Welfare System Sustainability and the Role of Welfare Technology in a Low-Birthrate and Rapidly Aging Society

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1 Introduction

1   Introduction 《

The fundamental dilemma of welfare policy is between the growing and diversifying demand for welfare services in the changing socioeconomic environment, on the one hand, and the limits of welfare funding, on the other.[1]

This dilemma is likely to grow worse in the coming years, as low birth rate, population aging, and slow economic growth are increasingly becoming the norms of the future welfare service environment. The problem of a declining birth rate, coupled with rapid population aging, is especially pronounced in Korea and seriously threatens the sustainability of the country's welfare system, requiring diverse solutions and approaches.

It is important to enhance the cost-effectiveness of Korea's welfare policies and programs. However, only few studies have focused on science and technology as the main approach to enhancing the cost-effectiveness of welfare programs. However, more appropriate use of science and technology can help meet new and diversifying welfare service demands and lead to more cost-effective alternatives to the current services.

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1) Within this study, "welfare" is used in a broad sense, i.e., encompassing both welfare and healthcare. In the broadest sense possible, the concept may also encompass all related fields of social policymaking, such as labor, education and safety.

In this study, we will first look into the matter of how low birth rates and rapid population aging threaten the sustainability of the welfare system. Next, we will explore the definition and key characteristics of welfare technology capable of enhancing the sustainability of the welfare system. Finally, we will discuss and examine the key requirements that must be met for such welfare technology to succeed.

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Low birth rates, population aging and the sustainability of welfare

2 Low birth rates, population 》 aging and the sustainability of welfare

1. Nordic experience

The Nordic states have experienced mounting challenges to their welfare system prior to the advent of Korea's current dilemma and have effectively applied welfare technologies to overcome them.[2] The main problems that the Nordic welfare system faced can be summarized as follows:

(1) Growing demand for more and better welfare services due to:

- Population aging;
- Growing need for nursing and care and the changing needs of retirees and retirees-to-be (e.g., demand for better quality of life and better welfare services, preferably available in the comfort of one's home).

(2) The scarcity of resources to meet the growing demand due to:

- Shrinking labor force as a result of declining birth rate (i.e., shortages of care providers for the growing

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2) Nordic Centre for Welfare and Social Issues (2010). *Focus on Welfare Technology.*

elderly population);

- Slow economic growth.

Faced with these challenges, the Nordic states became in-
creasingly concerned that their welfare system might not last
into the future.

Figure 1 neatly summarizes the challenges that Nordic welfare
states faced (Soendergaard, 2014). The demographic and other
accompanying changes in the future welfare environment, cou-
pled with the rising expectations for welfare services and quality
and the limited availability of resources, appeared to present
threats to the sustainability of the Nordic welfare system.

[Figure 1] Changing welfare environment and the crisis of the welfare state
in the Nordic countries
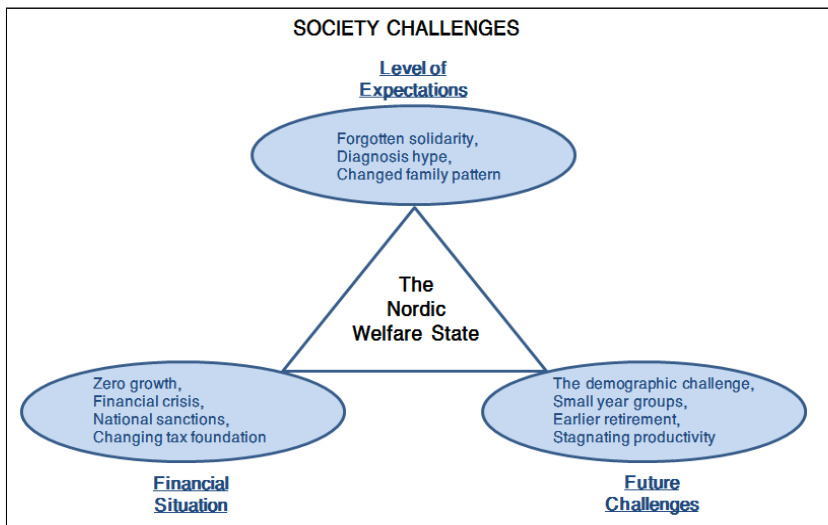
Source: Soendergaard(2014)

The Nordic states have decided that the failure to respond to these challenges with national strategies will lead to the decline of their welfare states. In other words, the failure to clarify and decide new goals, complete with specific targets to be achieved, would add to the growing uncertainty of the welfare system. When the main public providers of welfare services fail to respond to these problems, others would eventually come to dominate the welfare market. Under such a scenario, people who have the means to purchase the necessary care and welfare technology they need may not suffer as much, but others who lack such means are left to fend for themselves in the vacuum of public welfare. The Nordic states have thus turned to welfare technology. They have decided that no better alternatives could be found at the moment.

The Nordic states' choice of welfare technology can be explained in the following context. The increasing elderly population expands the need for nursing and care services. Yet the labor force in the Nordic states is shrinking due to the declining birth rate. Introduction of welfare technology therefore holds the key to the success of the welfare state. With technology, the Nordic states will be able to overcome the shortage of labor in welfare services, while also improving the quality of life and of welfare services for people who increasingly value independence and privacy. Welfare technology may also contribute to the fiscal sustainability of welfare programs by im-

proving their cost-effectiveness. Moreover, welfare technology
carries potential incentives for fostering new industries.
Welfare technology, in other words, may be a win-win solution
for all, including individuals, society and businesses.

2. Current status and prospects for Korea's population

Like the Nordic states, Korea today is undergoing a welfare
system crisis induced by demographic changes. The persis-
tently low birth rates and population aging are fueling the
growing demand for more and better welfare services, on the
one hand, and shrinking the labor force capable of meeting
that demand, on the other. The problem and the solution as
understood by the Nordic states therefore carry particular per-
tinence to the Korean case.

The continuous increase in the proportion of the elderly (at
age 65 or older) and the super-elderly (at age 85 or older) in-
dicates that the demand for healthcare and welfare services will
grow at an explosive pace in the near future. The majority of
the elderly in Korea depend significantly on hospitals and re-
tirement homes for needed care. Yet Korea's welfare system
expansion remains far from keeping pace with the growing size
and welfare demands of the elderly population.

The rates of premature deaths due to cardiovascular dis-
eases, cancer, and related ailments have been declining steadily

for some time, indicating the improving quality of healthcare services in Korea. In tandem with this constant increase in life expectancy, however, the ill health expectancy (i.e., the period of one's lifetime spent in ill health) is also on the rise. The growing inequality of access to healthcare presents yet another serious problem. The increasing size of the elderly population will raise the demand for industries that cater to the needs of the elderly. According to Statistics Korea, the number of people at age 65 or older in Korea has been steadily increasing, from 730,000 (2.9 percent of the total population) in 1960 to 5,450,000 (11 percent) by 2010, and will continue to increase even further to 12,690,000 (24.3 percent) by 2030 and to 17,620,000 (40.1 percent) by 2060.

[Figure 2] Demographic composition by age in Korea (1960-2060)
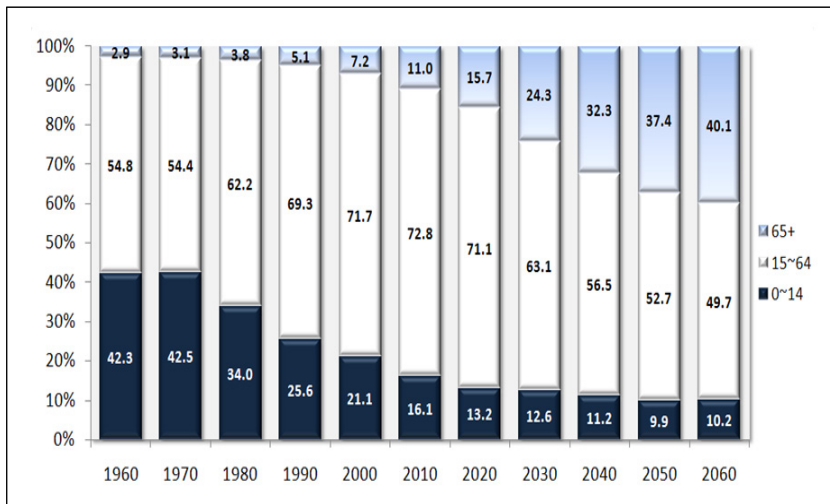
Source: Statistics Korea (2011). *Future Population Projections: 2010-2060.*

In particular, the number of the super-elderly at age 85 or older will multiply by more than ten-fold, from 370,000 (0.7 percent) in 2010 to 4,480,000 (10.2 percent) by 2060, making up 25.4 percent of the elderly population.

