스마트시티의 목적과 함의에 대한 탐색적 연구:
고령화 인구를 대상으로
Investigation on Smart City Objectives and Implications:
Adaption to Silver Population in Korea as Target Citizens

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요약

본 연구는 현존 스마트시티의 목표와 개념을 명확히 규명하며, 스마트시티와 관련된 주요 기술적 관점을 구체적으로 탐색하는 데에 목적을 두었다. 본 연구에서는 선행연구의 포괄적인 탐색과 분석을 통해 스마트시티와 관련된 기존의 모호한 논의를 구체화함으로써 향후 연구의 기반을 제공하고자 노력하였다. 특히 본 연구는 50대 중반에서 60대 초반의 실버인구를 연구의 대상으로 삼아, 이들을 핵심 표적으로 하는 스마트시티의 바람직한 모델을 이론적인 차원에서 제안하였다. 본 연구에서는 실버인구를 위한 미래지향적 스마트시티의 주제로서 의료보건관리, 은퇴 이후의 고용창출, 지역기반 관리체계, 친환경 사회기반시설 등 네 가지 사항을 제시하였다. 특히 실버인구의 복지후생은 미래지향적 스마트시티의 핵심적 사항이며, 친환경적인 고려가 우선적으로 이루어져야 함이 강조되었다.

■ 중심어 : | 스마트시티 | 노령화 인구 | 환경친화적 기반시설 |

Abstract

This research investigates the objectives, concepts, and technical aspects of existing Smart Cities in theoretical terms in order to resolve any ambiguities the definition of Smart City currently has. Through this, theoretical recommendations for Smart City that targets elderly citizen are made. The elderly citizens in question are people currently in their mid-50s to early 60s, in order to adequately employ futuristic technologies into four major sectors: healthcare, post-retirement employment, community-based governance, and environment-friendly infrastructure. The research concludes that while the technical application of welfare to the elderlies through constructing a purposeful Smart City is desirable, environmental consideration should come in prior concern as a sustainable foundation of livelihood is needed for citizen accommodation.

■ keyword : | Smart City | Ageing Population | Environment-Friendly Infrastructure |

I. Introduction

The global population is becoming an ageing society, where population that is older than 65 composes more than 14% and less than 20% of the total population[1]. This implies that silver citizens

will comprise a significant part of the society which will require a more characterized government policy and infrastructure. World Population Ageing 2015 Report proposes that a critical need to develop sustainable strategies for elderlies is needed[2]. Redevelopment of old cities is trending around the world, where implementation of Smart City technologies is becoming more frequent. It is important to note that those technologies are primarily installed with a purpose, which is to improve and enhance citizens' life and to inform them of necessary data more coherently and concisely. However, such redevelopment is under confusion due to the ambiguity of what Smart City genuinely stands for. The lack of unified regulations and notion that pertains to Smart City construction spurred such ambiguity, leading Smart Cities to be less effective and efficient. Picon (2015) states that the ambiguity of the Smart City concept emerges from its ununified definition; may it be too narrow or too broad, it both fails to answer a critical question of how far should the scope of the notion of the Smart City extend to[3].

As ageing population is a new and upcoming trend that the global population is anticipated in a matter of a few years, many technologies that are geared towards supporting the elderlies are already in place. Examples include remote monitoring and robots with the aid of sensor networks and communication[4], enabling elderlies to maintain independence as much as possible. Adopting these micro-technologies in a citywide blueprint, however, is an idea that has not occurred in practice just yet. The main reason for the hesitation would be the natural repulsion to an artificial completeness that is thought to extort 'humanness' from the environment. It is critical to employ different technological solutions in different parts of this 'Silver Smart City' without taking away the neighborhood culture where door-to-door

interaction is stimulated[5].

It is the vision of all Smart Cities for its citizens to experience active engagement and own autonomy rather than some ready-made welfare structure. It is prospected that since the future silver population would be the current 30-40s who are friendlier with smart electronic devices, adoption of high-end technologies within the city would approach to them with less wariness. Therefore, special needs that emerge especially for the elderlies, such as health, transportation, and eco-friendly environment must be combated through the means of appropriate technology. Within this research, a Smart City that targets ageing population or silver population as their main citizen will be most likely to serve as an alternative solution for the future society. The urgency for such a solution is evident, seeing from the increasing rate of countries entering ageing society in recent days. The GDP ratio of the countries that is situated at the northern hemisphere account for nearly 81% of global GDP, and 73.8% of these countries have already entered into an ageing society[1]. This implies the lack of working force, effectively slowing down the global growth rate[1]. This calls for not only an enhancement of traditional method of micro-managing of silver population, but also a wide-scale approach where silver population can interact with their outer environment with more autonomy for their own benefit.

