The cross-industry collaboration model in service design is also an important component of innovative directions. Collaboration between technology companies, medical institutions, and social organizations can fully leverage their respective strengths to jointly promote innovation and development in emotional health services. For instance, technology companies provide advanced technical support, medical institutions offer professional medical services, and social organizations promote the community-based dissemination and implementation of services, forming a synergy to elevate emotional health services.

Innovative directions in design concepts and methods also include rethinking and optimizing emotional health service models. For example, exploring a rehabilitation model based on a community-based service network can bring rehabilitation services to the community level, providing more intimate and convenient rehabilitation support for individuals with cognitive impairments. This innovative direction shifts the focus of services to individual needs and the community environment, aligning more with the actual demands of emotional health services and driving continuous optimization and improvement of service models.

6.2 Continuous Challenges in Advancing Emotional Health Services for Individuals with Cognitive Impairments

6.2.1 Alignment Between Service Models and Policy Environment

Continuous advancement of emotional health services for individuals with cognitive impairments faces numerous challenges, among which the alignment between service models and the policy environment is a significant issue. In the current societal context, the development of emotional health services for individuals with cognitive impairments encounters various challenges and difficulties. The compatibility issue of service models warrants attention. Existing emotional health service models may not fully align with the actual needs of individuals with cognitive impairments, leading to problems such as insufficient service content and limited service scope, resulting in individuals not receiving comprehensive emotional support and rehabilitation services.

The alignment between service models and the technological development is also an issue that needs attention. With the rapid advancement of technology, new technological applications present both new challenges and opportunities for emotional health services. Whether service models can fully leverage new technologies to achieve intelligent, personalized, and convenient service characteristics will significantly impact the quality and efficiency of services.

The alignment between societal awareness, cultural cognition, and service models is also a consideration. The

societal environment and cultural background in which individuals with cognitive impairments reside have a significant impact on the acceptance and effectiveness of emotional health services. If service models cannot align with societal awareness and cultural cognition, it may lead to challenges in service promotion and suboptimal outcomes.

Therefore, continuous advancement of emotional health services for individuals with cognitive impairments requires ongoing adjustment and optimization of service models, strengthening support and guidance from the policy environment, leveraging the advantages of new technologies, and considering factors such as societal awareness and cultural cognition to achieve alignment in service models across various aspects, thereby enhancing service quality and effectiveness to meet the emotional health needs of individuals with cognitive impairments.

6.2.2 Strategies to Enhance Social Awareness and Acceptance

Currently, issues such as low national and societal attention to elderly cognitive impairment, weak proactive screening and identification capabilities, high treatment and care costs, and fragmented social service systems are prominent. It is imperative to actively explore the establishment of a comprehensive care system covering the full course of elderly cognitive impairment, consisting of diverse welfare entities including the government, medical institutions, communities, charitable organizations, the market, and civil society organizations. (Du, J., Zhang, H. Y., Qiao, Y. C., et al., 2024)

Continuous advancement of emotional health services for individuals with cognitive impairments faces a crucial challenge of enhancing social awareness and acceptance, requiring a series of strategies to address. It is necessary to enhance publicity and education on emotional health issues for individuals with cognitive impairments, raising the public's awareness of cognitive impairments. Through promotional activities, specialized lectures, and the creation of relevant promotional materials, society can be informed about the emotional health needs of individuals with cognitive impairments and the importance of services, thereby increasing societal attention and understanding of these issues.

There is a need to advocate for the improvement of relevant laws, regulations, and policies to provide stronger support and guarantees for emotional health services for individuals with cognitive impairments. Establishing a sound legal framework clearly delineating responsibilities and service scopes for emotional health services for individuals with cognitive impairments, standardizing service behaviors and processes, enhancing supervision and evaluation of relevant institutions and individuals, and safeguarding the rights and interests of individuals with cognitive impairments.

Efforts are needed to enhance the construction and training of professional talent in the field, elevating service quality and standards. Training more professionals such as medical personnel, psychological counselors, social workers, etc., with specialized knowledge and skills, improving their understanding of emotional health issues faced by individuals with cognitive impairments and their service capabilities, to provide more professional and personalized services and support.

Furthermore, establishing a sound social support system and service network is essential to promote comprehensive coverage and effective operation of emotional health services for individuals with cognitive impairments. Building a diversified service network, integrating resources from medical institutions, social organizations, volunteer groups, etc., establishing a complete service mechanism and cooperation mechanism, achieving resource sharing, information exchange, enhancing overall service efficiency and coverage, and meeting the emotional health needs of individuals with cognitive impairments.

In conclusion, continuous advancement of emotional health services for individuals with cognitive impairments requires the implementation of various comprehensive strategies, including strengthening publicity and education, improving laws and regulations, enhancing the level of professional talent, and constructing a sound service network. These measures aim to enhance social awareness and acceptance, driving the development and progress of emotional health services for individuals with cognitive impairments.

7. Conclusion

Technological innovation and service design have vast prospects in promoting emotional health services for individuals with cognitive disabilities, but they also face many challenges. There is a need for continuous innovation, exploring new models such as personalized service design, cross-sector collaboration, and community-based service networks to address the matching issues between service models and policy environments. Additionally, efforts should be made to strengthen social awareness and education, improve laws and regulations, cultivate professional talents, and build sound service networks to enhance social awareness and acceptance. Together, these efforts will contribute to the development and progress of emotional health services for individuals with cognitive disabilities.

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