[Figure 3] Elderly population composition by age (2010–2060)
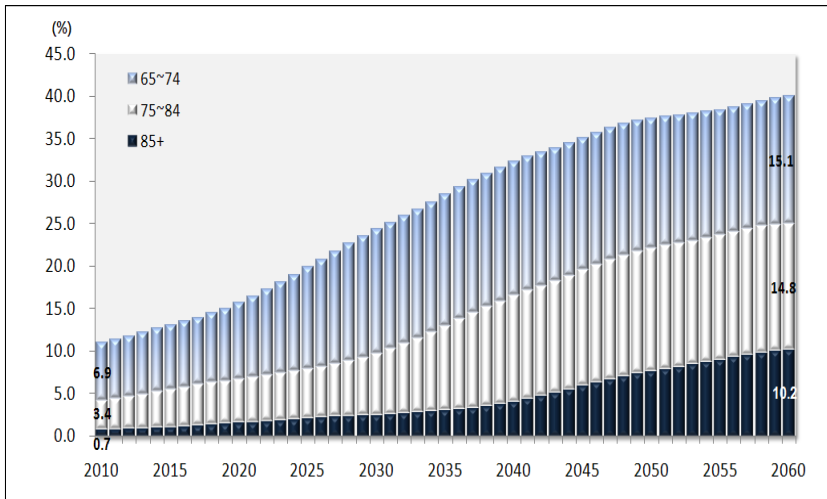
Source: Statistics Korea (2011). *Future Population Projections: 2010-2060.*

In addition to population aging, the persistently low birth rate in Korea is another major cause of the changing demographic structure. Many countries with low birth rates worldwide are striving to find effective measures to raise birth rates. The total fertility rate in Korea was 1.19 as of 2013. The total fertility rate refers to the average number of children a childbearing-age woman bears in a society. Among the member states of the Organization for Economic Cooperation and Development (OECD), Korea has the lowest total fertility rate.

[Figure 4] Birth rate trend in Korea
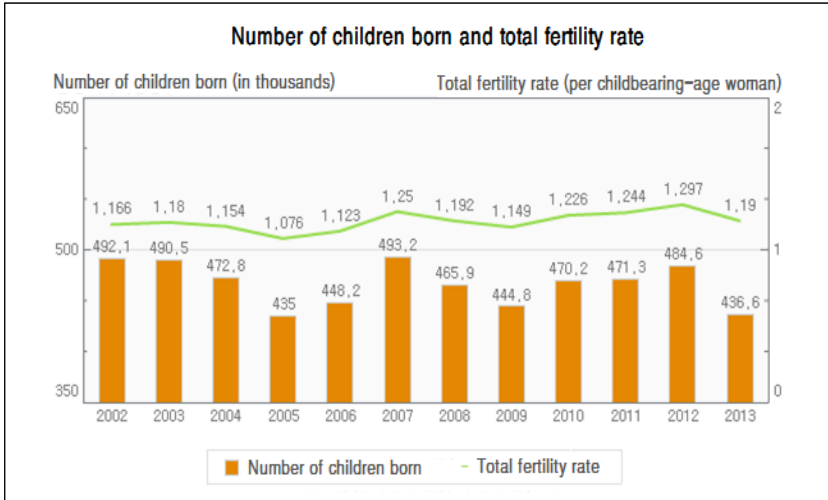
Source: Statistics Korea, "Birth Rate Estimates," *Government-Approved Statistics No. 10103.*

[Figure 5] Korea vs. OECD: total fertility rate comparison
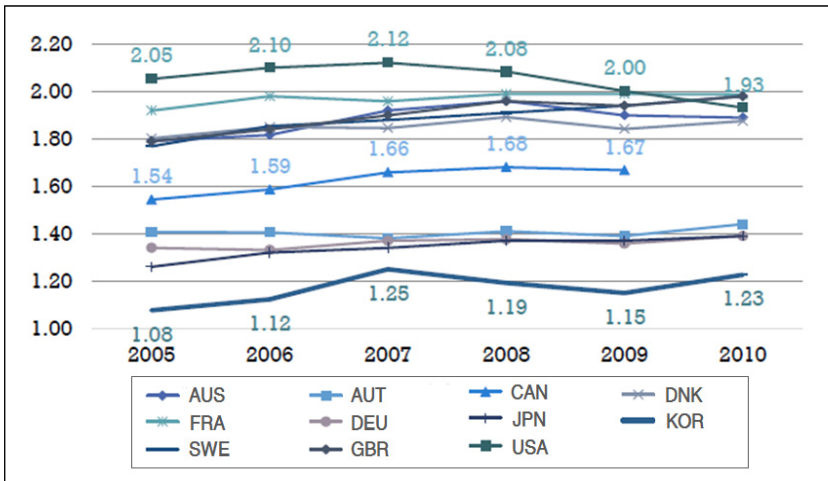
Source: Science and Technology Policy Institute (STEPI) Experts Meeting, as reported in Jeong Hye-ju's presentation.

The Korean government introduced its first population con-
trol policy in the 1960s, having judged that the country's high
birth rate at the time could complicate the prospects of eco-
nomic development. Population controls remained in place un-
til 1995, causing the birth rate in Korea to plummet and finally
approximate the OECD average. Continued economic growth,
rising income levels, the increase in the size of the elderly pop-
ulation, and extended life expectancy thanks to advancements
in medical technology have all contributed to population aging
in Korea. Mounting worries over the impact of possible labor
shortages on future growth led the Korean government to abol-
ish the population control policy in 1996 and switch to a new
policy focusing on improving the quality of human resources
and welfare services. Nevertheless, the birth rate continued to
drop afterward, falling to a low of 1.08 in 2005. The Korean
government today employs numerous policies to increase the
birth rate and overcome population aging.

⟨Table 1⟩ Total fertility rate trend in Korea (1980-2011)

(Unit: number of babies born)

Year	1970	1980	1990	2000	2005	2008	2009	2010	2011
TFR	4.53	2.83	1.60	1.47	1.08	1.19	1.15	1.23	1.24

Source: Statistics Korea, *Internal Migration Survey.*

The drop in the birth rate continues to shrink the labor force
available for Korea's future economic growth. As of 2010,

Korea was the country with the world's sixth-most rapid rate of decline in the birth rate.

[Figure 6] Projected rate of decrease in the Korean working age population (2040)
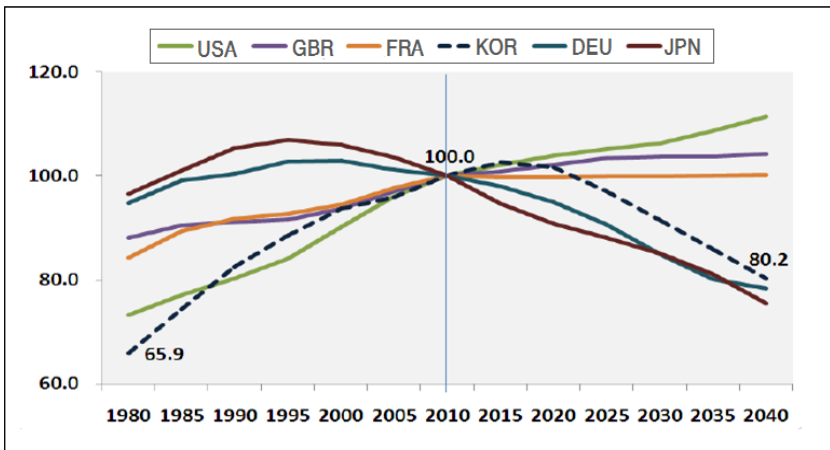
Source: Statistics Korea (2012b), *Changes in the Working-Age Population.*

The decreasing size of the working-age population, in turn, increases the social costs for supporting the retired, leaving the growing bill for future generations to pay.

