BUILDING A NATIONAL TECHNOLOGY AND INNOVATION INFRASTRUCTURE FOR AN AGING SOCIETY

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Abstract

This thesis focuses on the potential of strategic technology innovation and implementation in sustaining an aging society, and examines the need for a comprehensive national technology and innovation infrastructure in the U.S., capable of supporting the development and use of technologies by the aging population and their caregivers.

The pervasiveness of population aging makes it a primary concern for nations around the world today. As the inadequacies of existing resources become apparent, policy makers are now turning to technology and innovation to cope with the changing demographics. Technological innovations to accommodate the elderly have existed since centuries ago, and they been useful in extending the human capability beyond perceived limitations of aging. However, new technologies developed with the same objectives are not widely adopted and accepted by the aging population today.

The thesis is divided into two complementary sections. The first examines three hypotheses for the slow penetration rates of new technologies for aging: 1) Useful, affordable and usable technologies are unavailable, 2) Professional carers that can play a catalytic role between technological innovation and implementation are not technologically educated and prepared to incorporate the technologies into elderly care, and 3) The dynamics of policy formation and agenda setting are not conducive to the design and implementation of "technology for aging" policies.

The second section consists of two comparative studies to highlight the gaps within the existing "technologies for aging" industry infrastructure. A study of the domestic automobile and mobile telecommunications industry provides a national perspective, whereas a study of eleven industrialized nations engaged in technological innovations for the elderly provides an international perspective.

The research shows that useful, affordable and usable technologies are available, but their diffusion is hindered by inadequate human capital development and an unconducive policy formation and agenda setting climate. The comparative studies further illuminate existing infrastructure gaps and also provide useful frameworks to facilitate the bridging of these gaps. By facilitating the development of a robust "technology for aging" infrastructure, policy makers can help to ensure that the U.S. is ready to meet the challenges of an aging population.

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… …

The laughter shared will always bring a smile to my face.
The times spent together will always be held dear in my heart.

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MOTIVATION

Innovation is sometimes likened to bright sparks of ingenuity that emerge unexpectedly and unsynchronized, and at other times likened to fruits painstakingly nurtured by carefully designed policies and plans.

Often seen as the key to success for individuals, teams, organizations or countries, we now turn to innovation for answers to many of our problems and concerns today, from environmental pollution and energy scarcity to overburdened health care systems and economic security. Over time, we have come to associate innovation with cost savings, enhanced performance and increased productivity, and a lack of innovation with obsolescence, high costs and low capacities.

… … … …

Population aging is an issue understandable to all, yet it holds very different meanings for each of us. Some of us regard it as a macro social phenomenon to be dealt with by governments and community leaders, and some of us experience firsthand the emotional, financial and physical stress of caring for our aging parents.

As we prepare to take on the responsibility of caring for our aging parents, we begin to realize that aging is more complicated than it appears to be. The effect on families and societies are broad and far reaching, and many of us will be caught unprepared by the challenges of balancing school, work, family life and care giving.

How do we envision our own aging? What do we imagine our living, working, playing environments to be like? Do we have goals or dreams that we hope to fulfill, and how do we imagine ourselves fulfilling them? Most importantly, what resources do we have to help us achieve these goals?

… … … …

An aging society can be an ideal hatchery for innovations, as the heterogeneity of the aging population creates a myriad of demands for innovations, both technological and social. Technological innovations in particular hold much promise in helping us fulfill a wide range of physical and social needs that become more critical as we age. For the benefits of these innovations to be fully captured, there must be an innovation infrastructure that has the capacity to select, support and facilitate rapid diffusion of useful innovations into the society.

The need for an innovation infrastructure forms the foundation for this thesis. It creates the necessity for a study of current inadequacies, areas for improvement, and potential or existing barriers to infrastructure development. This thesis seeks to provide a comprehensive analysis and discussion of these issues, and aims to provide the building blocks of a framework for the successful construction of an innovation infrastructure for an aging society.

THESIS SCOPE

This thesis utilizes a systematic approach to illustrate and examine the need for an innovation infrastructure for an aging society. Although innovations may include both technological and social innovations, I have chosen to focus predominantly on technological innovations in this thesis. Past and existing research on the relationship between technological innovation and aging have focused on design aspects of technology development and preferences or demands of elderly users, without significant exploration of the role of government entities, policy makers and aging services providers. My research aims to bridge this gap by examining the roles of these actors in fulfilling the need for a comprehensive innovation infrastructure capable of supporting and nurturing technological innovations for an aging society.

To demonstrate the need for a national innovation infrastructure, I first discuss the social, economic and political challenges brought about by global aging and the opportunities for technological innovation. Despite the potentials of technological innovations, the society has not been successful in leveraging the benefits of technologies for the elderly in an efficient manner.

Three hypotheses to account for the suboptimal development and diffusion of these technologies were next developed and examined. The hypotheses are:

1. Useful, affordable and usable technologies are unavailable
2. Professional carers that can play a catalytic role between innovation and implementation are not technologically educated and prepared to incorporate innovations into elderly care.
3. The dynamics of policy formation and agenda setting are not conducive to the implementation of "technology for aging" policies.

After establishing the need for an innovation infrastructure and identifying key factors that impede the development of such an infrastructure, I present two comparative studies to illustrate the critical elements of innovation infrastructures. The first utilizes an industry level comparison to map out what successful industry infrastructures are like. The second adopts an international perspective by examining "technology and aging" policies and initiatives in 11 developed countries around the world. These two comparative studies can provide building blocks for policy makers to plan for rapid and successful development of the "technologies for aging" industry.

CHAPTER 1: AGING – AN INTRODUCTION

Population aging is one of the 20th century's greatest success stories. Rapid economic development, advances in health care and triumphs in science and medicine have given us the gift of longevity. Yet as we celebrate our victories over the limitations of human life expectancy, we need to face the challenge that longevity has placed before us. Countries that have rejoiced over lower mortality rates now have to grapple with national development and sustainability issues as they plan for their rapidly aging populations.

The subject of "Aging" can be studied from several different perspectives. Aging affects the sustainability of the world as a whole, the development and competitiveness of countries, the cohesiveness and vibrancy of communities, as well as the physical and psychological well-being of each individual.

Global Aging

Global aging was set in motion long before it first emerged as a concern for societies today. Its onset is certain, and its progress can neither be slowed nor stopped. By 2050, the world population aged 65 and above will reach a high of 1.5 billion, more than the combined total population of the US, India and Germany today (United Nations, 2006). In North America, Europe, Africa and Oceania, the elderly population will almost double in proportion by 2050. In Asia and Latin America, population aging will be even more pronounced, tripling the percentage seen today (Figure 1).

Although population aging has previously been associated with industrialized countries, and it is indeed true that these developed countries today have the highest percentages of elderly populations, the decline in fertility rates (Figure 2) and improvements in health care in less developed countries are speeding up the rate of population aging all around the world. As the size of the elderly population grows faster than that of the working age population (Figure 3), the strain on national physical and economic resources to sustain populations will become more burdensome. Within the next 10 years, the total dependency ratio [1] in developed countries will begin to accelerate rapidly, reflecting the cumulative effects of a fast growing elderly population and a working population unable to grow as rapidly. Figure 4 shows the change in old age dependency ratios in 12 developed countries, between 2000 and 2040. Less developed countries will come face to face with the same challenges in less than 20 years later.

As competition in the global economy heightens, policymakers will be assuaged by a myriad of demands that compete for space on the policy agenda. Among these demands, the issue of population must be addressed with utmost priority, because it has profound impacts on the social, economical, and political wellbeing of a country.

Aging Societies

Longevity has presented us with new challenges. On an individual level, we experience physical and cognitive decline that threaten our ability to age healthily and actively. The differences in health and income status among the elderly population have resulted

[1] The total dependency ratio is the ratio of the sum of the population aged 0-14 and that aged 65+ to the population aged 15-64. The child dependency ratio is the ratio of the population aged 0-14 to the population aged 15-64.The old-age dependency ratio is the ratio of the population aged 65 years or over to the population aged 15-64. All ratios are presented as number of dependants per 100 persons of working age (15-64).

in the emergence of diverse groups of older people who live with different degrees of chronic health problems or cognitive impairment. As this heterogeneity among the elderly population increases, societies and communities find it harder to meet the demands of the elderly.

The aging of the baby boomers signal the entrance of a new generation of seniors. Born between 1946 and 1964, baby boomers are set to redefine the portrait of aging. Not only are they more educated, healthier and more financially independent than previous generations of senior citizens, they also tend to have a variety of interests and spend more money on consumer or leisure goods and services.

As an aging person retires, his or her caregivers often assume some responsibility for the physical and social wellbeing of the individual. This may become a financial and psychological burden for caregivers, who often need to take care of their own children in addition to their aging parents.

The aging population also adds pressure on existing health care and social support systems. Expensive diseases of aging such as cardiovascular disease or strokes impose enormous strains on the financial viability of existing health care systems, and limited long term care resources are being stretched to their full capacities. The shrinking labor force participation, declining rates of savings and investments, and the shifting of electoral power to the graying population all present challenges for aging societies. For a society to remain sustainable, they will need to adapt opportunely to the demographic shift. Reshuffling resources to accommodate the aging population is no longer a realistic long term option due to tightening national budgets. In fact, committing less resources and energy to youth development may exacerbate the issue, because their contributions will become increasingly crucial in the aging world.

Aging in America

For America, time is critical.

According to the US Census 2000, there are close to 83 million baby boomers in the U.S, which makes up more than 29% of the entire population. This year, the oldest of the baby boomers will turn 60 years old. Between 2006 and 2040, the percentage of Americans above the age of 65 will increase more than 2-fold, from 37 million to an estimated 87 million.

Aging as a policy concern in America is not new, but policy makers need to adopt a paradigm shift to the way they think about aging policies. The Social Security Act introduced in 1935 contains till today some of the best known and most diverse social policies for the elderly, such as the Old-Age and Survivors Insurance and Medicare. In 1965, the Older Americans Act was signed into law by President Lyndon B. Johnson in and with it, the Administration on Aging was created. However, aging has all along been tied to disability, and in some cases, poverty or disease. As a result, policies have been focus on providing basic financial and healthcare support for all senior citizens. As the old age dependency ratio in the U.S. rises with the aging of the baby boomers, the burden on the working population increases. In 2000, each elderly person was supported by 5 working adults. In 40 years time, there will only be 3 working adults per elderly person. This threatens the sustainability of current health and welfare policies that focus on providing just financial support for the elderly.

To ensure America's sustained development and competitiveness, policy makers must reevaluate existing national policies and be willing and ready to introduce novel and disruptive innovations to meet the needs and demands of the aging population.

Figure 1. Global Aging: Percentage of population above 65 years of age, by region, in 2005 and 2050

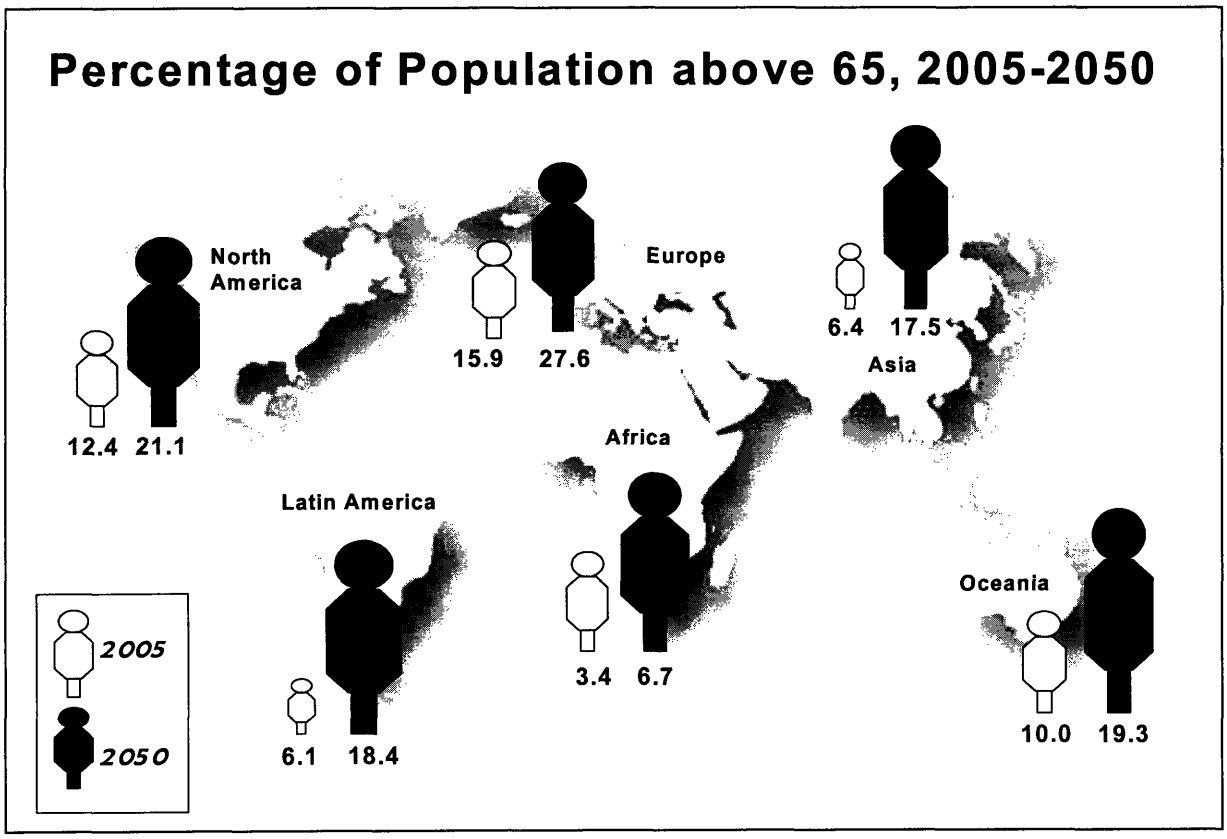


Figure 2. Changes in fertility rates of developed and less developed countries over time

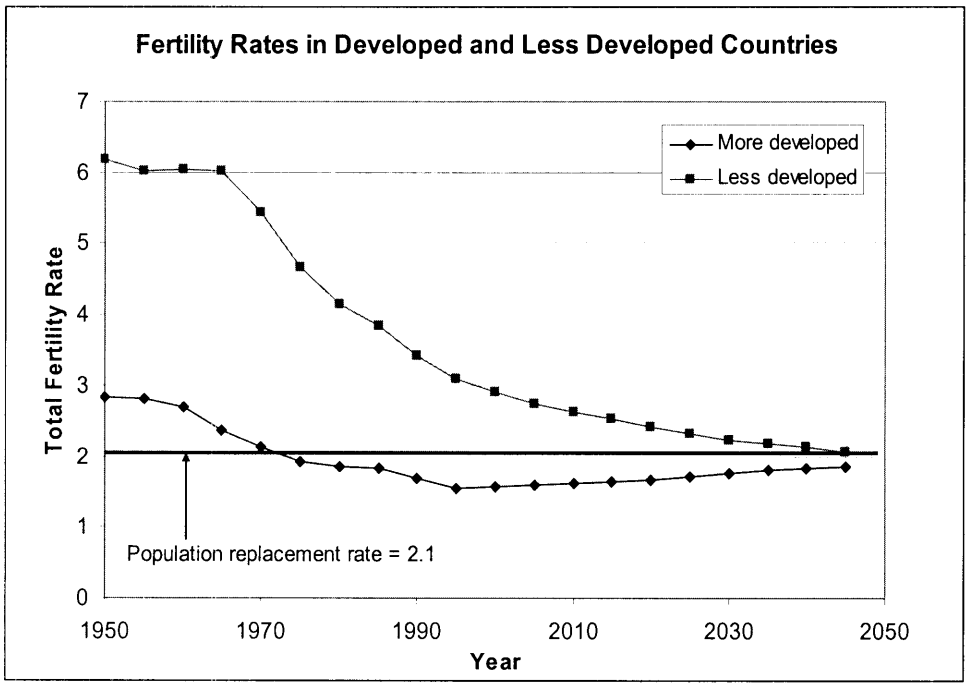


Figure 3. Change in world population, working age 15-64 vs. individuals above 65

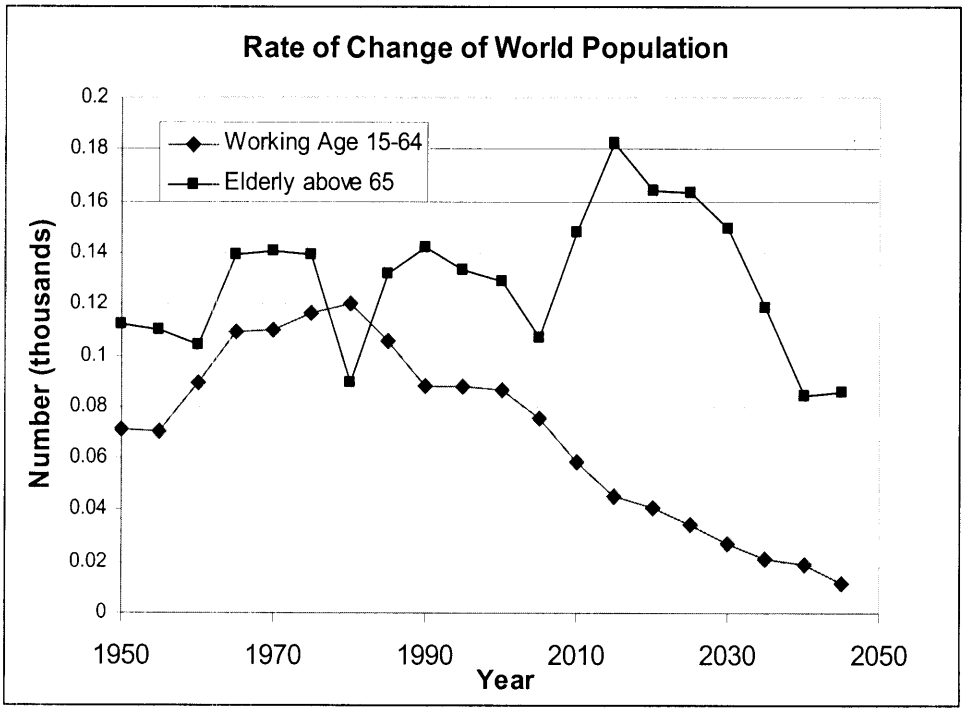
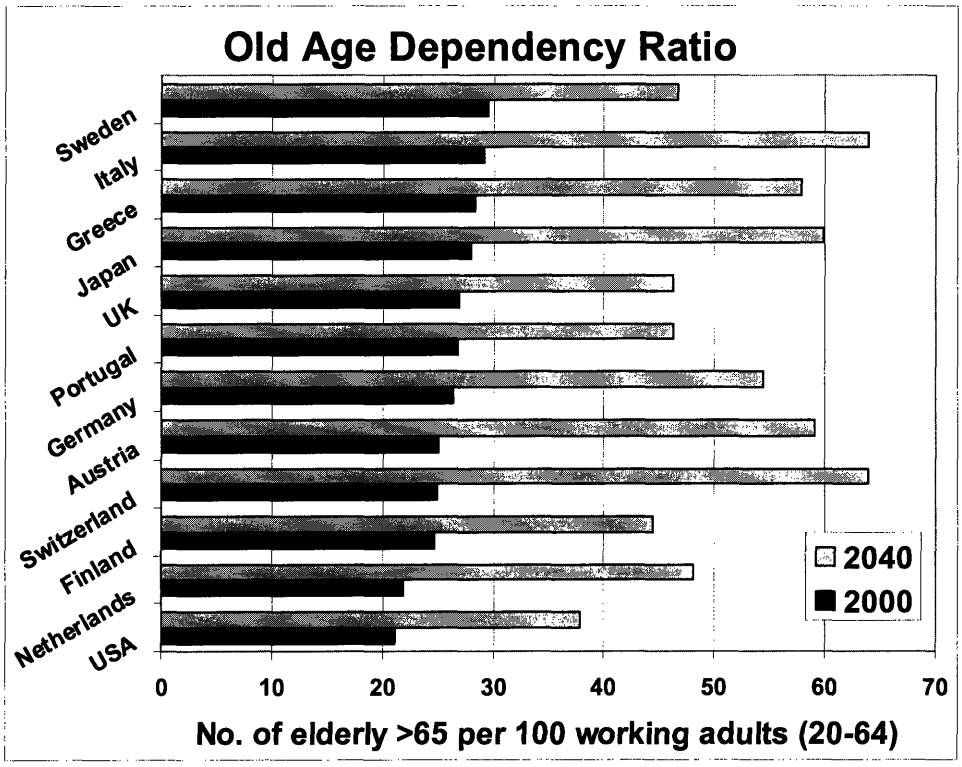


Figure 4. Old Age Dependency Ratio in 12 developed countries



CHAPTER 2: OPPORTUNITY FOR TECHNOLOGY AND INNOVATION

Living longer can be both a blessing and a bane. The physical and cognitive decline that accompanies aging often dampens the excitement of pursuing interests and dreams after retirement. For us, living forever is no longer desirable if we cannot enjoy their longevity. We want to age healthily, actively and successfully. The older person's desire to age successfully, the burden on caregivers, the shrinking labor force participation and the pressures on health care and welfare systems are merely snippets of the vast range of societal challenges brought about by aging. With constraints on physical and human resources, policy makers are beginning to turn to technology for solutions to this daunting challenge.

Technology and old age are not new to each other. Technological innovations to accommodate the aging process have emerged since centuries ago, some of which have become ubiquitous today. One of the first technological innovations associated with aging was the eyeglasses. In 1289, Sandra di Popozo wrote in a Florentine manuscript:

> *"I am so debilitated by age that without the glasses known as spectacles, I would no longer be able to read or write. These have recently been invented for the benefit of poor old people whose sight has become weak".*[2]

In 1595, King Phillip II of Spain had in his possession one of the earliest forms of a wheelchair – a rolling chair with movable arm and leg rests.[3] The early ancestor of

[2] http://www.teagleoptometry.com/history.html
[3] http://www.wheelchairnet.org/WCN_WCU/SlideLectures/Sawatzky/WC_history.html

today's hearing aid did not require engineering expertise or machining tools. Seashells and bulls' horns were used as simple ear trumpets, and these gradually evolved into the electrical hearing aids we see today, which were patented as early as 1892. [4]

Imaginative yet simple, these innovations were all developed in response to unmet needs of the aged. They extended the human capability beyond the limitations of aging and sparked off the notion that we can compensate for our physical decline by pursuing the benefits of technology. Since then, gadgets and devices have been developed with the same objectives, but with varying success.

As we face the challenges of global aging today, we can once again turn to technology for ideas. Given the limited window that policymakers have to address aging population concerns, waiting for creative inventors to chance upon groundbreaking innovations will not be feasible. Instead, a conscious and organized effort to address the needs of the aging populations through innovative services and technologies is needed.

Technology and Aging Policy developments in America

The importance of technology as a tool for providing support to the elderly has not been overlooked in America. The 10th objective of the original Older Americans Act introduced in 1965 states that it is the responsibility of the Nation to assist the elderly to secure equal opportunity to the full and free enjoyment of "Freedom, Independence, and the free exercise of individual initiative in planning and managing their own lives". [5] Since 1965, the Act has evolved to meet the changing needs of society and amendments were made to the Act in 1992 and 2000 in response to the needs of the

[4] http://www.ccent.com/PHS/history.html
[5] Older Americans Act 1965, obtained from Administration on Aging website www.aoa.gov

elderly and their caregivers. Before 2000, efforts have been focused on ensuring basic fulfillment of needs for older Americans with the greatest economic and social needs. In subchapter IV of the Act, after the 2000 amendments were made, we see the first clear signs of Technology being regarded as an important factor in managing the changing demographics. Funds could now be used to provide computer training and enhanced Internet access for older individuals in order to improve the employment related technology skills of the older individuals. [6]

In the last decade, policy makers have rolled out a series of initiatives that held significant promise for the elderly. The Assistive Technology Act of 1998 and the New Freedom Initiative of 2001 announced by President Bush to "remove barriers to community living for people with disabilities" [7] were the two major efforts that indirectly served the needs of the elderly, many of whom were living with disabilities. One key component of the New Freedom Initiative was to "Increase Access to Assistive and Universally Designed Technologies", and major increases in Assistive Technology Research and Development funding were promised. Along the same lines of "Freedom" and "Independence" that the original OAA set out to achieve, the reauthorization of the OAA in 2006 includes a proposal for a $28 million *Choices for Independence* project to promote consumer-directed and community-based long term care options. [8]

Technology as a Health Care Tool

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[6] United States Code, Title 42 Chapter 35 SubChapter IV Part A, obtained from http://www.access.gpo.gov/uscode/index.html on April 11, 2006.
[7] President George W. Bush, New Freedom Initiative 2001
[8] Department of Health and Human Services, Choices for Independence: Modernizing the Older Americans Act, March 9 2006

Concerns over escalating health care expenditures and shortages in the health care workforce have stimulated discussions to leverage technologies as health care tools. The recognition that technology can address some of our aging concerns has spurred the development of the Assistive Technology industry, in which devices are developed to help the elderly and disabled maintain their mobility and other basic needs. Examples of Assistive Technologies span from low tech innovations such as pencil grips and bathroom grab bars to high tech solutions such as voice synthesizers and Braille readers. Assistive Technology Initiatives in various countries emerged in the 1990s and early 2000s, following government efforts to protect the interests of the disabled. The New Freedom Initiative and the Americans Disability Act in the US, the Disability Discrimination Act and the National Service Framework for Long Term Conditions in the UK, the 1994 Commonwealth Disability Strategy in Australia and the 2002 Behindertengleichstellungsgesetz - BGG (law for equal treatment of people with disabilities) in Germany all represent legislation that have fueled the development and improved accessibility of Assistive Technologies

Telemedicine and Telehealth – remote healthcare, of the use of medical information exchanged from one site to another via electronic communications to improve patients' health status (American Telemedicine Association, 2005) – has been in use for almost 40 years. Adoption of telemedicine has been slow over the past four decades despite growing demands from aging societies, but recent trends in Europe, Japan and the US have attracted attention and investments from private industry as well as national governments. Health care providers facing increasing costs and tighter budgets are beginning to see the cost saving benefits of implementing telemedicine and providing incentives for its usage by patients and health care professionals. The connectedness of communities and regions will improve significantly over the next few years, as research funding for infrastructure development increases and rapid advances in

telecommunications technology continue to take place. Infrastructure networks that are built can then be leveraged for distance education and social connectivity.

These two developments are clear examples of how technology is being used to improve and enhance health care. However, limiting the application of technology to health care alone will prevent countries and businesses from capturing the full benefits of technology. For example, the Assistive Technology industry, however helpful to disabled or physically impaired senior citizens, is limited by its own definition. Fundamentally developed for the disabled, both young and old, assistive technologies tend to carry a "badge of infirmity" that older adults often wish to avoid. This will become more important with the aging of the healthier and wealthier baby boomers. Countries and businesses will need to adopt a change in mindset and prejudices in order to respond quickly and innovatively to evolving demands of the aging population.

Centuries after the invention of the eyeglasses and the wheelchair, we are still looking for and depending on innovations that can accommodate and somewhat compensate for the same physical and cognitive declines that we have tried to address years ago. Instead of focusing intellectual energy on the development of disruptive technologies whose technical principles are new for the product area, technology developers are focusing on developing incremental innovations by making marginal technological improvements within well-defined technologies and markets.

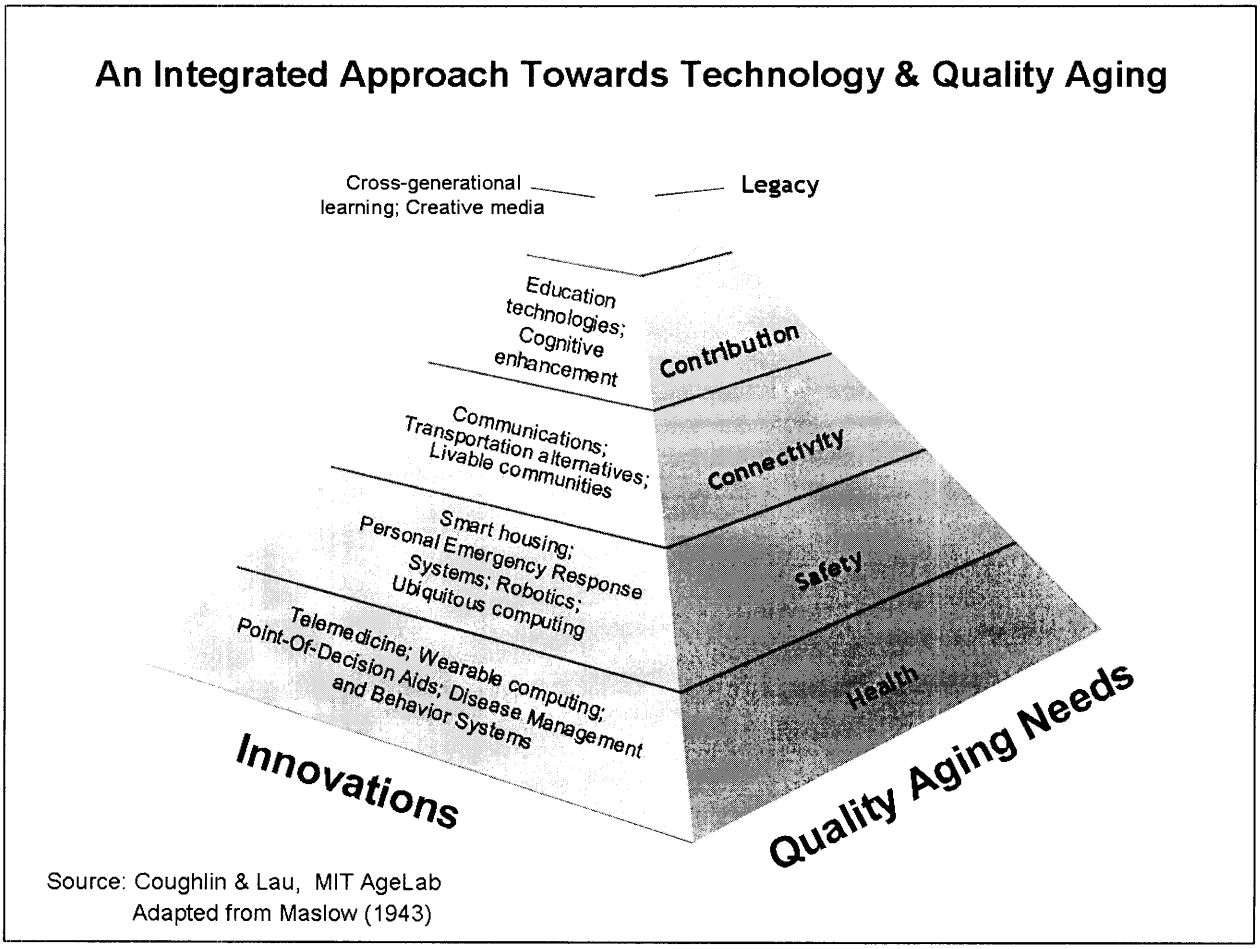
A Hierarchy of Quality Aging Needs

Before we can explore how technology can reshape and redefine the aging experience, we need to have a comprehensive understanding of the ideal of "quality aging". Abraham Maslow in 1943 contended that human needs can be represented in a

hierarchy in terms of their potency (Maslow, 1943). We adapt his hierarchical representation (Coughlin & Lau, 2006) in order to lay a partial foundation for identifying both the range of needs and the target opportunities for policy and market innovations. This 'quality aging' needs hierarchy includes and exceeds health, and can be used to guide technology development, public policy and private investment to fully realize the potential of technology for the aging population.

Figure 5 shows an integrated approach towards technology and quality aging. The hierarchy reflects selected needs of older adults alongside a list of technologies, applications and services that might respond to those demands. Five broad dimensions of Health, Safety, Connectivity, Contribution and Legacy are used to describe the needs of older adults.

Figure 5. Hierarchy of Quality Aging Needs



(Coughlin & Lau, 2006)

Health – The base of the hierarchy represent the most basic health needs, including fundamental needs such as physical wellness, nutrition, shelter and clothing. The common association of old age with frailty and disability has resulted in innovations today being focused on health needs. However, advances in health care and better nutrition have contributed to improved health among older, prompting us to shift our mindsets away from treatment and mitigation to prevention and management of diseases.