This research will investigate the objectives, concepts, and technical aspects of existing Smart Cities in theoretical terms in order to reinforce and enhance any ambiguities the definition of Smart City currently has. Through such investigation, this research will construct a strong foundation of a new Smart City design that targets the ageing population. It will incorporate the mechanics, green development, Information Communication Technologies, Internet of

Things(IoT), and other necessary sectors to plan smart city that purposes to better aid the retired and soon to be retired elderlies and improve their quality of life.

II. Research Background

1. Smart City

According to Manville et al. (2014), a Smart City is 'a city seeking to address public issues via information and communication technology based solutions on the basis of a multi-stakeholder, municipally based partnership'[6]. Skouby et el. (2014) describes the city as smart 'when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic development and a high quality of life, with a wise management of natural resources, through participatory action and engagement' [4]. Despite multiple definitions surrounding the concept of Smart City, the common beliefs all definitions share are the need for urban infrastructure, sustainable development, modern communication channel, and autonomous governance. Hence, this research assumes Smart City as an entity that pertains to the aforementioned four characteristics. The term urban, or municipal infrastructure refers to 'the services traditionally provided by the public works, transport sectors, and utilities[7]. Urban infrastructure is a basic component for all human living environment/civilized environment, however, its efficiency and quality can vary depending on how developed the environment is.

Sustainable development is another characteristic of a Smart City. It can be defined differently according to what context the term is interpreted in, however, generally sustainable development refers to a new balance between the use and the preservation of nature's potentials and resources[8]. Growing concern for global energy usage and its implication on the environment is also reflected in Smart City concept, where is generally interpreted as environmentally sustainable development. Modern communication channel is a term used to describe a mode of communication that facilitates participatory action an engagement in a modern way. These can include video conferencing, live web chatting, email, texting, phoning, and social media[9]. Each method should be applied in most desirable places, and can take many forms. This also includes the idea of e-governance, where technology supports the manner of vertical acting and communicating[10]. Autonomous governance is a central concept of Smart City. Many of Smart City definitions include this concept of autonomy and cooperation that includes active engagement of the citizens from within. Institute of the Future describes such concept as participatory public services, suggesting crowd sourcing as a method to drive participation[11]. Such participation will therefore be a spontaneous one, enriching politics of the city with real-time citizen involvement and participation[3].

2. Ageing Society/Population

According to UNFPA (United Nations Population Fund), people aged 60 and older currently make up 12.3% of the global population, and that number will rise to 22% by 2050[12]. In Korea in particular, people that are 65 or older comprised of 11% of the population in 2011[13]. Although the phenomenon of ageing population itself is desirable as it points to improvement of overall health, sanitation status, and better nutrition of global population and especially for the peripheral regions, it is important to note the other parts of the population pyramid in order to assess the

implication. [Figure 1]. illustrates the population pyramid of Korea, reflecting data from 2016. The pyramid displays a beehive-like shape, where the base is narrow and middle-aged groups have an inverted form. This constrictive pyramid shape is often characterized by countries with good education and health care, which leads to higher age expectancy, thus the ageing society. Korea's demographic dividend has ended, and has entered the era of demographic burden[1], where economic development slows down and working age population decreases.
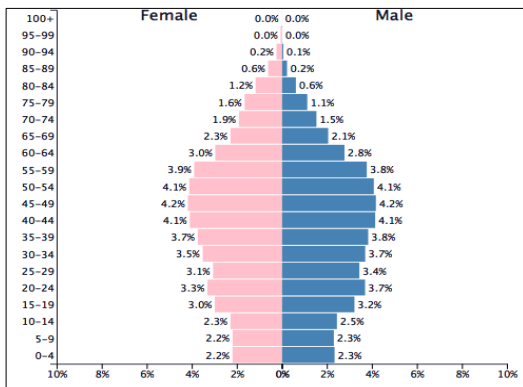

Figure 1. Korea's population pyramid

What this demographic characteristics show is that Korea is in great need for strategies for supporting and aiding the ageing society. As the most advanced country in terms of ICT and technology, identifying the most vulnerable sectors of ageing population and attempting to solve them through the utilization of digital intelligence seems to be the most urgent task at hand. It is important to note that in this research, the age group in target are those who were born during 1955-1963, so called 'Baby Boomers' or 'X-Generation'[1]. There are several characteristics the baby boomers of Korea specifically address to: 1) experienced both analog and digital world, 2) lived in the center of many significant historical moments, 3)