3

Welfare Technology

3   Welfare Technology »

1. Definition

The Nordic states began to introduce innovative welfare pol-
icy measures, mostly catering to their increasing elderly pop-
ulations, under the name of "welfare technology." The concept
encompassed the changing demographic situation, the re-
structuralization of the welfare system, and the development
and use of new information-technology (IT) infrastructure.
Over the years, the concept of welfare technology has ex-
panded to include the application, the underlying system, and
the management of related technologies.

The definition of welfare technology, however, remains a
topic of persistent controversy.[3] The Nordic Council has de-
fined it as a new area of business capable of solving medical
and healthcare field problems as they arise and generating new
opportunities for exports. Sustainable development and public
procurement are two core concepts behind welfare technology
in the Nordic states. These concepts underlie the emphases on
user-centered innovation, on the one hand, and cooperation
between businesses and public authorities, on the other.

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3) Östlund et al. (2014).

Nevertheless, the term "welfare technology" is often used, even within Nordic culture, to refer to different things. Whereas the term carries an emphasis on both health and care in Denmark and Finland, it is used more to denote care in Sweden and the role of local governments in Norway.

The terms in the Anglo-American world that roughly correspond to "welfare technology" as used in Scandinavia are assistive technology and gerontechnology. Assistive technology is broadly used to refer to the tools, devices, and/or production systems that enhance, maintain and/or improve the productive capacities of individuals with disabilities (Schneider, 1999). Accordingly, the term is used to refer to a tool as simple as one that latches a pencil to the hand of a disabled student to facilitate writing and all the way up to tools as complex as robotic devices (Schneider, 1999). Assistive technology consists of four components: (1) an assessment of the specific needs that individuals with disabilities have in their surroundings; (2) the choice, design, application and maintenance of the devices or tools involved; (3) the training on how to use the given devices or tools; and (4) the integration of the given tools or devices with other available services (Schneider, 1999).

Gerontechnology, a blend of gerontology and technology, refers to technology specifically catering to the needs of the elderly. It involves engineering and technology that serve the interests of the elderly (Fozard et al., 2000). Gerontechnology,

however, may also be used to refer to an academic discipline that is concerned with developing technology that serves the elderly (Czaja et al., 2002). There are five main objectives to this discipline: 1) to prevent or delay the progression of functional decline or disorder in the elderly; 2) to find technical supplements to aging-associated functional decline or disorder in the elderly; 3) to improve quality of life and vitality for the elderly; 4) to support the relatives and caregivers of the elderly; and 5) to promote basic and applied research on aging-related technologies (Czaja et al., 2002).

A major concept closely related to gerontechnology is "ambient assisted living (AAL)." The term originates from the European Commission (EC)'s Assisted Living Joint Program, which was implemented from 2008 to 2013. The EC continues to operate the program, now under the name of the Active and Assisted Living Joint Program, with a 2020 deadline (EC, 2015). The program was introduced in order to prevent and manage chronic diseases; to enhance the independence and active participation of individual seniors in social life; and to support the occupational activities of the elderly with IT solutions (EC, 2015). The term "AAL" is used today to refer to not only this specific program, but also the general goals and lifestyles that the program and other similar policy measures promote. In other words, we may understand the concept of "AAL" to encompass all IT solutions, products, services and systems that

are intended to provide safe living environments, improve the quality of life, and make medicine and care more affordable for the elderly and the vulnerable (Cardinaux et al., 2011).

For our purposes in this study, we use the broadest possible sense of the term "welfare technology," which encompasses all the means and ends entailed in the aforementioned concepts. As the primary objective of welfare technology is to improve the quality of human life, we need to find means and mediums that can help us achieve that end.[4] A welfare system[5] that seeks to improve the quality of human life can require a wide range of diverse means and mediums. These are tools that can enable us to attempt and do things we have not attempted or done before and that help us enhance the productivity or effect of what we have already been doing.[6] Along with the evolution of human history, the level of complexity of the tools we have been using to improve the quality of human life has also progressed, from material and physical resources to mental resources (e.g., knowledge and wisdom) and to social resources (e.g., trustworthiness and charm). Given this evolution, the means we are looking for are more akin to "mediums" than to simple "tools."[7] Welfare technology therefore should be broad-

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4) Yun, S. (2011), *The Right Way of Life*, Seoul: Wisdom House, p. 5.
5) Throughout the remainder of this study, "welfare" is intended in a broad sense, i.e., encompassing healthcare and welfare services that are publicly funded.
6) Ibid., pp. 18-19.
7) Ibid., p. 25.

ly understood as involving the active use of science and tech-
nology as mediums that can help us achieve our end.
Policymakers until now have relatively overlooked the sig-
nificance and capability of science and technology[8] as me-
diums for improving the quality of human life. The application
of these mediums should enable us to achieve the ideals and
objectives of welfare that we have been unable to achieve thus
far and/or apply greater efficiency and effectiveness to pre-
viously obtained welfare goals.

The objective of a welfare system is to provide needed health-
care and welfare services to existing or anticipated relevant
demands. The results of this system are the healthcare and wel-
fare services and benefits a society enjoys. To provide these
services and benefits, we require the use of other tools or
mediums. We may categorize these tools or mediums into four
groups: namely, resources, operation, funding, and organization.

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8) In this study, "science and technology" refers to knowledge that has been
   scientifically organized. To use science and technology as mediums means to
   apply this organized knowledge to given tasks in a systematic manner. Yang,
   B. (2006), *Healthcare Economics*, rev. 2nd ed., Seoul: Nanam Publishing, p.
   383.

[Figure 7] Welfare technology and welfare system definitions
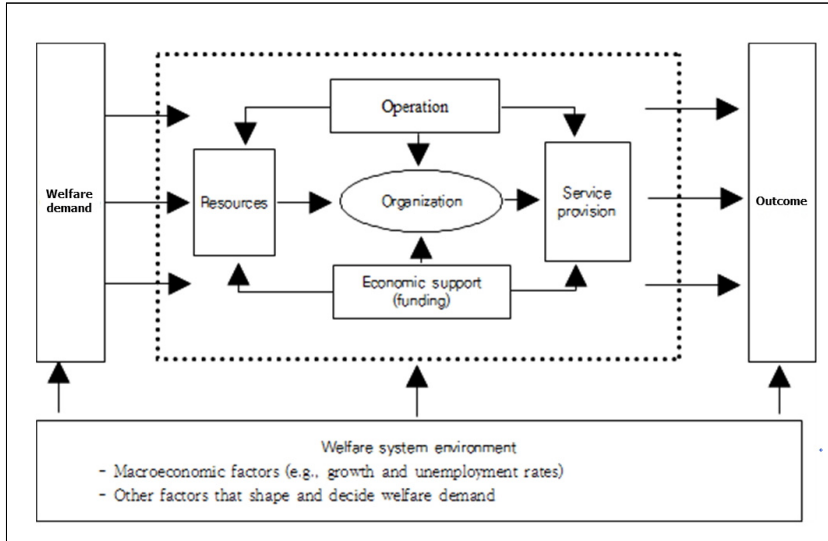
Source: Ryu et al. (2008), p. 92.

The means of welfare technology can also involve intangible knowledge pertaining to all four categories of inputs, i.e., resources, operation, funding and organization. Such knowledge may be put to use in order to produce welfare and healthcare services that directly solve the problems with demand or to assist the production and delivery of such services.

This study concerns both types of usage and comprehensively refers to all forms of science and technology used to solve the entire range of welfare problems. This concept of welfare technology encompasses the problems, ends and means of all other similar concepts worldwide, including welfare technology as used in the Nordic countries, the assistive technology and ger-

ontechnology of the Anglo-American world, and the European Commission's AAL.

2. Roles

The concepts of welfare technology as used in the Nordic states, the assistive technology and gerontechnology in the Anglo-American world, and Europe-centered AAL do not exactly distinguish the new and evolving roles of today's welfare technology from its more passive ones in the past.