Safety – Also a fundamental need, safety is an important concern for older adults as well as their caregivers. From the Alzheimer's disease patient at risk of wandering, to the older parent living alone, technology can be used to monitor the safety of the elderly in their home or in a long-term care facility. However, the trade-off between privacy and dignity of the older adult with safety concerns must be addressed sensitively

Connectivity – Staying healthy and safe is insufficient for older adults, who treasure connectivity to their families, friends and to society. Innovations in communications and transportation can enable them to remain socially connected while maintaining their independence. Senior centers can also be redesigned to incorporate technologies that meet the needs as well as social expectations of the aging. The internet and email are beginning to become an important tool for older adults to stay connected. The proportion of the 65+ who use the Internet at least occasionally is approximately 22%, and those reporting themselves as occasional computer users are closer to 29% (Pew Internet & American Life Project, 2004).

Contribution – The second highest need in the hierarchy is Contribution. Contribution needs reflect the desire of older adults to maintain or improve their self esteem and confidence. Both the *capacity* to contribute and the *means* to contribute are equally important to older adults. Technology can enhance an older adult's confidence in his or her own mental and physical ability; it can also improve cognitive function that is essential for an older adult to remain an active member of our family, community and society. Technology in the workplace can also extend productive work years and support lifelong learning or task point training. With the shrinking labor force participation due to the retirement of the aging baby boomers, the ability for older adults to remain productive is crucial for sustained national productivity.

Legacy – Legacy is the capacity of the older person to use their personal talents developed over a lifetime. The apex of the needs hierarchy represents the older person's desire for means to construct one's legacy, to attain self fulfillment and realize one's full potential. Its elusiveness may attract the most interest from older people, especially those who have had their basic health and safety needs satisfied. Innovations and technology that enables older adults to construct their legacies and transmit their experiences to future generations will improve the quality of life of older adults and enrich younger generations.

In this framework, the five dimensions of quality aging needs do not exist in isolation. Although the fundamental needs of health and safety tend to draw more attention from policy makers and business leaders, higher needs of connectivity, contribution and legacy cannot be ignored. If inadequately addressed by public policy, baby boomers will translate these higher needs into the critical mass of a new passionate politics of unmet expectations (Coughlin, 1999). Business will find that as large as the health and safety market may be, the willingness of older adults and family members to spend disposable income on these three "higher" dimensions is immeasurable.

Technology as an Economic Driver: Serving New Needs of an Older Marketplace

As we move away from the limited definition of technology for aging as merely a health care tool, we begin to see technology development for the elderly as an economic opportunity. For a country, the "Technology for Aging" industry holds tremendous potential as an economic driver. Businesses and corporate players are beginning to take note of the shifting demographics and are becoming more engaged in catering for the graying population. Because aging is a global phenomenon, goods and services that

emerge can tap into an enormous international market. What may be seen as a small national niche market now can evolve rapidly into a global market.

The aging of the baby boomers signal the entrance of a new generation of seniors. They are more educated, healthier and more financially independent than previous generations of senior citizens. Household wealth peaks at 55-74 years of age, making the baby boomer generation the most lucrative market for businesses to target their products and services to within the next few years. According to Nikkei Marketing Journal, starting in 2007, total leisure spending by Baby Boomers in Japan is expected to increase to $44 billion annually. In total, the market for pension-friendly goods and services was estimated to be worth $18 billion in 2002 [9].

For "Technology for Aging" to become an economic driver for a nation, policy makers must begin to incorporate the needs of older people into their innovation policies. The US has historically relied on dynamics of the free market to stimulate competitive industries, but the rapid pace of aging necessitates an organized and proactive approach by the government. As innovative countries in Europe and Asia embark on similar innovation policies and encourage their domestic industries to respond to their demographic changes, the international competition in the development of technologies and services for the elderly is likely to heat up and become more intense over the next few decades. Countries with a vision to turn the challenges of aging into a growth opportunity will gain access to a market worth more than $55 billion in 2004 [10], with expectations of exponential growth in 20 to 30 years when developing countries experience their peak demographic shift.

[9] The Economist: The World in 2004; pp 74-7
[10] The Economist: The World in 2004; pp 74-75

Technology Diffusion

The rate of technology diffusion has increased rapidly with the evolution of our economy, and it now takes less and less time for new technologies or products to make their way into the average American household (Figure 6). Getting an automobile or a telephone (both of which entered the mass market prior to 1900) to a quarter of America took 55 and 35 years respectively; the color TV (1954), 26, and the microwave (1967), 16 years. More recently, however, the PC required only 16 years, the cellular phone 13 and the Internet 7 (Table 1) (Cox & Alm, 1996).

Figure 6. Speed of technology diffusion of six common household technologies

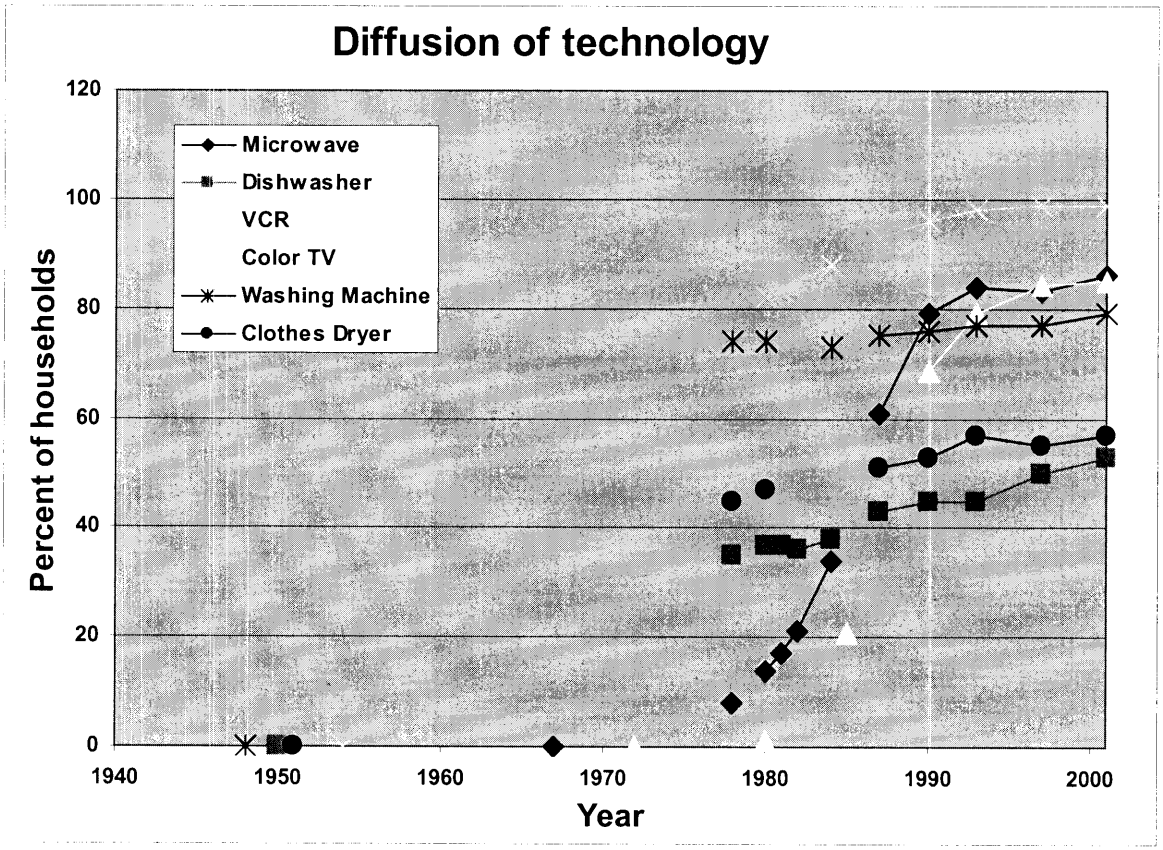


Table 1. Timeline for invention and diffusion of technologies

Technology	Year Invented	Year entered Market	Years to spread to ¼ of US population
Automobile	1886	Pre 1990	55
Telephone	1876	Pre 1990	35
Color TV	1926	1951	26
Microwave Oven	1953	1967	16
Personal Computer	1975	1977	16
Cellular Phone	1983	1983	13
Internet	1991	1993	7

Americans thirst for new technologies, and technology developers constantly seek out new and emerging markets for their latest creations. As concerns for the demands of the aging population grow, technologists are beginning to realize the emergence of a potentially enormous market for their products – the elderly and their caregivers. Every day, new devices are being invented and marketed to the older population, promising to improve their quality of life and to return to them the independence they had once enjoyed in their younger years. From sensory aids and mobility tools to telecare and robotics, more and more appliances are available today to support the elderly and their caregivers.

Markets are a way of linking users and producers, but there are cases where market signals work poorly. One of these is where new technologies are emerging and user needs (potential markets) are not well defined. Despite the availability of technology in aging services and the benefits they promise, the use of these technologies has not been widely adopted by the elderly or their caregivers. One example is the Personal

Emergency Response System (PERS) that can connect users immediately to emergency services in the event of a fall or serious illness. PERS was developed in the US in 1974 and has been on the market for over 30 years, yet only 2.4% of the elderly population in the US (over 65) has adopted the system. Of the 35.6 million older adults in the U.S above the age of 65, close to 5 million have at least one severe disability and lives alone (US Census, 2002). Even if all current PERS subscribers in the US are above 65, disabled and live alone, the market penetration rate will only be approximately 17%. .

The case of PERS will be discussed in the following chapter. For a technology that is simple to understand, beneficial to the elderly and their caregivers, and costs about as much as the average home's cable TV bill (Coughlin & Lau, 2006), its adoption rate is far from encouraging. Why are technologies for the elderly not experiencing the same rapid diffusion rate as other technologies?

CHAPTER 3: OLD AGE AND NEW TECHNOLOGY ADOPTION: A MULTI-NATION ESTIMATE OF PERSONAL EMERGENCY RESPONSE SYSTEM UTILIZATION

The development of innovations and inventions to help the disabled and the frail elderly remain mobile, communicate with others and manage their daily activities is not a new phenomenon. Otherwise known as "Assistive Technologies", this field of technological development has benefited from federal funding as well as active support from disabled persons or senior citizens advocacy group. However, the aging of the more active, better educated, healthier and wealthier baby boomer generation necessitates a reevaluation of the needs of the elderly. Dishman (2004) describes the development of new aging-in-place technologies that involve new interfaces, interaction paradigms and core technologies such as domestic robots, personal electronic health records and ubiquitous computing technologies. As computing power becomes more available and affordable, many are now promoting the use of sensors and related information technology for remote monitoring and management of older people in their homes Coughlin (2006). "Technology for the elderly" is set to take on a new meaning, no longer restricted to mobility aids and home modifications designed to compensate for losses of function.

Businesses have begun efforts to capitalize on the emerging elderly consumer market. Supported by research studies that show how innovative technologies are successful in improving the quality of life for the elderly and their caregivers, the "aging technology" industry has been garnering more attention from both industry and national

governments. From furry toys that remind the elderly to take their medication, to intelligent beds that track sleep patterns and automate lighting, a wide range of technology has been designed to enable successful aging-in-place. Unfortunately, new inventions often hailed as "*the* solution" are frequently met with lukewarm response from the elderly consumer market. One of the main reasons hypothesized is that useful and usable technologies are not available, affordable or acceptable. Using a case study of a useful, affordable and available technology – the Personal Emergency Response System, this chapter examines factors that influence the utilization rate of such systems in ten developed countries around the world.

Personal Emergency Response System – a pioneer in Aging Technology

Developed in the mid 1970s in the US as first generation telecare systems aimed to deliver home care to the elderly, the Personal Emergency Response Systems have been on the market for almost three decades and are currently still being upgraded and marketed. The basic Personal Emergency Response System has three components:

- a transmitter worn by the user in the form of a watch or a pendant,

- a communicator installed in the user's telephone, and

- a 24-hour emergency response center that receives calls from the user.

PERS provide immediate connectivity to family and emergency services for an older adult who may have fallen or become seriously ill. Studies have shown that PERS utilization provides significant benefits to the elderly, their caregivers, as well as to the government. About a third of all older persons fall each year and about 40% of these falls lead to hospitalization (Sattin et al., 1990). The longer an injured older person waits for emergency help, the higher the mortality rate (Bernstein, 2000). PERS users

who have fallen are able to get help faster and therefore can benefit from reduced hospital stays and subsequent financial savings (Sherwood & Morris, 1980, Dibner & Stafford, 1984, Koch, 1984, Cain, 1987). Caregivers enjoy relief and peace of mind with the knowledge that their elderly parent or family member has round the clock access to emergency services if needed. Their financial burden is also reduced due to cost-savings from reduced hours of live-in supervised care or personal care they would otherwise need to provide.[11] PERS also give users, their family members and their caregivers an increased feeling of security, which enables the users to continue living independently. Widespread adoption and usage of PERS can also ease the burden on the national health care system, by helping hospitals to maintain financial viability. By allowing medical intervention to take place early in emergencies, conditions are prevented from becoming more severe and needing more advanced and costlier health care delivery, and reduced hospital stays also help to free up resources in the hospitals. The PERS can also be a substitute for safety monitoring by home health aides, enabling health care to be provided outside the hospital setting. [12]

Despite its relatively long existence, simple technology and proven benefits, the penetration rate of PERS in the USA has been far from ideal. Introduced in the USA in 1974, the PERS saw a slow growth in subscribers until the mid 1980s. In 1992 the total

[11] A study done by New York City Human Resources Administration Medical Assistance Program (1988) found that on average, 172 PRS users required 91.2 fewer hours of Personal Care each month (a savings of $565 per client per month). Another study by Coordinated Care Management Corporation of Buffalo, New York found that PRS users required 144 fewer hours of Personal care at a savings of $956 per client per month

[12] Hyer and Rudick (1994) found that safety monitoring with PERS saved an average of 9.5 HHA hours per person, per day, for a net savings of approximately $4500 per person, per month. Based on 48 patients who had Medicaid as primary or secondary insurance coverage, a total of 94,000 hours of HHA were saved, yielding a net savings to Medicaid of $1.5 million.

volume of subscribers in the US was estimated to be 350,000 (1.08% of the 65+ population[13]). The most recent estimate, in 2004, was 850,000 (2.34%) [14].

The growth in PERS subscribers is lagging far behind the speed of technological innovation. Second generation telecare systems have already been developed and are being deployed in pilot projects around the world. These systems incorporate new technology such as motion sensors to provide continuous monitoring and are capable of generating alarms without patient intervention (Doughty et al, 1996). Plans to introduce third generation systems that create virtual communities connected by the telephone and the internet are already in the pipeline. To ensure that the benefits of the emerging advanced systems are fully realized, we first need to address the low penetration rate of the first generation systems. If simple, available and affordable technology is not successful in the market, is there hope for more innovative products and services?

Market Failure Hypotheses

Developers and advocates of telecare systems have not been oblivious to the suboptimal adoption rate of PERS. Studies have suggested that the underutilization of PERS might be explained by economic and psychosocial reasons (Mann et al., 1999). Dependent and frail elderly often do not have the financial resources to buy and use such technology, whereas independent and healthy senior citizens with financial ability are unable to see the tangible benefits of such a system. When PERS non-users were asked what they foresaw preventing them from using a PERS in the future, the most commonly cited

[14] Correspondence with Lifeline Sys.

reasons were cost (46.4%), lack of perceived need (44.4%) and lack of knowledge of device (17.0%) (Mann et al., 2005). Another often cited reason for the poor adoption rate of PERS by the elderly is its stigmatizing effect, as PERS is sometimes seen as a badge of dependency that highlights a loss of independence and ill health. These barriers to adoption have prompted calls for federal reimbursements as well as design improvements, but the success of these attempts is unclear.

PERS – an international survey

Looking at cost and need factors no doubt helps us to understand the elderly individual's demand for PERS, but these factors tend to be dependent on many macro level factors as well, such as socio-cultural attitudes, overall elderly support system in a community and financial support for general long term care. To appreciate how these factors contribute to the suboptimal adoption rate of PERS in the US, a multi-nation study of PERS utilization was conducted. This allowed us to determine the relative success of PERS in the US compared to other developed countries with aging populations.

A set of ten countries were chosen for comparison, based on the availability of data regarding PERS ownership or usage as well as a general existence of efforts to leverage the benefits of technology for elderly care. In Europe, PERS are also known as "community alarms", "social alarms" or "tele-alarms". Alarm schemes similar to PERS have been in existence in Europe since the 1960s but the earlier systems were wired and typically used within nursing homes or institutions. The use of such alarm services in many countries suggests that the benefits of the technology has been recognized and

acknowledged. Table 2 below shows the degree of PERS usage in the ten different countries.

Table 2. International Comparison of Elderly Population percentage and estimated PERS penetration rates

Country	Year of estimate	% elderly (65+)	% elderly with PERS
UK	2002	15.7	16.00
Sweden	2000	17.6	13.01
Malta	2005	13.6	11.77
Netherlands	2000	13.1	5.60
Australia	2005	12.8	3.14
USA	2004	12.4	2.34
Germany	2004	15.0	2.12
France	2000	16.2	2.06
Israel	2004	9.8	1.95
Japan	2004	19.0	1.03

PERS ownership data for Israel obtained from http://www.givingwisely.org.il/cgi-bin/xGWexpandF.pl?language=E&amuta=230. PERS ownership data for Sweden, Netherlands and France obtained from http://www.seniorwatch.de/reports/SW_D41_Final.pdf. Data for UK obtained from Turnstall, 2002. Data for USA obtained from Lifeline, 2004. Data for Japan obtained from UK DTI report, 2004. Data for Australia obtained from Persa Australia 2005. Data for Malta obtained from Malta Ministry of Health, the Elderly and Community Care – Telecare Service http://www.sahha.gov.mt/pages.aspx?page=180

Because PERS or social alarm services are provided by different service providers in each country and there is no central data collection mechanism for PERS ownership and usage worldwide, the data for different countries were obtained from different sources. In addition, data for 2004 or 2005 was unobtainable for UK, Sweden, Netherlands and France. Therefore the numbers for these countries are likely to be underestimated, taking into consideration growth in subscriber volume likely to have occurred from 2002 to 2005.

The degree of PERS utilization in each country is influenced by many factors. Data on four sets of characteristics (Demographics, Social Characteristics, Technology

Environment and PERS information) were collected so that a more comprehensive comparison between the ten countries can be made. These characteristics are listed in Table 3 below. Factors such as retirement age, life expectancy, population density, technological environment, costs of PERS and living arrangements are likely to affect on an individual's demand for PERS. For example, low population density or low levels of urbanization may heighten the perceived need for telecare and remote communication.

Table 3. Four categories of characteristics for country comparison

Demographics	**Social characteristics**	**Technology environment**	**PERS information**
Total Population	% elderly living alone	Mobile phones per 100 people	Year of estimate
Population Density (inhabitants/km^2)	Elderly support ratio -- 2000, 2030	% of households with PC at home	Year PERS introduced
No. of population > 65	Standard retirement age (male, female)	% households with internet connection	Number of Years PERS has been on the market
% of population > 65	Long Term Care Expenditure as % of GDP	Broadband subscribers per 100 people	Major Provider Company(s)
Births per 1000 population, 2006	% of >65 population institutionalized	% households with cable TV	No. of PERS users
Life expectancy, 2006	Women's share of the adult labor force (%)		% of elderly using/used PERS
Life expectancy at 65, 2003, Female and Male	Adult economic activity rate (%) (women)		Costs of PERS service
	Adult (15+) employment rate (women)		Primary funding for PRS units

A statistical analysis of the data collected is difficult due to two reasons. Firstly, factors such as management of PERS service and funding mechanisms are impossible to quantify. In addition, salient but significant effects of characteristics listed in Table 2 on each other are also difficult to identify and elicit. Instead, general trends and

correlations are observed and discussed descriptively, keeping in mind that policies adopted by each country reflect deep and complex social, cultural and political differences.

Demographics

The effect of a country's demographics on the degree of PERS utilization is unclear. There is no observable correlation between the percentage of population above 65 years of age (Figure 7), population density or life expectancy and the corresponding PERS adoption rate.

Social characteristics

Social and cultural differences appear to have more observable effects on PERS utilization rates in different countries. In Japan and Israel, the elderly are more likely to live with their children and rely on their children for care, whereas in Western countries such as UK and USA, there are fewer expectations of children to look after their parents as they age. Many adults also choose to live on their own instead of depending on their children. The most significant social factor appears to be the living arrangements of the elderly. Figure 8 shows that higher utilization rates of PERS occur in countries with higher percentages of elderly living alone (UK and Sweden) whereas countries with lower percentages of elderly living alone (Japan) have a lower PERS utilization rate.

However, there was no observable correlation between rate of institutionalization and PERS adoption rate. One possible reason might have been the fact that each country uses a different definition for *institutionalization*. For example, 2.9% of Japanese 65+ reside in nursing homes, but the 6% institution rate includes individuals in long-stay hospitals. The United States data does not include individuals in assisted living facilities, while the data for Netherlands includes those in "service housing."

Literacy rate of the elderly population does not appear to have an effect on the adoption rate of PERS. The percentage of elderly who complete a university education in the US (2001) was 26% for males and 18% for females, almost twice the number for Sweden – 12% for males and 11% for females. This is not surprising, because PERS is a simple technology that does not have a steep learning curve.

As seen from Figure 9, a country's spending on long term care, used as a rough indicator of general attitudes towards providing care and welfare services for the elderly, appears to be slightly correlated to PERS adoption rate. However, the direct relationship between Long Term Care spending and PERS utilization is unclear because no information was available on what fraction of spending is specially for supporting the usage of telecare or PERS. Long Term Care spending that provides coverage for PERS services is likely to increase demand for PERS, whereas schemes that do not provide PERS coverage may reduce the demand for PERS, since an elderly person may prefer to be taken care of by a social worker instead of relying on PERS. For example, the Long Term Care Insurance scheme in Japan provides financial support for home help services, day center care or short stay nursing care but does not provide financial support for PERS usage. This reduces the incentive for the elderly to substitute home help services with PERS, since it does not result in cost savings for themselves.

In most societies, care-giving roles are typically fulfilled by females. An increase in the female's share of the adult labor force is therefore likely to reduce the number of traditional care-givers and create a need for alternative care-giving provisions. Statistics of female employment appear slightly correlated with PERS adoption rates (Table 5). UK and Sweden both have a high percentage of women participating in the labor force (55.3% and 57.4% respectively), and a high employment rate of women above 15 years of age (95.9% and 95.6% respectively). In contrast, Germany, France,

Israel and Japan all had female labor force participation rates of less than 50% (49.3%, 49.2%, 49.1%, 48.4%). However, although the female labor force participation rate in the U.S. was the highest (59.5%), the PERS adoption rate was below that of UK and Sweden.

Technology Environment

Although PERS is a simple technology that does not require its users to possess significant technology literacy, its adoption rate may be indirectly influenced by the technological climate within a country, since it represents a substitution of human contact with technology. Many of the elderly living in developed countries today own and operate their television sets, video recorders and microwave ovens. The amount of trust that users and their caregivers have in the PERS service may be influenced by their overall level of trust in other technological devices such as mobile phones and computers. The figures below compare the adoption rate of the mobile phone, personal computer and broadband access among the ten countries included in the PERS case study.

Countries such as Sweden, UK and Netherlands that consistently rank high on technology adoption rates also reflect higher PERS penetration rates. Countries such as France and USA with lower technology adoption rates have lower PERS adoption rate. One exception is Malta, with a high level of PERS usage despite showing low general technology usage. This can be explained by the delivery of a heavily subsidized PERS service through a government department that provides for the social welfare of the elderly. The relationship between general technology adoption and PERS adoption is unclear because these figures do not reflect general technology adoption by age cohorts. It is impossible to infer the older population's general attitudes towards technology in

each of these countries. However, with the development of second and third generation telecare systems that incorporate computer technology and real time data transmission, the relationship between general technology usage and PERS usage may become more significant.

Characteristics of PERS service

Management of service

The management of PERS in USA is significantly different from that in European countries such as UK and Sweden. In the USA, Japan and Australia, PERS is mainly a private-pay service managed by private service providers. In the US, PERS is primarily marketed through hospitals, which means that most subscribers only learn of PERS after they have been hospitalized for a fall or illness. In UK and Sweden, alarm schemes are run mainly by housing departments or social services departments which also typically bear the costs of the services. In Malta, telecare services are provided by the Department for the Elderly and Community Services in conjunction with Maltacom. In France and Germany, private providers manage the alarm schemes which may be indirectly provided through public authorities or associations. In Israel, alarms can either be purchased privately or rented for free from voluntary organizations such as Yad Sarah.

There is no umbrella agency or organization for PERS providers in the USA. In UK, the Telecare Services Association (TSA), also known as the Association of Social Alarm Providers, functions as a representative body for the telecare industry in UK. The Personal Emergency Response Services Association (PERSA) in Australia performs a similar role. Such industry associations work with the government and statutory

regulators on maintaining quality standards and funding, support their members by promoting best practices, and also raises awareness of social alarms by providing information for users, potential users and caregivers. The creation of such industry associations depends on whether there exist a substantial number of suppliers and consumers interested in forming a common interest group. The lack of such an industry association in the US may be because PERS providers in the US prefer to maintain their autonomy and strategize independently in an industry with potential to grow exponentially; or they may already be part of a larger industry association such as the Assistive Technology Industry Association (ATIA). Malta is an exception as there is only one service provider (Maltacom) contracted by the government to provide PERS service.

PERS Providers

PERS providers come in all forms and sizes. Some providers specialize in providing PERS or telecare services, such as Lifeline Sys in the US and Tunstall in Europe. Other companies such as American Medical Alert Corp in the US and SECOM in Japan include PERS within a larger portfolio of security and alarm services. Companies such as Shahal in Israel specialize in telemedicine and health management services and provide PERS as one of their many diagnostic and monitoring services. Alarm services can also be provided by voluntary organizations such as Yad Sarah in Israel dedicated to help keep the ill and elderly out of institutions for as long as possible.

Costs

Costs of renting, owning and using PERS vary across the countries, and may range from practically free (Malta) to $500 for installation + $45 monthly fee (USA). Prices for

installation and usage also vary within each country depending on the brand, manufacturer or service provider and whether or not the systems are subsidized by the authorities. Differences in costs also reflect different levels of services. For example, US company AMAC provides voice-console units that represent the basic PERS and also integrated systems that combine voice console units with remote health monitoring that enable the elderly to communicate with their health care providers.

Funding

One of the most important factors affecting an elderly person's decision to use PERS is Cost. The funding or financial support schemes in each country are very different, but they can be loosely grouped into four categories (Pew & VanHemel, 2004). These four categories represent approaches to underwriting the cost of technology development and dispersal for usage.:

1. Direct government contributions through grants and contracts
2. Subsidization of costs through medical insurance programs like Medicare & Medicaid in the US although efforts have been made over the past decade to make PERS eligible for Medicaid reimbursements in many states.
3. Private health insurance subsidies
4. Direct payment for technology by the consumer

Funding systems have a significant impact on the penetration rate of PERS. Just like any other consumer product, demand is strongly dependent on the price of the product and the income level of the consumer. The Malta government provides heavily subsidized Telecare services to elderly citizens who meet a general eligibility criterion. Users do not pay for installation and are only responsible for telephone charges incurred if the device is used. In UK and Sweden, the costs of the alarm services are

mostly borne by local authorities but there is some regional variation with regards to eligibility criteria and cost-sharing schemes. Partial reimbursement is available in France and Germany, where users can apply for financial aid (Retirement funds in France, Statutory Care Insurance Scheme in Germany). The US and Japan have traditionally provided little external funding PERS usage, and both countries show a low PERS penetration rate. In Japan, telecare services are usually paid out of pocket as the Long Term Care Insurance scheme does not cover these alarm services. Within the last decade however, efforts have been made in the US to make PERS eligible for Medicaid reimbursements in many states and as of today, Medicaid waiver programs in over 40 states have begun to include the PERS as one of the items eligible for financial support, based on prescriptions in Medicaid Case needs. Although the direct impact of this development on the penetration rate of PERS is unclear, such provisions definitely widen the pool of potential subscribers that companies marketing PERS can tap into and may have contributed to subscriber growth over the past few years.

With regards to industry and commerce, Americans often prefer that the government adopt a policy of non-intervention in the market, believing that the market will generate optimal solutions independently. In the UK and Sweden, both the national and local governments play an active role in promoting the development and use of PERS, which play an important role in increasing the adoption rate of PERS among the elderly. Despite the higher penetration rate of PERS in UK, PERS providers in the US are not keen to see the PERS service becoming a commodity provided and funded by the government. They believe that non-intervention in market forces will promote healthy competition and allow service providers to compete based on price and quality of service

Conclusions

As with most multi-nation comparisons conducted to study and document factors that contribute to a distinct variable, it is difficult to ascertain exact cause-and-effect relationships between factors and the dependant variable. Not only are many social and organizational factors impossible to quantify, the influence each of these factors have on each other is also difficult to deduce. In this paper, quantifiable indicators such as living arrangements, long term care spending and technology adoption rates were used to sketch a rough picture of social, cultural and technology environment characteristics.

Two of the most significant factors that contributed to high PERS adoption rates were the proportion of elderly living alone and the costs of the PERS to the user. This is no surprise since studies have shown that non-users of PERS regard a lack of a perceived need and costs as the top two reasons for not using the technology (Mann, 2005). Both costs and perceived need are functions of the service provision structures and the current elderly support infrastructures within each country.

Funding mechanisms for the usage of assistive technology exist in most of the countries included in this report. However, these funding mechanisms are often complicated and not well-defined. They are typically dependent on eligibility criteria such as disability, poverty and illness. Most countries also have in place well-developed healthcare insurance and long term care support systems but do not provide for telecare related equipment. However, as telecare technology continues to evolve, the next generations of telecare systems will essentially be advanced Information Communications Technologies used to support home care, and no longer a form of "assistive technology". If the potential of these technologies are to be realized, policies and legislature must be

introduced to provide financial support for care-givers or users to use these technologies as alternatives to institutional or long term care.

Funding policies for care-related technologies such as PERS may become complex due to the overlap between social welfare policy and healthcare policy. For example in the UK, the Department of Health is responsible for health and social care policy. The Department of Transport, Regions and the Environment are responsible for issues relating to housing, and disability benefits are the responsibility of the Department of Social Security. One can see how designing a funding mechanism for PERS may be tricky within such an administrative system. Each department faces its own budgetary pressures, and the benefits of PERS cannot be completely captured by any single department since cost-savings occur in healthcare, employment, social care as well as social security. Who then should be responsible for funding the use of PERS by the elderly and their care-givers? Such a situation is not unique to the country. In the US, the same situation is seen with the Department of Health and Human Services, Department of Housing and Urban Development and the Department of Labor. In Germany, there is the Federal Ministry for Family, Seniors, Women and Youth, the Federal Ministry of Health, the Federal Ministry of Labor and Social Affairs, and the Federal Ministry for Transport, Building and Housing. Without proactive policy decision-making accompanied by financial investment in the form of grants or budget increases targeted specifically for funding care-related technologies, it is difficult to expect any branch within the government to voluntarily set aside a part of their budget for such purposes.

The UK has recognized telecare as a tool to change the design and delivery of health, social care and housing services. In July 2004, the Government announced a £80 million investment in telecare, in the form of the Preventative Technology Grant to be delivered

through the Department of Health. A comprehensive plan covering funding dispersal, implementation and performance assessment was designed, in order to "create the best possible atmosphere for the new telecare industry to flourish". Local authorities are required to work with health, housing, industry and the voluntary sector when developing and delivering telecare services. Although it is impossible to predict the success of this policy at this stage, it represents a clear recognition of the potential of technologies in reshaping and redefining health and elderly care in the future.

However exciting and promising policies implemented in various countries may seem, it is impossible to transplant them from one country to another. Each country develops a unique set of policies best suited for its demographics and its social, cultural characteristics. However, policy makers should consider adopting and modifying international best practices that can enhance the use of technology in the elderly care sector. These technologies can help the elderly to remain independent and capable of contributing to society, reducing the burden on the working population and enhancing the competitiveness of a country.

The future of PERS and telecare

The development of new generations of telecare systems proceeds in tandem with many other technologies today, and thus the low adoption rate of PERS warrants attention from technologists, manufacturers and policy makers who hail technological advances as the solution of aging concerns. For example, Telemedicine and PERS both share similar objectives concerned with the decentralization of care, improved standards and cost savings (Fisk, 1995). Their development trajectories may be somewhat aligned too, since they rely on related mediums of Information Technology communication, are likely to be influenced by the integration of information services

such as cable networks and the internet, and are poised to be integrated into "Smart Housing" in the future. In fact, it is possible that technologies such as PERS and telemedicine will converge into a comprehensive tele-(monitoring and care) alarm system, especially in the US where both services are often provided within a hospital or health care setting.

