A User-centered Classification Framework for Digital Service Innovation : Case for Elderly Care Service

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ABSTRACT

Digital technology has been changing everyday life of ordinary people let alone the structure of world industry. The elderly care service is also going through changes influenced by the unavoidable impact from torrents of digital technologies. There are numerous reports and news about the digital technologies increasing the efficiency and effectiveness of care service yet lacking systematic understanding of the sources of such improvement. This study aims to present a new classification framework for digital elderly care service innovation to fully utilize the power of digital technologies drawing on insights from innovation studies and service studies. First, 4 features of digital technologies are identified as sources of new value in service innovation. The co-creation of value by users and producers in service and technology development is discussed to illuminate users' contributions to service innovation. Communication of needs and ideas with producers and application of new technologies into everyday practice of life are identified as the source of new value which can be attributed to the elderly. Customization along with efficiency gains is the key to digital elderly care service innovation. The classification framework, thus, incorporates the needs of the elderly as one axis of criteria in the conventional technology-centered framework. The new classification framework would help give due weight to user-driven or demand-driven innovation in the elderly care service R&D activities.

Key words: Service Innovation, Digital Technology, Co-creation, Classification Framework, Users.

1. INTRODUCTION

Digital technology has been changing the world. Information and communication technology (ICT) has impacted upon not just industry but also everyday life of ordinary people for more than 50 years. Some people even proclaim the 4th Industrial revolution emphasizing the implications of extreme automation and connectivity [1].

This study aims to provide a classification framework for innovations in the elderly care service driven by digital technology. Many reports indicate that application of digital technology has improved elderly care service in terms of efficiency and effectiveness [2], [3]. Yet most of them introduce just cases, lacking systematic understanding of the source of innovation in elderly care service. For instance, tele-healthcare system, much heralded technological success, is adopted by the elderly not based on its usability but its ability to support autonomy in daily life where customization is crucial for the system to be meaningful for the individual [4].

Drawing on insights from innovation studies, this study intends to illuminate the types of digital innovation in elderly care service by providing classification framework. Innovation studies emphasizes that the innovation is not just a process driven by the introduction of new technology but an outcome of the interaction between users and producers of new technology in social context [5], [6]. For the proper management of digital innovation in elderly care service, a classification framework is required which reflect not only merits of digital technology but also contributions of the elderly.

First, features of digital technology are discussed to understand new values from digital innovation. Second, the needs of the elderly and elderly care service are interlinked with values from digital technology to build a classification framework. It concludes with policy implications along with future research direction.

2. TECHNOLOGICAL FEATURES OF DIGITAL INNOVATION

4 types of technological features can be identified with digital innovation [7].

First, fundamental contribution digital technology has made as a means is that it enables people to make, process, and utilize information with less cost and much more ease. Almost everything can be recorded in digital format with the help of sensors. Wearable devices such as Fitbit are the sensory nodes which detect, collect, process and deposit health-related information of individuals. Digitalization can begin with not just special information devices such as computer but also ordinary appliances like shoes. The base of digital innovation is its ability to change various activities into electronic data. Ordinary people can generate, edit and exchange their own contents with personal mobile devices like a smart phone.

Second, digital technology also enables ordinary people to enjoy a new kind of experiences. Using sensors and simulation software, Golf-zone has made it possible to play golf on screen. A virtual tumbling whale is called into a gym with virtual reality technology of 'Magic leaf'. New digital media technologies brings new user experiences, which has been making a big difference in marketing strategy as manifested in the case of PokemonGo.

Third, digital technology is evolving into a machine with intelligence. While the first and the second industrial revolution can be identified with mechanization of economic activity, so called the fourth industrial revolution is pursuing mechanization with autonomous intelligence. With rating prediction model based on personal purchasing data, Netflix makes movie suggestions to individual customers. Machine learning has produced Watson and Alpha-go which deals with highly sophisticated problem-solving activities. The robots may come to the real world much more quickly than one might think it would. Routine work whether it is cognitive or physical will be replaced by machines. The message of the 4th Industrial revolution can be summed up by the arrival of intelligent machine, a robot.