All of these concepts confine the role of welfare technology to the mere provision of services and benefits to help passive disabled and elderly recipients overcome daily obstacles and problems. There is, however, a more active and emerging role of welfare technology that enables the recipients to participate more actively in productive and social life. Failure to seize upon this new role and capacity of welfare technology will only add to the skepticism regarding its application. Recent discourse in the Nordic states examines the new and more active roles of welfare technology.[9] Soendergaard (2014) lists welfare technology's four roles in

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9) Soendergaard, Dennis (2014), "Future Challenges and the Role of Welfare Technology," International Conference on Welfare Technology (November 18, 2014, Koreana Hotel), KIHASA, STEPI, NVC.

(1) Economics (nationwide and local);

(2) Public service innovation;

(3) Improving the quality of life for individuals; and

(4) Improving working conditions

The third role—improving the quality of life for individuals—reflects the traditional and passive understanding of welfare technology as narrowly serving the vulnerable. The first, second and fourth roles, on the other hand, imply the expansion of welfare technology toward creating new values. Through its role in the economy, welfare technology can help us countervail the negative impact of demographic changes, mitigate the direct fiscal pressure on local governments, and thereby continue to provide quality welfare services at more affordable prices. Moreover, welfare technology can bring public service up to date, opening up new horizons for politics and policy-making, and innovating public service in general. As for the quality of life for individuals, welfare technology can improve the quality of public services, enhance individuals' autonomy and capability, and help them regain the functions and abilities they have lost due to disability or aging. Welfare technology, finally, can reduce the risks of injuries and accidents in working conditions, minimize the workload, maximize workers' satisfaction and self-esteem, and replace human labor for simple repetitive tasks.

3. Science and technology and welfare costs

Science and technology can certainly be used as a means of welfare for improving the quality of human life. Now that rising welfare costs are emerging as a major problem in many societies, application of science and technology can also help maximize the cost-effectiveness of welfare services and benefits. It is thus time for us to examine the pertinent characteristics of science and technology that could be marshaled to improve welfare.

The progress of science and technology almost always serves to improve efficiency in the private sector. Application of the latest science and technology in the public sector, however, may raise the cost of providing public services. Consider the case of Korea's National Health Insurance (NHI). The program relies on public sources of funding, but the provision of medical and healthcare services under this insurance is mostly handled by for-profit, private-sector actors, who prefer to employ the latest science and technology. These actors' investment in high technology, in turn, leads to an increase in the cost of producing healthcare services, and thereby raises the national health expenditure, complicating the long-term prospects and sustainability of the NHI.

Consider the relationship between scientific and technological progress and social welfare costs.[10] In a society with low-grade technology, medical practitioners know little about

the causes and treatments of diseases. Little welfare inter-
vention can be applied toward improving the general quality of
people's lives as the lack of knowledge into the causal relation-
ships of related phenomena and structures is pervasive. In such
a society, welfare intervention remains passive, primal and
inexpensive. The limit on the amount of medical knowledge
keeps the state of medical technology in that society relatively
low-grade and incapable of providing the needed treatment,
and therefore keeps healthcare costs from rising.

Now, consider a society with intermediate-level technology.
In the healthcare realm, the society's medical practitioners may
lack perfect knowledge of the fundamental causes of diseases
but are nonetheless active toward finding and providing
treatment. The government of this society may lack full in-
formation and knowledge about the exact causal relationships
involved in improving the quality of life for citizens but may
still be active in providing welfare intervention and services.
With respect to cancer and cardiovascular diseases, Korea is in
this state of technology. The Korean government also provides
welfare intervention and services with respect to critical and
serious situations, but without the exact knowledge of the
causes and solutions of such situations. Welfare intervention in
an intermediate-technology is therefore costly.

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10) Thomas, L., *The Lives of a Cell*, New York: Bantam Books, 1975, re-quoted
in Yang (2006), p. 387. Yang expands upon Thomas' examples of medical
technology to find implications for the welfare system in general.

Let us now consider a society with high technology.[11] In the realm of medicine, the causes and treatments of given diseases are fully known. In the realm of welfare services, policymakers are well aware of almost all the causal relationships involved in improving the quality of life for citizens. Intermediate-level medical technology often requires the use of invasive forms of treatment, such as surgery. In a high-technology society, on the other hand, vaccines and drugs are preferred. As vaccines and drugs cost less than surgery, the transition from an intermediate-technology society to a high-technology society naturally helps to reduce the cost of healthcare. In an intermediate-technology society, medical practitioners may attempt to treat seniors with senile dementia, for example, by stimulating their emotional responses by means of computer technology or virtual reality. In a high-technology society with a fuller knowledge of dementia and its progression, however, medical practitioners may achieve the same result by letting senior patients keep and raise pets. The latter is the more advanced and cost-effective technology.

Figure 8 sums up this relationship between welfare technology and welfare cost.

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11) The concept of "high technology" as used in this study differs from the general usage of the term.

[Figure 8] Relationship of welfare technology and welfare cost
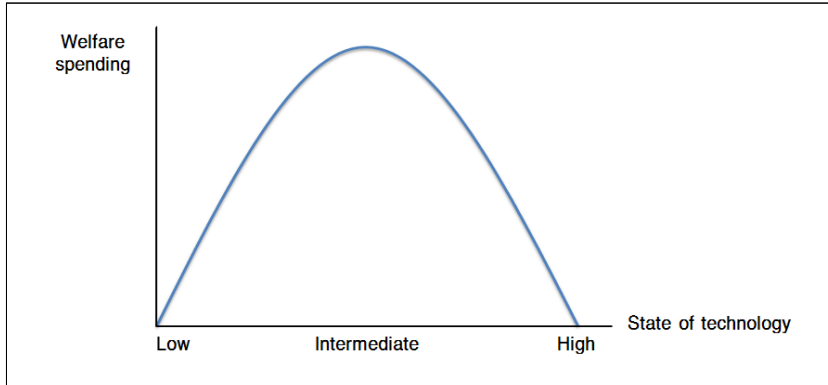
Source: Yang (2006), p. 308. Figure modified to suit this study.

In a welfare system, high technology based on full knowledge of the causal relationships involved in improving the quality of life helps to lower the welfare cost, while improving the quality of welfare services provided. This is why policymakers and researchers need to develop and adopt advanced science and technology into welfare policy, drawing on the full knowledge of the exact causes involved.

4. Welfare policy trajectory

(1) Reflections on the current state of the welfare policy and future aims

The foremost rule in introducing any new action or technology is that it ought to have a positive impact on people and the

world. Every action impacts the world system as we know it and affects human beings in diverse ways. We need to utilize a broad perspective on welfare policy by considering all options and alternatives in regard to all possible impacts before choosing any policy means.

People may differ on what "positive impact" a new welfare policy measure ought to achieve. Less controversial measurements of positive impacts on welfare policy include sustainability and improvement in the quality of life. Improving the quality of life is the central goal and direct end of welfare policies. As for sustainability, however, different policy choices may have different outcomes.

There are mainly three aspects to the sustainability of welfare policy measures: namely, ecological, social and fiscal. In order to be sustainable, a welfare policy measure must be ecologically feasible, socially inclusive, and fiscally viable.

Of these three, ecological feasibility is the first and foremost concept we associate with sustainability. Given the explosive pace of worldwide population growth and the exponential increase in the amounts of natural resources we consume, ecological considerations are key to the extinction or long-term survival of the entire human species. We may define a system's ecological sustainability as its capacity to preserve the natural environment enveloping its human inhabitants even while all the inhabitants continue to use the available natural resources

in the ways defined by that system. However, we also need to consider this ecological sustainability along with two other types of sustainability in order to reflect upon the current state of our welfare system and find pertinent implications for its future.

The discourse on our welfare system has been divided so far between left-wing advocates, who emphasize the social aspect of welfare sustainability and aspire toward a high-burden and high-welfare society, and the right-wing advocates, who emphasize the fiscal aspect of welfare sustainability and prefer a low-burden and low-welfare society. The ongoing controversy between these political camps is behind escalating social and ideological tension.