Second generation telecare systems incorporate sensors that provide continuous monitoring of the user's movements as well as environmental conditions such as room temperature and lighting. The sensors are able to trigger the alarm if they perceive an emergency condition, but as a result may generate false alarms. The loss of control over the alarm may make the alarm seem intrusive to the user and result in a loss of confidence in the device by the user. As data processing and bandwidth transmission requirements become more demanding, the cost of the device will also increase. Issues surrounding privacy, intrusiveness, ease of use and reliability are also likely to become more complex. Needless to say, these issues present critical barriers to the development and use of third generation systems that integrate even more complex technologies and services.

The Royal Commission on Long Term Care in the UK stated that the adoption of technology by the elderly is not solely dependent on chronological age and that familiarity with a technology makes it easier to learn to use. Since existing PERS or telecare users are likely to be the first adopters of second and third generation systems, countries with higher PERS penetration rates are likely to reap the benefits of advanced telecare systems earlier and faster. In a world where the speed of technological innovation is becoming almost blinding, the smallest possible disparity between the rates of technological innovation and technology adoption by the elderly is desired in order to reap the maximum benefits from technology. With the increasing excitement

over telemedicine and telehealth, It may therefore be a wise move for national governments, insurance companies and health care providers to invest in policies that speed up the adoption of basic PERS systems. This will help to build up a broad customer base for the eventual mass implementation of telemedicine programs.

Despite the suboptimal adoption rate of PERS today, there may not be a need for undue worry for advanced generations of alarms in the future. Advanced systems are capable of incorporating elements such as intelligent drug dispensing, gas monitoring, intelligent burglar alarms and telemedicine capabilities which may increase the marketability of these systems. Entities such as housing departments, health authorities, hospitals, healthcare management associations, long term care insurance companies will stand to benefit from the increased usage of such alarms, and hence may consider providing the elderly with financial incentives to use these alarms.

The changing characteristics of the elderly population may be another cause for optimism. After all, the aging baby boomers had dominated American culture in their adulthood, forcing the rest of America to fall in love with blue jeans and rock and roll music. Even though their energy may wane and their radicalism diminish, their idealism, materialism and spirit of self-indulgence may change the face of the "elderly market" completely. However, such optimism should be accompanied by a strong dose of careful pragmatism that establishes a strong industry infrastructure to ensure the market success and pervasive usage of future elderly technologies.

Demographics

Table 4. Demographics

Country	Year of estimate	Total Population (Year of Estimate) [1]	Population Density (inhabs/km2) [2]	No. of Population >65 [3]	% pop >65 [4]	Births per 1000 population, 2006 [5]	Life expectancy, 2006 [6]	Life expectancy at 65, 2003 (Female,Male) [7]
UK	2002	59912431	243	9373583	15.65%	10.71	78.54	19.1, 16.1
Sweden	2002	8,954,175	20	1,537,261	17.17%	10.27	80.51	20.3, 17
Germany	2005	82422299	230	16018097	19.43%	8.25	78.80	19.6, 16
Australia	2004	19,913,144	2	2548439	12.80%	12.14	80.50	21, 17.6
USA	2004	293027571	30	36251160	12.37%	14.14	77.85	19.5, 16.6
Netherlands	2002	16122830	395	2212609	13.72%	10.90	78.96	19.5, 15.8
Japan	2004	127333002	337	24224040	19.02%	9.37	81.25	23,18
France	2002	59925035	110	9709280	16.20%	11.99	79.73	21.3, 16.9
Israel	2004	6199008	302	616229	9.82%	17.97	79.46	19.1, 17.1
Malta	2005	398,534	1,261	54178	13.59%	10.22	79.01	19, 15

[1], [3], [4], [5], [6] obtained from US Census International Data Base 2005
[2] obtained from http://en.wikipedia.org/wiki/List_of_countries_by_population_density
[7] obtained from OECD 2003

Social Characteristics

Table 5. Social Characteristics

Country	% elderly above 65 living alone, 2000 [1]	% of >65 pop institutionalized * [2]	Elderly support ratio, 2000 [3]	Elderly support ratio, 2030 [4]	Standard Retirement Age (Male, Female) [5]	Tertiary attainment for age group 55-64, as % of age group, 2003 [6]	Long Term Care Expenditure as % of GDP, 2000 [7]	% elderly >65 Economically Active, 2003 [8]
UK	38.9	5.10%	27	42	65, 65	20.8	0.89	4.38*
Sweden	41.3	5.30%	29	46	65, 65	26.3	2.74	4.12*
Germany	36.3	5.40%	26	46	65, 65	21.6	0.95	2.90
Australia	26.1	6.20%	21	37	65, 60	23.3	0.86	6.16
USA	30.8	5.20%	21	37	65, 65	34.7	0.74	13.99
Netherlands	39.5	9.10%	22	42	65, 65	n/a	1.31	3.85
Japan	13.8	6.00%	27	53	60, 60	19.2	0.76	20.15
France	27.3	7.00%	27	43	60, 60	13.9	0.35	1.33
Israel	25.4	4.5% (2000)	18	26	65, 65	n/a	1.50	9.32
Malta	n/a	n/a	21	45	65, 65	n/a	0.60	5.5^

[1] : UK data obtained from National Statistics UK, http://www.statistics.gov.uk/lib2000/resources/fileAttachments/GHS2000.pdf, Sweden, Germany, France, Netherlands and Japan data obtained from OECD 2000, Israel data obtained from http://www.jdc.org.il/mashav/pdf/Ch01-2002-E.pdf , Australia data obtained from http://www.abs.gov.au/ausstats/abs@.nsf/ ,
USA data obtained from US Census 2006 http://www.census.gov/prod/2006pubs/p23-209.pdf
[2] obtained from Long Term Care in developed nations: A brief overview. AARP, Oct 2003
[3], [4] obtained from US Census International Data Base. Elderly support ratio refers to the number of elderly 65 and above per 100 people aged between 20 and 64 years.
[6] **OECD Factbook 2006: Economic, Environmental and Social Statistics at http://titania.sourceoecd.org/vl=1401861/cl=24/nw=1/rpsv/factbook/08-01-02.htm accessed 1st August 2006**
[7] obtained from the OECD Health Project, Long-term Care for Older People 2005. Data for Israel is obtained from Statistical Abstract of Israel 2005 No. 56. Data for Malta is for the year 2002 and is obtained from Malta National Statistics Office
[8] obtained from International Labor Organization, 2003. *data for UK and Sweden are for the year 2000 and are obtained from United Nations Statistics Division. ^ data for Malta is for % elderly >60.

Country	Adult economic activity rate (%) (women), 2003 [9]	Women's share of the adult labor force (%), 2003 [10]	Adult (15+) employment rate (%) (women), 2003 [11]
UK	55.3#	46#	95.9#
Sweden	57.4	48	95.6
Germany	49.3	44	90.5
Australia	55.9*	45*	93.9*
USA	59.5#	47#	94.3#
Netherlands	55.9	44	95.6
Japan	48.4	41	95.1
France	49.2	46	89.1
Israel	49.1^	46^	88.7^
Malta	30.6*	31*	91.3*

[9] Data obtained from United Nations Statistical Division http://unstats.un.org/unsd/demographic/products/socind/inc-eco.htm accessed 1st August 2006. # Persons aged 16 years and over, "De jure" population, ^ Excluding conscripts

[10] Data obtained from United Nations Statistical Division http://unstats.un.org/unsd/demographic/products/indwm/ww2005/tab5d.htm accessed 1st August 2006. # Persons aged 16 years and over, * "De jure" population, ^ Excluding conscripts

[11] Data obtained from United Nations Statistical Division http://unstats.un.org/unsd/demographic/products/indwm/ww2005/tab5a.htm accessed 1st August 2006. # Persons aged 16 years and over, * "De jure" population, ^ Excluding conscripts

Technological Environment

Table 6. Technological Environment

Country	Mobile phones per 100 people, 2003 [1]	% of households with personal computer, 2000 [2]	% of households with internet connection 2000 [3]	Broadband subscribers per 100 people, 2004 [4]	% households with Cable TV [5]
UK	89.2	47	40.9	13.5	13
Sweden	98.2	60	53.8	16.5	50
Germany	78.5	53	27.1	10.2	53
Australia	71.7	53	43.0	10.9	6.8
USA	54.4	51	41.5	14.5	67
Netherlands	80.7	64	54.8	22.5	89
Japan	67.9	51	n/a	16.4	17
France	67.7	27	19.0	12.8	12
Israel	95.5	44	n/a	16.3	n/a
Malta*	80.2	38	21.9	10.4	25.3

[1] obtained from International Telecommunication Union 2004
[2] , [3] obtained from Information Society Statistics – Pocketbook 2001 Eurostat
[4] obtained from International Telecommunication Union 2005
[5] obtained from OECD – The development of broadband access in OECD Countries, 2001
*All statistics for Malta obtained from National Statistics Office, Malta, 2005

PERS Service Characteristics

Table 7. PERS Service Characteristics

Country	Year of Estimate	Year PERS introduced	Major Provider Company (s)	Number of PERS users [1]	% of elderly using/used PERS [2]	Costs of PERS service [3]	Primary funding for PERS units [4]
UK	2002	1979	Tunstall	1500000	16.00	£220, £4 monthly	Scotland -- regional councils are responsible for social services and meet the costs of PERS services using their own revenue and budget. England – costs are usually Health, Social Services of Housing cover the costs
Sweden	2002	1981	TeleLarm Care, Ericsson	200000	13.01	US$67 entrance fee, $20 monthly	Costs are borne totally by local authorities or shared between user and local authority. Costs are NEVER covered by state, organization or insurance. The home help staff determines who will receive a care phone. This decision is based on a medical certificate and one of the following criteria must be fulfilled: the person 1)has had a myocardial infarct, 2) has problem with his balance, 3) is dependent on a wheel-chair, 4) suffers from dizziness, 5) is paralysed, 6) suffere from other medical reasons
Germany	2005	1979	Tunstall, ANT Telefunken	340000	2.12	monthly 25-60 Euros	Part of the PERS costs can be reimbursed under the statutory care insurance scheme. This was introduced in 1995 and resulted in a significant increase in usage. This financial support is deducted directly between PERS service providers and care insurance
Australia	2004	1993	Silverchain	130000	5.10	Purchase	Costs are usually borne by the users' family

			CareLink, Tunstall			plan -- A$550, monthly $14 Rental plan -- A$120, $24 monthly	members or by the users themselves. No insurance plans that cover devices such as the PERS exists
USA	2004	1975	Lifeline, AMAC,	850000	2.34	$500-1000, monthly $35-$45	The user pays, sometimes with the help of relatives of local civic groups/church. Occasionally, private insurance companies help to cover costs, especially with recommendations from physician. Most states now provide financial support for PERS under Medicaid Home and Community Support Based Services Waiver Programs.
Netherlands	2002		Tunstall, KITTZ, TeleAlarm	120000	5.60		
Japan	2004		SECOM	250000	1.03		Basic alarm units are not reimbursable through the Long Term Care Insurance Scheme. Instead, they are supplied into and distributed from a number of regional municipalities that are significant in size but do not represent national coverage for PERS alarms.
France	2002		GTS, Tunstall	200000	2.06		Concerning alarm services there is financial aid procured by public authorities as well as the retirement funds (assembled under CNAV, Caisse Nationale d'Assurance Vieillesse), but this support is as a rule paid out to associations and public authorities, never on an individual

							basis. The associations are then free to offer free or low-cost alarms to persons needing it. (http://www.seniorwatch.de/reports/SW_D41_Final.pdf)
Israel	2004		Shahal, Tadiran Lifecare	12000	1.95		Most users pay for PERS out of pocket but the PERS service is also provided by voluntary organizations such as Yad Sarah. Borrowing equipment is free through Yad Sarah
Malta*	2005	1991	Maltacom	8783 (60+)	11.77		The Telecare Service is a highly subsidized service. No administrative fees are incurred in applying for this service. However, if the applicant is not: * 60 years or over; * in possession of the pink form; * lives totally alone or with two or more elderly persons Applicant must pay the Telecare rental fee, which is in the region of Lm1 to Lm1.33c + VAT. The service is nationalized and provided through the Ministry of Health, the Elderly and Community Care
[1] and [4] UK data obtained from British Telecommunications. Sweden, Netherlands and France data obtained from European SeniorWatch Observatory and Inventory – A market study about the specific IST needs of older and disabled people to guide industry, 2002. Japan data obtained from UK DTI Report 2004. Australia data obtained from "Management of Interference from Broadband over power line applications", PERSA submission to the Australian Communications Authority Discussion Paper, 2005. Germany data obtained from personal correspondence with Ludger Lappenküper, Tunstall Germany, January 2005. Israel data obtained from Yad Sarah, 2004. Malta data obtained from Ministry of Health, the Elderly and Community Care – Telecare Service, 2005.							

Figure 7. Percentage of population above 65 years of age and PERS ownership

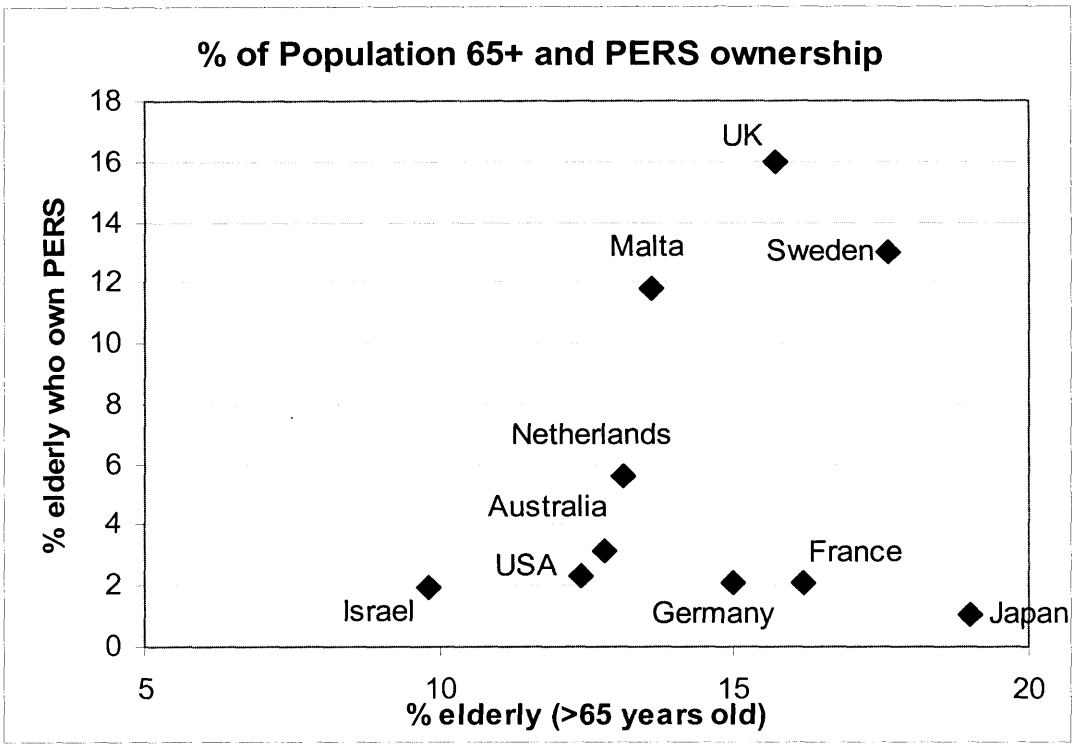


Figure 8. Solitary living and PERS adoption rate

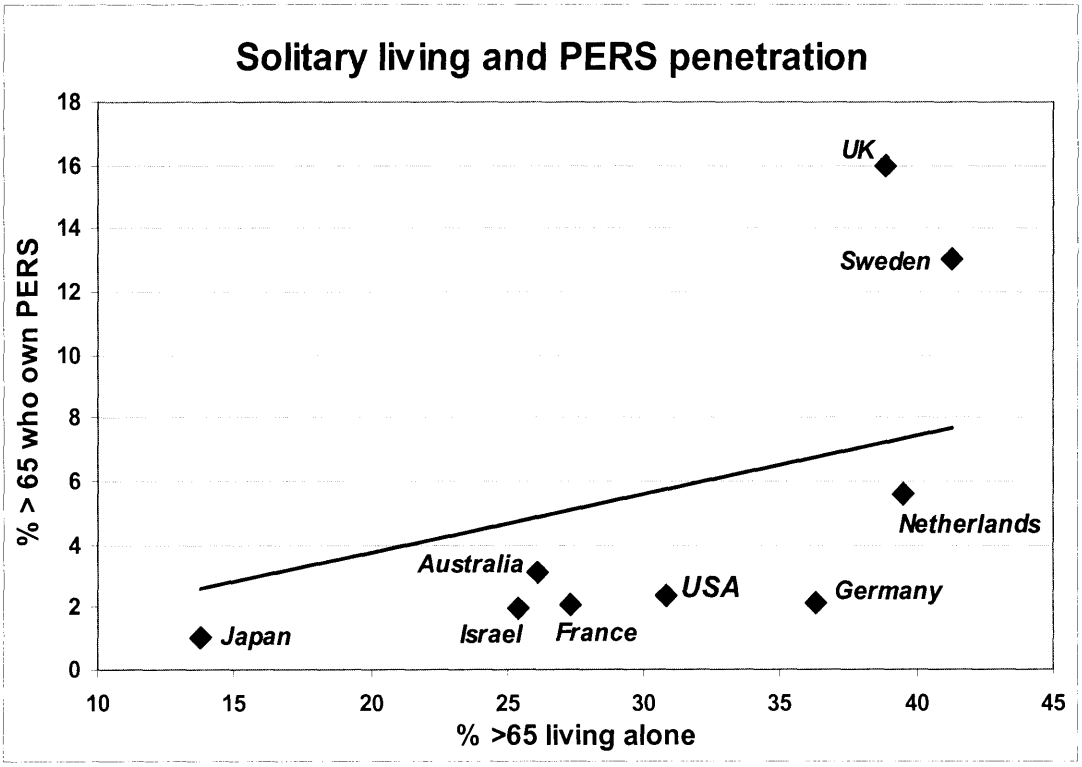


Figure 9. Public Long Term Care Spending as % of GDP and PERS Ownership

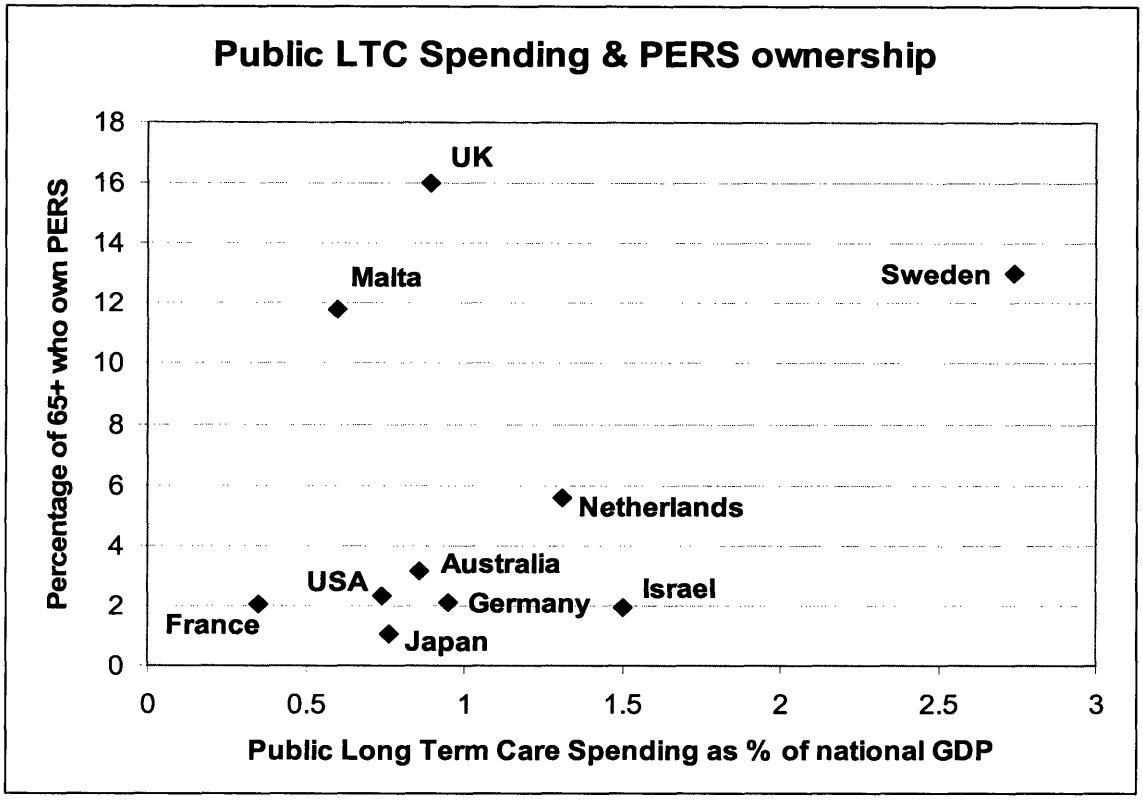


Figure 10. Number of mobile phones per 100 inhabitants, 2003

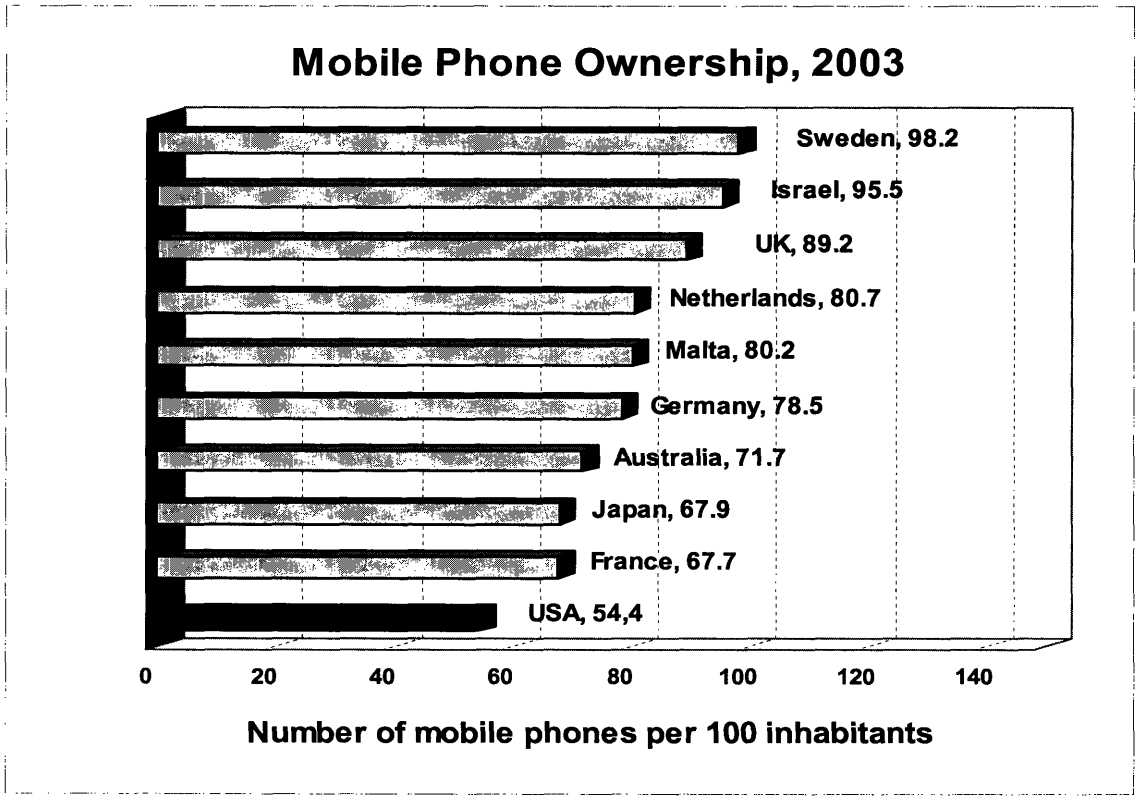


Figure 11. Percentage of households with Personal Computer, 2000

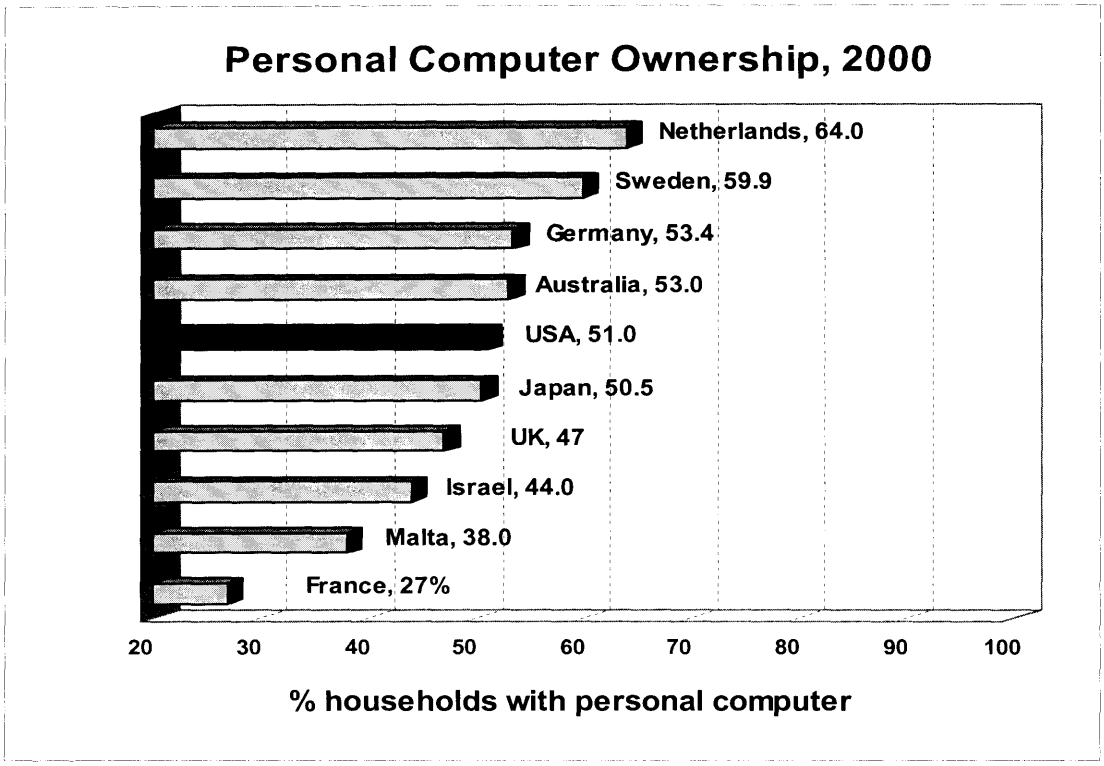
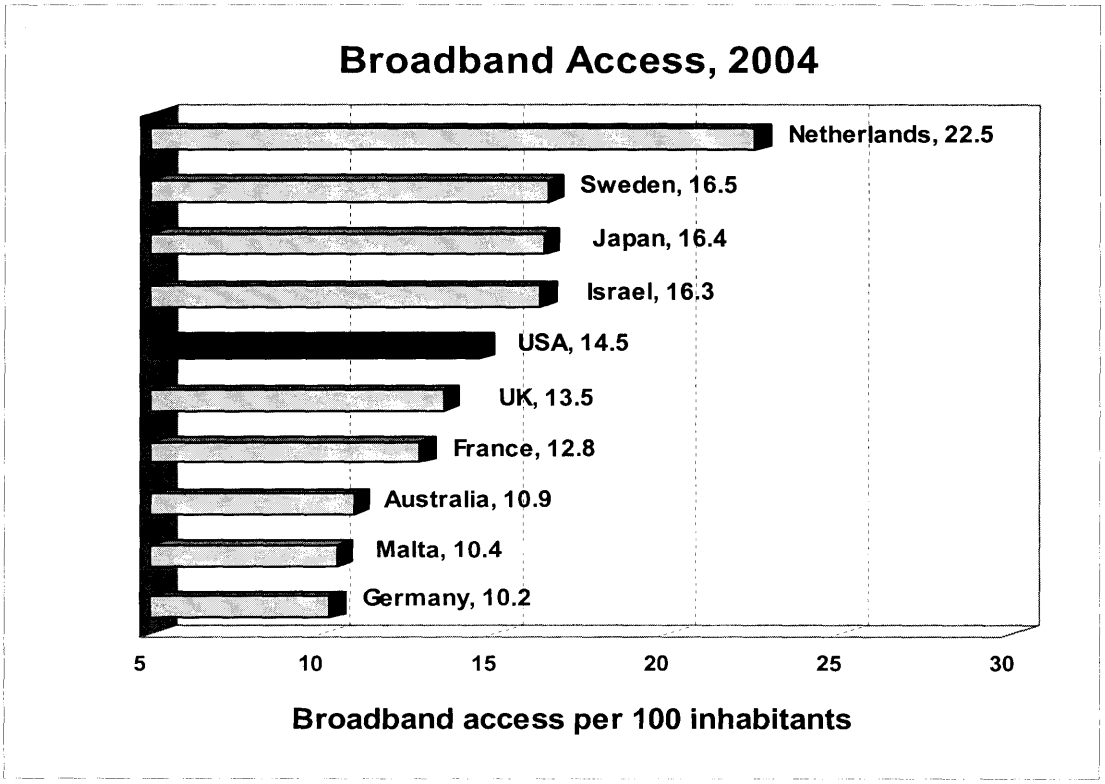


Figure 12. Broadband access per 100 inhabitants



CHAPTER 4: EDUCATING THE NEXT GENERATION OF ELDER CARE PROFESSIONALS

The previous chapter showed that the availability and affordability of a useful and usable elderly care technology does not guarantee its adoption by older adults or their caregivers. This chapter proceeds to examine the second hypothesis for the slow diffusion of these technologies, focusing on the issue of human capital development in the elderly care profession.

Assistive technologies in the form of mobility aids, communication devices and home modifications have the potential to greatly improve the quality of life for older adults and their caregivers by enabling the elderly to "age-in-place." (U.S. Senate Hearing 108-33, 2004). On a societal level, technology-based monitoring systems such as Personal Emergency Response Systems that provide round-the-clock emergency aid and telehealth systems can ease caregiver stress and reduce the financial burden of elderly care on the national health system (Hyer & Rudick, 1994, Roush & Teasdale, 1997).

Older Americans use a disproportionately larger share of health care services provided by physicians, nurses, pharmacists, physical therapists and other care professionals. In 2000, adults 65 and older made up only 12% of the population but use 23 percent of U.S. ambulatory care visits, 48 percent of hospital days, 69 percent of home health services, and represent 83 percent of the residents in nursing facilities (Kovner et al. 2002). The complex needs of older patients often require health care providers with aging-related expertise to work together to coordinate care in a variety of settings – the patient's home, the physician's office, the hospital, the nursing home (O'Neill & Barry, 2003). These demands, coupled with the limited capacities of long term care institutions and the

worsening nursing and social care worker shortages (AACN, 2006, Social Work, Aging & Public Policy, 2005), have stimulated an increase in policy and public dialogue over the usefulness of telemedicine and telehealth systems for meeting the demands for elderly care. Although there are mixed opinions about the benefits of available technologies, there is consensus that the benefits of such technologies can only be realized if users have the capabilities to understand and interact with the devices.

Coughlin (2004) identified "technology education" as a key element of the infrastructure needed to support the use of technology in elder care, emphasizing the need for traditionally "high touch but low tech" social workers, gerontologists, physicians and nurses to understand how emerging technologies are going to fundamentally change their practice". The utilization of technology for elder care involves a multi-sided platform where the technology has to be adopted by both care providers and the elderly users themselves. Extensive research has been done on barriers to the adoption of technology by the elderly (Czaja et al. 2005, van Berlo, 1998, Technology for Adaptive Aging 2004), but it is critical that we also consider the adoption of the same technologies by the care providers.

