Part A. THEORETICAL FOUNDATION

2 The Silver Market Phenomenon

2.1 Demographic Development and Transition

The number of humans living on Earth has been constantly increasing. While the global human population did not reach 1 billion until the beginning of the 19th century, it has been growing rapidly ever since. The population reached two billion in 1927 (123 years later), 3 billion in 1960 (33 years later), and 4 billion in 1974 (14 years later). Since then an additional billion has been added approximately every 12 to 14 years, culminating in over 7 billion people today.[36]

The key drivers of population size and growth are mortality, fertility, and migration, but migration is irrelevant on a global level. Improvements in medicine and healthcare, e.g., discovery of penicillin, nationwide immunizations, and precautions against communicable diseases, have led to significantly lower mortality rates and higher life expectancies across all regions (see Figure 1 below). The world's life expectancy at birth increased from 46.9 years in 1950-55 to 70.0 years in 2010-2015. The current life expectancy for the most developed countries is even higher: 78.9 years in the US, 80.7 years in Germany, and 83.5 years in Japan.

Fertility is measured in accordance with the fertility rate, which is defined as "*[…] the average number of children a woman would bear over the course of her lifetime […]*"[37]. A fertility rate of 2.1 is required for constant reproduction. Over the past 50 years fertility rates have constantly declined (see Figure 1 below). While they were already well below the reproduction rate in developed countries, the less and least developed countries have seen an especially sharp decline. The decreasing fertility rate leads to a slower overall population growth. While the annual population growth rate peaked in the late 1960s at 2.1 %, it is currently at 1.3 % and will continue to decline. Nevertheless, the global population will continue to grow during the 21st century and is expected to stabilize at just above 10 billion people after 2200.[38]

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36 Cf. United Nations 1999, p. 8. Several studies have tried to estimate historical population figures. Two good overviews on existing studies and their key findings can be found under the following links:
http://en.wikipedia.org/wiki/World_population_estimates
http://www.census.gov/population/international/data/worldpop/table_history.php

37 United Nations 2010, p. 60.

38 Cf. United Nations 2013.

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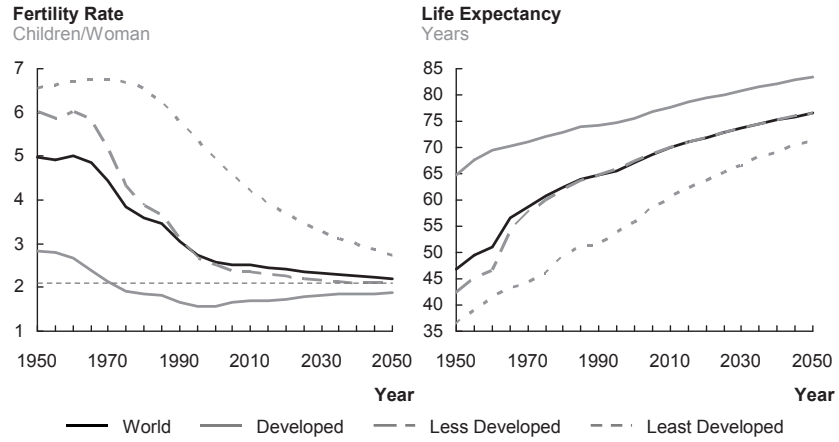

Figure 1: Development of Fertility Rate and Life Expectancy from 1950 - 2050[39]

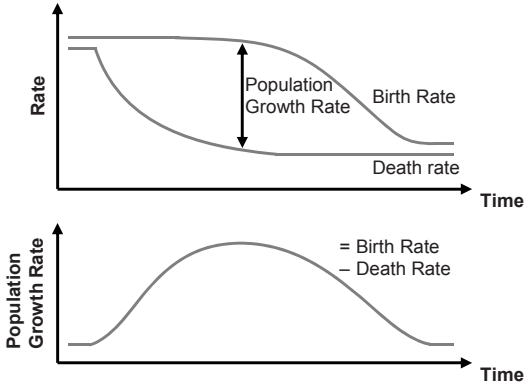

Figure 2: The Demographic Transition and Population Growth Rate over Time[40]

The decrease in fertility typically begins only after the decrease in mortality has already become apparent. This lag creates population growth (see Figure 2 above)

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[39] Own illustration. Data based on United Nations 2013, medium-variant scenario.
Developed countries comprise of Europe, North America, Australia, Japan, and New Zealand.
Less developed countries comprise of Africa, Asia (excluding Japan), Latin America, the Caribbean, Melanesia, Micronesia, and Polynesia without the least developed countries.
Least developed countries comprise of 48 countries (33 in Africa, 9 in Asia, 1 in Latin America, and 5 in Oceania) as designated by the United Nations General Assembly in 2011.