In reality, however, a high-welfare and high-burden society needs not be fiscally unsustainable, as the successes of Sweden and Germany illustrate. A low-welfare and low-burden society, similarly, is not always socially unsustainable, as attested to by the United States and Japan in their heydays. We need to outgrow the narrow-minded left-versus-right framework on welfare and find truly effective measures to improve it.

Consider the characteristics of a successful welfare state. The absolute level of welfare spending is, surprisingly, not as important as the following characteristics in such a society. First, whether that society is high-welfare and high-burden or low-welfare or low-burden, there is a broad society-wide con-

sensus on the appropriate level of welfare spending, as decided through representative politics. Second, the level of welfare spending, as approved by the entire society, is capable of solving the welfare problems to the extent desired by that society. Finally, the given level of welfare spending benefits the given economy, or at least does not exert negative impact thereupon. The welfare spending level is connected to a virtuous cycle within the whole economy.

There is one last crucial consideration we need to make. A given society cannot become a successful welfare state without securing strong society-wide consensus and support. The question of why some states succeed in achieving that consensus while others fail holds the key to finding successful welfare policy measures. While the question can be approached from a variety of perspectives, this study focuses on Samuelson's happiness equation.[12] According to Samuelson, happiness has the following ancient formula:

$$\text{Happiness} = \frac{\text{Material consumption}}{\text{Desire}}$$

In pursuit of happiness as conceived as such, humankind has been making efforts in two opposite directions. One involves minimizing desire. The other involves maximizing material consumption. The left-wing advocates and their right-wing

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12) Samuelson, Paul A., Economics, 8th ed., New York: McGraw-Hill, 1970, p. 745.

counterparts at least share this in common: that both equate greater happiness and better quality of life with increased material consumption.[13] In order for us to attain this goal, however, either our desire must remain the same or at least increase at a pace slower than that at which our material consumption increases. The problem today, however, is that we live in a society that endlessly increases and multiplies individual desires so as to keep the economy running and growing. The contradiction between the aim of welfare and the organizing principle of the economy is often behind the failure of a welfare policy, whether it be left- or right-leaning. We cannot, however, unrealistically assume that we can solve this problem by minimizing desire. The reason the West has historically been able to improve its quality of life far more substantially and successfully than the East can be found in the East's philosophical and social insistence on controlling desire. It is this Eastern approach that has failed to increase the overall society-wide level of happiness.

In reality, however, there are successful welfare states, such as Sweden, albeit few in number. These societies have experienced their shares of internal and external shocks that required

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13) Left-wing advocates believe that expansion of welfare is crucial to increasing material consumption society-wide, while their right-wing counterparts believe that material consumption can be increased society-wide only by reducing the government's role and expanding the sphere of the private sector. At any rate, both agree that increasing material consumption is imperative for happiness.

them to adjust their spending levels. Nevertheless, all of these societies have successfully reached broad consensuses on the desired levels of the three aspects of welfare sustainability. They have been able to achieve such consensus because they have transcended the either/or choice between material consumption and desire control. In other words, these societies exhibit a greater ability than other societies to readjust and redefine the relationship between material consumption and desire as the situation dictates. These societies appear to contain more autonomous individuals who are capable of adjusting the levels of their desire and material consumption. These societies also appear to be equipped with a public environment that fosters such individuals and greater civic initiatives over social issues. These individuals and societies start and finish their consensus building with ecological sustainability. In order for us to reach this kind of consensus on the future of our welfare system, we need to focus on the ecological sustainability of our welfare policy and redefine the relationship between material consumption and desire with freedom that transcends the left-right divide.

(2) Future of the welfare system and appropriate technology

Appropriate technology may hold the key toward achieving a society-wide consensus on the future of our welfare system. The concept is given diverse definitions. Consider the following:

"Can we overcome social conflicts with science and technology? I believe so, granted that a certain order is met. Let us first relinquish the blind belief in science and technology as capable of providing an answer for everything. Let us, instead, turn our attention to appropriate technology, which caters to the needs and narratives of people who are at the center of social conflicts."[14)

"Appropriate technology is technology that is appropriate. The term was originally conceived to refer to nature-friendly technologies that catered to the specific needs of the Third World and that helped to save resources and energy. Today, however, the term is used to refer to any technology that is used to create products that are appropriate to modern societies."[15)

"Appropriate technology refers to a technology that does not require much investment for its realization, that is energy-efficient, and that anyone could learn and apply easily. The core characteristic of appropriate technology is that it enables a small number of people to produce what they need using readily available local resources. That is why appropriate technology renews the hopes and dreams of people who have to fight daily for survival in the least developed countries."[16)

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14) Kim, J., "Can we solve social conflicts with science and technology?", bbs1.agora.medea.daum.net
15) EBS, "Eco-friendly Appropriate Technologies for Autonomous Life," *One Earth We Know* (aired on September 6, 2013).

These remarks reveal the evolution of appropriate technology from a term referring to sustainable and eco-friendly technology specifically suited to the resource- and energy-saving needs of developing countries to a term today that refers to technology that caters to the needs and conditions of the people who need and use it. Given the pressing nature of growing concern worldwide with ecological sustainability, appropriate technology today needs to be first and foremost eco-friendly. In this day and age, we need ecologically sustainable technology that will allow us to use natural resources without destroying the natural basis for our survival. This function and role of technology can help us drive and shape the consensus on welfare that we need to reach.

Given our desires and human-centered perspectives, we need high technology that is also appropriate, as opposed to the most cutting-edge, in order to find and develop well-suited means to improve our quality of life. This is because, first, the latest cutting-edge technology is more likely than not to be vulnerable to global crises, such as climate change, food insecurity, financial crises, energy crises, and natural disasters. Second, cutting-edge technology may not be suited to all societies and therefore turn out to be unsustainable in implementation. Third, cutting-edge technology also tends to

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16) Korea Intellectual Property Office (KIPO) official blog, "A World of New Ideas," blog.daum.net/kipoworld/1734.

reduce the scope of the user's autonomy and capability.[17]

Consider a hearing impairment that substantially lowers the quality of improvement without proper care and support.[18] This kind of impairment can seriously limit the scope of one's activity and interpersonal relations. A hearing aid costs about KRW 2 million (USD 1,665) on average in the Korean market, and national health care only covers KRW 0.34 million (USD 283) of that expense. Hearing aids are so expensive because they are custom-made for each wearer. Delight Hearing Aids® provide a good example of appropriate technology. These earphone-like hearing aids of universal design can fit almost any wearer and are offered at a significantly lower price (KRW 0.34 million), so government support could cover the entire cost. This kind of appropriate technology does not require a lot of resources and is exceptionally sustainable, resilient to external economic shocks and helpful for the poor, thereby enhancing the autonomy and capability of hearing-impaired individuals.

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17) Kim, bbs1.agora.medea.daum.net.
18) Kim, bbs1.agora.medea.daum.net.

4 Preconditions for welfare technology success

4

Preconditions for welfare technology success 《

1. A common prerequisite: coordination infrastructure

There is yet no established body of literature on the common grounds and prerequisites for the success of welfare technology. Based on a literature review and consultation with experts, this study identifies preconditions that must be met for welfare technology to succeed in a given society. These preconditions form an overarching infrastructure upon the basis of which welfare technology is to be introduced and implemented. They include the following:

(1) Mechanisms for coordination among diverse stakeholders (particularly between the public sector and the private sector with respect to funding);

(2) A structured process for developing and implementing welfare technology;

(3) An evaluation system;

(4) A system for collecting and sharing relevant experiences and data.

2. Coordination among diverse stakeholders (public sector vs. private sector)

The Nordic experience attests to the paramount importance of local governments in adopting and advancing welfare technology. In order for welfare technology to be effective, it must be implemented amid appropriate motives and incentives with management structures to accommodate change and expansion. Local governments are better equipped than non-public actors to procure the financial resources necessary to prepare these preconditions.

In Denmark, for example, the public sector and the private sector work together and divide their roles and responsibilities regarding welfare technology in three phases. In the first phase of development, the private sector remains reluctant to invest in welfare technology, which still harbors much uncertainty and risks. The innovative and creative Danish public sector thus steps up to the task of providing sufficient financial and other incentives for private businesses, research organizations and universities to develop welfare technology.