Table.1 Technological Features of Digital Service Innovation

Features	Example
Information	*Wearable/Fitbit* *User-Created Contents(UCC)*
New Experience	*Golf-zone,* *Magic Leaf, Pokemon Go*
Intelligence	*Netflix Rating Prediction Model,* *Alpha Go, Waston*
Network Platform	*Facebook, Cacao Talk, Line* *Shapeways.com*

Finally, ICT interconnects people with people, people with machines, and machines with machines. Internet puts consumers in direct contact with producers so as to reduce the transaction cost by removing intermediaries as well as by communicating customer needs more accurately. Breaking the wall of information asymmetry between producers and users helps to build a digital network where various actors interact and transact on a shared infrastructure. The network effect, namely demand side scale economy [8], makes the platform the focus of business model innovation. The larger the network/platform is the more dominant it is in the market as one can notice in cases of Facebook, Cacao talk, Line and other Social Network Service. Shapeways.com act as a platform for the whole range of 3D printing businesses, where people can design, order, buy and sell 3D printing product. Furthermore the interconnection between machines, i.e. IoT (Internet of Things), is expected to open a new type of platform where interconnected home appliances' network such as Google's Nest would generate a new wave of value generation as Smart phone has done before. So called the 2nd economy, the neural system comprised of interconnected machines, is not just growing but also making a qualitative change to human society [9]. Table. 1 shows technological features of digital innovation which would create new value through digitizing information, providing new experience, utilizing machine intelligence and building platform for direct transactions. .

3. CLASSIFICATION FRAMEWORK FOR DIGITAL SERVICE INNOVATION

3.1 Customization and Digital Service Innovation

Service providers can make 2 types of innovations using digital technology.

First the service process can be digitalized. By making electronic records of service activities or changing service devices into data collecting nodes, doctors, nurses and caregivers can increase the efficiency of care service process. Since care service is a highly information-intensive practice, the exchange of electronic health-related data and images between caregivers, the elderly and families reduces substantial cost of care service process. Online network or platform would increase both efficiency and effectiveness of elderly care services by facilitating search and exchange of desired information and services.

Second, digital technology can contribute to the development of new service products. Customized solutions to the needs of each elderly based on personal activity data can be new products enabled by the intelligence of digital technology. In addition, the VR(Virtual Reality) or AR(Augmented Reality) technology can provide new user interfaces and experiences which might deter the development of degenerative disorders such as dementia. Care robots such as 'Pepper' in Japan would be one of the most advanced products of digital care service representing machines with intelligence.

The introduction of new digital technology, however, does not necessarily lead to the elderly care service innovation. Unless the elderly accept, adopt and use those new digital technologies, they never will make it to everyday life and the market. It is well known that inherent uncertainty and related risk sometimes make it difficult for people to adopt new technologies as in the case of genetically modified organisms [10]. Digital technology alone cannot make the elderly care

service innovation. The elderly, users do have a role to play in bringing about service innovation, namely creation of new value. Technological innovation is the outcome of interactions between producers and users [5], [6].

The elderly can contribute to service innovation by communicating their needs and ideas more clearly and directly. The elderly know much better what they really want than the producers of new care service technologies. The input from user's information & ideas is recognized as a critical source of innovation [11], [12]. Sometimes lead users not just adopt new products or services earlier than others but also make new ones by themselves. Some users are more capable than producers or experts. For instance, those with chronic diseases would have more information than doctors and nurses, which enables business model of 'dLife' or 'patientlikeme' where patients and family share and exchange information and experiences. Demand-pull innovation or user-driven innovation takes the other side of innovation coin along with technology-push innovation or expert-driven innovation [13].

The elderly can also contribute to creation of new service value by integrating new digital technologies and applying them into everyday life practice. People adopt and use technologies to fulfill a certain function of their life. The satisfaction from new technology, therefore, does not depend on adopting or purchasing it but the extent to which it performs targeted function. The actual usage is the key to the creation of new service value. In other words, it is the changes of personal routines or every day practice that generates new service value. The value of service is co-created by both providers and users [14]. Customization, therefore, is one of the key to the innovation in digital elderly care service along with efficiency gains in service activities.

Recently, 'Living lab' approach is adopted by numerous elderly care service researchers to help improve service by articulating needs from the elderly's point of view, identifying hurdles for changing routines and practices including regulatory barriers, and developing new solutions [15], [16]. The elderly and caregivers are participating in R&D process not as a testing entity of already-made products or services but as a contributor to the development of new products and services. Customization to the needs of the elderly and actual working in real life situation is the key to the elderly care service innovation through living lab approach. The needs of the elderly, therefore, is crucial elements for the whole activity.

3.2 Classification Framework for Digital Elderly Care Service Innovation

The classification framework, therefore, needs to incorporate user's activities as well as features of digital technology that could co-create new values in the elderly care service. Since the discussion above clearly indicates that the success of service innovation is greatly influenced by the users' communicating needs & ideas with producers and integrating technologies into everyday life practice, it would be much logical to have them built into the classification framework.

Service innovation is not solely dictated by new digital technologies but completed with the epistemic as well as ontological contributions from users. The classification of service innovation needs to go beyond the currently prevalent technology-focused criteria. The incorporation of features of users into the framework would emphasize their importance in innovation and give due weight to demand-driven innovation or user-driven innovation.