[40] Illustration according to Bloom et al. 2003, p. 31.

and triggers a demographic transition.[41] At first a large cohort is born and, as it traverses through the working ages, it fuels economic growth and provides a demographic dividend.[42] This large cohort of the current demographic transition is the so called *baby boomer generation* born between 1940 and 1960. Once that large cohort is past the median age of the population, the older age cohorts of a population grow at a higher rate than the average population, leading to a demographic burden. The resulting phenomenon is the overall aging of the population. This is visible as an increasing median age and a growing share of older age cohorts. The median age of the world population grew from 23.5 years in 1950 to 28.5 years in 2010. In Japan, currently the oldest nation in the world, the median age more than doubled in the same time period from 22.3 years in 1950 to 44.9 years in 2010. The older segment of the population (aged 60 years or over) currently accounts for about 11 % of the global population, but its share is expected to increase to 22 % (over 2 billion people) by 2050.[43] In Japan and Germany, this segment already accounts for more than 31 % and 26 %, respectively (see Figure 3 below). While most of the growth of the older age cohorts in recent years has come from developed countries, in the future it will be driven by growth in the less developed regions of Africa, Asia, and Latin America.[44]

As stated above, Germany (alongside Japan) has already experienced the demographic transition and is currently one of the oldest countries. Its fertility rate is currently at 1.42 (recovering from an all-time low after the reunification at 1.30), and life expectancy at birth is currently 78.2 years for men and 83.1 years for women. The additional life expectancy at the age of 60 was 22 years for men and 25 years for women, which means that a German man at the age of 60 today will on average live until he is 82. As a result, the median age grew from 35.3 years in 1950 to 44.3 years in 2010 and is expected to rise even further to 51.5 years in 2050.[45]

Based on data by the Federal Statistics Office of Germany, there are currently 28 million people of at least 55 years of age living in Germany. They account for 35 % of the overall population.[46] Since 1990, the share of that age group has grown from 22 % and is expected to reach 42 % in 2030 (see Figure 4 below).[47] The shape of Germany's population age structure will then change from a pyramid to something like a mushroom.

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41 Cf. Bloom et al. 2003, pp. 30ff..
42 Cf. Fent et al. 2008, pp. 4f.
43 Cf. United Nations 2012, p. 1.
44 Cf. United Nations 2012, p. 1.
45 Cf. United Nations 2013; Statistisches Bundesamt Deutschland 2011, pp. 10ff.
46 The explanation for defining the cut-off value at 55 years will be delivered in chapter 2.2.
47 Cf. Statistisches Bundesamt Deutschland 2009.

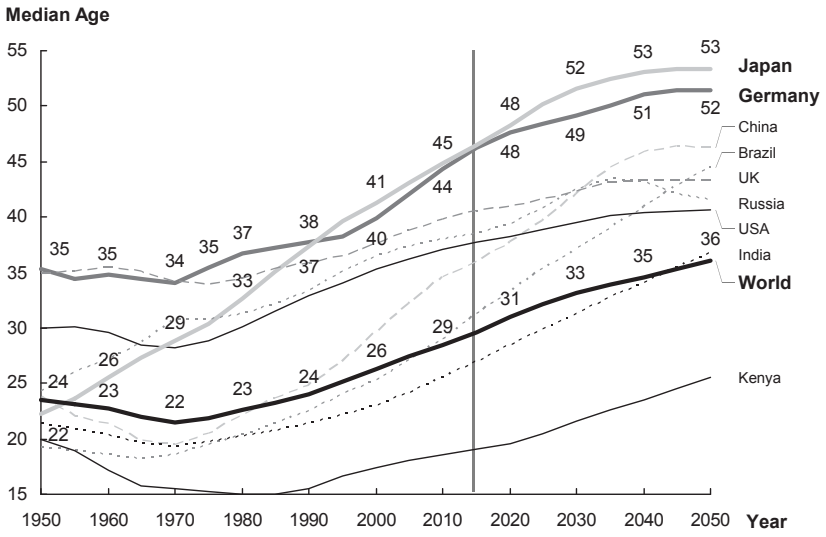

Figure 3: Development of Older Population from 1950 - 2050[48]