The research for this chapter examines the efforts of our national education system to develop a technologically ready professional care workforce. The development of technology evolves at a rapid pace each day, making it more challenging to keep medical and care professionals up to date with the most recent technological developments. The Association of American Medical Colleges has specified a set of informatics skills mandatory for addressing the professional needs of all medical students. [15] Doctors today have access to courses that teach them how to use Tablet PCs,

[15] Association of American Medical Colleges, Report II Contemporary Issues in Medicine: Medical Informatics and Population Health, Medical Schools Objectives Project 1998

Personal Digital Assistants and Electronic Notebooks to enhance their clinical interaction and information management efficiency. However, the physician's responsibility is primarily to heal or cure, and with the strains on demand for medical care, patients are transferred to secondary care as soon as possible. This is where patients spend more of their time, and begin to plan for moving back into their own homes and regaining their independence. If we look at human capital as a bridge to facilitate the entry of technology into the life of a senior citizen, we should focus on the points of contact in secondary care, when the patient's priority is to regain normalcy in life.

We now ask this question of our professional care workforce: With the introduction of complex information technology systems such as telemedicine, wireless monitoring and robotics, are our nurses, social workers and public health workers informed and prepared to incorporate these technologies into elderly care?

Literature review

The need for a trained professional workforce to implement and effectively use e-health and information technology innovations in health care has been articulated by several researchers. More than a decade ago, Estes et al. (1993) identified a liability to the provision of high-technology health services to homes as an "increased need for highly skilled, specially trained staff and changes in organizational structure". Kaye et al. (1995) reinforced this notion, adding that health care staff need to be familiar with using these technologies as they are responsible for teaching the patient and informal caregivers how to perform certain self-care tasks that may require the use of the technologies. Richardson et al. (2002) describes the big challenge faced by the healthcare sector around the world in "managing the change in practices and roles as a

result of the widespread integration of IT and the resulting healthcare reform". Constantelou & Karounou (2004) stress that an important prerequisite for the successful use and widespread introduction of new technologies in the health sector is the "acquisition of new types of skills by citizens, patients, doctors, nurses and other health care professionals." In addition, they emphasize that "human resource development through appropriate education and training is a key factor in coordinating efforts by stakeholders, introducing new working methods and gradually transforming traditional healthcare service providers into agencies that provide a wide range of eHealth services".

Inadequate user training has been identified frequently as a barrier to telemedicine adoption. Livens & Jordanova (2004) described this as a "paucity of staff with IT skills and experience in the health environment". With respect to specific disciplines, Yellowlees (2005) identified the "inadequate training of physicians to use the system as a barrier to successful adoption, and Lamb & Shea (2006) described the lack of telehealth education as a "major barrier to nurses being able to acquire the necessary knowledge and skills to incorporate new technologies into their practice".

Calls for the incorporation of IT skills into nursing and social work curriculums have been made by educators and practitioners. McNeil et al. (2003) highlighted the need for additional education of nursing directors and faculty specifically addressing the importance of information technology for supporting evidence-based health care. The implementation of telemedicine systems will require nurses to learn how to "install, calibrate and operate the equipment, as well as to recognize and fix technical problems" (Dansky et al. 1999) Scharlach et al. (2000) asserts that social work is not adequately prepared to practice in the aging society and emphasizes the need for gerontological

social work education and training to evolve in response to societal forces and emerging intervention technologies.

Previous research has examined the incorporation of geriatrics or gerontology into nursing and social work curricula (Quinn et al., 2004, Lee & Waites, 2006). Other research has examined the use of information technology for academic teaching in social work (Sandell & Hayes, 2002), nursing (Staggers et al., 2001) and the extent to which nursing programs have incorporated IT skills and knowledge into curricula (McNeil, 2003).

This study provides a unique perspective on the technological readiness of the aged care workforce, which includes not only nurses, but also social workers, public health workers and gerontologists.

Research questions

This study was designed to answer the following questions:

- Do professional carers have the opportunity to learn about technology and its implementation in elderly care in undergraduate or graduate school?
- If so, what specific technology knowledge and skills are the students being taught?
- If not, what are the reasons for a lack of education curricula in this area?

Methodology

A curriculum survey was conducted to obtain information about professional care education, in particular whether professional nurses, social workers and public health

workers were being educated about technologies being earmarked for implementation into the elderly care setting.

Selecting the sample set

The education programs included in the sample set were selected using the 2004 USNEWS graduate school rankings. The sample set consisted of the top 20 Nursing (Masters) programs, top 15 Nursing (Gerontological/Geriatric Specialty), top 15 Social Work programs, and top 15 Public Health programs. In addition, eight schools with established "Technology and Aging" research centers or programs were identified for a similar curriculum survey. Six of these research centers were mentioned in the "Technology and Innovation in an Emerging Senior/Boomer Marketplace" report, prepared by the US Department of Commerce for the 2005 White House Conference on Aging. The other two were selected for their relevant work in Technology and Aging. From the set of colleges among the 4 sets of USNEWS rankings listed above, gerontology programs from 15 of these colleges were selected randomly. Examining the professional care programs (though they are not among the USNEWS top 15 rankings) in schools with established technology & aging research allows us to make observations on whether technological innovation and development can fuel or stimulate changes in curriculums in different disciplines within the same university. The motivation for including the gerontology programs was to find out if "technology for elderly care" education was incorporated into curriculums through other departments or channels. A total of 77 different programs from 48 different universities were examined in this study. (See Table 8 and 9)

Table 8. Colleges included in the study (alphabetical order) (n=48)

Boston College	University of Chicago
Boston University	University of Colorado Health Sciences

Case Western Reserve University	Center
Columbia University	University of Florida*
CUNY- Hunter College	University of Illinois - Chicago
Duke University	University of Iowa
Emory University	University of Maryland, Baltimore
Florida State University*	University of Massachusetts—Boston
Fordham University	University of Miami*
Georgia Tech University*	University of Michigan - Ann Arbor
Indiana University - Purdue University	University of Minnesota -- Twin Cities
Ithaca College	University of North Carolina, Chapel Hill
Johns Hopkins University	University of North Carolina–Greensboro
Massachusetts Institute of Technology*	University of Pennsylvania
New York University	University of Pittsburgh
Oregon Health and Sciences University*	University of Rochester*
Penn State University	University of Southern California
Rush University	University of Texas - Austin
University of Alabama, Birmingham	Univ. of Texas Health Science Center–Houston
University of Arkansas for Medical Sciences	University of Washington
University of Arizona	University of Wisconsin-Madison
University of Buffalo, New York*	Washington University in St Louis
University of California, Berkeley	West Virginia University
University of California, Los Angeles	Yale University
University of California, San Francisco	

*marked colleges make up the set of eight colleges with established Technology & Aging research programs

Table 9. Programs included in Curriculum Survey (alphabetical order) (n=70)

Nursing (n=30)	Social Work (n=17)
Boston College	Case Western Reserve University
Case Western Reserve University	Columbia University
Columbia University	CUNY- Hunter College
Duke University	Florida State University*
Florida State University*	Fordham University
Indiana University - Purdue University	University of Buffalo, New York*
Johns Hopkins University	University of California, Berkeley
New York University	University of California, Los Angeles
Oregon Health and Sciences University	University of Chicago
Rush University	University of Michigan, Ann Arbor

University of Arizona University of Arkansas for Medical Sciences University of Buffalo, New York* University of California, Los Angeles University of California, San Francisco University of Colorado Health Sciences Center University of Florida* University of Illinois, Chicago University of Iowa University of Maryland, Baltimore University of Miami* University of Michigan, Ann Arbor University of North Carolina, Chapel Hill University of North Carolina, Greensboro University of Rochester* University of Pennsylvania University of Pittsburgh, Main Campus Univ. of Texas Health Science Center, Houston University of Washington Yale University	University of North Carolina, Chapel Hill University of Pennsylvania University of Southern California University of Texas, Austin University of Washington University of Wisconsin, Madison Washington University in St Louis
Public Health (n=15)	**Gerontology (n=15)**
Boston University Columbia University Emory University Harvard University Johns Hopkins University University of Alabama, Birmingham University of California, Berkeley University of California, Los Angeles University of Michigan, Ann Arbor University of Minnesota, Twin Cities University of North Carolina, Chapel Hill University of Pittsburgh University of Texas Health Science Center, Houston University of Washington	Case Western Reserve University Ithaca College Pennsylvania State University University of Alabama, Birmingham University of Arizona University of California, Los Angeles University of Florida University of Iowa University of Massachusetts, Boston University of Minnesota, Twin Cities University of North Carolina, Greensboro University of Southern California University of Texas Health Science Center, Houston University of Washington

Yale University	West Virginia University

* marked Colleges were included in the set of eight colleges with established Technology & Aging research programs and not selected from USNEWS rankings

Curriculum Survey Procedure

For each of the 77 programs in the sample, the course catalogs for Fall 2005 and Spring 2006 semesters were obtained from the college registrar website or the program department website. A manual, visual scan of both undergraduate and graduate courses listed in the catalogs was done to identify courses that introduced or addressed the use of technology in elderly care provision. Courses with titles containing keywords such as "Elderly, Older adults, Aging, e-Health, Geriatric, Long Term Care, Home Health care, Informatics, Technology, Telehealth, Telemedicine, Digital, Gerontology, Geriatric, Robotics, Assistive, Devices" were identified and compiled, together with their course descriptions.

Seeking Expert Opinion

To add to and to validate the conclusions from the curriculum surveys, we sought the opinions of leading academics and researchers on the issue of technology education for professional carers. We identified the individuals through faculty bios on top graduate programs, publications and recommendations from other leading academics active in the field of technology, aging and health care provision. A total of 17 individuals were selected (Nursing-6, Technology & Aging research-7, Gerontology / SocialWork / PublicHealth-4). Each individual was sent an email questionnaire relevant to their institution, teaching responsibilities and research interests. We received a total of 11 responses (65% response rate). Responses were collected and grouped into common

themes that addressed the research questions for this study. Questions included in the email questionnaires include:

1. Do you feel that the health care profession being adequately prepared to incorporate such technologies (e.g. Telemedicine and consumer-centric telehealth tools) into treatment or caregiving?)
2. Do you feel that there a missing educational component that is hampering the diffusion of aging technology into the society?
3. Do you feel that incorporating technology-related courses into nursing curriculums to familiarize nurses with new technologies will improve the adoption rate of such technologies, especially in geriatric care?
4. Do you feel that there is an urgent need to add such courses to the nursing school curriculums?
5. Do you feel that incorporating aging-related courses into engineering or design curriculums or technology-related courses into health care curriculums will improve the adoption rate of subsequently developed technologies such as telecare and home monitoring systems?
6. Do you feel that there is an urgent need to develop such inter-disciplinary curriculums within educational institutions?
7. Do you feel that there is a role for the government to play in encouraging such interdisciplinary education?

Results

The findings from the curriculum survey show that elderly care is addressed significantly in almost every professional care education curriculum examined. The

courses can be loosely grouped, based on their course titles and descriptions, into the following categories:

1. Sociology of Aging
    - Labor force participation, retirement, health care, family structure
    - Stratification, marginalization
    - Political participation and mobilization
2. Biology of Aging
    - Physiological changes, frailty, mental illness
    - Cognitive Aging, changes in intelligence, attention, memory, perception
    - Onset of chronic diseases or common elderly diseases
3. Health Care for the Aging
    - Nursing Strategies
    - End of Life Care, Disease management strategies
    - Rehabilitation
    - Health Informatics to improved nursing administration efficiency
4. Public Policy for the Aging
    - Financing the Aging / Economics of Aging
    - Federal and state health policies, Medicare and Medicaid
    - Long term care systems

Although there is increasing attention placed on technology, especially on health informatics as a tool for improving administrative efficiency or reducing costs, the number of courses that focus on introducing technology into the professional care setting is limited. Of the 77 programs in the sample set, only 12 programs (16%) had a course or courses listed in the catalog that was relevant to the implementation of technology in elderly care (Table 10). Of the 12 programs, 9 were Nursing programs

and 3 were Public Health programs. . None of the social work curriculums surveyed contained relevant technology courses.

We documented 14 relevant courses in total. With the exception of the Robotics Applications course offered in the University of Pittsburgh, which addresses elderly users, all of the 13 other courses are focused on Information Technology in Health Care for the general population, which reflect current implementation trends in the US health care system.

Table 10. Programs & Courses addressing Technology & Elderly Care

(Course descriptions can be found in the Table 12)		
University	**School**	**Course**
University of Washington	Nursing	NMETH 526 Patient-Centered Interactive Health Communication Technologies
University of Pennsylvania	Nursing	551. Applied Health Informatics
University of Pittsburgh	Nursing	NUR 2840 Robotic Applications
University of Pittsburgh	Public Health	PUBHLT 2010 Online Public Health – Informatics and Intervention
University of Alabama-Birmingham	Public Health	HB604 High Technology Approaches to Health Communications and Behavior Change Interventions
University of Colorado Health Sciences Center	Nursing	NURS 6284 Telehealth Applications NURS 6013 Human Technology Interface
University of Texas – Houston	Nursing	N6131 Technology Assisted Health Care Management
University of California, Berkeley	Public Health	243C Information Systems in Public Health.

New York University	Nursing	N41.2236 Consumers and Interactive Health Care
University of California, San Francisco	Nursing	210A. Intro to Health Care Informatics.
University of Michigan	Nursing	Nursing 565 Current and Emerging Issues in Home Health Care.
University of Rochester	Nursing	NUR 338 Information Technologies in Health Care NUR 561 Using Emerging Information Technology to Enhance Clinical Teaching

The curriculum survey conducted for the 8 schools active in Technology and Aging Research shows that these schools, with the exception of the University of Rochester and Florida State University, do not offer technology-related courses in their professional care curriculums, or do not offer health care or social work education programs at all (Table 11). Schools such as MIT and Georgia Tech are at the forefront of technological development – both schools are developing smart home monitoring technologies and wearable electronics – but neither of them have nursing, social work or public health degree programs. The University of Rochester's Center for Future Health engages both engineering and health care experts in the development of self care and self monitoring technologies for the aging population, and its Nursing School incorporates Information Technology education into the curriculum. Florida State University is part of CREATE (Center for Research and Education on Aging and Technology Enhancement), a consortium of three universities (The University of Miami, Florida State University and Georgia Institute of Technology) that aims to enhance the usefulness and usability of technology by conducting research to understand aspects of human interaction with technology. It has both nursing and social work degree

programs, and Florida State University's Pepper Institute on Aging and Public Policy offers an interdisciplinary Aging Studies program with courses such as "Age and Human Performance" that addresses smart homes and medicine adherence design issues.

Table 11. Curriculum Survey of Professional Care Programs in Schools active in Technology & Aging Research

School	Professional Care Education	Rank	Relevant course
MIT	None	n/a	None
Georgia Tech	None	n/a	None
University of Miami	Nursing	# 115	None
Florida State University	Nursing Social Work	# 115 # 28	ISS 2937-02 Age and Human Performance
University of Florida	Nursing	# 39	None
University of Buffalo – NY	Nursing Social Work	# 94 # 46	None
University of Rochester	Nursing	# 29	NUR 338 Information Technologies in Health Care NUR 561 Using Emerging IT to Enhance Clinical Teaching
Oregon Health and Sciences University	Nursing	# 6	None

Table 12. Programs with courses addressing the implementation of technology in care (n=12)

University	School	Course	Course Description
University of Washington	Nursing	NMETH 526 Patient-Centered Interactive Health Communication Technologies	Overview of current and emerging consumer-centric e-Health tools and technologies. Researchers and practitioners from multiple disciplines present theories, concepts, and principles from health, information, cognition, and human-factors sciences as they relate to the development and use of these tools and technologies
University of Pennsylvania	Nursing	551. Applied Health Informatics	This course is designed to address issues related to the impact of information technology on health care practitioners and consumers of all ages. Students will learn about and gain experience with practical applications of information technology (Access, handheld devices, telehealth, Internet resources) that improve the quality of health care communication and delivery and facilitate health care research. Class projects include working with clinical databases and evidence based information sources.
University of Pittsburgh	Nursing	NUR 2840 Robotic Applications	This course brings together an interdisciplinary group from nursing and other health disciplines, computer science, and robotics to design and evaluate mobile robot systems that help community-residing, frail older adults and persons with disabilities sustain their

			independence. In collaboration with faculty, students will engage in hands-on learning of skills relevant to the design, development, and evaluation of service robots that assist elderly/disabled people. Thru seminar discussion and lab, students will learn from faculty and each other how to design technology that can serve people.
University of Pittsburgh	Public Health	PUBHLT 2010 Online Public Health – Informatics and Intervention	The internet is a tool that has not yet been fully exploited by the field of public health. This course is designed to promote the necessary skills both to retrieve and manage public health information from the internet and to create online public health interventions. The course is designed to be a hands-on learning experience with classes held in a computing lab classroom.
University of Alabama-Birmingham	Public Health	HB604 High Technology Approaches to Health Communications and Behavior Change Interventions	To present students with an initial, in-depth exposure to concepts, technical skills and research findings associated with the integration of computer technology and health communications
University of Colorado Health Sciences Center	Nursing	NURS 6284 Telehealth Applications	This course focuses on the design and application of telehealth principles to the delivery of health care. The course reviews the current state-of-the-art applications and allows students to examine these applications in terms of human computer interaction, legal, ethical and policy issues. The course highlights the evidence-based support for telehealth applications

		NURS 6013 Human Technology Interface	The analysis of the legal, ethical policy in human interface issues related to the impact of technology on the individual, health care and society
University of Texas – Houston	Nursing	N6131 Technology Assisted Health Care Management	This course is designed for advanced practice nursing students preparing for health care delivery. The purpose of this course is to provide a framework for addressing the health care concerns of patients and their families using technology. Students will have the opportunity to use technology to provide distanced health care support for a patient and their families. They will generate a plan to monitor quality, address legal implications, and consider implications for patient populations at risk.
University of California, Berkeley	Public Health	243C Information Systems in Public Health.	An introduction to new information systems, such as the Internet and interactive television, and how they may be used to improve human health. The course has three objectives: first, to familiarize students with new information technologies; second, to review how these technologies will be used by public health professionals, consumers, health care providers, and others; and third, to study related ethical and legal issues such as privacy, access, and liability. The course is designed for people with minimal

			understanding of interactive technologies
New York University	Nursing	N41.2236 Consumers and Interactive Health Care	This course prepares nurses to employ a variety of interactive strategies and technologies to enhance health care delivery to consumers, with an emphasis on increasing access to underserved populations through reducing health disparities. Strategies for the successful deployment of technologies, as well as policy, research, funding, and reimbursement issues are explored. Consumer and computer interaction is emphasized and exemplified through specific computer applications
University of California, San Francisco	Nursing	210A. Intro to Health Care Informatics.	Introduction and overview of healthcare informatics focused on the building blocks for computer-based systems with specific application examples, such as clinical information systems, educational technologies, telemedicine, digital libraries, simulation and modeling.
University of Michigan	Nursing	Nursing 565 Current and Emerging Issues in Home Health Care.	Provides a multidisciplinary group of graduate students with an overview of current and emerging issues in home health care as well as a historical perspective of the field. Organizational structures and services within home health agencies are reviewed. Emphasis is placed on analyzing how legislative, technological, economic, and social forces

			impact administrative planning and decision-making in home health care. Factors that influence professional and para-professional service delivery, health policy development, marketing strategies, and research development in home health, are also explored.
University of Rochester	Nursing	NUR 338 Information Technologies in Health Care	This course will explore information technology as it applies to the health sciences. It will provide participant s with an overview of information technology from basic desktop computing to the use of the worldwide web. Also included will be content on health care information systems as well as the ethical and public policy implications of information technology. The format of the course will be intensive class days combined with internet-based learning. This course is intended for students who are self-directed, as there is a large amount of independent learning required.
		NUR 561 Using Emerging Information Technology to Enhance Clinical Teaching	This course is designed to give the student an overview of the use of technology in health care. The student is presented with examples of how technology interfaces with health care in the areas of education, research and clinical practice. Examples of technological applications are presented throughout the course.

Discussion

In a country high on inventions and innovations, technology holds great promise for our aging population. However, for technology to realize its full potential, it must rapidly move from research laboratories into living rooms, health care settings and long term care. This requires both the elderly and their care providers to understand, adopt and embrace the technologies. Professional care providers engaged in care delivery must not only be technologically competent. As one respondent puts it aptly, they need a "better awareness of the opportunities that these technologies care provide". Care providers must be able to see the tangible benefits of technology and actively promote the use of these technologies to the elderly and also other health care providers.

The observations from the curriculum surveys reflect a gap that may hinder the transfer of knowledge and expertise between engineering (technological innovation) and health or social care (implementation) disciplines. The development and delivery of curriculum lags behind the rapid development and market entry of technologies developed for the aging population. This sentiment was echoed by respondents who felt that "education has not kept up with the pace of technological development" [16] and that "implementation in practice is far ahead of curriculum" [17]. To address this, educators must overcome a range of barriers that currently hinders the development and delivery of technology curriculum in nursing, social work and public health curriculums. The existence of these barriers was echoed by the experts who responded to the email questionnaires.

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[16] Professor, Department of Occupational Therapy & Director of a Technology and Aging research facility
[17] Associate Chief, Nursing Research

Change Management

"There are misconceptions with telehealth that we will lose the human touch or replace nurse." [18]

"I believe that the more people who know about these technologies the more likely they are to be introduced and accepted into practice." [19]

"We do have lots of discussion about the "peopleware" issues surrounding decision support technologies" [20]

In any organization, the implementation of new procedures and technologies in response to external changes or to achieve internal objectives will often meet with resistance to change. In professional care provision, the introduction of technology into the care setting leads to significant attrition, due to the ingrained perception among the elderly and professional carers that "high tech" and "high touch" (Naisbitt, 2001) are mutually incompatible.

Cost of Technology, Velocity of technological innovation and half life of curriculum

"Currently, much of the technology is costly and, as we all find out with our computers, the technology is almost constantly being updated..."[21]

"Since the field of aging and technology is still being currently investigated, I would not expect there would be classes on the subject yet... we don't have enough information to develop classes..."[22]

[18] Associate Professor, Department of Nursing
[19] Associate Professor, Department of Nursing
[20] Assistant Professor, Department of Health Management and Informatics
[21] Associate Chief, Nursing Research
[22] Assistant Professor, Psychosocial and Community health

Technologies fresh out of research laboratories tend to be costly and become obsolete upon successive releases of new or updated versions. Investing in technologies that are relevant for a one semester course may not be an attractive option for educators. Also, infrastructure costs e.g. wireless or cable networks costs needed for some of today's technologies can be difficult to overcome, especially if there is insufficient financial support from schools or the government. The perception that research is not yet ready for translation into curriculum may be a result of the velocity of technological innovation. Technological innovation will not come to a standstill, hence users are likely to feel as though research in technology and aging is in constant progress and hence not ready for translation into curriculum yet. However, waiting for research to develop further without a parallel effort to update educational curricula will only widen the gap between user-training and implementation.

Usability by students and faculty

"There aren't enough easily implemented useful technologies out there, and those that exists work as a solo item." [23]

"Physicians often aren't interested in technology that improves a patient's life, especially if they themselves are not comfortable with technology" [24]

The rapid development of health care technologies has resulted in the introduction of multiple technological tools into the health care provision setting. Some of the technologies fail to live up to the hype that precedes their introduction, and therefore not all technologies adopted by health care providers have proven to be useful and usable. Useful technologies developed and manufactured by different companies are

[23] Medical Director of a Technology and Aging research facility
[24] Associate Chief, Nursing Research

often incompatible with each other, hence care providers are often required to learn how to switch between tools and technologies that operate on different principles or system architectures.

Ageism and Technology

"Many manufacturers do not conceptualize how an older person might use, or be able to use a device (electronic medication reminder / dispenser" [25]

"The curriculum push should be on the engineers, even more than health care providers" [26]

"There is a serious lack of collaboration among different disciplines in professional education" [27]

"It might be better to think of it as a two sections course, one for life science students emphasizing technology, and one for computer majors emphasizing the user population, social echological issues, etc." [28]

Although the focus of this study is not so much on the design of technology for older users, it is important to keep in mind that much more than training care providers is needed to make technologies acceptable by users. The good news is that concerns about inclusive design and the need for greater awareness of elderly demands has not gone unnoticed. Efforts to integrate design-for-all concepts and human factors engineering approaches to the development of technologies for the elderly are ongoing and receiving significant public and policy attention.

[25] Medical Director of a Technology and Aging research facility
[26] Medical Director of a Technology and Aging research facility
[27] Professor, Department of Occupational Therapy & Director of a Technology and Aging research facility
[28] Principal Investigator and Director of a Technology and Aging research facility

Limitations

Limitations of this study include the following:

- Technology education may have been hidden in other courses and our method did not catch it – may be in other degree programs such as Rehabilitation / Occupational Therapy. If cross-registration is allowed, professional carers can benefit from these courses too.
- Syllabus content for the courses was not examined. Technology education may have been part of a course but was missed during the curriculum survey which looked at course titles and course descriptions found in the catalogs only.
- The curriculum survey did not include inter-disciplinary health related programs that may have integrated engineering or technology topics and health care or aging topics into a single curriculum.
- Technology Education may be offered in Continuing Medical Education but not in the current curriculum affecting the next generation of care professionals (who will be caring for the baby boomer generation) who is graduating in 2006.
- On the job learning is one way of equipping care professionals with technical skills and familiarity. However, it is unclear how fast the learning curve is and what kind of impact this may have on change management

Conclusions and Recommendations

The results of this study reflect a gap in technological education and preparation of the elder care workforce in their undergraduate and graduate school curriculums. Although many graduates may pick up relevant technical skills on the job or through continuing education, the increasing ubiquity of technology in education may be

available In the few programs that offer relevant technology education courses, the focus tends to be on the implementation of telehealth and telemedicine systems. Through the expert responses, we were able to identify some factors that contribute to the lack of education curricula in "technology and aging". These barriers include change management issues, cost and usability of emerging technologies, velocity of technology development and ageism stereotypes.

The need to train our professional care workforce for the rapidly aging population is urgent. Technology in its various forms promise to assist, complement and enhance the capacity of our elderly care workforce, but their potential can only be realized if the barriers to successful implementation are removed. In this study, we examined one such barrier – the inadequacy of human capital development.

Integrating technology successfully into quality elder care will require an interdisciplinary approach that assimilates cutting edge developments in health care provision with frontline technology development. Academic institutions must seek ways to create synergies between traditionally distinct academic domains such as health care and engineering research in order to keep pace with the evolving technological arena and changing consumer demands. Developing effective interdisciplinary curriculums requires time and financial support, both of which are becoming scarcer today.

Financial support can be provided in the following ways:

1) Planning and Curriculum Development Grants can be provided by the Federal Government. Federal agencies and institutions such as the Department of Veteran Affairs (VA), the Department of Education, the National Institutes of

Health (NIH), the National Institute of Aging (NIA), the Department of Defense (DOD), National Aeronautics and Space Administration (NASA) can provide curriculum development grants to academic institutions seeking to develop integrative curriculums that combine technology development with health care provision for the elderly. There is significant potential for technologies developed by the DOD and NASA, such as robotics and remote monitoring systems, to be implemented in health care or elderly care settings. By encouraging the development of such curriculums, agencies can optimize the benefits from these cutting edge technologies.

2) Grants from foundations and non-governmental organizations can be used to encourage collaborations between universities that research and teach professional care education, and also between schools in the same university. The study result showed that many schools developing modern technologies for the elderly are unable to translate these technologies into practical usage efficiently because they lack departments that provide professional care education (nursing, social work, public health, gerontology). Even within universities that develop technologies as well as provide professional care education, there is often a lack of interdisciplinary collaborations. Foundations such as the John A. Hartford Foundation, the American Geriatrics Society's Foundation for Health in Aging and the Atlantic Philanthropies all seek to promote innovations in the development and delivery of services for the elderly, and have been enthusiastic in supporting educational programs that focus on geriatric care. Organizations such as Hebrew SeniorLife and advocacy groups such as the Association for Advancement of Retired Persons (AARP) can also provide financial support for collaborative efforts. Hebrew SeniorLife already participate in collaborations with academic institutions such as the University of

Massachusetts and Northeastern University, and the AARP has been supporting education efforts through its Office of Academic Affairs.

3) The private sector can also support curriculum development or collaborative efforts by providing financial support or technology equipment to academic institutions. Similar to physician detailing efforts of the pharmaceutical and medical device, the provision of services and equipment to elderly care professional training programs can be beneficial for both the private sector and the academic institutions. This approach creates a larger role for companies and technology developers to play in education and training. By emphasizing the marketing opportunity available to technology developers and manufacturers, academic institutions can overcome the high costs of purchasing and integrating new technologies into their curriculums. The burden of equipment maintenance and upgrade can also be reduced if manufacturers collaborate with academic institutions. The establishment of such partnerships can be facilitated via trade or industry associations such as the American Telemedicine Association, or through platforms such as the Center for Aging Services Technologies (CAST). Policy makers can also consider the feasibility of tax incentives to encourage private businesses to establish partnerships with educational institutions.

Aside from financial support, other measures can also be adopted in order to foster and encourage innovative curriculum development efforts. These measures include:

1) Highlighting "best practices" or programs that have been successful in developing interdisciplinary collaborations that equip elderly care professionals with adequate and appropriate technological knowledge. One such example is the "Aging in Place" project started in 1996 at the University of Missouri-

Columbia. It involves an active collaboration between the Sinclair School of Nursing and the Computer Engineering and Health Informatics department. These successful initiatives can encourage educators and curriculum developers to adopt a proactive approach to this issue, as they provide ideas about how to incorporate "technology-focused" education into their curriculums.

2) Develop course frameworks that are not time-bound and less likely to become obsolete. Instead of developing courses for specific technologies that are likely to become obsolete quickly due to the rapid speed of technological development, course frameworks that are easily adaptable to technology upgrades or to the incorporation of new technologies will be more lasting. Robust yet flexible frameworks will also be more suitable for private industry participations, as the companies and manufacturers involved may change or the equipment and services they contribute may require frequent upgrading.

3) Umbrella associations or professional carers interests groups such as the Council on Social Work Education, National Gerontological Nursing Association, Association for Gerontology in Higher Education, Association of Schools of Public Health and the American Association of Colleges of Nursing (AACN) can partner with their counterparts in the informatics area such as the American Nursing Informatics Association (ANIA), American Medical Informatics Association, to address curricula development needs for leveraging informatics and other technologies in elder care. Initiatives introduced by these associations may have greater visibility and are more likely to be accepted and acted upon by their respective members.

By becoming familiar with useful technologies at an early stage of their educational experience, care providers will not only be more comfortable with using these technologies, they will also be more likely to welcome emerging technologies and novel innovations into their working environments. The dual-understanding of geriatric care and technology usage will enable care providers to become active participants in the design and implementation of even newer and more advanced technologies. Technical competency, coupled with the trust that the elderly have in them will position care providers as vital channels for technology diffusion from the laboratories into elderly homes.

CHAPTER 5: DYNAMICS OF AGENDA SETTING IN THE "TECHNOLOGY & AGING" ISSUE NETWORK

Despite the availability of technology in aging services and the benefits they promise, the use of these technologies has not been widely adopted by the elderly or their caregivers. Although the benefits of these technologies appear at first glance to accrue only to the individual user and their immediate caregivers, the societal benefit of widespread adoption cannot be understated or neglected. As these technologies diffuse through the population and gain acceptance among the aging and the aged, they will strengthen the foundation for the incorporation of technology into strategies for independent and quality aging. Leveraging technology for aging is not just a "solution" for the aging population crisis; it will create positive spillovers into areas of national concern such as health care and long term care costs, labor force productivity, pension and welfare costs that are not difficult to imagine.

The 2005 White House Conference on Aging marked the emergence of "Technology for Aging" as an item for agenda contention. It signaled the recognition by policy makers and experts that technology could provide answers to the challenges of the changing demographics. Out of 73 resolutions, 5 directly addressed the issue of Technology and Innovation for Aging, and these were placed under the resolution category "Technology and Innovation in Marketplace". The visibility of these technologies was enhanced through the CAST Imagine: the Future of Aging Technology Pavilion at the WHCoA, which spanned more than 10,000 square feet and featured an exciting technology showcase by companies and universities. Yet as the Conference came to a close, it was apparent that "technology for the aging" was not high on the priority list of

decision makers at the WHCOA. When the vote tally was released, all five resolutions within the category failed to make it to the Top 10 list. [29]

Useful technologies are available but under-adopted. The push for policy is visible yet stagnant. If Technology and Innovation is indeed an answer to the demographic challenge, we need to ask and answer the question -- Why is there a paucity of policies supporting the development and diffusion of these technologies into the population?