accumulation of a large amount of assets. Combining these three characteristics result in 'Active Senior' that tends to live 'younger' and invest more on themselves. Baby boomers had the opportunity to experience both analog and digital world. This is particularly important in that the global population will soon face the fourth industrial revolution, that is, technology-driven society where processing power, storage capacity, and access to knowledge is unlimited[14]. Baby boomers of Korea also experienced through many historically significant moments, increasing the capacity to embrace social changes and altered perspective of modes of life. Baby boomers will be able to handle the forthcoming turbulence of change, that is not only limited to technological aspect, but to every single sector of human society, increasing the need to expect new customs of life that no longer mirrors that of their parents[1]. They are especially significant in that they will be one of the major agents that will be able to freely experiment with forthcoming changes with the assets they have accumulated up until now. The amount of assets baby boomers accumulated during 1990-1997 amount to 65% of the total economy, indicating their financial capacity to invest in the future economy[1].
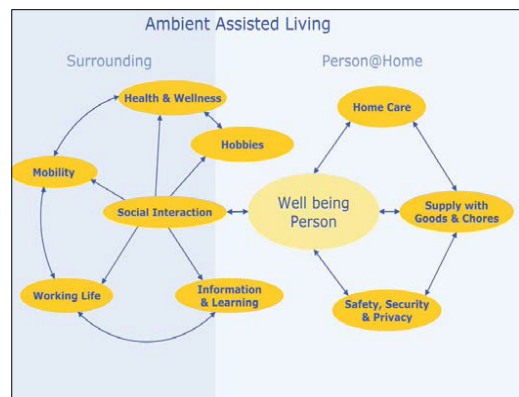

Figure 2. A multi-factor model

Nevertheless, vulnerabilities of seniors still exist. In order to identify the vulnerabilities, ambient assisted living will be served as a source of methodology. Ambient Assisted Living (AAL) is a programme funded by the European commission and 19 countries that exists to 'enhance the quality of life of older adults while strengthening the industrial base in Europe through the use of ICT. [Figure 2]. demonstrates which parts of elderly living AAL attempts to provide ICT-based solutions[4].

III. Harmonious Smart City for the Elderlies

1. Health and Wellness

The major social problem the ageing population faces is health-related issue. Although the life expectancy rose, there is no guarantee that the long life will be a healthy one. According to Korea Health Industry Development Institute, medical care expenditure per person increases by a huge extent after one's forties, and that number will rise to 42% of lifetime medical expenditure during their 65-84 years[1]. In this context, collaboration between bio industry and Smart City is needed.

The most needed health care system in future Smart Cities targeting the elderly citizens will be the monitoring system that allows the elderlies to collect real-time data on their health status and get recommended what actions are to be taken. SCRIPT Project was 2011-2014 project partially funded by the European Commission and focused on 'Supervised Care & Rehabilitation Involving Personal Tele-robotics'[15]. Among its many aims, two are notable: to reduce hospital or home visit frequency be remote management and support; to infer impact on health and recovery and its potential cost implications[15]. These remote technologies and

prediction of future health and its costs are important in that it reduces the dependency on doctors and allows the elderlies to manage him/herselves.

MobiServ project was developed in order to 'design and evaluate an intelligent proactive personal robot, integrated with innovative smart home sensors and smart textiles, and to offer home care for (semi-)independent living with a focus on health, nutrition, well-being, and safety[16].' This project ran from 2009 to 2013, and resulted in new Mobiserv prototype that was tested in a large range of studies in several settings. It is important to note that this project was initiated in hoped to embody the functionality that will support and analyze elderlies' health condition in the form of robots. Through developing wearable fabrics that monitors the health status, and smart sensors that detect eating and drinking patterns[16], this project can be prospected to collect real-time data of the elderlies, thereby providing personalized support for each individual[4].

2. Post-Retirement Employment

Baek (2017) argues that the 'new normal' this century is facing was a consequence of rapid demographic transition that includes the increase of life expectancy and the decrease of fertility rate[1]. These two key changes demonstrated huge economical challenges, that is, reduction of working age population which leads to higher dependency ratio. Working age population only comprises of 73.1% and is prospected to drastically decrease by 49.6% in 2060. While the proportion of an ageing population will increase from 13.2% in 2016 to 32.8% in 2030, population growth is slowly decreasing, with 0.45% in 2016 to minus growth in 2032. Dependency ratio, for a grand finale, will increase by four times from 18 people in 2016 to 82.6 people in 2060[17]. Such rapid and drastic movement in demographic model

yields for structural change in society. UN introduced a new classification as regards to the population division on age groups: 0-17 as under-aged, 18-65 as youth, 66-79 as middle-aged, 80-99 as elderlies, and 100+ as centenarian[1]. This shows that without injecting newly classified 'middle-aged' group into the labor market, Korea will be facing immense economic consequences. In other words, extending the mandatory retirement age and devising post-retirement job plans are necessary. Smart City, in this context, can serve great opportunity for elderlies to participate in social works and education-related markets.