Along with the changing age structure also come challenges for the social systems of these countries, as the (decreasing) members of the workforce must support the (increasing) transfer recipients. Common measures to express the amount of pressure that is on the workforce are dependency ratios or, more specifically, old-age dependency ratios. The old-age dependency ratio is defined by the ratio of people aged 65 and older and the number of people within the age limits of the workforce (15 - 64) represented as the number of dependents per 100 persons of working age. Although there is considerable criticism regarding the simplifying assumptions of this measure, it is still commonly applied.[49] The old-age dependency ratio in Germany is currently at 33 and is estimated to increase to 60 by 2050. In other words, one person 65 or older is currently supported by 3.1 members of the workforce. In 2050, this ratio will be reduced to only 1.7. For Japan this ratio will drop from 2.4 (the current ratio) to 1.4 in 2050. Globally, the old-age dependency ratio is currently at 13

[48] Own illustration. Data based on United Nations 2013, medium-variant scenario.

[49] Typically criticism concerns the notion that it only compares the sizes of the age groups without incorporating the fact that some old people might still be members of the workforce while some middle-aged people may not. Additionally, the value of transfers is not included. The measure assumes that the cost for supporting a child and supporting a retired person is equal. More fundamental critics argue that the term dependency ratio already implies that population aging is a burden to society and neglects the idea that older people are the source for many financial transfers to younger generations, especially in developed countries. For an overview, the reader may refer to Crown 1985.

(≙ 7.9 supporting workforce members) and is estimated to increase to 25 (≙ 4.0 supporting workforce members).

Figure 4: Development of Age Structure in Germany from 1990 - 2030[50]

As shown, the demographic transition, especially in developed countries, presents societies with tremendous challenges. Social support systems must accommodate an increasing number of the elderly, and many states do not even have a public pension system in place.[51] But the demographic transition is not solely a threat. The soon-to-retire baby boomers are well educated, healthy, and wealthy and can be a great business opportunity for tailored products, as the following chapter will discuss.

2.2 Silver Market Phenomenon

There are currently around 800 million people in the world who are 60 years or older. About a third of them are living in developed countries. By 2050, there will be more than 2 billion people of at least 60 years of age, and most of this growth, about 80 %, or 1.6 billion people, will come from developing countries.[52] The sheer size and rapid growth of this age group, coupled with the assumption that the group has different needs than younger age groups provide promising business opportunities for tailored products and services.

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50 Own illustration based on Statistisches Bundesamt Deutschland 2009. Model 1-W2 with the following assumptions: nearly constant birth rate at 1.4 children per woman, life expectancy of newborns in 2060 at 85.0 years for boys and 89.2 years for girls and a positive annual net migration of 200,000 persons.

51 Cf. United Nations 2012, p. 4.

52 Cf. United Nations 2013.

Academia has realized the importance of the demographic transition and is slowly analyzing the characteristics and specific requirements of the so-called *Silver Market*. The following chapters will provide an overview of the SiMa phenomenon and existing attempts to incorporate members of the SiMa into the product development process.

2.2.1 Description of Silver Market

Although it has been identified as an interesting segment, there is no clear and agreed-upon definition of the SiMa. There exist numerous labels used to describe the customer segment of the elderly. The German Wikipedia entry for "Best Agers" lists, besides Silver Agers, the alternative labels "*[…] Generation Gold, Generation 50plus, […] Golden Ager, Third Ager, Mid-Ager, Master Consumers, Mature Consumers, [and] Senior Citizens*"[53]. This multitude of labels indicates a multitude of approaches adopted to define this market segment. Generally, the segment is defined by a minimum age between 50 and 65 years.[54] The definition of a cut-off value based on chronological age is difficult, because phases of life do not only depend on chronological age but on one's mental and physical state, marital and occupational status, or need for autonomy.[55] Nevertheless, some phases are institutionalized and defined by chronological age. The most drastic is the transition into retirement age, which is highly regulated in most countries (and typically occurs between 60 and 65 years).[56] Typically the minimum age for the definition of the SiMa ranges from 50 to 55 years.[57] For this research, the minimum age is defined as 55 years, which is in line with the definition adopted by most researchers who do not use the entrance into the retirement age as a boundary but rather argue with the changing needs and preferences that typically occur at that age.[58] Additionally, based on a life expectancy of 82 years (which corresponds to the current life expectancy for most industrialized countries), 55 years marks the beginning of the last third of one's life span.[59]

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53 Wikipedia contributors 2014.