This chapter attempts to shed light on the process of policy formation and agenda setting relevant to the issue of Technology for an Aging Society. By examining the dynamics of issue definition within the "Technology for Aging" community as well as the structure of the "Technology for Aging" issue network as it is today, I hope to identify and articulate the barriers to policy formation and implementation that prevent or slow the elevation of the issue onto the formal agenda (or decision agenda), as well as to provide some insights on how policy movement can be jumpstarted.

Theoretical Perspectives on Policy Formation and Agenda Setting

The complexity of policy formation and agenda setting in America has been studied by scholars for many centuries. Cobb and Elder (1983) provided an illuminating perspective of agenda-building, linking the dynamics of mass participation with those of governmental decision-making. They distinguished between the "systemic" agenda that reflects the "mobilization of bias" within a community and the "formal" agenda that reflects a set of items up for active and serious consideration of authoritative decision makers. Cobb and Elder postulate that "perhaps the surest way for an issue to

[29] see 2005 WHCoA Resolution Vote Tally)

attain and maintain formal agenda standing is first through entry onto the systemic agenda of controversy." In their discussion, they identified processes likely to be critical to success. These processes include issue creation, symbol utilization, issue expansion, and entrance access.

A second model, the Garbage Can Model, was first conceptualized by Cohen et al. (1972) and later adapted by Kingdon (1984) to illustrate the process of agenda setting in the American federal government. Kingdon likened the government to an "organized anarchy" (Cohen et al. 1972) that contains three separate "streams" or variables: problems, policy proposals, and politics. The meeting or alignment of these three streams opens up "policy windows" which Kingdon describes as preconditions for issues to get onto the decision agenda. However, the independence of each stream makes the opening of policy windows an infrequent and fleeting occurrence. If no deliberate efforts are made by "policy entrepreneurs" to seize the opportunity and elevate the issue onto the agenda, the window will close and the opportunity will be lost.

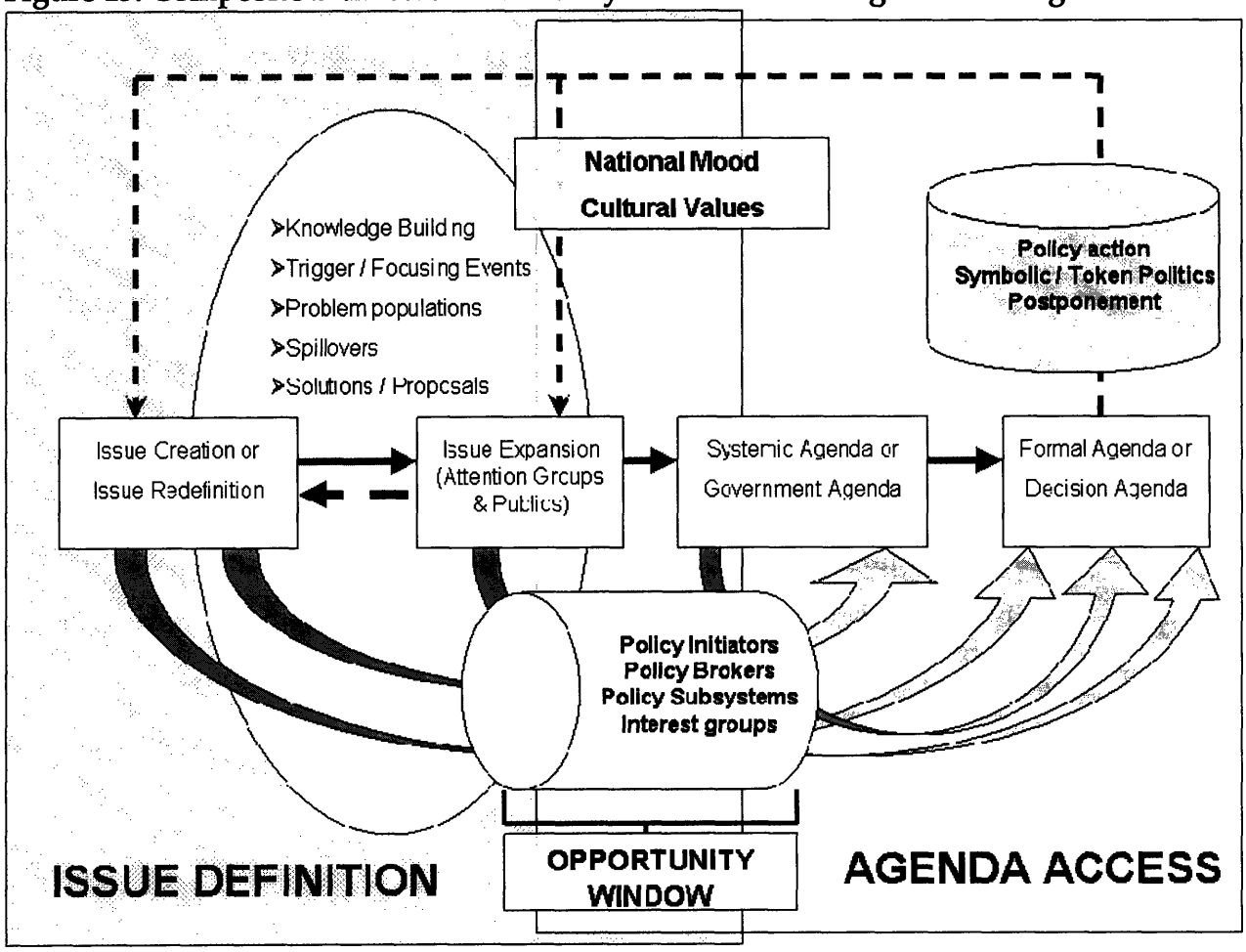
Almost ten years later, Baumgartner and Jones (1993) used the evolutionary theory concept of "punctuated equilibrium" to describe the agenda-setting process. They suggest that the government can best be understood as a series of institutionally enforced stabilities, periodically punctuated by dramatic change. In their model, quiet periods of policymaking are accompanied by the domination of negative feedback, and policy innovations during these periods seldom capture the imagination of many individuals, so change is slow or rare. During periods of rapid change, positive feedback dominates and change is accelerated since each action generates disproportionately large responses. Baumgartner and Jones refer to such periods as "windows of opportunity."

Each of the three models described above have been analyzed and critiqued by scholars over the years. The complexity, irregularity and unpredictability of the agenda building and policy formation process make it impossible to develop a complete and flawless process blueprint applicable in every scenario. Integrating critical elements from the three core models of agenda setting described above, I develop a composite (or hybrid?) framework of issue definition and agenda setting that I will use to examine the agenda building and policy making process relevant to the issue of Technology for an Aging Society. I attempt to include in my framework most of the elements emphasized by the authors of the models above, and I have been conscious to be biased towards redundancy rather than incompleteness, overlap rather than gaps. I believe such an orientation will facilitate a more exhaustive approach in this analysis, through which I will try to identify and describe the shortfalls and obstacles to policy formation and implementation with regards to Technology for Aging.

A Composite Framework for Policy Formation and Agenda Setting

Figure 1 shows the composite framework for policy formation and agenda setting, adapted from the models developed by Cobb and Elder (1983), Kingdon (1984) (adapted from Cohen et al. 1972), and Baumgartner and Jones (1993). The framework consists of two overlapping areas that represent the overall processes of Issue Definition and Agenda Access.

Figure 13. Composite Framework for Policy Formation and Agenda Setting



ISSUE DEFINITION

"Issue Definition" or "Problem Definition" is used in political discourse to explain, describe, recommend and persuade. It has to do with what we choose to identify as public issues and how we think and talk about these concerns (Rochefort and Cobb, 1994). Petracca (1992) stated that "How an issue is defined or redefined, as the case may be, influences: 1) the type of politicking which will ensue around it; 2) its chances of reaching the agenda of a particular political institution; and 3) the probability of a policy outcome favorable to advocates of the issue." Lustig (1985) emphasized the power of issue definition in politics, claiming that "it is an old truth of politics that

power is revealed not by those who have the ability to provide answers but by those who frame the original questions". Deborah Stone (1989) describes problem definition as "centrally concerned with attributing bad conditions to human conditions instead of fate, or nature" and as "the active manipulation of images of conditions by competing political actors." Before a problem is able to attract attention from policy makers or government officials, there must be an image or an understanding that links the problem with a possible governmental solution (Baumgartner and Jones, 1993).

The importance of Issue or Problem Definition in policy making is highlighted in all three models discussed earlier. In Cobb and Elder's agenda building model, issue definition involves two stages – issue creation and issue expansion. The formation of an issue is dependent on the dynamic interplay between an "initiator" (a person or group involved in manufactures the issue) and a "trigger device" (an unforeseen event that helps share the issue defined by the initiator). The underlying proposition for the role of Issue Expansion is that the greater the size of the audience to which an issue can be enlarged, the greater the likelihood that it will attain systemic agenda standing and thus access to a formal agenda. Cobb and Elder suggest that the issue characteristics critical to successful issue expansion include Concreteness, Social Significance, Temporal Relevance, Complexity and Categorical Precedence.

Kingdon differentiates between a "condition" and a "problem" by stating that "a condition becomes defined as a problem when we come to believe that we want to or should change the condition. Values, comparisons and categories contribute to the translation of conditions into problems. A mismatch between the observed conditions and one's conception of an ideal state becomes a problem. If one is not achieving what others are achieving, and if one believes in equality, then the relative disadvantage constitutes a problem. The categorization of problems structures people's perception of

the problem and the emergence of new categories can create new definitions of problems and conceptualizations of solutions (Kingdon, 1984: 109-113). According to Kingdon, how problems come to the attention of governmental decision makers depends on 1) Indicators, 2) Focusing Events, Crises and Symbols, and 3) Feedback (Kingdon, 1984: 90-103).

Issue Definition is emphasized by Baumgartner and Jones as "the driving force in both stability and instability, primarily because issue definition has the potential for mobilizing the previously disinterested." The authors use the term "Policy Image" to describe how a policy is understood and discussed and define Policy Image as "a mixture of empirical information and emotive appeals" that plays a critical role in the expansion of issues to the previously apathetic. In their "punctuated equilibrium" model of agenda setting, they contend that "issue definition and institutional control combine to make possible the alternation between stability and rapid change that characterizes political systems". Although the incentives for policy makers to portray issues in various ways depending on what they stand to gain from the different images, Baumgartner and Jones stress that "no single policy maker is often in a position of determining alone what understand will come to dominate". If that is true, what then determines how issues are defined?

Raw Materials, Tools, Techniques and Craftsmen

Issue Definition involves expert craftsmanship. Armed with a set of tools, techniques and raw materials, experienced craftsmen are able to create and mold an issue such that it is able to attain a place on the government agenda. The availability of higher quality materials, the possession of sharp and durable tools, and the mastery of well-honed techniques will enable the craftsman to produce superior works of art. In this section, I

apply the same concept to the art of issue definition and will proceed to describe the materials, tools, techniques that "issue craftsmen" will utilize in issue definition. I attempt to incorporate most of the critical elements of problem or issue definition as presented in Cobb and Elder (1983), Kingdon (1984) and Baumgartner and Jones (1993), by categorizing them (in Table 13) as "Raw Materials", "Tools, "Techniques" and "Craftsmen".

Table 13. Elements of Issue Definition

Raw Materials	Tools	Techniques	Craftsmen
- Trigger Devices & Focusing Events - Statistics and Indicators - Problem or Target Populations - Policy Proposals and Solutions - National Mood & Cultural Values - Spillovers	- Language - Mass Media - Personal Experiences - Awareness Campaigns	- Issue Expansion (Scope) - Connecting Solutions to Problems - Interconnections, - Problem Ownership - Comparisons	- Initiators - Policy Entrepreneurs - Interest groups

Raw Materials

Cobb and Elder (1983) categorize *Trigger Events* into internal and external events that correspond to the domestic and foreign spheres. Examples of internal trigger devices include natural catastrophe, assassinations, imbalance distribution of resources and ecological change; examples of external devices include war, innovations in weapons technology, changing world alignment patterns and international conflict. A *Focusing Event*, as described by Kingdon, can be a crisis or disaster that comes along to call attention to the problem a powerful symbol that catches on, or the personal experience of a policy maker.

Statistics and Indicators (Kingdon, 1984) are used by decision makers to assess the magnitude of a problem and to become aware of changes in the problem. "A steady state is viewed as less problematic than changing figures" – Policy makers consider a change in an indicator to be a change in the state of a system; this they define as a problem. Constructing an indicator and getting others to agree to its worth become major preoccupations of those pressing for policy change.

Portrayals of *Problem Populations* are important in issue definition. Cook (1979) found a link between the favorability of attitudes toward different groups and popular support for providing aid to them. Rochefort and Cobb (1984) support this finding, stating that "political willingness to make commitments is conditioned by societal perceptions of the people who are going to benefit, and hence how a target population is perceived will influence the level and nature of public interest in its plight, the tools government selects for intervening and the forms of rhetoric with which policy action is justified." Schneider & Ingram contend that the social construction of target populations refers to the cultural characterizations or popular images of the persons or groups whose behavior and well-being are affected by public policy, and that it has a powerful influence on public officials and shapes both the policy agenda and the actual design of policy. In their 2 by 2 matrix of Power vs. Constructions, they characterized the elderly as an advantaged group that is both powerful and positively constructed. They add that public officials realize that target groups can be identified and described so as to influence the social construction. Hence, a great deal of the political maneuvering in the establishment of policy agendas and in the design of policy pertains to the specification of the target populations and the type of image that can be created for them.

The existence of *Solutions or Policy Proposals* is necessary for an issue to attract attention from public officials. According to Wildavsky (1979), "public officials will not take a

problem seriously unless there is a proposed course of action attached to it....A problem is linked to a solution; a problem is a problem only if something can be done about it". Kingdon (1984) postulates that alternatives, proposals and solutions are generated in communities of specialists, or what Hilgartner and Bosk (1988) terms "communities of operatives". A plethora of ideas are generated, but their selection or elimination is dependent on criteria such as technical feasibility, congruence with the values of community members, and the anticipation of future constraints, including budget constraints, public acceptability, and politicians' receptivity. (Kingdon, 1984: 200) In discussing how certain solutions or proposals are adopted for implementation, Rochefort and Cobb (1984) describe a three part criterion for determining the likelihood of alternatives becoming government policy. The criterion focuses on a proposal's availability (is it viable?), its acceptability (moral efficaciousness), and also its affordability (do the necessary resources exist to implement the policy choice?).

The *National Mood, Cultural Values and Historical Precedence* that characterize the environment in which a policy issue and its solutions are considered are critical to issue definition. The idea of a national mood is also known by different names – "climate in the country", "changes in public opinion", or "broad social movements" (Kingdon, 1984: 146). Portz (1994) asserts that political acceptability of an issue is dependent on how it aligns with the existing political economy, and that issue definitions most consistent with existing economic conditions, institutional and community interests were most likely to survive. Kingdon supports this view, saying that "the values one brings to an observation play a substantial role in problem definition" and that the incongruence between the "ideal" and the "observed" results in the emergence of a problem. Cultural values also affect peoples' perception of a government's role, as it shapes their view of whether government should guarantee certain rights such as health care or welfare, or whether government should adopt a more hands-off approach. Historical treatment of

a problem also tends to shape the national mood and values embraced by a community. Overprotection or neglect of problem populations through past policies is likely to cause an oscillation of values and moods within a community.

Although the elements above are described individually, it is important to note that the raw materials for issue definition do not exist independently without relation to each other. In fact, their interrelationships often shape their individual evolutions. For example, the availability and acceptability of solutions can influence the attribution of blame, since political actors will be inclined to emphasize causes that can be targeted by their strategies. (Rochefort and Cobb, 1984: 25)

Tools

The power of *Language* cannot be understated in Issue Definition. Edelman (1971) describes political events as "largely creations of the language used to describe them" (Edelman, 1971: 65). The use and manipulation of language can lend legitimacy to one definition and undermine the legitimacy of another. Professional groups try to gain control over the way a problem is perceived by introducing symbols of their expertise and authority (Cobb and Elder, 1983). Stone (1988) describes four forms of language and symbolic representation in political discussions: (1) stories which provide explanations, (2) synecdoches in which parts of things are said to depict the whole, (3) metaphors which claim likeness between things, and (4) ambiguity in which multiple meanings are evoked simultaneously. Language can be used to expand or restrict the scope of an issue. Nelkin (1975) first alludes to this by saying that "to restrict participation, issues may be defined to procedural or narrow technical terms." Cobb and Elder (1983) expresses a similar opinion, that the redefinition of an issue in

technical terms can change the scope of the issue by making it difficult for some people to understand it (Cobb and Elder, 1983: 45). The rhetoric use of language to convey a sense of crisis or emergency contributes to the dramatization of an issue, which tends to attract greater attention and evoke emotions and reactions from publics. Hilgartner and Bosk (1988) emphasize that this "rhetoric of calamity is important in problem definition. Rochefort and Cobb (1984) describe the terms "Crises" and "Emergencies" as terms used to denote a "special condition of severity where corrective action is long overdue and dire circumstances exist (Rochefort and Cobb, 1994: 21).

The *Mass Media* plays a pivotal role in highlighting the interplay between symbol usage and the techniques that groups utilize to gain and direct supportive public attention (Cobb and Elder, 1983: 141). For most people, mass media may be the most direct link to politics, and many often rely on the television as their primary form of political exposure (Elder and Cobb, 1983). Other media sources include the print media, the radio and the internet.

Techniques

Scope (Issue Expansion), Connecting Solutions to Problems, Interconnections, Problem Ownership, Comparisons. Rochefort and Cobb (1984) listed several dimensions of problem definition that were linked to agenda access. These included "causality, severity, incidence, novelty and proximity". An issue's potential to seize the imagination of the public and ascend onto the national agenda can be enhanced through strategic manipulation of these dimensions. An issue portrayed to be unprecedented, serious, urgent, and hitting close to home tends to attract greater attention from the public. The attribution of causality deserves additional mention here, because blame can be strategically assigned to develop momentum for particular policy

directions. Competing perspectives that allocate blame to humans or technology, to individuals or groups, to intentional or accidental actions, all have very different effects on public or policy reaction. In a similar fashion, Cobb and Elder (1983) described five fundamental definitional dimensions that issues can be defined along – "degree of specificity, scope of social significance, extent of temporal relevance, degree of complexity and degree of categorical precedence". Knowing when, and whether to expand or narrow the scope of the issue is also important, as the level of awareness and participation in shaping the issue characteristics is directly related to the process of issue definition. Closely related to the managing of the issue scope is the idea of Problem Ownership, described by Rochefort and Cobb (1984) as the "domination of the way a social concern is thought of and acted upon in the public arena." By "serving as the recognized authority on essential questions of causes, consequences and solutions" (Gusfield, 1981), stakeholders and advocates who are seeking to pursue a specific course of policy action will have greater control over issue definition.

Craftsmen

Kingdon (1984) used the term "*Policy Entrepreneur*" to describe advocates for proposals or for the prominence of an idea. These advocates can be within or outside of the government, in elected or appointed positions, in interest groups or research organizations. They are willing to invest their time, energy, reputation and sometimes money for future returns, which may come in the form of policies that they approve of, satisfaction from participation, job security or career promotion. They are skilled in using the tools of issue definition, are able to optimize the raw materials to define issues in the most effective way possible, and they understand how to "soften-up" the public and policy communities that tend to be resistant to major changes and new ideas. Policy entrepreneurs have a keen eye for identifying and capitalizing on policy

windows and are adept at coupling solutions to problems, problems to political forces, and political forces to proposals. The likelihood of an issue obtaining a space on the agenda increases with the involvement of a skilled entrepreneur and decreases if no entrepreneur takes on the cause, pushes it, or makes the critical coupling when policy windows open.

Cobb and Elder (1983) view policy entrepreneurs to consist of two groups, "*Initiators*" and "*Brokers*". Initiators build public support and shepherd ideas to the governmental agenda, while brokers act to see an idea through the maze of institutional processes necessary for its adoption as policy (Cobb and Elder, 1983: 187). This dichotomy was originally conceptualized by Eyestone (1978). They further categorize issue "initiators" into "readjustors", "exploiters", "circumstantial reactors" and "do-gooders". Examples of policy entrepreneurs outside of government include 1970s consumer rights activist Ralph Nader and Lois Gibb, the Love Canal housewife turned environmental activist in the early 1980s.

Baumgartner and Jones (1993) points out that the primary interest of policy entrepreneurs is to "establish a monopoly on political understandings concerning the policy of interest, and an institutional arrangement that reinforces that understanding. " They accomplish this by constructing a positive policy image (p7) and by taking advantage of favorable public attention and quickly moving to ensure a quick assignment by government officials to an encouraging institutional venue. Policy entrepreneurs also have the ability to mobilize those excluded from the policy subsystem, such as previously disinterested and apathetic citizens.

AGENDA ACCESS

Agenda Access, the second component of the framework, depicts the pathways and processes by which an issue moves onto a formal agenda and effects policy action or alternative reactions. Of course, issues may not reach the desired platform, or may elicit undesirable or unsatisfactory outcomes. Its overlap with the Issue Definition component of the framework reflects the significance of issue definition in agenda access. Many of the elements critical to the successful definition of issues and problems are just as important to agenda access, although there are some important distinctions to be made. This section will focus on institutional structures (different agendas and policy venues), opportunity windows, and brokers or gatekeepers (policy communities, issue networks, politics) that characterize the process of agenda access, as well as agenda outcomes that eventually emerge.

Different Agendas

Cobb & Elder (1983) identifies two related but somewhat distinct agendas – a "systemic" agenda where

"issues are perceived by members of the political community as meriting public attention and as involving matters within the legitimate jurisdiction of existing governmental authority" and a "formal" agenda with "items explicitly up for the active and serious consideration of authoritative decision makers". For issues to reach the systemic agenda, they must command "widespread attention or at least awareness, a shared concern of a sizeable portion of the public that some type of action is required, and a shared perception that the matter is an appropriate concern of some governmental unit and falls within the bounds of its authority". The authors also emphasize the distinction between a formal agenda and a "pseudo-agenda", which they describe as "any form of registering or acknowledging a demand without explicitly considering its merit, often used to assuage frustrations of constituency groups and to

avoid political ramifications of a failure to acknowledge the demand". By saying that the "surest way for an issue to attain and maintain formal agenda standing is first through entry onto the systemic agenda of controversy", it is clear that their model of agenda-setting involves a translation of items from the systemic agenda to the formal agenda. However, they are careful to emphasize that the formal agenda may not simply be composed of items previously on a systemic agenda. Government may create its own agenda and mobilize support from the public, rather than respond solely to public pressures, social movements or advocacy groups.

Kingdon (1984) distinguishes between a "governmental agenda", a list of subjects that are getting attention within government, and a "decision agenda", a list of subjects within the government agenda that are up for an active decision or moving into position for an authoritative decision. The two agendas are affected by somewhat different processes. Governmental agendas "can be set solely in either problems or political streams, and solely by visible actors" (Kingdon, 1984: 202), whereas partial couplings of problems, policy proposals and political receptivity are less likely to rise on decision agendas. Agenda change also occurs due to turnover of key personnel (p 153) which brings new priorities onto the agenda.

Baumgartner and Jones (1993) mention both "public" and "formal" agendas, as well as "institutional" agendas. They add that "when a problem accesses the formal agenda, governmental bodies are scheduling the event for discussion and possible action." However, the authors focus more on the concept of "policy venues", which they describe as "institutional locations where authoritative decisions are made concerning a given issue" (p31) The interaction between policy image (how an issue is defined) and policy venue affects agenda access, because some types of images are well received in one venue but inappropriate for others. Hilgartner and Bosk (1988) described this

interaction earlier, stating that "different public arenas have different 'selection principles' that are satisfied more or less well by different problem definitions. Venue receptivity also varies between federal, state and local governments, and the different levels of government pursue fundamental different mixes of public polices. However, connections and linkages (e.g. professionals within professional associations) between different policy venues ensure a flow of policy ideas across venue boundaries.

Gaps between the systemic and the formal agenda can be attributed to narrow and insulated policy communities involved in formulating the formal agenda (Cobb and Elder, 1983: 180), or to the absence of plausible solutions to commonly recognized but ill-defined problems." (p176)

Battle for Jurisdiction

Agenda setting is affected by battles over policy turfs and jurisdictions. Administrative agencies and congressional committees often participate in battles over policy directions that reflect their perceived jurisdiction and interests. Jurisdictional competition can sometimes result in stalemates, and at other times result in greater movement. Turf disputes may slow the likelihood of governmental action, because jurisdictional disputes among congressional committees and subcommittees often diminish the chances for enactment of important initiatives. Turf disputes may also promote the rise of an item on the governmental agenda, for example when congressional committee chairs compete with one another to claim credit for some initiative that they sense will be popular. Many potential agenda items never are the subject of a given policy maker's attention, largely because they fall into someone else's jurisdiction. So an item

may be ignored with the rationale that it is being taken care of somewhere else or they are defined away by the drawing of jurisdictional boundaries

Issue Networks

Policy initiatives have played a significant role in shaping the US economy and industries. In the 1960s, the term "Iron Triangles" was coined to illustrate "sub-governments" that formed from the symbiotic relationships between legislative committees, government agencies and special interest constituencies that share a common concern. Iron triangles were seen as arrangements that led to the passing of narrow policies that served the interest group's agenda but not necessarily the general public interest.

In 1978, political scientist Hugh Heclo developed the notion of "Issue Networks" which drew attention to entities whose "webs of influence provoke and guide the exercise of power". Heclo described issue networks as comprising "a large number of participants with quite variable degrees of mutual commitment or of dependence on others in the environment". These participants moved in and out of the networks constant and no one participant is in control of the policies and issues. Network participants "reinforce each other's sense of issues as their interests, rather than interests defining positions on issues". The role of issue networks in public policy was seen to be the refining, debating and provision of alternative options by knowledgeable networks of people. Heclo asserts that the reliance on issue networks and policy politicians is consistent with larger changes in society, where voters are less constrained by party identification and more attracted to an issue-based style of politics. However, issue networks may serve to exacerbate the lack of public understanding and support for national policies, since there is not a majority of citizens who are seriously attentive to public affairs or

mobilized in issue networks. The development of issue networks may also make democratic politics more difficult, since the increased complexity of participation makes it more likely for actions relevant to one policy goal to be inconsistent with others. In addition, the building of consensus among participants in the network tends to become harder as the size of the network grows.

The emergence of an issue network is a significant development in agenda access, as it has substantial impact on the life cycle of an issue. As the number of participants in the network increases and the web of stakeholders enlarge, the issue network can extend the lifespan of an issue on a government agenda (Sharp, 1994). Sharp (1994) also adds that the "institutionalization of issue niches occupied by organized interests with competing definitions of the problem keeps the issue alive on the agenda."

Within an issue network, we can loosely categorize participants into three groups to facilitate the discussion: Policy Communities in which discussion focuses on the feasibility and attractiveness of alternatives, solutions and proposals, Interest Groups in which effort is centered on advocacy of rights and values, and Brokers or Gatekeepers who exercise control over agenda access. These three groups are not mutually exclusive, as members of policy communities may also be members of interest groups and may also act as brokers or gatekeepers.

Policy Communities

Cobb and Elder (1983) use the term "policy subsystems" to describe limited and relatively stable sets of actors operating within relatively closed communications networks that dominate many areas of policy (Cobb & Elder, 1981). At a national level, these policy subsystems may be composed of members of executive agencies,

congressional committees or subcommittees, and representatives from major interest groups. Subsystem participants tend to share a common perspective on what is and is not problematic and on how those problems should be defined. In order to "insulate the subsystem and preserve the prevailing mobilization of bias in the policy area, actors in the subsystems are often able to restrict participation in problem definition by defining issues in technical terms or specialized language. Policy subsystems as described by Cobb and Elder (1983) were responsible for much of the federal agenda in the 1960s and 1970s but many have since evolved into less tightly structured or impenetrable policy communities described by Kingdon (1984)

According to Kingdon (1984), policy communities are composed of "specialists in a given policy area" and may be "scattered both through and outside of government". They may belong to congressional committees, congressional staff agencies, universities, consulting companies, or interests groups. Policy communities may be closed and tightly-knit or diverse and fragmented, depending on the policy issues being dealt with in each community. Policy communities consider ideas, policy proposals and alternatives that are generated by members of the community or adapted from elsewhere. Ideas that catch on diffuse through the policy community as members become more aware of the problems and start to agree on solutions or proposals. (Kingdon, 1984: 139-143)

Baumgartner and Jones (1993) do not make an absolute distinction between policy subsystems and policy communities. They found hat the American political system "spawns numerous policy subsystems which are characterized by inclusion of the interested and exclusion of the apathetic." These subsystems are often institutionalized as "structure-induced equilibria" in which a prevailing policy understanding dominates. They also observe that some policy communities are organized into prestigious

professional societies that have no organized adversaries, whereas some tend to face intense conflict from within (p175-176). Some are unified, powerful and autonomous, while others are more adversarial and less autonomous. Looking at the effect of internal dynamics on subsystem effectiveness, Baumgartner and Jones (1993) observe that "constant internal bickering reduces subsystem independence from the broader policy system" and that "groups of experts that are able to exhibit a united front toward the outside world are better able to get what they want from the political system." (p176) Their findings also point to a change in the characteristics of policy subsystems, from one-sided representation of interests in the pre-1960s and 1970s era to vast mobilization of citizens' and consumers' groups in recent decades.

Interest Groups

Interest group environments structure the incentives and possibilities of policymakers seeking to expand or contract participation (Baumgartner and Jones, 1993). The growth in the number of interest groups has led to increasing diversity of views within previously homogeneous policy subsystems. In the absence of conflict, issues are likely to reach the agenda only through what Baumgartner and Jones termed "a mobilization of enthusiasm." Issues considered within consensual interest-group environments are expected to be treated far from the glare of public attention, and to be able to maintain a combination of positive tone and low attention. When these issues do emerge on the public agenda, they are expected to ride on a wave of popular enthusiasm led by proponents of some new policy, which is likely to lead to the subsequent institutionalization of a policy subsystem designed to support the industry of policy in question. This phenomenon is coined "Downsian mobilization" by Baumgartner and Jones. They emphasize the fact that policy making for different issues varies not only because the structures of government are different and the issues are of greater or lesser

complexity, but also due to the relative mobilization of diverse interests, which varies both across time and across issue areas at a single time.

Brokers and Gatekeepers

For an issue to attain agenda status, it must command the support of at least some key decision-makers, for they are the ultimate guardians of the formal agenda (Cobb and Elder, 1983). According to Cobb and Elder, entrance access is dependent on where issues are confined to since the distribution of influence and access in any system has inherent biases which will operate to the favor of some and to the disadvantage of others. If the issue is confined to identification groups, formal agenda status is most likely to be attained only when disputants threaten to disrupt the system. Issues confined to attention groups typically require threats of imminent sanctions (election votes or campaign contributions. Brokerage channels such as political parties and the mass media provide means of entrance access to issues confined to the attentive public. For issues that attract attention from the mass public, the response from the decision making system is almost reflexive and decision makers automatically place the issue on the governmental agenda

Opportunity Windows

Kingdon (1984) uses the term "policy window" to describe an opportunity for advocates of proposals to push their pet solutions, or to push attention to their special problems (p165). Policy windows represent a chance for an issue to transition from a governmental agenda onto a decision agenda, and may vary in terms of frequency, duration and predictability. Policy windows may open due to administration changes, national mood shifts, or when crises and focusing events occur. However, for policy

windows to be useful for agenda access, the separate streams of problems, solutions and politics in the Garbage Can model must come together, and a policy entrepreneur must exist to take advantage of the policy window to push the issue onto the decision agenda.

Baumgartner and Jones (1993) -- Policymakers hoping for greater governmental activity in the area take advantage of a momentary burst of public or media concern with the issue and push for new legislation. "Initial public enthusiasm with the potential of a new technology leads policymakers to create institutions and to support research into how best to take advantage of them. Then public attention dies away, leaving those in the new institutions to carry on with significant public support, but with little political oversight."