The first step of incorporation would be the inclusion of needs of the elderly into the classification framework. According to the discussion of welfare technology [17], 8 functions of the elderly life are expected to be fulfilled by technologies; Communication support, Compensatory/Assistive support, Everyday practical tasks, Disease monitoring, Remote treatment, Rehabilitation(exercise) technology, Entertainment, Social and emotional support and stimulation.

These needs of the elderly can be streamlined into 4 groups; Everyday practical tasks, Social & Emotional support/Entertainment, Health monitoring/management, Compensatory support/Rehabilitation. Doing everyday practical tasks would be the first basic need or function to be fulfilled by technologies. Housekeeping, personal hygiene, nourishment, exercise, shopping and other activities are required to keep life go on. The second need would be related to social & psychological aspect of the life. Neighbor, friend, stimulation, dialogue and entertainment are not only elements of civilized way of life but also one of the fundamental elements of human life. The third need reflects more prominent demand from the aged members of a society. Health monitoring and management is an important issue to the elderly individuals as well as public health authority. There will be numerous problems and opportunities for technology to tackle. Finally, rehabilitation/compensatory assistance would need technological support such as wheelchairs, intelligent prostheses, sound-based orientation help and cognitive training & assistance in the case of people with dementia.

The classification framework can, thus, be comprised of 4 needs from the elderly on one hand, and features of digital technology on the other hand as shown in Table 2. Each need or demand throws new problems for which new solutions and technologies are devised and developed. The key to digital elderly care service innovation is customization to personal needs as well as efficiency gain in service activities.

Table.2 Classification Framework for Digital Elderly Care Service Innovation

Features \ Needs	Information	New Experience	Intelligence	Network Platform
Everyday Practical Task	Digital Key in emergency system Smart Home		Digital drug dispenser with record keeping function	
Social & Emotional Support/ Entertainment		Personalized Screen Gate-ball, Customized World Tour	Personalized Life-story theater	
Health Monitoring/ Managing	Fitbit as a personal node for monitoring system		Remote Home Sensing Emergency Alarm	Patientlike-me, dLife
Compensatory Assistance Rehabilitation	Fitbit as a personal node for monitoring system		GPS-based wheelchair platform	

For instance, digital key can be upgraded to address problems of the old person living alone in case of emergency. Fitbit could be used as a basic personal instrument of health monitoring system of increasingly aged rural community where the share of senior citizens are very high. The personal game result of screen gate-ball could be recorded with other health related information to provide not just physical but also psychological health information of each elderly. In relation to emotional entertainment, the life of the elderly itself can be the source of movies and theater and be developed into personalized life-story theater. New community platform emulating dLife can also be developed where high quality information on chronic diseases and their treatment are easily exchanged and transferred. GPS-based wheelchair for people with disability can be used as a platform to serve different needs while they are moving.

'Smart Home project' in Baerum, Norway and 'Home Care Service' in Alvsbyn, Sweden utilizes digital keys, GPS locator for the dementia, body sensor and mobile PDA for care visitors to extend care service to the elderly people's home[18]. 'CareNnet' in Denmark and 'Proxim's Services' in France, both provides network where the elderly, the family, caregivers and service providers contact each other directly without intermediaries. Patientsknowsbest.com and Patientlikeme.com demonstrate a new business model based on much cheaper yet powerful digital mediating technologies.

Digital technology certainly provides new ways of solving problems the elderly face and consists one axis of classification criteria. Yet what new needs-incorporated framework emphasizes is that the quality of digital technology and digital service innovation does not depend on its technological novelty or superiority but on the fulfillment of the needs; satisfaction of the elderly and actual adoption in everyday life. Low-level technology may turn out to be more useful than advanced hi-tech digital equipment. What matters is the solving of the problem and meeting the needs, not the development of science-intensive highly advanced technological artifacts. The digital elderly care service innovation does not occur with the advent of a new digital technology alone but customized use of those technologies. Since the value of service is co-created by producers and users, the first step to the classification framework for digital elderly care service innovation would be the incorporation of the needs of the elderly as one axis of criteria in order to explicate the importance of and opportunity for customization.

4. CONCLUSION

Digital technology has been changing everyday life of ordinary people let alone the structure of world industry. The elderly care service is also going through changes influenced by the unavoidable impact from waves of rapidly advancing digital technologies.

This study presents a new classification framework for digital elderly care service innovation to fully utilize the power of digital technologies. 4 features of digital technologies are identified as sources of new value in service innovation. Users'

contributions to service innovation are also discussed to help understand the co-creation of value by users and producers. Communication of needs and ideas with producers and application of new technologies into everyday practice of life are identified as the source of new value attributed to users, the elderly. Customization of products and services to those needs and ideas would be the core of digital elderly care service innovation. The classification framework, thus, includes the needs of the elderly on one hand, and features of digital technology on the other hand. It would be further developed through the comparison with existing classification related to service innovation and through case studies of elderly care service innovation, which would be the next research projects.

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