54 In a meta-analysis of 67 studies on older consumer behavior by Tongren 1988, the threshold for old age was defined at 49+ (1 study), 55+ (11 studies), 60 / 62+ (9 studies), 64+ (3 studies), and 65+ or older (36 studies). 7 studies did not specify the applied threshold.

55 Cf. Mayer 1990, pp. 9 & 14; Kohlbacher et al. 2011b, pp. 7ff.

56 Cf. Kohli 1985, p. 8.

57 Cf. Szmigin & Carrigan 2001, p. 115; Auken et al. 2006, p. 440; Gassmann & Reepmeyer 2006; Kohlbacher & Herstatt 2008a, p. xi; Fisk et al. 2009, p. 8; Kohlbacher et al. 2011a, p. 193.

58 Cf. Auken et al. 2006, p. 440; Szmigin & Carrigan 2001, pp. 114f. See also Tongren 1988.

59 See World Health Organization 2013.

The term *silver service* was first used in Japan in the 1970s. On September 15, 1973, the "Respect for the Elderly Day"[60], the Japanese National Railway introduced silver seats specifically reserved for the elderly.[61] The Japanese word *shirubā* (derived from the English *silver*) refers to the white hair of older people.[62] The name was then applied to other silver products and services and is now a widely-used term.

Compared to previous generations, today's elderly are healthier, more self-reliant, and more demanding of their quality of life.[63] In addition they have the means to afford to become a major driver of economic growth. The median net worth of US households in the age group over 65 is more than double that of the age group 45 to 55.[64] In the UK, the average household expenditures per capita for the age group 65 to 74 are 9 % higher than the average per capita household expenditures. 18.4 % of total household expenditures are made by those of at least 65 years.[65] Individuals over 55 years "*[…] are 48 per cent more likely to spend their day shopping, and are 14 per cent more likely to eat out than other adults.*"[66] German households with residents older than 55 years own 57 % of the net assets although they represent only 44 % of all German households (and 34 % of the population).[67] In Japan, people in their 60s have the highest consumption expenditures, 21 to 39 % above that of the younger non- SiMa age groups.[68]

These highlights show that the SiMa members are, on average an interesting customer segment.[69] Their considerable wealth makes them less price-sensitive. As such, other product characteristics, like quality, convenience, and fostering health are more important as buying criteria.[70] SiMa members are searching for products and services that support them in leading an active and high-quality life.[71] Tempest, Barnatt, and Coupland (2008) suggest a simple segmentation of the SiMa based on the individual's state of health and state of wealth. They show that individuals seek

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60 In Japanese called *keirō no hi* and since 1966 a National holiday. It was moved from September 15 to the third Monday in September in 2001 in order to create a long weekend. Cf. Backhaus 2008, pp. 463f..

61 Cf. Coulmas 2008, p. vi.

62 Cf. Ogawa 2008, pp. 151f.

63 Cf. Usui 2008, p. 73.

64 Cf. United States Census Bureau 2011.

65 Cf. Office for National Statistics 2012, pp. Table A9.

66 Szmigin & Carrigan 2001, p. 115.

67 Cf. Deutsche Bundesbank 2013, pp. Table 1_A_1 & 5_A_1.

68 Cf. Kohlbacher et al. 2011a, p. 194.

69 At the same time, poverty among the elderly is a growing problem in developed as well as developing countries. Although it is not to be neglected, it will not be detailed here for reasons of conciseness.

70 Cf. Arnold & Krancioch 2011, p. 155.

71 Cf. Usui 2011, p. 334; Reinmöller 2008, p. 160.

products that either improve their state of health, their state of wealth or both. Older customers who are healthy and wealthy seek a high quality of experience.[72] For the purchase, elderlies prefer stores with easy access, sales assistance, and proximity to their home.[73] They are also more likely to be store-loyal and base their purchasing decisions on informal sources of information like recommendations from family and friends.[74]

The majority of companies have not yet targeted the SiMa. In a study among German companies doing business in Japan, Kohlbacher et al. (2011a) found that although more than 90 % acknowledged the medium-term importance of the SiMa, only 45 % saw business opportunities for themselves, and only a small minority is conducting specific marketing (5.4 %) or is developing tailored products (6.5 %).[75]