Agenda Outcomes

One may assume that an issue that completes the climb onto the decision or formal agenda will give rise to the development and subsequent implementation of a satisfactory and appropriate policy action. However, this may not be the case. Constraints on budgets, inertia of bureaucracies and other obstacles tend to stall or hinder the creation of new legislature or implementation of policies that have real and lasting impacts. This may not represent a failure in the policy making and agenda setting process, because oftentimes the process of policy formation and deliberation is more important than the final outcome. Elder (1983) argues that "satisfaction can accrue from the process even if the process fails for one reason or another to produce actual policy outputs. Whatever is produced tends to give symbolic testimony to 'responsibility' being fulfilled." (Elder, 1983: 23)

A range of agenda outcomes are possible. Clear and effective policy actions in the form of new laws, regulations, legislation are often desired by the public or organized interests. Symbolic politics or token politics that act on a limited grievance in a larger problem may also be used to provide reassurance or restrict conflict expansion. New organizational units, agencies or committees may be created to giver the impression of action although they may in fact represent little policy innovation. Postponement is also a possible outcome, where the grievance is taken under advisement in an effort to seek out additional information. One example of postponement is the establishment of special commissions and committees composed of notable people to investigate specific problems. (Cobb and Elder, 1983: 127)

Technology for an Aging Society

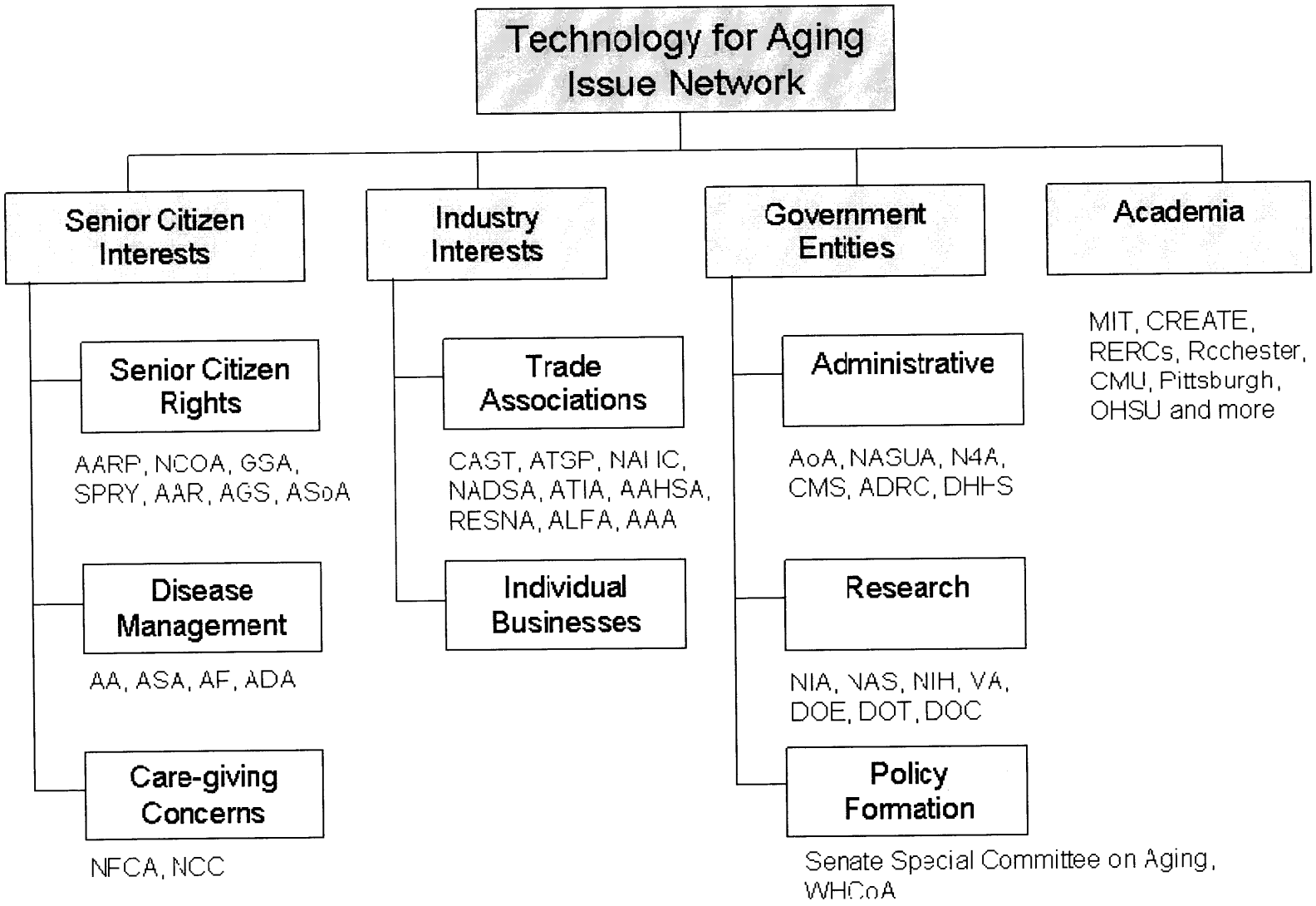
The inclusion of Technology and Innovation on the 2005 White House Conference on Aging agenda and congressional and senate hearings on technology as a tool for addressing the changing demographics may appear to some as evidence of formal agenda status. However, the results of the resolution vote tally during the WHCoA as well as the paucity of policies that have emerged suggest otherwise. These efforts may be mere symbolic demonstrations of political consideration rather than actual policy formation and implementation. The issue has definitely claimed a spot on the systemic agenda, but its position on the formal agenda is unclear. If one argues that the issue has achieved formal agenda status, then the agenda outcomes can be said to be merely symbolic.

According to Elder (1983: 23), "oftentimes, not even the semblance of definitive action is required to provide symbolic reassurance that a problem is being taken care of; mere consideration of the problem in an auspicious setting will suffice. Thus, with great flourish, special commissions, task forces, and study groups are appointed to conduct "comprehensive" investigations and to provide policy recommendations. The reports of these groups are ceremoniously heralded and received with elaborate ritual, often only to be forgotten or ignored." Symbolic politics is often used by politicians to douse flames that grow out of popular concern over a certain issue. The Technology Administration of the Department of Commerce prepared a comprehensive report on Technology for Aging, entitled "Technology and Innovation in an Emerging Senior/Boomer Marketplace", for discussion at the WHCoA. The report presented the case for recognizing aging-related technology, the need for public-private partnerships, and it also articulated the need for additional research and discussion on specific needs and barriers. However, the disappointing lack of policy action in this area upon the

conclusion of the conference suggests that such efforts may end up being merely symbolic politics. By demonstrating efforts to consider, deliberate and discuss an issue, politicians are often able to satisfy public calls for action without committing to real policy actions that will have a significant effect on the administration. Symbolic politics, as described by Rochefort and Cobb (1984: 110) exhibits a pattern of "deliberate defusing of an issue relatively quickly after placing it on the agenda."

To understand why the push for policies in this area has been unfruitful so far, I will now examine the Technology for Aging issue along the elements of the composite framework described earlier. I argue that the two main reasons for the lack of policy action are 1) Poor issue definition and 2) Organizational Shortfalls within the Issue Network. Because issue definition is highly influenced by the mix of participants within the issue network as well as how they interact with each other, it is necessary to first describe the issue network and its shortfalls. The "Technology for Aging" Issue Network today consists of many stakeholders that can be broadly categorized into Senior Citizens Interests, Industry Interests, Government Entities and Academia. The categories, subcategories and groups of participants are shown in Figure 14. The fluidity of the issue network makes it difficult to compile a complete and exhaustive list of participants, but this list presented here provides a good snapshot of the network as it is today.

Figure 14. Participants of the Technology for Aging Issue Network



Alphabetical Key

AoA	Administration on Aging
AA	Alzheimer's Association
AAA	American Automobile Association
AAHSA	American Association of Homes and Services for the Aging
AAR	Alliance for Aging Research
AARP	Association for Advancement of Retired Persons
ADA	American Diabetes Association
ADRC	Aging and Disability Resource Centers
AF	Arthritis Foundation
AGS	American Geriatrics Society
ALFA	Assisted Living Federation of America
ASA	American Stroke Association
ASoA	American Society on Aging
ATIA	Assistive Technology Industry Association
ATSP	Association of Telemedicine Service Providers
CAST	Center for Aging Services Technologies
CMS	Centers for Medicare and Medicaid Services
CMU	Carnegie Mellon University
CREATE	Center for Research and Education on Aging and Technology Enhancement
DHHS	Department of Health and Human Services
DOC	Department of Commerce
DOE	Department of Education
DOT	Department of Transportation
GSA	Gerontological Society of America
MIT	Massachusetts Institute of Technology
N4A	National Association of Area Agencies on Aging
NADSA	National Adult Day Services Association
NAS	National Academies of Science
NASUA	National Association of State Agencies on Aging
NAHC	National Association for Home Care & Hospice
NCC	National Center on Care-giving
NCOA	National Council on the Aging
NFCA	National Family Caregivers Association
NIA	National Institute of Aging
OHSU	Oregon Health and Sciences University
RERCs	Rehabilitation Engineering Research Centers
RESNA	Rehabilitation Engineering & Assistive Technology Association of North America
SSCA	Senate Special Committee on Aging
VA	Veterans Administration
WHCoA	White House Conference on Aging

ORGANIZATIONAL SHORTFALLS IN ISSUE NETWORK

According to Kingdon (1984), a close-knit community will generate common outlooks, orientations, and ways of thinking, whereas system fragmentation begets instability and will lead to policy fragmentation (Kingdon, 1984: 119). Baumgartner and Jones (1993) support this viewpoint, saying that "consensual policy communities are better able to foster a positive public image of their issue and to insulate themselves from broad political concerns" and that "communities marked by intense internal conflicts, on the other hand, are much more likely to be the subject of broad political debates."

Fragmentation of interests

The "Technology for Aging" issue network exhibits significant fragmentation in terms of issue focus and policy proposals. Just as issue definition is dependent on the composition of the issue network, the mixture of participants and their activities are also affected by how the issue is defined. Fragmentation creates a disunited front for the community, and the assortment of policy proposals being thrown out by the network results clogs up the agenda space and makes it more difficult for each of the proposals to achieve formal agenda status. The ambiguous and transient definition of "aging-related technology" and the drawing of jurisdiction boundaries by issue network participants combine to create an issue space that can be molded and expanded to accommodate a wide range of participants with different jurisdictions or objectives. The policy areas of concern to participants of the Technology for Aging issue network are broad and wide-ranging, spanning the domains of health, safety and equal opportunities, to technology R&D, employment and economic development. The technology needs of an aging population identified in the "Technology and Innovation

in an Emerging Senior/Boomer Marketplace" report prepared by the Technology Administration in the Department of Commerce for the 2005 WHCoA were grouped under Lifestyle, Employment, Healthcare, Care-giving, Communication, and Cognition. However, many of the participants within the network today have had their roots firmly established in other policy domains, in particular healthcare provision, welfare financing, equal opportunities advocacy, transportation accessibility and long term care sustainability. As a result, the "Aging Policy community" as a whole is fragmented with respect to policy alternatives that each entity in the community is pushing for. The dominance of aging policy by health or pension related problems leaves little room left in the system to address innovation in other areas. Powerful groups, sub committees, and a wide range of stakeholders are focused entirely on social security and Medicare and are motivated to keep other issues off the agenda fear they will lose power on these vital issues.

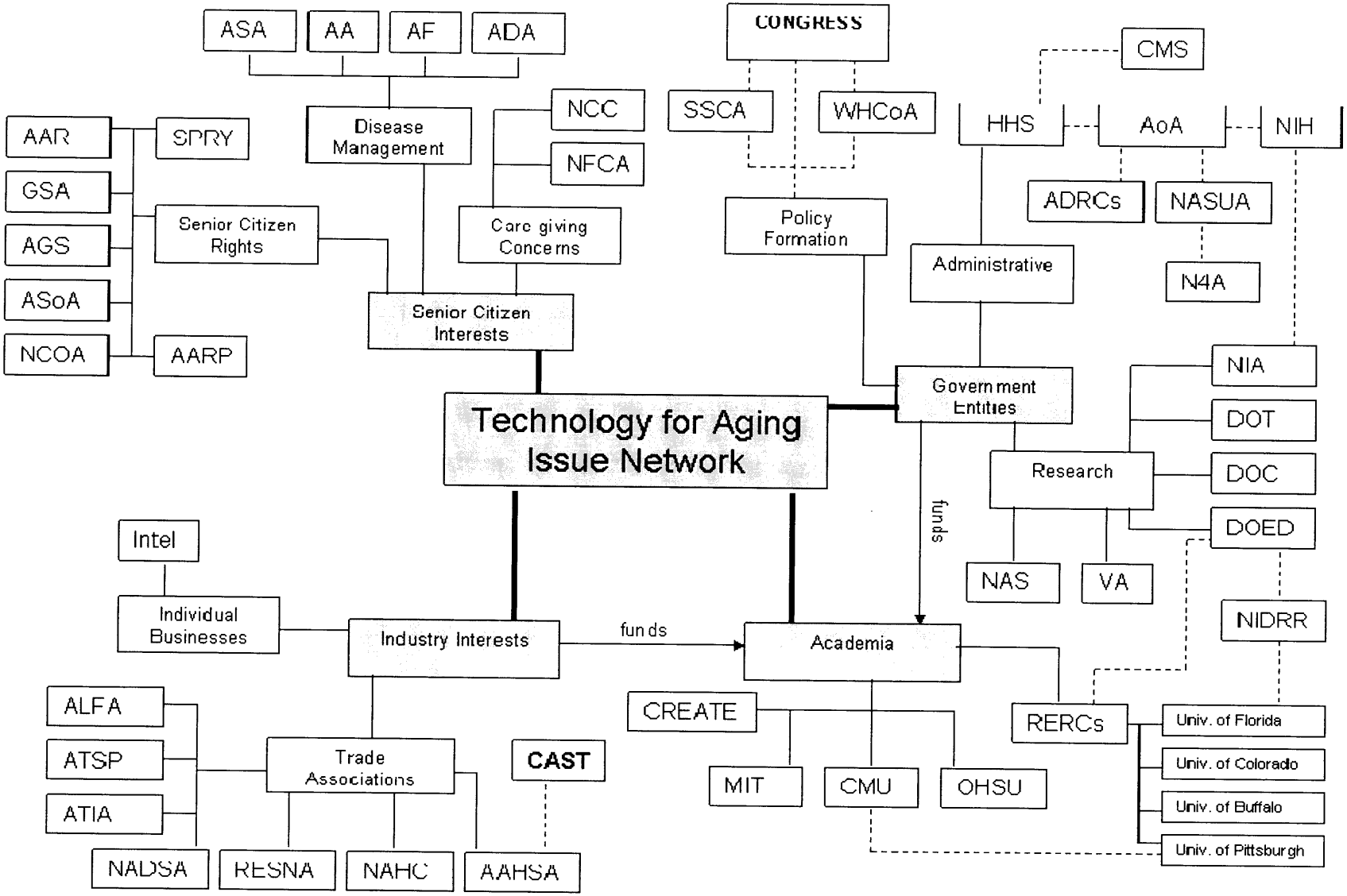
Lack of Connectivity and Collaboration

The "Technology for Aging" Issue Network today consists of many stakeholders but is characterized by a less than ideal level of connectivity and collaboration between the participants. A map of participants in the network is shown in Figure 15. Many of the participants perform more than one function, as can be seen from the significant number of federal agencies and advocacy groups who also conduct technological and policy research as well. The expanding mosaic of participants within the Aging Technologies network has attracted positive attention from the government, policy makers and the media. The expansion of organizational participation in policy-making had its benefits, as it fostered information exchange and dialogue among the large number of stakeholders involved. However, the sheer number of participants, coupled

with their variable degrees of commitment to the issue, can also be a barrier to the movement of the issue up on the decision agenda.

One aspect of the chart that stands out is the relative disconnect of trade associations from the other participants of the network. Apart from CAST (Center for Aging Services Technologies) that aims to provide opportunities for collaboration between participants in the network, there is a clear need for greater connectivity between trade associations and other entities. Collaborations between research entities and members of the aging services delivery infrastructure can accelerate the translation of laboratory research into practical applications for the aging population.

Figure 15. Map of Technology for Aging Issue Network participants



Lack of Policy Entrepreneurs and Brokers

Kingdon (1984) describes the qualities of successful policy entrepreneurs need as: a claim to a hearing, political connections, negotiating skills, and sheer persistence. Entrepreneurs are opportunists who are able to take advantage of fleeting windows of opportunity to draw attention to their proposals. They try to highlight the lack of consensus of certain policies or generate demand for new policies by creating new definitions or offering new solutions to a problem. In the "Technology for Aging" issue network, there is a lack of successful policy entrepreneurs with the passion and the resources to push the issue onto the formal agenda.

Current advocates of the issue have had opportunities to elevate their proposals to a higher agenda space. Novel technological innovations are often able to attract media and popular attention, and the White House Conference on Aging presented a platform for advancing the issue onto the formal agenda. However, existing advocates are mostly outside the government. For them to be successful, they must be able to craft and leverage political events to their advantage, and be able to define or redefine the issue as larger, more urgent, novel, personal yet of great public import to all so as to launch the issue into the formal agenda space and achieve policy action and implementation. Without foraying beyond the domains of health and long term care policies, redefinition of the issue is unlikely and policy movement will remain stagnant. Without establishing connections with institutions that have budgetary power or implementation authority, current advocates will find it difficult to achieve significant policy success beyond the symbolic actions we have observed so far.

The Technology and Aging Issue Network does not have a strong congressional representation. Its only channel for action within the Congress is the US Senate Special

Committee on Aging, currently chaired by Gordon Smith of Oregon. Unfortunately, the efforts of the committee are focused on Health (Medicare and Medicaid, Prescription Drugs and Long Term Care), Safety (Elder Fraud and Abuse) and Financial support (Pensions and Social Security). There is also a lack of a strong trade association that represents the interests of the entire "technology for aging" industry, in part because the definition for this industry is still ambiguous and transient. The Center for Aging Services Technologies (CAST) is perhaps the closest entity to a trade association for the issue network today. CAST was created to establish a foundation for ensuring that technology solutions attain their fullest potential to meet the needs of the aging society, and has grown into a national coalition of over 400 industry and advocacy organizations today. One of CAST's functions is to "engage government representatives to gain support for technology-related policy and facilitate private public sector partnerships to advance technology development and application." Although CAST was the organizer of the "Imaging Technology Pavilion" at the 2005 WHCoA, there has not been much success in the designing and implementation of new policies with relation to technology R&D or delivery for the aging population. The issue definition aspect will be discussed later.

Policy Jurisdiction

The problem of policy jurisdiction is closely related to issue definition. Baumgartner and Jones (1993) suggests that the institutional authorities in charge of some policy problems may be unclear because of the existence of many possible solutions but no clearly superior ones, the lack of routine in societal responses to new problems, or because problems are extremely complex and pose many contradictory or unrelated questions. They also note that policy communities that have been able to exist

independently of each other in the past are now forced to interact because of the increasing complexity and interdependence of the economy. Because technology policy and aging policy have traditionally belonged to very different domains, there is a lack of clear jurisdiction and responsibilities. Should new technologies for elderly health care be the responsibility of the Department of Health and Human Services or the Office of Science and Technology? Who should fund research on technologies for the elderly? Who should regulate the technologies that are developed for the elderly? These are all questions that arise from blurred or overlapping jurisdictions. For issues that provide political incentives for its advocates, overlapping or unclear jurisdiction may sometimes lead to intense competition for jurisdiction that will draw attention to the issue and result in a flurry of policy action. However, unclear jurisdiction often result in issues becoming ignored because 1) they are defined away by the drawing of jurisdictional boundaries, or 2) they are ignored with the rationale that it is being taken care of somewhere else.

In their discussion of policy venues, Baumgartner and Jones (1993) also discuss how federalism in America has created a range of autonomous venues for policy action. The demarcation of federal and state policy venues creates ambiguity in policy jurisdiction, because the policy venues have, over the years, developed different receptivity to particular policy proposals. We see this trend in the issue of Technology for Aging, where efforts on a state or local level to introduce technological solutions into the lives of elderly have taken off and have been supported politically and financially by local governments. State and local governments are more receptive to policies directed at the development of the human and physical infrastructure that is the federal government (Baumgartner and Jones, 1993: 216), and this receptivity coupled with the delivery platforms provided by the State and Area Agencies on Aging allow advocates of technology for aging to try out their new ideas. There are advantages and

disadvantages of developing policy action on either level, and may involve some tradeoff between uniformity vs. standard setting. Because the policy venue is unclear, policy advocates will tend to engage in what Baumgartner and Jones (1993) describe as "venue shopping", which relies less on a dual-strategy of image presentation and a search for more receptive policy venues. A well connected network of policy venues can work for rapid policy diffusion, and this model may be suitable for the Technology for Aging issue, where effective policy implementation on a smaller scale can spread and diffuse to other local or state governments.

POOR ISSUE DEFINITION

The importance of issue definition plays a major role in the framing of the Technology for Aging issue. How the issue is defined is closely related to the structure and the mix of participants within the issue network. The issue of Technology & Innovation for Aging is competing for scarce agenda space with a host of other pressing problems in America today. From racial tensions to international relations, labor to R&D, human rights to environmental protection, American policy makers are being bombarded on all sides with issues begging to be addressed. The fight for agenda space is a fierce one and one of the key elements in determining which issues make it onto the agenda and which do not is that of issue definition. The power of issue definition in politics is emphasized by Lustig (1985), who said that "it is an old truth of politics that power is revealed not by those who have the ability to provide answers but by those who frame the original questions".

Population aging is neither new nor exciting. As a problem, it lacks a blamable cause. As a sustainability concern, it lacks the excitement of uncertainty. As a policy issue, it lacks novelty. According to Kingdon (1984), "a steady state is viewed as less problematic than changing figures." While statistics and indicators reflect changes in demographic characteristics, expected changes have already been predicted with certainty. John Scanlon aptly coined the phrase "Demographics is destiny" (quote??), reflecting the recognition of aging as fate Population aging cannot be stopped or reversed, yet neither will it become worse or accelerate. The absence of crisis symbols, triggering events and focusing events makes population aging a rather "unfashionable" issue that commands little attention.

Interest in the place of aging in politics has grown over the past few decades, due to demographic, political and budgetary changes. The growing proportion of those above 65 and the proliferation of research centers on aging have led to a greater social awareness of the elderly population as an important and influential group in our society. As we hear more and learn more about the aging and aged population, we are unconsciously driven to form our own perceptions and opinions about them, based on our experiences with them as well as our societal cultures and values. The tensions and contradictions in societal values complicate the process of successful issue definition for Technology & Aging. Achenbaum (1983) identified seven sets of dual-value systems inherent in societal institutions and public policy, including the following:

- Self-reliance and interdependence
- Expectation and entitlement
- Public and Private
- Individual and Family
- Work and Leisure
- Tradition and Novelty

- Equity and Adequacy

How we envision our own aging to be and how we view our roles in caring for the aging depends on our positions in each of these systems. Our positions, in turn, depend on our personal experiences and our evolving perceptions of the status of the elderly population over the years. The introduction of social security, Medicare and other government benefits or assistance programs over the past few decades has changed the characteristics of the elderly and has consequently affected our value sets. The personalization of perceptions and views creates a spectrum of attitudes towards the elderly or the aging population, which creates a challenge for policy makers hoping to come up with an optimal issue definition. Some view the elderly as frail, poor, lonely and disadvantaged, whereas others see the elderly as rich, retired and politically powerful. The Medicare Prescription Drug coverage introduced in 2006 was designed as one measure to control the expanding health care expenditure, but a side objective was to provide financial assistance and drug coverage to poor, sick and older adults. In contrast, Schneider and Ingram (1993: 335-336) specified four types of socially constructed target populations, and they classified the elderly under "advantaged groups" that are perceived to be both powerful and positively constructed. Cool (1979) demonstrated a link between popular support for aid provision and favorability of attitudes toward different target groups. Such an association suggests that our perception of the elderly will affect the level and nature of public interest in the issue of population aging, as well as the tools that government selects for intervening, e.g. financial aids, services, subsidies, research and development etc.

The issue of Technology for the Aging involves more than just the elderly. If the characteristics of the elderly are said to be ill-defined, the "technology" aspect of the issue is even vaguer. Two current definitions of "technology" with regards to aging

exist – technology in the form of Assistive Technology e.g. wheelchairs, hearing aids, and technology as innovative "toys and gadgets" that may be useful and fun but not necessary. These two contrasting perceptions of what technology for the aging represents may account partly for the failure to move policy in a desired direction. Assistive Technology has been supported by various policy initiatives, such as the Assistive Technology Act of 1998 and the New Freedom Initiative of 2001 announced by President Bush to "remove barriers to community living for people with disabilities" [30] One key component of the New Freedom Initiative was to "Increase Access to Assistive and Universally Designed Technologies", and major increases in Assistive Technology Research and Development funding were promised. Technology as "toys or gadgets" on the other hand, is likely to be seen as consumer goods whose diffusion should be left up to market forces and not interrupted or influenced by policy initiatives.

Recent efforts to redefine the population aging issue have focused on portraying the graying population as an asset, an economic driver, and a valuable resource for a country facing labor shortage. Such a definition lies in stark contrast to that of population aging as a sustainability problem, a crisis that threatens to undermine the social and economic infrastructure of the country if not dealt with appropriately. Although these efforts at redefinition contribute to the shaping of a positive image for the issue, there has to be a synchrony within the issue network with regards to which definition to use at each specific time. This aspect of issue definition affects is tightly linked with the concern over policy jurisdiction. Defining technology development for the aging society as a potential for economic growth, in contrast to defining it as a way of lowering health care costs and ensuring the sustainability of the aging population, has significant implications. Technology R&D is traditionally supported by agencies

[30] President George W. Bush, New Freedom Initiative 2001

and funding sources such as the National Academies of Sciences, the Office of Science and Technology and the Technology Administration within the Department of Commerce. If defined as a health care tool, jurisdiction will be shifted towards the National Institutes of Health or the Department of Health and Human Services.

CURRENT DEVELOPMENTS

Despite the lack of concrete policy action in response to the interests of the "Technology for Aging" advocates, there have been encouraging developments that reflect a sustained interest in this issue, as well as emerging venues that may present opportunities for advocates to push for their proposals. On 17 July 2006, a $15 million NSF grant for the Quality of Life Technology Engineering Research Center[31] to be set up by Carnegie Mellon University and the University of Pittsburgh was announced. The Center aims to develop robotics and computer science technologies that will help the elderly and disable to live more independently. Oatfield Estates, in the Portland suburb of Milwaukie, is a high-tech assisted-living facility opened in 2000 that has attracted significant media attention over the past month. Described to "represent a future of assisted living"[32], it is one of many innovative facilities that have emerged over the last decade that reflect a growing recognition of the usefulness of technology in care-giving or independent living.

Also, although the resolution rankings from the WHCoA was disappointing for the advocates of technology and innovation, a closer examination of the resolutions shows that several of the top 10 or 50 resolutions can be fulfilled through the incorporation of technologies. The #1 resolution to reauthorize the Older Americans Act (OAA)

[31] http://news.moneycentral.msn.com/provider/providerarticle.asp?feed=AP&Date=20060718&ID=5874868
[32] http://www.usatoday.com/tech/news/techinnovations/2006-07-05-elder-tech_x.htm?POE=TECISVA

included a proposal for the Choices for Independence pilot, a $28 million project to promote consumer-directed and community-based long term care options. The OAA supports the national aging services network, which includes the state and area agencies on aging and other community based organizations and volunteer groups. Within the top 50 resolutions, there are several more resolutions that offer possible opportunities for the introduction and integration of technological solutions. One can envision the implementation of telemedicine or tele-health solutions to "promote the integration of health and aging services to improve access and quality of care for older Americans" (#19) or to "improve access to care for older adults living in rural areas" (#23). One can also imagine the development of novel and useful technologies that help enhance safety behind the wheel, which will help to "ensure that older Americans have transportation options to retain their mobility and independence" (#3) and also to "support older drivers to retain mobility and independence through strategies to continue safe driving" (#47).

It is up to advocates of elderly technologies to identify these opportunities and take full advantage of them. As the pool of ideas and alternatives grows, policy advocates and policy entrepreneurs will need to become more creative, practical and persistent in order to ensure that their proposals are the most available, acceptable and affordable ones.

Conclusion

A comprehensive composite model of agenda setting was developed for the purpose of this analysis, integrating the elements from three well known models by Cobb and Elder (1983), Kingdon (1984) and Baumgartner and Jones (1993). By examining the characteristics of issue definition and agenda access with regards to "Technology for

Aging" policies, we find that the current stagnation in policy innovation can be attributed to two main factors that are closely linked and highly dependent on each other: 1) organizational shortfalls within the issue network and 2) a poor issue definition. We emphasize the need for a consensus on definitions and policy alternatives among participants of the issue network, as well as the need for a policy entrepreneur that possesses qualities that can help push the issue onto the formal agenda space. Although policy developments so far have appeared to be symbolic in nature, there are opportunities for growth and expansion, but progress will depend on how the issue network and the issue definition evolves and becomes refined.

CHAPTER 6: ESTABLISHED INDUSTRY INFRASTRUCTURES – AUTOMOBILES AND CELLULAR PHONES

The previous chapter discussed the role of issue networks in policy formation and agenda setting, and looked at a current map of the Technology for Aging issue network. The analysis of the issue network leads us into a discussion of a National Industry Infrastructure. Issues can take the form of ideological conflicts, granting of rights, distribution or redistribution of resources, industry development, and more. For industries, an element critical to their development is the existence of a strong industry infrastructure. Its continued growth, as well as its ability to elicit favorable policies from national, state or local governments is dependent on the capacity and effectiveness of its national industry infrastructure. A National Industry Infrastructure can be understood as a set of interconnected groups, organizations, associations, agencies, standards, legislature and initiatives that provide the framework supporting the industry. As the backbone of the industry, the infrastructure provides organizing structure, operating procedures, management practices and development policies that interact with societal demands.

How does an issue network fit into an industry infrastructure? The existence and growth of an issue network precedes the building of an industry infrastructure. As the issue network grows, common interests among participants are identified and mutual commitment and dependence between participants increases. Simultaneously, the industry infrastructure begins to take shape. Interest groups, associations and agencies are set up, and standards and regulations are established. The development of the industry infrastructure reciprocally infuses positive energy into the issue network,

enhancing its ability to influence policy formation and agenda setting. Examining the composition of an issue network allows us to identify shortfalls that hinder or slow the process of policy formation and agenda setting, but it does not give us a complete picture of the industry infrastructure. The set of Industry infrastructure elements tend to be more permanent compared to that of the issue network, which is typically more fluid and prone to frequent entries and exits of participants. Elements of the infrastructure are often set up through government policies, or tend to develop close ties with the federal government and policy makers.

To understand the concept of a national industry infrastructure better, we examine two industries with well developed industry infrastructures – the automobile industry and the mobile telecommunications industry. These two industries have traditionally benefited from favorable government policies, and have been successful in defining issues coherently, convincing, and in a united voice. There is a high degree of agenda congruence (an issue priority of the public matches the identical element on the governmental agenda) as well as policy congruence (issue priorities of the public matches actual policy outputs of government) in both industries, which can be attributed to the power and capability of the industry infrastructure. From our observations of the two industries and our understanding of industry infrastructures, we such that a successful industry infrastructure consists of the following key elements:

Trade/Industry Association. Trade or Industry associations help to present a unified voice of industry interests from manufacturers and suppliers or consumers. They provide a platform for information exchange, networking, policy advocacy and enable the furthering of members' business opportunities and economic growth.

Research and Development. A vibrant research and development environment is an important element for the continued growth and flourishing of an industry. Government support for industry R&D usually takes the form of federal funding allocated to educational institutions or national laboratories. Government-industry or government-academia collaborations are other examples of federal support for R&D. The development of human capital is important to the sustenance of the industry and necessary to keep the R&D environment active and productive. Education and scientific organizations facilitate information exchange and ideas sharing, help to evaluate training programs or college curriculums, provide career information, and may also play a role in the setting of production or safety standards

Political representation. An industry is empowered in government and has greater influence on policy formation and agenda setting if it is well represented in both the legislative and executive branches of the government. Legislative representation can be in the form of congressional subcommittees or senate committees, whereas executive representation takes the form of executive departments or independent government agencies.

Standards and Regulations. Standards organizations develop, revise and maintain standards that address the interests of producers or consumers. Organizations may be national or international, voluntary or non-voluntary, government agencies or non-governmental organizations. Due to the accelerating pace of technology evolution, industry driven standards are becoming more common, and these efforts do not necessarily have a formal organizational structure. Standards and regulations developments are usually concerned with interface and interoperability standards, as well as safety standards, and they help to set a baseline for future research and development.