In the second phase of evaluation, the public sector simulates actual environments of use in order to assess and evaluate the welfare technology resulting from the first phase and thoroughly assesses it in order to find and determine truly cost-effective alternatives. In the third phase of execution, the public sector compiles a list of cost-effective welfare technologies that

have been selected in the second phase, and encourages increased participation from the private sector. The Danish local governments may also mandate the use of welfare technologies whose cost-effectiveness has been proven and leave their fate up to market competition from then on.

In order for the public sector to play a leading role in funding and developing welfare technology, the public sector itself must be innovative, creative and efficient. Given the need for the aforementioned preconditions to be met and also the heavy public emphasis placed on the Korean welfare system, it is nearly impossible for the Korean private sector to lead the process of developing and implementing welfare technology on its own at present.

3. Structured workflow

The successful establishment of welfare technology requires a streamlined and structured workflow. Such a workflow or process enables policymakers to identify and collect all the possible economic benefits of implementing such technology to maximize the likelihood of success and also to maximize the returns on the resources invested in developing that technology.

Denmark, again, has such a well-established structured workflow with respect to implementing medical welfare

technology. The Danish model assumes that the aging of the Danish population will increase the demand for medical services, including treatments and hospital wards, while the available amount of economic resources will either remain the same or decrease in the future. The model also assumes that the size of the labor force in medicine will also decrease. Under these assumptions, Danish medical practitioners and policymakers believe that the quality and success of medical care in the future will depend on enhancing the efficiency of services provided, for instance, by reducing the required number of hospitalization days from three to one. This will require careful diagnoses; release of patients after initial treatment; and provision of rehabilitation, monitoring, care and additional treatments at home so as to prevent re-hospitalization.

[Figure 9] Danish "Platform Model"
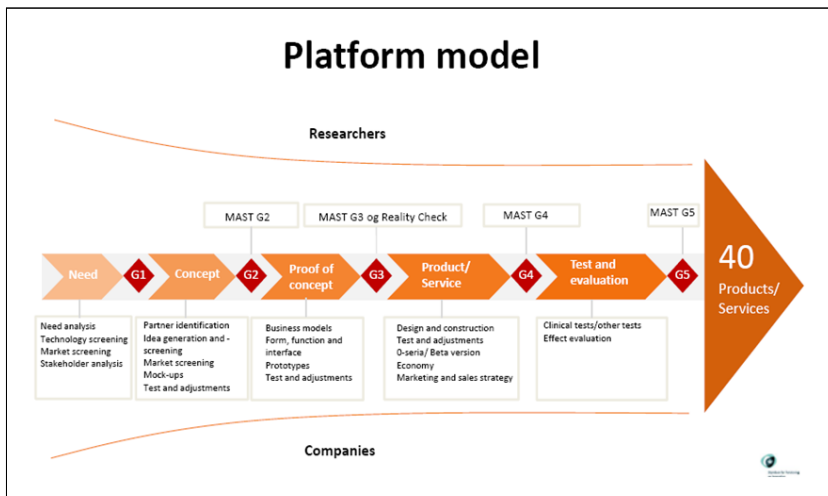
The platform model provides for a structured workflow that proceeds from researchers via corporations to public clients and that involves the following six phases:

(1) Need: need analysis, technology screening, market screening, and stakeholder analysis;

(2) Concept: partner identification, idea generation and screening, market screening, mock-ups, testing and adjustments;

(3) Proof of concept: business models, form/function and interface, prototypes, testing and adjustments;

(4) Product/service: design and construction, testing and adjustments, O-series/beta version, economy, marketing and sales strategy;

(5) Testing and evaluation: clinical/other tests, effect evaluation; and

(6) Products/services.

It is important to note that this process starts with need analysis. Need analysis is crucial in order for the final product or service to cater to the actual needs of consumers. The process also involves the continuous use of an evaluation program known as the Model for Assessment of Telemedicine (MAST). This is also crucial to the success of the final product or service on the market.

The model can be simplified to a more generic formula:

(1) Match the needs with technology (a job for the government/public sector);

(2) Choose the right technology (a job for researchers and re-
search organizations);

(3) Commercialize the technology and conduct pilot tests
through innovative projects (using appropriate test envi-
ronments, such as robotic labs and simulated living envi-
ronments); and

(4) Choose the procurement agency and supplier and execute
(a job that involves the private sector and possibly other
stakeholders).

The two central components that must be supported by a
structured workflow for welfare technology are research and
development, on the one hand, and implementation and com-
mercialization, on the other.[19] There is a growing emphasis on
implementation and commercialization today more than on re-
search and development. This reflects the reality in Denmark
that the public clients of welfare technology are involved in
hundreds of pilot projects at any given moment, but only a few
of these projects ever lead to successful implementation and
commercialization. The main job of public clients is to provide
the necessary welfare services, not to research and develop
technology. There are, however, far more innovative attempts
that fail than succeed.

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19) Nijhoff, Joost (2014). "The Coordination of Welfare Technology, International
Conference on Welfare Technology" (November 18, 2014, at the Koreana
Hotel), KIHASA, STEPI, NVC.

4. Construction of an evaluation system

Evaluating and keeping records of welfare technology under development require resources and time. In reality, too many projects and tests take place, leading to the multiplication of infeasible commercial examples and ineffective evaluations. In order to achieve significant improvement in the quality and feasibility of welfare technology under development, it is crucial to evaluate the ongoing projects thoroughly according to a predefined scheme from the very beginning. Consider the example of MAST, the EC's evaluation manual regarding telemedicine.

A. Background and development

(1) Necessity of telemedicine

MAST is an evaluation manual that the EC has developed, through its Metho-Telemed Project, for the assessment of telemedicine technology under development (Nykänen et al., 2006). Telemedicine can be defined as a process of creating and delivering medical services to patients at remote locations via the means of information and communication technology. The concept encompasses not only specific devices that are used to provide such services, but also the entire range of activities and services involved in producing and delivering such services (Kidholm et al., 2012).

Europe's population continues to age, the number of patients with chronic diseases is increasing, and the size of the available medical staff is shrinking, while the demand for better quality medical care is on rise. The EC is seeking an effective alternative solution in telemedicine (EC, 2009). There are three main benefits of telemedicine (EC, 2009). First, on the individual level, telemedicine enables patients with chronic diseases to stay within the comfort of their own homes by providing constant monitoring, thus minimizing the number of hospital visits and thereby improving their health and satisfaction. By allowing patients to stay in a familiar environment and social network, telemedicine also minimizes isolation, thus diminishing psychological stress that could impede recovery. Second, telemedicine can be an effective solution to the shortages of medical practitioners at remote and sparsely populated locations. It also helps patients save money by minimizing the length of their hospitalization. Finally, on the level of the European economy, telemedicine holds out much promise as a new and emerging market and may possibly become a new source of growth for the European economy in the future.

(2) Effectiveness of telemedicine

Nevertheless, there is a persistent dearth of literature that scrutinizes the effectiveness of telemedicine (Kidholm et al., 2012). Hailey et al. (2002) surveys 66 studies that were pub-

lished between 1966 and 2000 on the effectiveness of telemedicine, 37 of which concluded that telemedicine offered many benefits that other approaches and alternatives lacked. A number of these affirmative studies, however, entailed methodological defects. Few of these studies were sufficiently quantitative. The majority of the studies offered findings and results that could not be generalized. Currell et al. (2000), a similar attempt at surveying the existing literature, also concludes that little evidence exists as to the clinical benefits of telemedicine.

Addressing the shortage of studies that satisfactorily prove the effectiveness of telemedicine, the EC launched the Metho-Telemed Project in 2009 with the goal of developing guidelines to support consistent evaluations of telemedicine programs (Kidholm et al., 2012). The project involved systematic reviews of established studies on telemedicine. Led by Ekeland et al. (2010), these reviews concerned studies on the benefits and costs of telemedicine services, including all forms of electronic healthcare interventions, information and communication technology used for medical purposes, Internet-based interventions and treatments, and social care. The authors reviewed 1,593 studies in total, but their goal was identifying the basic factors and criteria that must be considered in evaluating telemedicine rather than determining the effectiveness of telemedicine itself. Ekeland et al. (2010) became a building block for the development of MAST.