2.2.2 Product Development for the Silver Market

The difficulty in developing products for the SiMa is that there is a very thin line between a tailored product and one that labels the user as being old. Older people typically perceive themselves as being about 10 years younger, so age stigmatization, whether in product design or marketing, decreases customer satisfaction and will most probably lead to the product being a flop.[76] Levsen (2015) shows that age-based products are often discriminated against in retail markets insofar as they are not provided with shelf access. Of course, non-stigmatization is not possible for all products because some are aids for highly age-specific problems; these include walking frames, adult diapers, and stair lifts. For less age-specific products and services, there exist design criteria to develop ubiquitous products, i.e. they respond to age-specific needs while providing benefits to all age groups, e.g., barrier-free homes, the easy-to-use washing machine Miele Klassik, or cars with an elevated seating position for better circumferential visibility (like the Volkswagen Golf Plus). The most prominent set of design principles is known as *universal design*. Universal design considers the needs and requirements of all potential user groups and does not differentiate between young and old, able and disabled. It aims to integrate all these requirements into one standard instead of creating exceptions for specific user groups.[77] The Center for Universal Design at North Carolina State University defined seven design principles that are generally accepted by product

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72 Cf. Tempest et al. 2008, p. 247.
73 Cf. Arnold & Krancioch 2011, pp. 150ff.
74 Cf. Moschis 1992b, pp. 245 & 259f.
75 Cf. Kohlbacher et al. 2011a, pp. 196ff.
76 Cf. Schmidt-Ruhland & Knigge 2008, p. 107. The effort of non-stigmatizing marketing is visible by the application of terms like *silver agers* or *best-agers*, instead of *seniors* in marketing.
77 Cf. Gassmann & Reepmeyer 2008, p. 128.

developers: 1) equitable use, 2) flexibility in use, 3) simple and intuitive use, 4) perceptible information, 5) tolerance for error, 6) low physical effort, and 7) size and space for approach and use.[78] Pirkl's (2011) *transgenerational design* follows similar design principles, showing that associations of age and disability are similar. Young people grow old, as able people can become disabled. In the end, both groups need products that enable them to lead a regular life.[79]

Although these guidelines describe how product design should be considered FOR the elderly, they do not define how it can be done WITH them. Suggestions range from asking product designers to envision the mindset of the elderly by simulating typical troubles[80], via the observation of habits and behaviors[81], to active integration in the definition and design process[82]. Research projects like *sentha* ("Everyday Technology for Senior Households", development of products to maintain independent living), *Open ISA* ("Open Innovation Platform for Health-related Services during Old Age"), and *SMILEY* ("Smart Independent Living for the Elderly", technology-based products to assist independent living)[83] have shown that the elderly can efficiently verbalize their specific requirements and that the resulting products could not have been developed by product designers on their own.

Nevertheless, no studies exist that have analyzed whether older people are also creators of age-based innovations and how these innovations can be applied to the creation of silver products.

2.3 Defining Age

At first glance, age seems to be a simple concept. The more time has passed since the birth of a person, the older he or she is. But some people look older than they are and some people do not behave according to their age. Several disciplines of science have developed theories of aging, e.g., biology, psychology, and the social sciences.[84] Age manifests itself in the individual through behavior and the state of the body, but also in conceptions of age in society and culture.[85]

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78 Cf. NC State University 1997.
79 Cf. Pirkl 2011, p. 130.
80 Cf. Schmidt-Ruhland & Knigge 2008, pp. 114ff.
81 Cf. Schmidt-Ruhland & Knigge 2008, pp. 109ff.; Helminen 2008.
82 Cf. Schmidt-Ruhland & Knigge 2008, pp. 111ff.; Östlund 2011, pp. 18ff.
83 For more information on the projects, please visit the respective project websites: www.sentha.udk-berlin.de, www.tim.rwth-aachen.de/index.php?menu=forschung&inhalt=openisa, http://macs2.psychologie.hu-berlin.de/ smiley_projekt/.
84 See Bengtson et al. 2009a; Backes & Clemens 2008, p. 92.
85 See Staudinger & Häfner 2008.