Table 14 shows the components of industry infrastructure within the Automobile industry and the Mobile Telecommunications industry.

Table 14. Industry Infrastructures of the Automobile and Mobile Telecommunications Industries

Industry	Automobile	Mobile Telecommunications
Trade and Industry Associations		
International	Association of International Automobile Manufacturers www.aiam.org	1. International Telecommunications Union www.itu.int 2. GSM Association www.gsmworld.com
National	Consumers: American Automobile Association www.aaa.com Manufacturers: Alliance of Automobile Manufacturers www.autoalliance.org Dealers: National Automobile Dealers Association www.nada.org	United States Telecom Association www.ustelecom.org Cellular Telecommunications and Internet Association (CTIA) www.ctia.org Personal Communications Industry Association www.pcia.com Telecommunications Industry Association www.tiaonline.org
Research		
Federal Research	1. National Research Council – Transportation Research Board (NRC-TRB)	1. Institute of Telecommunications Science[33] 2. National Research Council – Computer Science and Telecommunications Board (NRC – CSTB)
Government/Industry Research Initiative	1. FreedomCAR and Vehicle Technologies Program (FCVT) by Dept of Energy and USCAR[34]	Food and Drug Administration – CTIA (mobile phone safety)

[33] ITS is the research and engineering branch of the National Telecommunications and Information Administration (NTIA), a part of the U.S. Department of Commerce (DOC).
[34] USCAR – United States Council for Automotive Research, formed in 1992 by DaimlerChrysler, Ford and General Motors

	2. US Alliance for Technology & Engineering for Automotive manufacturers (US A-TEAM) by Dept of Commerce and USCAR	
Educational/Scientific organization	Society of Automotive Engineers www.sae.org National Automotive Technicians Education Foundation www.natef.org	
Legislative representation		
Congressional Committee/Subcommittee	1. US House of Representatives Transportation and Infrastructure – Subcommittee on Highways, Transit & Pipelines 2. US House of Representatives Energy and Commerce – Subcommittee on Energy & Air Quality	1. US House of Representatives Energy and Commerce – Subcommittee on Telecommunications & the Internet
Senate committee	Commerce, Science & Transportation	Commerce, Science & Transportation
Executive representation		
Executive Department	Dept of Transportation – National Highway Traffic Safety Administration – Federal Highway Administration	Dept of Commerce – National Telecommunications and Information Administration
Independent Government Agency		Federal Communications Commission www.fcc.gov

Standards		
Voluntary standards body	Federal Motor Vehicle Safety Standards and Regulations	Telecommunications Industry Association American National Standards Institute
Regulatory/Standards program in NIST	Automotive materials, Safety, Reducing Emissions, Electronics, Systems Integration & Interoperability	Signal Transmission, Wireless, Networks, Public Safety, Electronic Information NIST-TSL http://www.itl.nist.gov/
Standards setting groups	1. American National Standards Institute 2. Institute of Electrical and Electronics Engineers 3. American Transportation Research Institute 4. American Association of State Highway and Transportation Officials	1. American National Standards Institute 2. Institute of Electrical and Electronics Engineers 3. Alliance for Telecommunications Industry Solutions (ATIS)

Trade and Industry Association – Both industries have well established international trade associations as well as domestic trade associations that represent manufacturers or providers and consumers or users. These associations have close relationships with the legislative and executive branches of the government, which allows them to influence policies, laws and regulations that will affect the industry.

Research and Development – Research and development efforts in both industries are well supported by the federal government and each industry has its own division within the National Research Council. Federal support for R&D is also observed through the establishment of government-industry research collaborations and the setting up of educational or scientific organizations.

Political representation – Both industries are well represented by U.S. House committees and specific subcommittees, as well as Senate committees. Within the executive branch of the government, there is a specific department and division to deal with related issues for each of the two industries.

Standards – The main federal agency responsible for standards setting is the National Institute of Standards and Technology (NIST). Both industries are well addressed by standard setting programs within NIST. Standards can also be set by industry associations, voluntary standards bodies and other groups.

Model for a "Technology for Aging" National Industry Infrastructure

What is a national infrastructure for technology in an aging society? Based on the common element observed in the two successful industry infrastructures, it appears important for the "technology for aging" industry infrastructure to have the following elements:

- A representative trade or industry association that addresses the interests of technology developers involved in the design and manufacturing of technologies for the aging population
- An interest group that represents the interests of consumers or users of technologies
- Research and Development funding and programs targeted specifically for Technologies for Aging
    i. A central R&D vision with an official funding channel (with contributions from DOT, DOC, DOED, HHS etc)
    ii. Federal stake in research
    iii. Incentives or subsidies for R&D investments
- Political representation, both legislative and executive
    i. Standards – interoperability, quality control, coherent or consistent financing policy
- Regulation – safety, privacy, security etc
- Developed linkage with physical infrastructures, e.g. IT backbone for telecommunications

The "Technology for Aging" Industry Infrastructure today

Within the "Technology for Aging" issue network, we identified organizational shortfalls in the form of fragmentation of interests, unclear policy jurisdictions, lack of connections and collaborations between participants in the network, and a lack of a successful policy entrepreneur. These shortfalls can be partly attributed to poor issue definition. When we examine the current bricks of the national industry infrastructure, we are able to identify the elements that are currently missing. The trade associations that exist today are fragmented in focus, as each of them address the interests of a sub-industry, e.g. Assistive Technology Industry Association, Adult Day Services Association, National Association for Home Care and Hospice. Funding for research and development is sparse and fragmented, coming mostly from the National Institute on Aging (NIA). Apart from the NIA, there is little federal stake in R&D. One of the only programs targeted specifically for "Technology for Aging" is the National Institute on Aging – Small Business Innovation Research (SBIR) grant. The SBIR program is supported by 2.5% of the Department of Health and Human Services' extramural budget for domestic small business concerns to conduct Research and Development with potential for commercialization. However, only small businesses were eligible for this grant and the R&D outcomes so far have not reflected significant commercial success.

Within the legislative branch of the federal government, the interests of the Technology for Aging industry are at best indirectly represented by the Senate Special Committee on Aging. Unfortunately, the limited attention capacity of the Senate committee has to be divided among a plethora of issues ranging from health care to pensions. There is no congressional subcommittee representing this industry. In the executive branch of the government, aging interests come under the jurisdiction of the Administration on

Aging (AoA), an office within the Department of Health and Human Services. The AoA's annual budget is slightly less than $1.4 billion, of which close to $1.3 billion now goes into home and community-based supportive services, nutrition, preventive health services and caregiver support program.

Standards and regulations for the "Technology for Aging" industry have not been established. This can be attributed partly to the lack of a clear industry definition for these technologies, which currently span across a few domains such as healthcare technologies, telecommunications and housing. Each domain has its own set of standards and regulations that are often complex to navigate. A comprehensive framework that integrates existing standards and regulations has to be established for this industry, in order to protect consumer safety and privacy and to ensure optimal interface and interoperability of products.

CHAPTER 7: GLOBAL AGING & TECHNOLOGY POLICY -- EXTENDING THE VISION OF INNOVATION IN AGING SOCIETIES

In this second comparative study, I examine policy developments in eleven developed countries that contribute to the development of "technology for aging" industry infrastructures.

Engineered Innovation and Enhanced Delivery

The limited time window for policy responses to the demographic shift is a challenge for many national governments. It takes significant time and human resources to develop complex and effective policies that can not only alleviate the growing strains on health and social support systems but also transform the aging population into a competitive advantage. It may appear far easier to earmark funding and monetary resources to support human services already in existence, such as institutional long term care or home help services. However, such fiscal policies are unfeasible for governments facing increasingly tight budgets. They will at best mitigate some of the demands created by the demographic shift and will not contribute to the stimulation of the economy. Realizing the futility of reshuffling budget allocations in addressing the burgeoning issues on a nation's policy agenda, governments must now begin to explore innovative models to provide for their constituencies.

In many developed countries, the private sector has already recognized the dormant economic potential in the powerful and approaching demographic current. Unfortunately, early birds attempting to catch the worm have developed products based on deep rooted stereotypes about older adults and their needs. Companies have also neglected to consider the importance of a distribution network for their products

and have assumed that market dynamics will create the forces necessary to induce adoption by the aging population. Needless to say, early innovations have not shown substantial success in the marketplace.

The framework developed in this chapter is a pioneer endeavor to integrate strategic innovation policy with governmental organization to create both an incubation ground and a delivery network for technologies designed to enable quality aging.

By incorporating aging population concerns into a nation's innovation policy, policymakers and industry stakeholders are forced to reexamine their value networks and reassess their business models and strategies. A formalized discussion of aging needs and demands can articulate the changing profile and character of the aging population. This will in turn attract attention from different industry sectors – health care, security, transportation, insurance, banking, investments, education and information technology, all of which can contribute to the vast landscape of technologies for the older adult.

International Policy Awareness

The global scale of population aging has set the stage for a new model of policy research and planning. However, the exciting opportunities and potential benefits for countries to learn from each other have not been underexploited.

In 2004, the UK Department of Trade and Industry sent a Global Watch Mission to Japan to investigate the development and implementation of technologies which promote the independence of older people and to evaluate the impact of the Long-Term Care Insurance (LTCI) system, introduced in 2000 on the delivery of care to the elderly.

[35] The mission team came away with more than just ideas for potential collaborations. They were also able to perform an objective evaluation of their own country's strengths and weaknesses with regards to the development of these technologies. In their mission report, the team praised the ability of Japanese companies to remove the "badge of infirmity" in the design of assistive technology products, but questioned the comparatively weaker integration of technologies developed by private Japanese companies into the service provision framework that they can support. The team also noted that "Japanese companies that had built expertise in AT, based on the LTCI initiative, were targeting the US and European markets directly or by setting up joint ventures", but that "the Japanese system has not yet developed a full appreciation of the qualitative aspects of social care that is considered a strength for UK companies and a requirement for successful access to the European market."

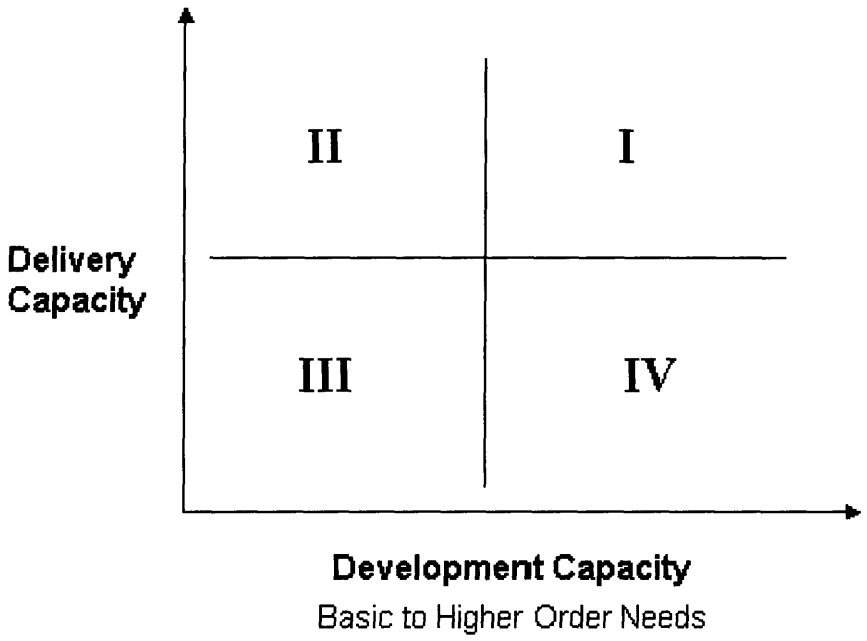
The value of the knowledge and information gathered by the UK Mission Team in their short week-long visit to Japan is understated. International and cross cultural explorations are becoming more important for countries hoping to gain a lead in the global economy today. By understanding others, we are not only in a better position to critique our own policies, but we are also exposed to alternatives that we might not have thought of before. A keen awareness of the political, social and industrial cultures in other countries also reduces the barriers to access when our industries consider expanding their markets internationally. It is certainly not difficult to see the market potential for technologies that satisfy unmet demands on a global scale.

[35] UK Department of Trade and Industry, Technology and delivery of care for older people – a mission to Japan, Global Watch Mission Report, October 2004

Delivery And Development Capacities Framework

I present a typology (Figure 16) to locate, map and compare the capacities of countries to develop and deliver technologies and innovations to their elderly population.

Figure 16. Delivery and Development capacities framework



I define *delivery capacity* on the vertical axis as the *existence* of government agencies, industry stakeholders, senior citizen groups, non-profits and charitable organizations, that deliver aging services, innovations and technologies, as well as the *synergy and extent of collaborations* within the network to provide a range of business, health, social and transportation needs to the elderly and family caregivers.

I define *development capacity* on the horizontal axis as the capacity of government agencies, senior citizen groups or non-profit aging services organizations to develop or

influence the development of novel technologies and applications in partnership with business and technology research communities along a hierarchy of quality aging needs. In Chapter 2, a hierarchy of quality aging needs was described and shown in Figure 5 (p15). Here, I use the same hierarchy for identifying both the range of needs and the target opportunities for policy and market innovations. This approach enables us to examine and compare current national policy foci and highlight the existence of unmet quality aging needs.

In this framework, the five dimensions of quality aging needs do not exist in isolation. Although the fundamental needs of health and safety tend to draw more attention from policy makers and business leaders, higher needs of connectivity, contribution and legacy cannot be ignored. If inadequately addressed by public policy, baby boomers will translate these higher needs into the critical mass of a new passionate politics of unmet expectations (Coughlin, 1999). Business will find that as large as the health and safety market may be, the willingness of older adults and family members to spend disposable income on these three "higher" dimensions is immeasurable.

As shown in Figure 16, we then divide the typology into four quadrants to represent four sub categorizations of countries according to their relative development and delivery capacities. The four quadrants are characterized as:

I High Delivery / High Development

II High Delivery / Low Development

III Low Delivery / Low Development

IV Low Delivery / High Development

Locations along this four quadrant typology are not necessarily static, but they do show the potential policy strategies and directions available to decision makers. This framework is valuable to governments in assessing their current capacities to absorb and leverage new technologies. It also suggests possible policy directions that lay ahead and is instructive to businesses seeking to develop new products for aging markets.

Methodology

In this study, we examine the capacities of four industrialized economies to develop and deliver novel technologies and innovations to their aging populations. The four countries – Germany, United Kingdom, Switzerland and Japan, were chosen because they best typify the characteristics of each quadrant, and they are part of an ongoing multi nation study. Delivery capacity is characterized by the existence of government, private and voluntary sector organizations to access and deliver services to older people and caregivers. The existence of these groups is a necessary but not sufficient condition of delivery capacity. We also look for indications of collaboration in the provision of integrated services. Data collection was done through policy reports, literature reviews, industry reports & interviews. To evaluate the characteristics of each nation's network, a template for information gathering was developed (Table 15). This allowed us to represent information on the different actors involved in the networks in a comprehensive and comparable format. We grouped participants in the networks into five main categories: Government, Senior Citizens Representation, Industry Stakeholders, Health Care and Aging Services Delivery and Human Capital Development.

Table 15. Country Information Template

	Delivery	Development
Government • Agencies • Plans		
Senior Citizens Representation • Interest / Advocacy • Political Representation		
Industry Stakeholders • Industry / Trade Associations • Technology & Aging Interest Groups • Major Private Companies		
Health care and Aging Services Delivery System • Provision System • Financing System		
Human Capital Development • Technology training for professional carers • Major Educational Institutions		
** **Visible Projects** **		

Government – Governments in developed countries respond to the needs of the aging through existing health and welfare departments or by establishing specialized agencies, task forces and inter-agency collaborations. Strategic planning and goal setting efforts reflect national awareness and intention to address aging issues and may indicate active development of delivery capacity.

Governments influence development capacity through science and technology policies. Resource commitments, investment in education and training, intellectual property protection, and R&D tax policies affect the overall innovative capacity of a nation. The launching of national programs or earmarking of funding streams to develop these innovative capacities provide incentives for R&D efforts and improve

collaborations between public and private actors. Incorporating "Technology and Aging" initiatives into national innovation policies as a strategic focus can provide useful mental maps for research institutes, universities and private businesses. Government agencies established to implement technology policy help to foster policy awareness and provide a roadmap to guide technological development. As bridging institutions, they also help to coordinate collaborations in technological developments between private industry, academic and research institutes, and user groups.

Senior Citizens Representation – Senior Citizens Groups can facilitate the diffusion of technologies into the aging populations. Their effectiveness is enhanced by the legitimacy that they embody, which allows them to act as trusted advisors for their constituencies, providing a platform for adult children and older adults to gain access to useful technologies.

Senior Citizens Groups are united voices that represent the interests of the elderly in a country. They can articulate unmet aging needs and exert political influence to varying degrees. To the extent that unmet needs can be fulfilled by innovative technologies, senior citizen groups can enhance development capacity by pressuring national governments to promote "Technology & Aging" innovation strategies. These groups are valuable to industries and research institutes developing technologies for aging, as their direct interaction with the elderly and their caregivers can provide important consumer demand information.

Financially endowed interest groups can also provide support for research initiatives to develop technologies for the aging.

Industry Stakeholders – In countries that tend to rely on free market provision of goods and services, private companies and industry associations often develop their own business models and delivery channels to advance the diffusion of their innovations. Industry interest groups or trade associations strengthen the industry's potential to successfully penetrate the consumer market. As the scope of the "Technology for Aging" industry shifts away from disability aids and health based technologies, an industry association representing the evolving needs of industry participants may become necessary. Depending on the characteristics of the product or innovation, strategic partnerships between industry and traditional service delivery networks can facilitate the development and diffusion of new and beneficial technologies.

Best practices by individual companies can also help to guide emerging businesses. Successful businesses may establish delivery networks that can be leveraged upon by new entrants through mergers, acquisitions or alliances. This can reduce the perceived risk of a new industry sector and can also stimulate pooling and coordination of investments among participants. Needless to say, Industry interest and support in the form of funding and human capital investment is critical to the development capacity of the network.

Health Care & Aging Services Delivery System – The historical association of aging with frailty and illness is likely to lead to a natural adoption of the health care system as the main channel for delivering technologies to the elderly. Public systems may have a broader reach, but they are deeply rooted in national infrastructures and tend to undergo incremental changes. Private systems may be more responsive to environmental changes but less accessible to everyone.

The availability of delivery systems can influence industry interest and investment in the development of new technologies for the aging. The willingness of health care or social care providers to partner with technology developers can help to reduce barriers to market penetration, providing an added incentive for the private sector and research institutions to develop new technologies rapidly and thus enhancing the development capacity of the network.

Human Capital Development – How well the technology & aging network functions is dependent on the human resource capability within it. The "Technology for Aging" industry is a multi-sided platform market whose customers include service delivery professionals, caregivers and the elderly users themselves. Individuals involved in the delivery of technologies to the elderly, e.g. healthcare and social care professionals, need to be trained to use the technologies and to be able to teach the elderly how to use the technologies.

The investment in human capital development is just as important for the development capacity of the network. Engineers, scientists and

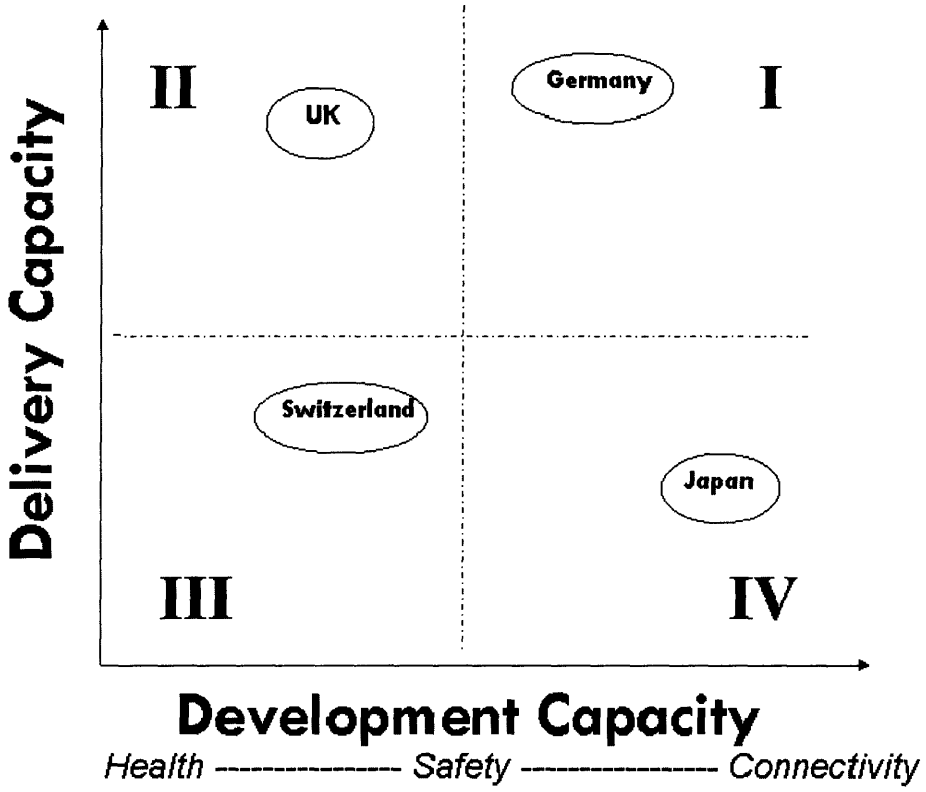
technology developers need to gain a comprehensive understanding of the elderly consumer market profile, their needs and demands. Universal design and "design-for-all" concepts reflect growing efforts to understand and focus on the specific demands of the elderly.

Identifying key academic institutions involved in the enrichment of human capital for both the delivery and development capacities of the network will give us an idea of the level of investment in human capital. Examining the relationships between academia and industry or government can also provide information on the knowledge transfer from the academic setting into practical applications.

Technology & Aging In 4 Industrialized Countries

A comprehensive survey of actors and relationships within the technology and aging networks in four developed economies enable us to present a static snapshot of the current development and delivery capacities of each nation's aging and technology network. This static snapshot neither indicates how successful a country's "aging policy" is, nor does it indicate the rate of growth of development or delivery capacity in each country. We discuss the general characteristics of the countries in each of the four quadrant of the framework.

Figure 17. Relative delivery and development capacities of four industrialized countries



Quadrant I: High Service / High Technology

Germany

Countries in the High Service / High Delivery quadrant have well aligned networks of providers, users and technology developers that engage in synergistic partnerships to develop and deliver a range of technologies that meet basic and somewhat higher-order individual needs. The needs of senior citizens are well articulated through senior citizen groups and responded to by both the public and the private sector.

BAGSO, the German National Association of Senior Citizens' Organizations, represents over 10 million senior citizens and comprise of 76 national associations. Major German

political parties have special working groups for older people, such as the "60plus" of the Social Democratic Party and the Senioren-Union of the Christian Democratic Party, and Länder governments each have their own local senior councils. The Sentha interdisciplinary research project[36] is an example of a project that focuses on older people in the development of household technology and appliances

Industry Associations focusing on technology for the aging population have also emerged. The Deutsche Gesellschaft fur Gerontotechnik (German Society for Gerontology Technology and Equipment) and the Bundesfachverband Elektronische Hilfsmittel für Behinderte e.V. (a union of companies developing assistive technologies) in Germany coordinate industry and private sector efforts to further developments in the Technology & Aging Industry. Technology and Aging interest groups such as the Association for Gerontotechnology and the Center for Gerontotechnology in Iserloh generate greater awareness and also serve as platforms for the creation of collaborations between the private and public sector to develop and promote technology for the aging. The Association for Gerontotechnology also issues certificates for household products that are supposed to be suitable for elderly people.

National governments recognize the economic potential of the demographic shift. Germany's Federal Ministry of Family Affairs, Senior Citizens, Women and Youth (through its "Selbstbestimmt Wohnen im Alter" – Living self-determined even at high age program) promote actively the development of technologies for the elderly. Regional initiatives such as the North Rhine-Westphalia Senior Citizens Economy Initiative in Germany have also been developed to mobilize senior citizens' purchasing power and encourage economic and innovation activities.

[36] Sentha is an interdisciplinary research project funded by the German Science Foundation (Deutsche Forschungsgemeinschaft) (1997-2003). http://www.sentha.tu-berlin.de/index_e.html

Current technological developments include safety monitoring, smart houses, robotics and wearable computing. Germany's Intelligent House Duisburg Innovation Center - "inHaus" are among the current projects under development.

Quadrant II: High Service / Low Technology

United Kingdom

Countries in the High Service / Low Technology quadrant have well developed organizational capacity to access and deliver existing services to elderly. In the United Kingdom, senior citizen interests are addressed by government departments depending on the issues of concern. Departments include Health, Social Security, Labor and Housing. Significant planning and vision setting efforts, such as the "Extending Quality of Life for Older People" initiative (EQUAL) in 1993, the work undertaken by the Royal Commission on Long Term Care for the Elderly in 1998 and the Technology Foresight Exercise in 1999, have been taken by the UK government to address aging needs. The UK government provides public, universal health care systems funded by public taxation. Residential elderly care is also financed by national government, with some services provided by religious, charitable or for-profit providers. Policy strategies are focused on improving accessibility of home care and home help services. Service provision is significantly decentralized and local authorities are responsible for organizing and providing public welfare services.

Senior Citizen interests are represented by groups such as Age Concern, Help the Aged and the Association of Retired and Persons Over 50. These groups focus on helping the

disadvantaged elderly and campaign mainly for issues such as pensions, mobility, health and elder abuse.

Development capacity in the UK is moderate and current technological trends are focused on assistive technologies such as mobility aids, telecare and home modifications. The Foundation for Assistive Technology (FAST) is a good platform for raising awareness about emerging technologies for disabled and older people, bringing together users, developers and manufacturers to build partnerships and coordinate collaborations within the assistive technology community. However, assistive technologies – devices typically used by the disabled to maintain and enhance their independence – tend to target only the health, safety and mobility needs of the elderly.

There is significant effort to develop the telecare industry. The government is aggressively developing telecare ubiquity, announcing in 2004 its plans to invest £80 million between 2004 and 2006 in a Preventative Technology Grant designed to develop Telecare services. Industry associations such as the Telecare Services Association (TSA), and the Social Alarm and Telecare Association (SATA) represent the interests of providers and users to government departments and statutory regulators and also support the development of open standards within the sector.

Quadrant III: Low Service / Low Technology

Switzerland

Countries in the Low Service / Low Delivery quadrant have limited development and delivery networks to leverage technologies and innovations for their elderly populations. Residential elderly care is still a commonly sought after service for elderly

care, although rising costs and limited capacities are creating concerns for these countries.

In Switzerland, the interests of the elderly are fairly well represented by senior citizen groups. The Pro Senectute is the biggest foundation representing and lobbying for elderly interests. It also provides services for the elderly in areas such as home care and education. The Schweizer Seniorenrat SSR (Swiss senior citizens council), the Schweizerisches Verband für Seniorenfragen (Swiss organization for senior citizens), and the Verinigung aktiver Senioren- und Selbsthilfe-Organisationen der Schweiz (Association for active senior citizens and self-help organizations in Switzerland) are other groups that help to articulate the demands and needs of the elderly.

Development capacity in Switzerland is moderate. The Swiss Foundation for Rehabilitation Technology (Fondation Suisse pour les Téléthéses FST) is active in the development of assistive technologies, especially communications technologies and safety technologies within the home. In 2004, the Swiss announced the Commission for Technology and Innovation initiative 'Innovation for Successful Ageing' (CTI-ISA), designed to target R&D projects that lead to innovative solutions addressing the specific needs of older people. This initiative provides financial incentives for industry and academia to engage in collaborative or independent projects to develop innovations for the aging population. The Smart House project Futurelife – an inhabited intelligent house, and the Project Quo Vadis – an anti-wandering system are two examples of current technologies undergoing development in Switzerland.

Quadrant IV: Low Service / High Technology

Japan

Countries in the Low Service / High Technology quadrant exhibit high levels of innovation activity in the private sector. Companies and businesses recognize the market potential of the aging population and are striving to meet the unmet aging needs through product innovations. However, delivery capacity is underdeveloped or fragmented. Elderly services are typically provided by the private sector, with some support from charitable organizations.

The introduction of the Long Term Care Insurance in 2000 reflects the Japanese government's interest in encouraging the elderly to remain independent, although a large part of the services it supports focus on home care or nursing care. Local governments bear responsibility for procuring and supplying technologies and services. The interests of senior citizens in Japan are represented by the Japan NGO Council on Aging (JANCA) as well as other organizations such as the Foundation of Social Development for Senior Citizens, the Japan Association of Retired Industrial Persons and the Japan Pensioners' Union. JANCA consists of about 50 organizations, including seniors' and retirees' associations, care provider organizations for the elderly, educational and recreational service providers, and research institutes on aging. It engages in activities ranging from planning symposia, to making recommendations on social security system reforms. However, its activities do not significantly emphasize the implementation of technology to address social participation, employment and health care issues.

National Industry development strategies also reflect efforts to reap rewards from the growing elderly market. The Tohoku Industrial Cluster Project – "Project to promote industries corresponding to Aging Society" in Japan is an example of a national effort to encourage private industry innovation in Aging Technologies and Services.

Visible projects in Japan reflect innovative vision and creativity that are beginning to address the higher order needs of the aging populations. The Robotics industry in Japan has responded actively to the demographic shift by developing innovations such as the Matsushita Electric – Robot Bear Companion and the Hybrid Assistive Limb (HAL) 5 Robotic Suit. Brain Age, a brain training video game developed by Japanese software maker Nintendo, has proved extremely popular with baby boomers who desire to have fun and remain cognitively fit through intellectual stimulation.

Conclusions And Future Work

The use of the two-dimensional typology to represent the relative capacities of countries to develop and deliver technologies to their aging populations highlights the existence of two factors vital to the overall ability to leverage the benefits of technology for aging populations.

For national governments, understanding their current capacities relative to other countries creates an international policy awareness that can help them develop trade and sustainability policies tailored for technology and aging issues. Countries in the Low-Delivery / High-Development quadrant can consider exporting their technologies to countries in the High-Delivery / Low-Development quadrant, capitalizing on well established delivery networks that can speed up the adoption and diffusion of technologies into the market. Conversely, countries in the High-Delivery / Low-Development quadrant can still benefit from technology by importing technologies from countries in the Low-Delivery / High-Development to address and meet the needs of aged care. Such a strategy of choosing from available technologies rather than creating new technologies can lead to savings on R&D investment, which can be

channeled to meeting other social needs. Chosen technologies for import can then be adapted and refined according to the unique characteristics of the elderly population in the home country.

This chapter provides an exploratory examination of selected industrialized nations to assess their capacities to leverage technology in order to meet the growing and urgent demands of their aging populations. The next chapter presents detailed country reports of eleven industrialized countries that can provide important insights on their development and delivery capacities.

CHAPTER 8: TECHNOLOGY & AGING IN ELEVEN INDUSTRIALIZED NATIONS

In Chapter 7, I set up a framework for comparing the capacities of countries to develop and deliver technological innovations to their elderly populations. The four case studies of Germany, United Kingdom, Switzerland and Japan were chosen to typify the characteristics of each quadrant in the framework (Figure 16), and they form part of an 11 multi nation study. The other 7 countries examined were Australia, Finland, USA, Sweden, Israel, Singapore and the Netherlands.

In this Chapter, I present country reports for each of the eleven countries, collated using the template shown in Table 14 in Chapter 7. Using the information obtained, I then position each country on the quadrant map to represent their capacities relative to each other. A policy map with potential policy pathways was next developed to highlight the potential for future developments in the "technology and aging" industry.