(3) Development process

MAST was developed on the basis of Ekeland et al. (2010) through two workshops organized in July and November 2009, respectively. Each workshop comprised 20 stakeholder representatives and telemedicine users (EC, 2009).

The purpose of the first workshop was to identify and gather all the literature and information needed to simplify the telemedicine technology decision-making process (EC, 2009). The workshop first began with a discussion of how telemedicine was to be evaluated at the local, regional and national levels. The attendants emphasized that an evaluation model must examine the diverse aspects of telemedicine technology, including economic sustainability, patients' perception of the technology and its effects, safety, the technology's impact on workflow and cooperation between primary care and secondary care, ethical and legal issues, and the generalizability and applicability of the results of evaluation.

In the second workshop, the participants proposed and discussed diverse candidate models and approved a draft plan (EC, 2009). The participants offered diverse takes on the proposed models, and noted that: 1) the model should have clearly stated goals and objectives; 2) descriptions of the objectives of telemedicine technology should be included in preceding considerations; 3) the effects of using telemedicine technology on the family members and caregivers of patients should be taken into

account; and 4) studies on safety and feasibility should be conducted before studies on the clinical and economic benefits of telemedicine technology.

B. Content of MAST

1) Evaluation objectives

Based on the two workshops, the Metho-Telemed project team concluded that the model should provide a multidisciplinary process of evaluation if the goal of such evaluation is to provide information on the effectiveness and quality of telemedicine to support decision-making. In other words, the resulting model should provide, in a systematic, accurate and scientifically valid manner, information on the medical, social, economic and ethical implications of using telemedicine (Kidholm et al., 2012).

The keywords we should note here are "multidisciplinary," "systematic," "accurate," and "scientifically valid" (EC, 2009). The first of these terms indicate that the resulting model should take into account all the diverse effects of telemedicine on patients, doctors, the medical system and the society as a whole. The "systematic, accurate and scientifically valid" manner in which such a model is to be used indicates the importance of the scientific method in its development.

2) Phases

The MAST evaluation process is divided into three phases: preceding considerations, multidisciplinary assessment, and transferability assessment (Kidholm et al., 2012). Each phase is explained in greater detail below on the basis of EC (2009) and Kidholm et al. (2012).

(1) Preceding considerations

The purpose of preceding considerations is to clarify the objectives of telemedicine applications and determine other possible alternatives for achieving those objectives. The process involves determining the health problems addressed by the applications and how and why the applications should be used to treat those problems. The advantages and benefits that the applications have over alternative treatments must become clear in this phase.

Preceding considerations are also necessary with respect to the following questions: 1) Does the given telemedicine service comply with existing law?; 2) How is the cost of the service to be allocated and shared?; 3) How mature is the given technology?; and 4) How many patients are likely to use the given technology?

First, in regard to telemedicine technology compliance with existing local and national laws, the evaluator must take into

account laws that regulate the provision of medical services, the procedure for authorizing medical service providers, and the legal liabilities attendant upon the provision of medical services. Next, the evaluator must consider how the cost of the given telemedicine service is to be allocated. Cost considerations are particularly important, as they could decisively affect the ensuing analysis of economic feasibility.

The evaluator must also consider the maturity of the technology involved in the given telemedicine application. This means that the application must be first and foremost safe to use and supported by a well-realized technology. Technology that is still under development and requires much improvement is not a fitting subject of evaluation, according to MAST.

Finally, the evaluator should also take into account the likely number of patients to benefit from the telemedicine application. The development of such an application can be a costly affair and also requires the re-training of medical practitioners and the altering of their working conditions. Adopting a telemedicine application therefore could generate a serious amount of fixed costs. It should, consequently, be supported by a sufficient number of patients who are to benefit from it.

(2) Multidisciplinary evaluation

Multidisciplinary evaluation specifically involves assessing the anticipated outcomes of a given telemedicine application

in terms of seven areas, according to a systematic review criteria. The areas include: 1) description of the target health problem and the application; 2) safety; 3) clinical effectiveness, 4) patient perspectives; 5) economic aspects; 6) organizational aspects; and 7) socio-cultural, ethical and legal aspects.

In reviewing the description of the target health problem and the application, the evaluator examines the main purpose of the application and how it is being used at present. The evaluator's focus is on the nature of the given health problem, the description and aspects of the technology used, and how commonly the technology is being used today. As for safety, the evaluator examines the clarity and predictability of all the possible side effects and losses associated with using the given application and the extents of their severity. In particular, the evaluator should be concerned with the clinical safety of the application on target patients and medical practitioners and also with its technical safety/reliability. Next, the evaluator assesses the clinical effectiveness of the application on the target patients' health. This may be measured in terms of the application's effects on death rates, prevalence rates, indicators of health and the quality of life, behavioral changes, and access to medical services. As for patient perspectives, the evaluator reviews the application pertinent to various issues from the perspective of patients and caregivers. These issues include patient satisfaction with or acceptance of the application, pa-

tients' comprehension of the relevant information, the certainty of treatment, patients' or caregivers' ability to use the application, accessibility of the application, and other self-efficacy concerns.

As for economic aspects, the evaluator assesses the cost, income and other business opportunities or losses that the application might generate. These include the amounts of resources required to deliver the application to target beneficiaries, the price of each resource, changing rates and prices of medical services, clinical effectiveness, and the yearly cost and benefit of using the application. As for the organizational aspects, the evaluator reviews what types of resources are to be transferred or mobilized to use the given application and other additional organizational changes that the use of the application could cause, particularly with respect to the production process and structure, culture, and management. Finally, the evaluator takes into account the socio-cultural, ethical and legal implications that the use of the application could entail for the lives of patients and the society.

(3) Transferability evaluation

Another key criterion that must be considered in evaluating telemedicine technology is whether the results of the evaluation could be generalized and applied to other environments and technologies. (Generalizability and applicability must also

be considered in each of the seven areas of multidisciplinary evaluation.)

Consider the example of clinical effectiveness: it should be clear that the clinical effectiveness ascertained by the evaluation must be obtainable using the given application in actual and different environments. In economic evaluation, the evaluator should also consider by how much the cost of the application will rise if the number of patients in need of it increases abruptly and significantly.

Each evaluation, moreover, should be made on the basis of the existing literature. The technology underlying the given application may be unusable in other regions due to legal, financial and/or organizational issues, and the cost-effectiveness of the same application may vary from nation to nation or region to region due to these issues. It is only when sufficient considerations are given to these matters that the application can be used widely and commonly across different regions.

MAST is not a legally required evaluation scheme. It is rather a manual of evaluation that is meant to help people make proper evaluations of the increasing number of emerging and diverse telemedicine applications. MAST serves to show us that there are indeed diverse dimensions and aspects we must consider before adopting a telemedicine application, and that cost-effectiveness of such applications matter at least as much as clinical effectiveness. It should remind us of the fact that

there is no reason for us to assume that a cost-effective in-
novative application in Europe will be similarly cost-effective
and beneficial in Korea. Korea thus needs to develop its own
scheme or manual of evaluating new telemedicine and other
medical technologies. MAST is meant to serve reference pur-
poses only.

5. Collection and exchange of experiences and data

As for the conditions necessary for the successful collection
and exchange of experiences and data, we may refer to the
case of the Nordic Center for Welfare and Social Issues'
CONNECT program.[20]

The program authors acknowledge that welfare technology
should outgrow the stage of innovative pilot projects and merge
with effective channels of public service provision and delivery.
There are, however, numerous challenges that must be over-
come in order for this transition to occur. These include:

- Too many projects with too little end product;

- A general tendency for having too much focus on
  simply participating in projects rather than insuring
  that the knowledge obtained is actually embedded

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20) See "CONNECT: Collecting Nordic Best Practice within Welfare Technology,"
   http://www.nordicwelfare.org/PageFiles/18765/connect%20folder.pdf.

throughout the organization;

- A continuous reinvention of the wheel through a profound lack of knowledge sharing, leading to inefficient use of public resources; and

- A weak common Nordic market for welfare technology.