Fiscal policies that mirrors the demographic change is already underway, including the passing of The Korean Senior Citizens Association's suggestion to increase the age of 'elderly' classification from 65 to 70 and governmental decision to set this change in place in a form of medium-and-long-term plan as announced in 2015 report[18]. Educational institutes, therefore, should be set up in the Smart Cities guides elderlies into formal training. Michitaka Hirose leads research and development of 'Senior Cloud' project[19]. This Senior Cloud created a new system of work, namely a 'mosaic-type work model' where experience, knowledge, and skills of elderly workers are matched with the desired form of work through cloud data[19]. By this, virtual workers are created that decreases the limitation of physical capacity as provision of labor is done through content-based interaction.

3. Community-based Governance

Community-based governance is the cornerstone of Smart City. It is only when a citizen-driven control is achieved the concept of Smart City is fully established. Boyd Cohen(2015) asserts that there are three generations of Smart Cities[20]. The third and the most advanced version of Smart City had the outstanding characteristic of citizen co-creation, meaning it aims to integrate citizen involvement into the bigger picture. This is significant in that the nature of individual cities can transform according to the major needs of the citizens that live inside of the city. City for elderlies, therefore, would be generated by the elderlies into a more applicable city for their own needs.

There are five different technologies that could manifest and facilitate citizen co-creation: Broadband Connectivity, Public Interfaces, Smart Personal Devices, Cloud Computing, and Open Data Infrastructure[11]. *Broadband Connectivity*. By 2020, most countries in the world will be provided with 4G wireless networks through implementation of long-haul fiber optic networks. With increased connectivity, communication rate will enhance, thereby facilitating the access to urban information for all. *Public Interfaces*. Public interfaces refer to those digital displays that allows both passive and active participation in civic matters possible. These will be integrated into buildings, kiosks, and furnishings that will in future become one of the 'ambient' infrastructure that quietly signal us to either provide information or engage in decision-making. *Smart Personal Devices*. Having these smart personal devices will allow better access to information and potentially higher engagement in civic matters through the use of applications and such. *Cloud Computing*. Cloud computing will become a core strategy that transforms the personal computer into the network computer, amalgamating citizen engagement into one central location. Technology of data mining will become a key determinant of a cloud computing strategy as its efficiency will enlarge the domains of cloud computing. *Open Data Infrastructure*. Currently, we

are able to access public databases in order to examine information freely. In the future, this transparency will be extended by the utilization of Application Program Interfaces (API), which not only allows the users to read the data, but also add to public databases as well[4][11][20].

4. Environment-friendly Infrastructure

As civic areas where a considerable number of people stay significant amount of time are conducive of problematic energy consumption, environmental consideration is imperative when planning a city. Moreover, outdoor environment is in close association with elderlies' quality of life. By environment, this research will refer to the strategies the city should use for energy consumption and interaction between natural surroundings. LEED-ND (Leadership in Energy & Environmental Design - Neighborhood Development) has 'stemmed from an attempt to inject environmental awareness into a process[21].' It was developed to address the sustainability of city planning, which includes objectives such as Smart Location and Linkage, Neighborhood Pattern and Design, Green Infrastructure and Buildings, Innovation and Design Process, and Regional Priority Credit[22]. From a more design-based, aesthetic point of view, environment-friendly architecture can come into the recommendation. The idea that balance between natural surroundings and human living is possible and crucial.

Ⅳ. Conclusion

Many of the aforementioned recommendations are based on the assumption that people will agree to offer their private information such as health indicators and past occupational experiences. In reality, however, it is highly unlikely that people would willingly provide their private information to be shared with. Even if they do so, security breach such as hacking will present a severe threat, especially if the hacker has an access to the health information. The benefits presented by the IoT must outweigh the value of private information. The future we are facing is changing its form by the second and our perception towards privacy will change with it. The future may be an acceptable world where knowing the counterpart's information is the basis of all relationships.

This research successfully outlined the internal and infra-structural needs of Smart City that targets silver citizens. Through an elaborate study on Smart City and ageing population, it was possible to deduce four sectors that should be in great consideration when planning for Smart City for elderlies. Those sectors are as follows: health and wellness, post-retirement employment, community-based governance, and environment-friendly infrastructure. It is integral to note that environmental concern should not be overlooked by the adoption of rapid technological advancement. It is only possible to stand on Earth if certain environmental conditions are satisfied, and without that, the whole notion of the city, let alone Smart Cities, could be abolished. Baby boomers, once the driving force of the Korean economy, is prospected to once again dominate the Korean economy as leading citizens, meaning a large portion of environmental and social obligation is laid on them. Therefore, through an adequate combination of infrastructure and environment, the active senior of Korea will serve as a governing body of Korean Smart Cities that will lead the social changes and pro-actively solves environmental concerns.

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