2.3.1 Shortcomings of Chronological Age and Alternative Age Measurements

A person's chronological age is the time in years that has elapsed since his or her birth. This measure is applied in almost all cultures except for some Asian ones which measure chronological age from conception.[86] The basic stages in life, like childhood, education, work life, and retirement, are typically defined according to chronological age.[87] According to the life course principle, aging occurs at any time from birth until death, and it is defined through biological, psychological, and social processes.[88] Although chronological age is a good indicator of the general characteristics of a specific age for a larger population, it does not reliably describe someone's individual capabilities and preferences.[89] Some people are vital and in the best of health at 90 years, while others are in delicate health in their 50s. Some older people experience a dramatic loss of cognitive capabilities while others perform as well as much younger people. A good age measure must be "*[…] more sensitive to individual differences.*"[90]

In fact, although the underlying reasons behind aging have been intensively researched, they are not yet completely understood. Gerontology, which is the science of the biological, psychological, and social aspects of aging, has been labeled "*data-rich but theory-poor*"[91]. A detailed overview of existing theories on the reasons for aging cannot be provided, because the required depth would be beyond the scope of this work.[92]

Several alternative age measures have been suggested, mainly biological age and functional age. Biological age focuses on the health status of an individual and assesses relative age based on the presence of specific biomarkers.[93] The assessment of biological age requires profound medical knowledge, time, and direct contact with the subject under investigation, which makes its application in a business environment almost impossible.

In addition to the health status, functional age also takes cognitive capacities and behavior into account. Studies on functional age typically include anthropometric,

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86 Cf. Charness & Krampe 2008, p. 244.
87 Cf. Kohli 1985, p. 2; Mayer 1990, p. 14.
88 Cf. Bengtson & Allen 1993, pp. 470ff.
89 Cf. Super 1994, p. 254; Sudbury & Simcock 2009, p. 23.
90 Settersten, Jr. & Mayer 1997, p. 239.
91 Bengtson et al. 2009b, p. xxi.
92 The interested reader is referred to comprehensive standard works, like Bengtson et al. 2009a; Hofer & Alwin 2008; Hooyman & Kiyak 2011; Schaie & Willis 2011 or gerontology journals, especially Age (ISSN: 0161-9152), Age and Ageing (ISSN: 0002-0729), and The Journals of Gerontology (ISSN 1079-5006 and 1079-5014).
93 Cf. Ludwig & Smoke 1980; Baker, III. & Sprott 1988, p. 228.

dental, sensorimotor, physiological, cognitive, psychosocial, and behavioral variables.[94] Since there is no generally accepted definition of functional age, the selection of biomarkers varies widely, based on availability and functional outcome. In a review of empirical studies on measuring functional age, Anstey, Lord, and Smith (1996) analyzed 24 studies using 177 different biomarkers.[95] The effort required for the assessment of functional age again makes its implementation in a business context unprofitable.[96]

All age measurements are oriented on a standardized progress of age through a comparison with the average. Therefore, they are all linked to chronological age and use it to make relative statements ("You have the biological age of a 50-year-old man.").

2.3.2 Cognitive Age

A measurement that is more reliable than chronological age (with regards to capabilities and preferences) but is easier to estimate than functional age was required. Kastenbaum et al. (1972) realized that people often perceived their own age differently than their true chronological age. They introduced the "ages-of-me" model which took into account self-evaluations of several dimensions. Building upon this model, Barak and Schiffman (1981) suggested the use of a person's self-perceived cognitive age, based on the evaluation of his/her feel-, look-, do-, and interest-age. The age-dimensions relate to "*emotional (feel-age), biological (look-age), societal (do-age), and intellectual (interest-age)*"[97] aspects of the individual. Following studies have shown that cognitive age is superior to chronological age in explaining the self-perceptions and behaviors of older consumers.[98] Cognitive age has been associated with self-respect and reputation[99], need for security[100], internal locus of control[101], fashion interest[102], willingness to try new brands[103] and interest in seeking information[104]. More recent studies have also shown the usefulness of

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94 Cf. Anstey et al. 1996, pp. 252ff.
95 Cf. Anstey et al. 1996, pp. 250ff.
96 Cf. Kohli 1985, p. 14.
97 Barak 2009, p. 3.
98 Cf. Kohlbacher & Chéron 2011, p. 180; Wilkes 1992, p. 292.
99 Cf. Cleaver & Muller 2002, pp. 238f.; Wilkes 1992, p. 297; Sudbury & Simcock 2009, p. 31.
100 Cf. Sudbury & Simcock 2009, p. 30.
101 Cf. Hubley & Hultsch 1994, p. 433.
102 Cf. Wilkes 1992, p. 297.
103 Cf. Stephens 1991, p. 44.
104 Cf. Gwinner & Stephens 2001, p. 1046.

cognitive age for segmentation.[105] Since its correlation with the most prominent demographics (like gender, marital status, race, education, and income) is low, it provides valuable information not captured by those demographics.[106]

The age difference between cognitive age and chronological age for older consumers is typically between 8 and 15 years.[107] Although it has been predominantly researched in Western, Anglophone countries, research could also establish functional, conceptual, and measurement equivalency for Eastern (e.g., China, Korea, Japan) and non-Anglophone countries (e.g., Brazil, France, Croatia).[108] These results suggest that cognitive age is truly "*the global age-identity construct*"[109].