The CONNECT authors locate the fundamental cause of these problems in the lack of a system for collecting and sharing relevant experiences and data. The CONNECT Project therefore aspires toward presenting a complete tool for collecting data on the best practices of welfare technology in the Nordic countries throughout their entire processes. The project thus requires 10 chosen and leading local governments in the Nordic countries to collect, in a bottom-up manner, the best practices and knowledge of welfare technology. This will maximize the likelihood that numerous welfare technology projects can bear actual and substantial fruit that can be readily used in real life.

A common working tool like CONNECT will promote the exchange of knowledge and data not only within a nation but throughout a region. The common standards of welfare technology that will be bred and developed through this process will enable welfare technology businesses to access other markets in the region with greater ease, thus strengthening a com-

mon regional market.

The project, moreover, will also have a positive impact on politics. As the 10 chosen local governments compile and share their experiences with various structural, organizational and legal obstacles to the successful implementation of welfare technology, policymakers will be able to identify and focus on key problems and produce better and more effective legislations in the future.

5 Conclusion

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Welfare technology is capable of providing effective solutions for foreseeable welfare system problems caused by declining birth rates, population aging, and slow economic growth amid the rising demand for more and better welfare services and the increasing shortage of available resources.

Welfare technology refers to all attempts to make active use of science and technology to improve welfare. From the perspective of the welfare system, the concept encompasses intangible knowledge about all the resources, operations, funding, and organizations involved in providing welfare services. Welfare technology, in other words, may be used not only to produce and deliver new welfare services directly, but also to supplement and reinforce the production and distribution processes of the existing services.

Welfare technology today is not only about providing predefined welfare benefits and services for passive recipients but increasingly concerns enhancing the ability of recipients to participate actively in productive and social life. Welfare technology today therefore not only strives to improve the quality of life for individual recipients but also plays pivotal roles in the national economy, innovation and the improvement of

working conditions.

In order for welfare technology to play all of these new and more active roles, it must be economically feasible with high technology supported by almost complete knowledge of all the causal relations involved in the target phenomena and appropriate technology that takes into account the particular characteristics and needs of a given society.

Developing and applying such welfare technology requires the following policy considerations and innovations. First, technology is crucial to welfare because the enhanced efficiency and reduced costs can stop or delay deterioration of quality in welfare services. To achieve this, however, policymakers need to identify and choose appropriate welfare technologies capable of improving the quality of services and life and minimizing the consumption of resources simultaneously.

Second, the role and powers of local government organizations should be strengthened. In order for welfare technology to be effective and useful, it should be implemented with appropriate motives and incentives and also be supported by proper, adaptive management systems. All of these can be best achieved when the public sector and local governments invest their own resources instead of waiting for external actors and private-sector entities to start investing.

Third, welfare technology should be developed and introduced in a structured workflow. Such a standardized process

is crucial to identify and ensure the anticipated economic benefits of implementing welfare technology. Only with such systematic and structured efforts can we maximize the likelihood of success and the resulting returns on investment.

Fourth, necessary resources and time must be invested in developing a systematic program or scheme for evaluating welfare technology so as to produce and record valid evaluations. Too many projects and pilot tests lead to the multiplication of invalid and ineffective reports and products. In order to ensure the economic benefits of welfare technology, technology should be submitted to thorough assessment from the very beginning.

Fifth, we need a systematic program for collecting and sharing the relevant experiences of welfare technology to minimize redundancy and the waste of resources. Systematic collection and exchange of such data at home and abroad is crucial to the optimization of the use of resources. Cooperation and exchange can be best achieved with the help of a structured public workflow and thorough preparations for evaluation.

References

[KOREAN SOURCES]

Kim, J., "Can we solve social conflicts with science and technology?", bbs1.agora.medea.daum.net (retrieved on May 5, 2014).

Yang, B. (2006), *Healthcare Economics*, rev. 2nd ed., Seoul: Nanam Publishing.

Ryu, G. et al. (2008), *Achieving Appropriate Healthcare and Welfare Spending*: Policy Tasks, KIHASA.

Yun, S. (2011), *The Right Way of Life*, Seoul: Wisdom House.

Statistics Korea (2011). *Future Population Projections*: 2010-2060 (press release, on December 7, 2011, from the Population Trend Division under the Social Statistics Bureau).

Statistics Korea, "Birth Rate Estimates," *Government-Approved Statistics No. 10103*.

Statistics Korea, *50 Million in South Korea* (press release, on June 22, 2012, from the Population Trend Division under the Social Statistics bureau).

Statistics Korea, "Birth Statistics of 2013 Confirmed" (press release, on August 26, 2014, from the Population Trend Division under the Social Statistics Bureau).

KIPO official blog, "A World of New Ideas," blog.daum.net/kipoworld/1734.

EBS, "Eco-friendly Appropriate Technologies for Autonomous Life," *One Earth We Know* (aired on September 6, 2013).

[ENGLISH SOURCES]

Cardinaux, F., Bhowmik, D., Abhayaratne, C., Hawley, M. S. (2011). Video based technology for ambient assisted living: A review of the literature. *Journal of Ambint Intelligence and Smart Environments*, 3, pp. 253-269.

Currell, R., Urquhart, C., Wainwright, P., Lewis, R., (2000). Telemedicine versus face to face patient care: effects on professional practice and health care outcomes. *Cochrane Database of Systematic Reviews*, 2, CD002098.

Czaja, S., Charness, N., Fisk, A. D., Rogers, W., (2002). Welcome to gerontechnology 2002: Creative use of technology for better aging. *Gerontechnology*, 2(1), pp. 1-2.

EC. (2009). *Telemedicine for the benefit of patients, healthcare systems and society, Commission Staff Working Paper, SEC (2009) 943 final.*

EC. (2015). *The Active and Assisted Libing Joint Programme.* (http://ec.europa.eu/digital-agenda/en/active-and-assisted-living-joint-programme-aal-jp, retrieved on January 15, 2015).

Fozard, J. L., Rietsema, J., Bouma, H., Graafmans, J. A. M., (2000). Gerontechnology: Creating enabling environments for the challenges and opportunities of aging. *Educational Gerontology*, 26, pp. 331-344.

Hailey, D., Roine, R., Ohinmaa, A., (2002). Systematic review of evidence for the benefits of telemedicine. *Journal of Telemedicine and Telecare*, 8 (Suppl. 1), pp. 1-7.

Kidholm, K., Ekeland, A. G., Jensen, L. K., Rasmussen, J., Pedersen, C. D., (2012). A model for assessment of telemedicine applications: MAST, *International Journal of Technology Assessment in Health*

Care, 28(1), pp. 44-51.

Nijhoff, Joost, (2014). *The Coordination of Welfare Technology, International Conference on Welfare Technology* (2014. 11. 18. Koreana Hotel), KIHASA, STEPI, NVC.

Nordic Centre for Welfare and Social Issues (NCWSI). (2010). *Focus on Welfare Technology*.

Nykänen, P., Brender, J., Talmon, J., de Keizer, N., Rigby, M., Beuscart-Zephir M., Ammenwerth, E., (2011). Guideline for good evaluation practice in health informatics (GEP-HI). *International Journal of Medical Informatics*, 80, pp. 815-827.

Östlund, B., Olander, E., Jonsson, O. and Frennert, S. (2014). STS-inspired design to meet the challenges of modern aging. Welfare technology as a tool to promote user driven innovations or another way to keep older users hostage? *Technological Forecasting and Social Change*, available online, 1-9.

Samuelson, Paul A., (1970). *Economics*, 8th ed., New York: McGraw-Hill.

Schneider, M., (1999). Achieving greater independence through assistive technology, job accommodation and supported employment. *Journal of Vocational Rehabilitation*, 12, pp. 159-164.

Soendergaard, Dennis, (2014). Future Challenges and the Role of Welfare Technology, *International Conference on Welfare Technology* (2014. 11. 18. Koreana Hotel), KIHASA, STEPI, NVC.

Thomas, L., (1975). *The Lives of a Cell*, New York: Bantam Books.