Japan

	Delivery	Development
Government • Agencies	Ministry of Health, Labor and Welfare – Bureau for the Elderly	- Ministry of Economy, Trade and Industry - Japan Science and Technology Agency
• Plans	Long Term Care Insurance 2000 (5 year review) Gold Plan 21 (2000-2004)	* Tohoku Industrial Cluster Project – "Project to promote industries corresponding to Aging Society" [37]
Senior Citizens Representation	1. Foundation of Social Development for Senior Citizens 2. Japan Association of Retired Industrial Persons JARIP 3. Institute of Lifespan Development (ILD) 4. Japan NGO Council on Ageing [38]	
Industry Stakeholders • Industry / Trade Associations	1. Japan Robot Association 2. RESJA (Rehabilitation Engineering Society of Japan)	
• Technology for the Aging Interest Groups	No information	
• Major Private Companies	Matsushita Electric, NTT, Secom Medical System Co Ltd, Sanyo Electric	
Health care and Aging Services Delivery System	Mostly private, not for profit hospitals Universal health and long term care insurance	
Human Capital Development	No national training infrastructure for both social and healthcare staff working with the elderly under the LTCI system [39]	Tokyo Metropolitan Institute of Gerontology National Institute for Longevity Sciences -- Department of Gerontechnology [40]
Visible Projects	1. Matsushita Electric – Robot Bear Companion 2. Robotics -- University of Tsukuba, Yaskawa Electric Corporation[41] 3. PLANET system -- an open and secure interactive medical information network with web technology 4. Home Monitoring and Location Devices (Coco-Secom) 5. Finland-Japan Sendai well-being Center (part of Tekes' iWell technology program)	

[37] Angelino, Henri and Collier, Nigel, Comparison of Innovation Policy and Transfer of Technology from Public Institutions in Japan, France, Germany and the United Kingdom, NII Journal No. 8 (2004.2) p 32

[38] http://www.jarc.net/aging/04jan/page4.shtml

[39] Technology and delivery of care for older people – a mission to Japan, Report of a DTI Global Watch Mission, October 2004 p 23

[40] Kitani, Kenichi, The first Six Years at the National Institute of Longevity Sciences, Japan, Ann. N.Y. Acad. Sci. 959: 517–526 (2002).

[41] http://www.msnbc.msn.com/id/8656746/

Australia

	Delivery	Development
Government • Agencies	1. Department for Health and Aging (Aging and Aged Care Division) 2. House of Representatives Standing Committee on Ageing	1. Department of Industry, Tourism and Resources [42] 2. Commonwealth Scientific and Industrial Research Organization (CSIRO)
• Plans	1. National Strategy for an Ageing Australia 2001 2. Aged Care Act 1997 3. National Research Priority area 'Ageing Well, Ageing Productively"	
Senior Citizens Representation	1. Aged Care Association Australia 2. Aged & Community Services Australia 3. National Aged Care Advocacy Program (NACAP) 4. COTA National Seniors Hon Tony Abbott MHR - Minister for Health and Ageing Senator the Hon Santo Santoro, Minister for Ageing	
Industry Stakeholders • Industry / Trade Associations	1. Australian Rehabilitation and Assistive Technology Association (ARATA) 2. ACROD – National industry association for disability services	
• Technology for the Aging Interest Groups	1. Health Informatics Society of Australia (HISA) 2. Australian Center for Ageing & Aged-Care Services Technologies 3. Collaboration for Ageing & Aged-Care Informatics Research	
• Major Private Companies	Tunstall	
Health care and Aging Services Delivery System	Public health care system funded by public taxation. Free to most citizens. Residential aged care is also financed by the state, with some services provided by religious / charitable organizations or for-profit organizations	
Human Capital Development		National Ageing Research Institute Australian Association of Gerontology
Visible Projects	1. Making the Connections: Non-metropolitan Older People and Technology [43] 2. 50 Plus Project [44] 3. Project Nightingale [45]	

[42] http://www.innovation.gov.au/

[43] http://www.ruralfutures.une.edu.au/resources/downloads/publications/makconn.pdf

[44] The 50 plus project was designed to promote positive ageing through facilitating the uptake of technology by older adults. Its three parts were the provision of a number of computers placed in a residential Day Care Centre community 'hub', the production of a 50 Plus Activities Booklet and the staging of a 50 Plus Expo.

[45] Project Nightingale is a joint research effort between Smart Internet and NICTA which explores the needs of Australia's aging population and the role of Internet technologies in "reminiscing and memory sharing". http://www.zdnet.com.au/news/0,39023165,39162036,00.htm

United Kingdom

	Delivery	Development
Government • Agencies	1. Department of Health 2. Department of Social Security 3. Inter-ministerial Group on Older People 4. Royal Commission on Long Term Care for the Elderly, 1998	Department of Trade and Industry
• Plans	1. "Extending Quality of Life for Older People" initiative (EQUAL) 1993 [46] 2. Technology Foresight Exercise	SPARC (Strategic Promotion of Ageing Research Capacity) [47]
Senior Citizens Representation	1. Age Concern, UK 2. Association of Retired and Persons Over 50 3. Help the Aged 4. Older People's Advisory Group (OPAG)	
Industry Stakeholders • Industry / Trade Associations	1. FAST (Foundation for Assistive Technology) 2. TSA (Telecare Services Association) 3. SATA (Social Alarm and Telecare Association)	
• Technology for the Aging Interest Groups	No information	
• Major Private Companies	Tunstall	
Health care and Aging Services Delivery System	National health service, funded from general taxation Home care mainly provided by municipalities (49%) with a significant private market (34%). Funding for home care services is mainly tax-based funding (82%) with some out-of-pocket (18%)	
Human Capital Development		Royal College of Art, London – Helen Hamlyn Research Centre – Centre for Inclusive Design
Visible Projects	Telecare Smart Homes: The Application of Home Automation and Assistive Technologies within Social Housing (SPRU — University of Sussex, UK)	

[46] Seniorwatch report, "Older People and Information Society Technology: A Comparative Analysis of the Current Situation in the European Union and of Future Trends", April 2002.
[47] Multi-disciplinary network launched by EPSRC and the Biotechnology and Biological Sciences Research Council (BBSRC)

Germany

	Delivery	Development
Government • Agencies	1. Federal Ministry of Health and Social Security 2. Federal Ministry of Family Affairs, Senior Citizens, Women and Youth 3. Federal Ministry of Economy and Labor 4. Federal Ministry of Education and Research	1. German Research Foundation 2. VDI/VDE Innovation + Technik GmbH 3. Federal Ministry of Education and Research
• Plans	1. Statutory Long Term Care Insurance, 1995 2. German IS plan "Info 2000 – Germany's way in the Information Society" [48]	
Senior Citizens Representation	1. BAGSO (Federal Association of Senior Citizens' Organizations) 2. Graue Panther 3. "60plus" of the Sozialdemokratische Partei Deutschlands 4. "Senioren-Union" of the Christian Democratic Party 5. Local senior councils in the Länder governments	
Industry Stakeholders • Industry / Trade Associations	1. Deutsche Gesellschaft fur Gerontotechnik (German Society for Gerontology Technology and Equipment) 2. Bundesfachverband Elektronische Hilfsmittel für Behinderte e.V. [49] 3. Forschungsinstitut Technologie- Behindertenhilfe, Volmarstein [50] (Research Institute for Technology-Assistance to the Disabled)	
• Technology for the Aging Interest Groups	1. Association for Gerontotechnology 2. Center for Gerontotechnology in Iserloh	
• Major Private Companies	Siemens, Honeywell, Braun, Philips, Infineon, Deutsche Telekom AG, Vodafone, Attendo Systems	
Health care and Aging Services Delivery System	Statutory Health insurance covers almost 90% of citizens. Only 21% of funding comes from general taxation. Home care – mainly family carers (51%) followed by non-profits (31%). Funding is mainly insurance based.	
Human Capital Development		German Center for Research on Aging (DZFA),
Visible Projects	1. North Rhine-Westphalia Senior Citizens Economy Initiative 2. "Selbstbestimmt Wohnen im Alter" (Living self-determined even at high age) [51]	

[48] Seniorwatch report, "Older People and Information Society Technology: A Comparative Analysis of the Current Situation in the European Union and of Future Trends", April 2002. In Germany's IS plan, a specific working group was established to address the needs of senior citizens and one of the aims of the group is to increase internet uptake amongst older people from 10% to 30% within two years.

[49] Bundesfachverband Elektronische Hilfsmittel für Behinderte is a union of companies producing or selling assistive technology to improve the quality of providing disabled people with such assistive aids. Information, consulting and procuration between companies and people with disabilities.

[50] http://www.ftb-net.de/

	3. MORPHA [52] 3. "Online Competence for the Genreration 50over" initiative, 2004 4. BeSeCo (Autumn 1998, Berlin) by JAHRESRINGE e.V. [53] 5. Smart Homes (In-Haus) [54] 6. Sentha [55]

[51] "Selbstbestimmt Wohnen im Alter" (Living self-determined even at high age) was a programme initiated by the Federal Ministry of Family Affairs, Senior Citizens, Women and Youth, running from 1998 to 2001. Via a network of 12 regional agencies, the programme aimed at supporting the capability of elderly people to maintain a high standard of living at their own home even at a very high age. One focus was to implement technical devices in order to enhance the quality of life at home.

[52] The idea of the MORPHA project was to equip intelligent mechatronic systems, particularly robot assistants or service robots, with the capability to communicate, interact and collaborate with human users in a natural and intuitive way. This capability should enable a robot assistant to cooperate with and assist the human user in a variety of tasks, under the user's guidance and control. http://www.morpha.de/php_e/index.php3

[53] BeSeCo (Autumn 1998, Berlin) by JAHRESRINGE e.V. with Federal Ministry for Family Affairs, Senior Citizens, Women and Youth -- idea behind the project is to instruct senior citizens with restricted mobility and people with physical disabilitieis how to use computers in individual training and in their own domestic setting

[54] http://www.inhaus-zentrum.de/en/

[55] http://www.sentha.tu-berlin.de/index_e.html

Switzerland

	Delivery	Development
Government • Agencies	1. Federal Social Insurance Office 2. Federal Office of Public Health	1. Swiss Science and Technology Council 2. Swiss National Science Foundation (SNSF) -- funding 3. Federal Department of Economic Affairs --> Federal Office for Professional Education and Technology OPET
• Plans	Federal Law on Old-Age and Survivors' Insurance (LAVS)	CTI Innovation Promotion Agency -- Innovation for Successful Ageing
Senior Citizens Representation •	1. Viva50plus 2. Schweizer Seniorenrat SSR (Swiss senior citizens council) 3. Schweizerisches Verband für Seniorenfragen (Swiss organization for senior citizens) 4. VASOS (Verinigung aktiver Senioren- und Selbsthilfe-Organisationen der Schweiz, Association for active senior citizens and self-help organizations in Switzerland) 5. Pro Senectute - the Swiss organization for the elderly	
Industry Stakeholders • Industry / Trade Associations	1. Swiss Federation for Consultations on Aids for the Handicapped and Elderly (SAHB) 2. FST Fondation Suisse pour les Téléthèses (Swiss Foundation for Rehabilitation Technology) [56]	
• Technology for the Aging Interest Groups	No information	
• Major Private Companies	TeleAlarm, Ascom, Leitronic AG, Strack AG, Phonak, GHE – CES Electronic AG, Swiss Center for Electronics and Microtechnology (Smart Home Technology) [57]	
Health care and Aging Services Delivery System	Insurers use recognized healthcare providers. Doctors practice independently. Hospitals are public or publicly subsidized	
Human Capital Development		Institut Universitaire Kurt Bösch (University Institute of 'Ageing and Generations') Zentrum für Gerontologie (ZFG, Center for gerontology)
Visible Projects	1. National Research Program (NRP32) 'Ageing' 2. Smart House -- Project Futurelife [58] Project Quo Vadis (Anti wandering system)	

[56] www.fst.ch
[57] http://www.csem.ch/fs/home_auto.htm
[58] http://www.futurelife.ch/

Finland

	Delivery	Development
Government • Agencies	1. Ministry of Social Affairs and Health 2. Association of Finnish Local and Regional Authorities	1. Science and Technology Policy Council 2. National Technology Agency (TEKES)
• Plans	1. "Ageing Policy up to 2001" [59] 2. FinnWell, 2004 - 2009[60] 3. iWell[61] 4. PROACT 2002-2005	
Senior Citizens Representation	1. Central Union for the Welfare of the Aged 2. Svenska Pensionarsforbundet (Association of Swedish-Speaking Pensioners)	
Industry Stakeholders • Industry / Trade Associations	No information	
• Technology for the Aging Interest Groups	STAKES (National Research and Development Centre for Social Welfare and Health)	
• Major Private Companies	Securitas Systems Oy, Celotron, International Security Technology Oy, Respecta, Pikosystems Inc., Nokia	
Health care and Aging Services Delivery System	Health care is mainly provided by municipalities and the state. Funding is balanced between state and local taxation with some national insurance and some private payments. All citizens covered by mandatory sickness insurance funded by state, municipalities and employers. Home care – mainly municipalities (68%) followed by non profits (25%) with some home care privately paid for (7%). Funding is mainly tax-based (84%) with some out of pocket (16%)	
Human Capital Development	ITSE project (2001-2004) [62]	FACTE (Finnish Academies of Technology)
Visible Projects	1. Inclusion of Disabled and Elderly People in Telematics (INCLUDE) [63] 2. Satakunta Macropilot Project (1998-2001) [64] 3. ENABLE (Enabling technologies for people with dementia), 4. **Vivago WristCare®** 5. Future Senior Living – Assistive Automation [65]	

[59] Seniorwatch report, "Older People and Information Society Technology: A Comparative Analysis of the Current Situation in the European Union and of Future Trends", April 2002

[60] http://websrv2.tekes.fi/opencms/opencms/OhjelmaPortaali/Kaynnissa/FinnWell/en/projektilistaus.html

[61] www.tekes.fi/english/programmes/iwell

[62] The ITSE project was to improve the knowledge and skills of social welfare and health care staff, service users and their relatives regarding good solutions provided by technology and information

[63] INCLUDE is a project based in Finland that collects and disseminates information on user-centered design, user needs, standardization matters, and legislation regarding access to telecommunications.

[64] The Satakunta Macropilot Project (1999–2001) tested the regional application of information technology (IT) in social welfare and health care.

[65] The Assistive Automation project studies home automation and home robotics in the service of senior citizens. It also builds an actual system automation and robotic system, TerveTaas (HelloHelper) –project, an automation and communication system to help disabled and elderly people at their homes.

USA

	Delivery	Development
Government • Agencies	1. Department of Health and Human Services -- Administration on Aging 2. Veteran Affairs 3. Department of Transportation 4. State Agencies on Aging and Area Agencies on Aging	1. Department of Commerce 2. Department of Education 3. National Institute of Health
• Plans	1. New Freedom Initiative 2001 2. Assistive Technology Act 2004 3. White House Conference on Aging	National Institute of Aging -- Small Business Innovation Research/ Small Business Technology Transfer Program
Senior Citizens Representation	AARP (Association for Advancement of Retired Persons) [66] NCOA (National Council on the Aging) [67] Senator Larry Craig (Senate Subcommittee on Aging)	
Industry Stakeholders • Industry / Trade Associations	1. ATIA (Assistive Technology Industry Association) 2. RESNA (Rehabilitation Engineering and Assistive Technology Association of North America) 3. ATSP (Association of Telemedicine Service Providers) 4. NADSA (National Adult Day Services Association) 5. NAHC (National Association for Home Care & Hospice)	
• Technology for the Aging Interest Groups	CAST (Center for Aging Services Technologies) [68]	
• Major Private Companies	Philips, General Electric, Lifeline, Ford, ADT	
Health care and Aging Services Delivery System	Health care provision and insurance are private. The government provides insurance assistance for the old and the poor (Medicare and Medicaid), and some states are looking to introduce mandatory insurance coverage for all residents	
Human Capital Development		1. MIT AgeLab, MIT Media Lab 2. Georgia Tech, University of Miami, Florida State University – CREATE 3. Center for Future Health, University of Rochester
Visible Projects	1. In-Home Health Status monitoring 2. Telemedicine / Telehealth 3. Automobile Telematics	

[66] http://www.aarp.org
[67] http://www.ncoa.org
[68] http://www.agingtech.org/index.aspx

Sweden

	Delivery	Development
Government • Agencies • Plans	1. Ministry of Health and Social Affairs 2. The National Board of Health and Welfare, Unit for Elder Care	1. Ministry of Industry, Communication and Employment 2. Ministry of Education and Culture 3. Swedish Agency for Business Development (NUTEK), 4. VINNOVA Swedish Agency for Innovation Systems
Senior Citizens Representation	Swedish Association for Senior Citizens Swedish Minister for Health and Elderly Care, Ms Ylva Johansson	
Industry Stakeholders • Industry / Trade Associations • Technology for the Aging Interest Groups • Major Private Companies	1. Swedish Handicap Institute [69] 2. Confederation of Swedish Enterprise 3. The Swedish Association of Suppliers of Medical Devices No information Swedish Telecom, CareLink	
Health care and Aging Services Delivery System	Comprehensive public sector health systems with strong local democratic control. Funded mainly by local taxation supplemented by state funds and national insurance	
Human Capital Development		1. Lund University, School of Social Work 2. Stockholm University 3. Swedish Institute of Computer Science 4. KTH Technical University
Visible Projects	1. Old@Home project (2002-2005) [70] 2. Senior Online 3. SENAV - Senior citizens and navigation in electronic environments 4. TilliT project for home care in Umea, Northern Sweden, 2000 [71]	

[69] The Swedish Handicap Institute (HI) is a national resource centre on assistive technology and accessibility for people with disabilities.

[70] http://www.vinnova.se/vinnova_shop/ItemView____9163.aspx?farParentLink=613

[71] www.tillit-projektet.se TilliT is a three-phased project aimed at giving workers information on the elderly, sick and disabled when and where needed using tablet PCs based on Intel® Centrino™ mobile technology, PDAs based on Intel® architecture and SMS messages on mobile phones. Healthcare workers can access centrally-held patient information much more quickly, upload and download patient details, distribute medical data and check research from the point of care in the home. They can also contact each other more easily to exchange information or seek reinforcements when required.

Israel

	Delivery	Development
Government • Agencies	1. Ministry of Health 2. Ministry of Labor and Social Affairs 3. National Insurance Institute (Israel's Social Security Administration) [72]	1. Ministry of Science and Technology 2. Ministry of Trade, Industry and Labor
• Plans	Community Long-term Care Insurance Law, enacted in 1988	
Senior Citizens Representation • Interest / Advocacy	1. (ESHEL) The Association for the Planning and Development of Services for the Aged in Israel. 2. Association of Senior Citizens Histadrut Hagimlaim - Israel	
Industry Stakeholders • Industry / Trade Associations	MILBAT [73]	
• Technology for the Aging Interest Groups	GeronTech [74]	
• Major Private Companies	SHL Telemedicine, CogniFit	
Health care and Aging Services Delivery System • Provision System • Financing System	Each citizen has a choice to belong to one of four Health Maintenance-like Organization (HMOs) or "sick funds". Funds provide some supplementary personal care services, particularly during the first several months of disability, and for the more severely disabled on a discretionary basis. They are the exclusive providers of professional home care, including home care visits by nurses, doctors and other paraprofessionals.	
Human Capital Development		1. Technion - Israel Institute of Technology 2. The Israel Gerontological Data Center (IGDC)
Visible Projects	1. CogniFit [75] (MindFit, DriveFit)	

[72] http://www.jewishvirtuallibrary.org/jsource/aging/one.html

[73] http://www.milbat.org.il/scripts/txt.asp?pc=213554161 MILBAT is a resource and information center established with the aid of ESHEL – The Association for Planning and Development of Services for Aged in Israel. MILBAT is dedicated to assisting people with disabilities with the goal of enabling them to engage in satisfying occupations and to perform basic daily functions helping to achieve improved quality of life.

[74] GeronTech is a non-profit organization established in 1998. Joint venture of ESHEL and MJHS. GeronTech promotes and facilitates the development and application of innovative technical solutions to assist the elderly and disabled in the activities of daily living (ADL).

[75] http://www.cognifit.com/page.php CogniFit's easily adaptable, user friendly, and personalized cognitive training products improve the quality of life through software developed to evaluate, train and enhance cognitive abilities.

Singapore

	Delivery	Development
Government • Agencies • Plans	1. Ministry of Community Development, Youth and Sports 2. Ministry of Health 3. Inter-ministerial Committee on Ageing Population	Ministry of Trade and Industry -- Agency for Science Technology And Research
Senior Citizens Representation	Singapore Action Group of Elders (SAGE) [76]	
Industry Stakeholders • Industry / Trade Associations • Technology for the Aging Interest Groups • Major Private Companies	No information No information Healthstats International (BPro)	
Health care and Aging Services Delivery System	A mix of public and private health care providers and insurance programs. Medisave, introduced in April 1984, is a national medical savings scheme which helps individuals put aside part of their income into their Medisave Accounts to meet their future personal or immediate family's hospitalization, day surgery and certain outpatient expenses.	
Human Capital Development		1. National Technological University of Singapore 2. A*STAR
Visible Projects	1. VTT – A*STAR collaboration [77] 2. BPro by Healthstats 3.Activity Monitoring Using Wireless Wearable Sensors 4. Brain Machine Interface for Collaborative Wheelchair Assistant 5. Acoustic Bathroom Activity Monitoring System 6. Eyeglass Audio Interface	

[76] www.sage.org.sg

[77] VTT has developed together with A*STAR Emtele and Comptel a Global Health Monitoring Platform service. In the first phase there are two concrete global scale pilots – a telemedicine solution to acute health failure care in Finland and independent living of elderly and disabled in Singapore.

Netherlands

	Delivery	Development
Government • Agencies • Plans	1. Ministry of Labor and Social Affairs 2. SeniorWeb -- national government-subsidized information organization National Action Programme Older People and Technology [78]	1. Netherlands Organization for Scientific Research 2. Ministry of Education Culture and Science 3. Ministry of Economic Affairs
Senior Citizens Representation	1. ANBO (League for 50+) [79] 2. Netherlands Platform Older People and Europe (seniorweb) 3. Unie KBO (Association of Catholic Organizations of Senior Citizens)	
Industry Stakeholders • Industry / Trade Associations • Technology for the Aging Interest Groups • Major Private Companies	No information KITTZ (Institute for Quality and Applied Home Care Innovation) [80] Tunstall, TeleAlarm	
Health care and Aging Services Delivery System	Complex system of public and private insurance but moving to a national scheme. Funding is mostly from compulsory insurance schemes with some voluntary or private insurance. Home care – Mainly family carers (75%) followed by non profits (24%). Funding is mainly tax-based (94%) with some small out of pocket funding (6%)	
Human Capital Development		1. Delft University of Technology 2. Eindhoven University of Technology
Visible Projects	1. Homelab [81] 2. Smart Homes Foundation [82]	

[78] National Action Programme Older People and Technology - tries to involve older people more in the development of user-friendly (design for all) products.

[79] Seniorwatch report, "Older People and Information Society Technology: A Comparative Analysis of the Current Situation in the European Union and of Future Trends", April 2002. ANBO lobbies for the recognition of "The Senior Label" as a quality goal for existing and newly construct houses. To acquire the label, housing must be accessible, affordable and provide appropriate reimbursable ICT applications for older people.

[80] http://kittz.leonesit.com/kr_kittz/default.asp

[81] Homelab www.philips.com/homelab (Eindhoven, NL)

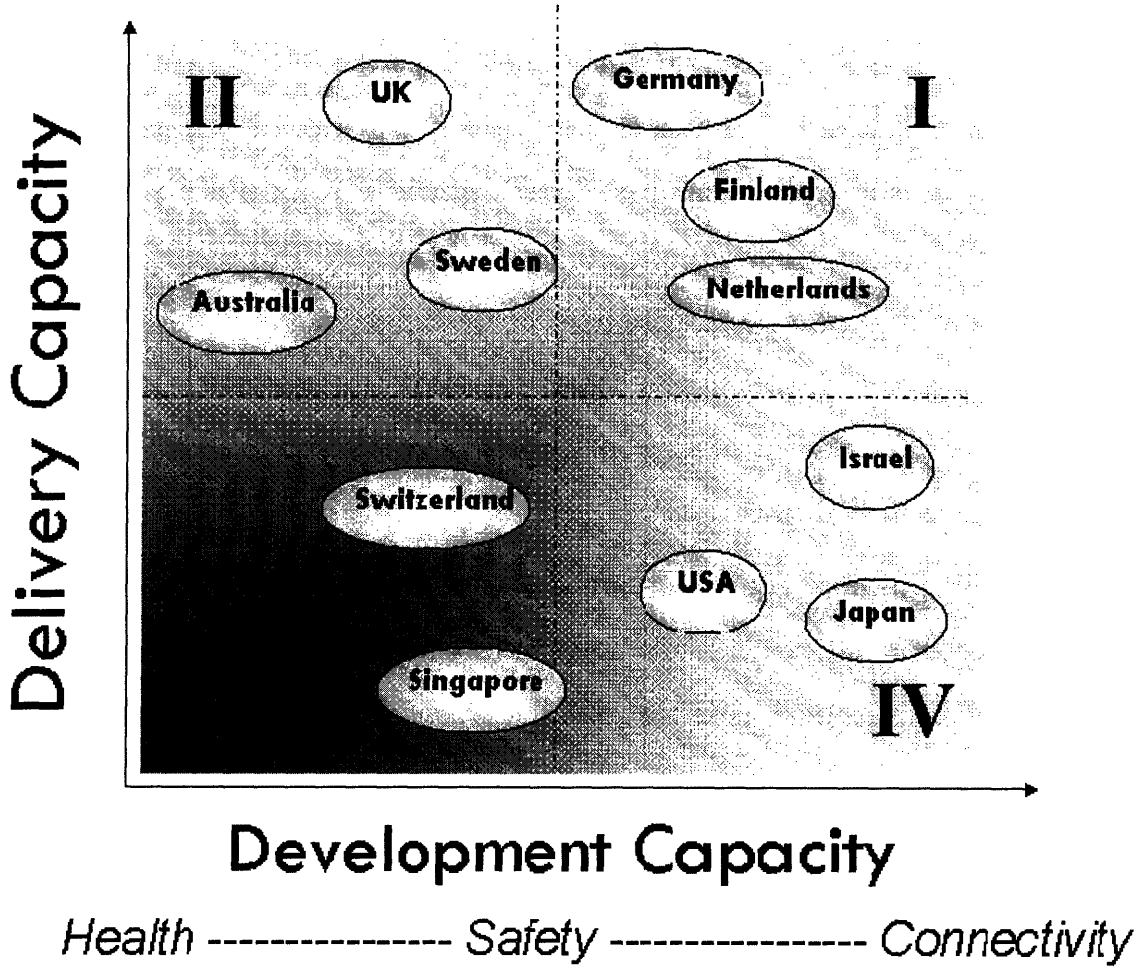
[82] http://www.smart-homes.nl/engels/index.html The Smart Homes Foundation is a new internationally oriented platform for promoting smart home technology, exchanging ideas, initiating projects and implementing technology and services into practice.

Delivery and Development Capacities of Eleven Countries

The use of the information template to collect country specific information facilitated a comparison of the capacities of countries to develop and deliver technologies and innovations to their elderly populations. Each country can be represented on the typology developed in Chapter 7, as shown in Figure 18 below. This typology is a static snapshot of current capacities, and countries in the same quadrant tend to exhibit similar characteristics. This typology does not indicate the rate of growth of development or delivery capacity in each country.

A country's relative position on the plot now does not indicate success or failure of the country's "aging population policy". On a macro level, countries differ based on aging demographics, wealth, population density, family structure, culture and tradition. Each country's governance structure is also very different, and their innovation policies may be focused on different industries or different points of the innovation life cycle (some on invention, some on commercialization).

Figure 18. Delivery and Development capacities in eleven countries

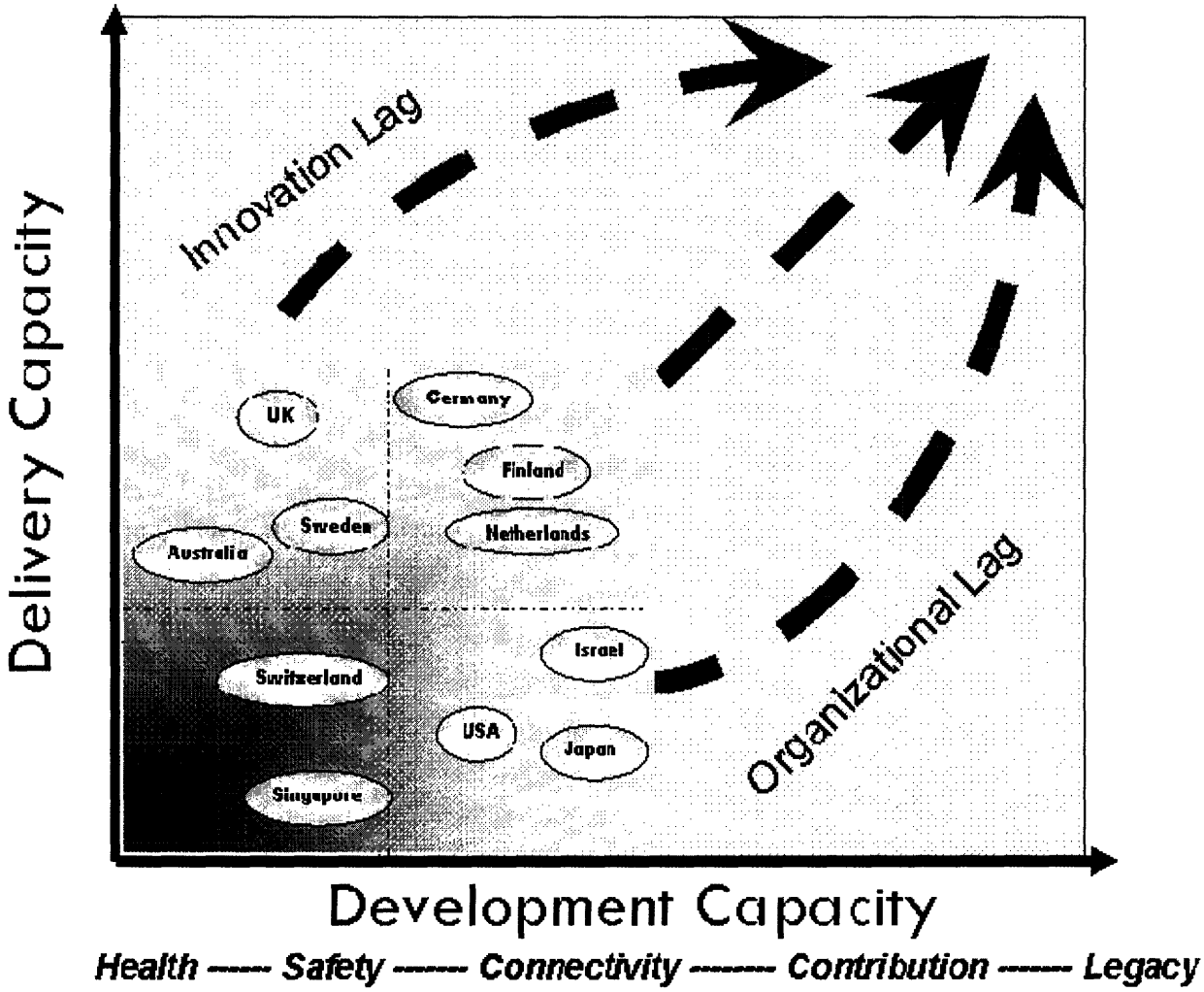


A policy map for Technology and Aging

The map as shown in Figure 18 may appear to suggest that countries such as Germany, Finland and the Netherlands are close to achieving the ideal levels of delivery and development capacities. However, this is hardly the case. By extending the policy map for "Technology and Aging" industries using the five level quality aging needs hierarchy developed in Chapter 2 (Figure 5), the potential for further developments is

revealed. Figure 19 below demonstrates a visionary policy map for Technology & Aging, providing a visual tool to illustrate the opportunities yet to be captured.

Figure 19. A Policy map for Technology & Aging



Although the diagonal policy path appears to be the most efficient path to achieve the maximum development and delivery capacities, and it can be achieved by synergistic public-private partnerships that work to achieve balanced investments in development and delivery capacities, two types of policy paths are more likely to exist:

1. *Organizational Lag path* – Countries that progress along this path are likely to show high industry innovation but under-developed delivery networks. The benefits of technologies are not readily provided to the domestic population and the technologies developed are more likely to be exported. Countries likely to follow this path are typically reliant on market forces and believe that consumers will respond efficiently to worthy innovations that emerge in the market.

2. *Innovation lag path* – Countries that progress along this path are likely to show lower industry innovation but highly developed delivery networks. The domestic population can benefit from imports of innovations, but little competitive advantage is developed. These countries will typically develop delivery capacities well positioned to absorb, integrate and deliver innovations and technologies to their populations, but may find themselves unable to fully utilize their delivery networks due to a lack of innovations and technologies. Countries likely to follow this path may be traditionally reliant upon government provision of health, social services and aging services.

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Society of Automotive Engineers www.sae.org

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