2.4 Effects of Aging

Although the reasons for why organisms age are not fully understood yet, the effects of aging on the human body have been investigated. Aging affects the physical, sensory, and cognitive capabilities. As such, developers of age-based products must take these into account. Although the following effects can be regarded as generally applicable, the timing of occurrence and intensity of the effects can differ greatly between individuals.[110]

The human body changes with age, leading to anatomical changes, like an increase in hand thickness, the width of thumbs and the index fingers, and a reduced flexibility of the cervical spine and wrists.[111] Minute motor activity is reduced, along with the grip strength and the length a firm grip can be maintained.[112] The decrease in muscular mass leads to a decline in overall physical strength.[113] Lung volume and pulmonary elasticity are reduced, and the rate of cerebrovascular and cardiovascular diseases steadily increases.[114]

Sensory capabilities are also affected. Several aspects of hearing (e.g., ability to hear high-pitched sounds, tolerance for background noises), vision (e.g., light

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105 Cf. Sudbury & Simcock 2009, p. 32; Auken & Barry 2009, pp. 323f.
106 Cf. Henderson et al. 1995, p. 455.
107 Cf. Cleaver & Muller 2002, p. 238; Hubley & Hultsch 1994, p. 416.
108 See Auken et al. 2006; Barak 2009; Barak et al. 2011.
109 Barak 2009, p. 5.
110 Cf. Backes & Clemens 2008, p. 93.
111 Cf. Bleyer et al. 2009, p. 11.
112 Haigh 1993, pp. 9ff.
113 Cf. Moschis 1992b, p. 96.
114 Cf. World Health Organization & US National Institute of Aging 2011, pp. 18f.

requirements, visual acuity, color perception), and tactile sensation (e.g., number of tactile corpuscles, skin sensibility) are negatively affected by aging.[115]

Some cognitive capabilities seem to be immune to aging. Studies have shown that crystallized intelligence (e.g., general knowledge, vocabulary) does not differ among age groups, in contrast to fluid intelligence (e.g., short-term memory, problem-solving).[116] The information processing speed and capacity is reduced, and the elderly require more time to fulfill complex tasks.[117] The ability to quickly switch between tasks is reduced and the time required to learn new schemata is increased.[118] On the other hand, reasoning about social conflicts (Grossmann et al. (2010) call it wisdom) actually improves with age, meaning that older people perform better in mediation.[119] The decline of cognitive capabilities is not a phenomenon of old age. Rather, it begins when adults are in their 20s and 30s.[120]

Physical, sensory, and cognitive decline result in a higher susceptibility to accidents and diseases among elderlies. But they have strategies to cope with some deficits. In a working environment, older employees tend to solve stressful tasks more slowly but with a greater precision.[121]

Research on older consumers has shown that the elderly clearly have a different set of attitudes and values than younger consumers. They are less selfish and show compassion for others. The importance of this attitude becomes even more important because it is already higher among the currently younger age cohorts.[122] Safety and security are two very important values for the elderly, as well as a sense of purpose, social connectedness, and independence/need for autonomy.[123] Their increased desire for security and safety does not necessarily make older people completely risk averse. In an investigation of the influence of perceived risk on high-involvement purchasing decisions, only physical risk was higher among the elderly. All other risk types, i.e., functional, financial, social, psychological, and time risk, did not show significant differences.[124]

Regarding the marketing of products, Wolfe (1994) identified five underlying key values that drive product selection among older consumers: 1) autonomy and self-

[115] Cf. Saup 1993; Gruca & Schewe 1992, pp. 19f.; Fisk et al. 2009, pp. 15ff.
[116] Cf. Horn & Cattell 1967, p. 107; Sorce 1995, pp. 470ff.; Fisk et al. 2009, p. 242.
[117] Cf. Grossmann et al. 2010, p. 7247; Sorce 1995, p. 467.
[118] Cf. Schapkin 2012, p. 82.
[119] Cf. Grossmann et al. 2010, p. 7249.
[120] Cf. Salthouse 2009, p. 507.
[121] Cf. Schapkin 2012, p. 82.
[122] Cf. Plutzer & Berkman 2005, p. 80.
[123] Cf. Dychtwald & Flower 1990; Schewe 1991, pp. 61ff.; Kohlbacher et al. [in press].
[124] Cf. Simcock et al. 2006, pp. 357ff. & 365.

sufficiency, 2) social and spiritual connectedness, 3) altruism, 4) personal growth, and 5) revitalization.[125] Marketers should emphasize comfort, convenience, and a good experience when targeting older consumers.[126] The importance of different information sources for making purchasing decisions remains unclear in the literature. While some authors show that older consumers rely more on informal sources (e.g., family, friends, and neighbors)[127], others argue that formal sources (e.g., sales assistants, mass media) are more important.[128] Wolfe (1994), on the other hand, suggests that older consumers rely mostly on their own subjective experience, rather than on external sources.[129] Schiffman and Sherman (1991) confirm this suggestion in their description of the new-age elderly.[130]

2.5 Age and Innovative Behavior

In consumer research, innovativeness or innovative behavior is defined as the early adoption of new products, and not as the actual development of new or improved products.[131] Under this adoption-oriented view, age has a negative impact on consumer innovativeness,[132] although some studies have failed to confirm a significant relationship.[133] Cognitive age also plays a relevant role, because older people who perceive themselves as younger are typically more likely to adopt new products and try new brands.[134]

Innovative behavior by users in terms of the development of new products in conjunction with age has not yet been the focus of research. The existence of the phenomenon across all age groups has been indicated by Hippel, Jong, and Flowers (2012) and Ogawa and Pongtanalert (2011) (see also chapter 3.2 below). Most of the insights into the relationship between age and innovative behavior stem from literature on organization and human resources, which focuses on the capabilities of employees in R&D departments. Inventive output of R&D personnel over age shows an inverted u-shape with a climax reached in the early 30s and a significant drop

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125 Cf. Wolfe 1994, p. 32.
126 Cf. Wolfe 1994, pp. 35f.; Schiffman & Sherman 1991, pp. 189f..
127 Cf. Lumpkin et al. 1989, p. 182.
128 Cf. Arnold & Krancioch 2011, pp. 150ff.; Tongren 1988, p. 148.
129 Cf. Wolfe 1994, p. 35.
130 Cf. Schiffman & Sherman 1991, p. 192.
131 Cf. Im et al. 2003, p. 61; Rogers 2003, p. 247; Roehrich 2004, p. 671; Midgley & Dowling 1978, p. 229.
132 Cf. Im et al. 2003, p. 69; Steenkamp et al. 1999, p. 65.
133 Cf. Schreier & Prügl 2008, p. 343.
134 Cf. Stephens 1991, p. 44.

after the age of 40.[135] Eisfeldt (2009) claims that the chance to be an innovator decreases 3 % per year for individuals with a high education. Therefore, a 40-year-old is 26 % less likely to become an innovator than a 30-year-old.[136] The main driver seems to be a decrease in creativity, but the advantage of greater experience can compensate for most of this decrease.[137] Bergmann, Prescher, and Eisfeldt (2006) even found no significant relationship between age and inventive output among engineers in SMEs.[138] One factor that is usually not included in these studies was the fact that engineers potentially switch into roles along their career path in which their focus is no longer on product development but rather on managing a department.[139] A look at the output of academic scholars, who usually are not affected by such changing job requirements, nevertheless shows a very similar pattern. Their output is also an inverted u-shape with a climax depending on the specific discipline. Some disciplines are characterized by a peak at the late 20s or early 30s, e.g., mathematics and theoretical physics, while at others the peak is not reached before the late 40s, e.g., history, philosophy, and medicine.[140]

An analysis of Thomas Edison's patents provides an excellent example of the inventive output of an individual. Over the course of his life, Edison filed 1,093 patents from the age of 21 until his late 80s. Many of his inventions heavily influenced people's lives, including the first commercially practical light bulb, the phonograph, the motion picture camera, and the stock ticker.[141] The graph of his patents (see Figure 5 below) shows a sharp increase in his early 30s and a peak at the age of 35, when he filed 106 patents under his name. Besides a gap between the age of 45 and 50, the numbers then slowly decrease but remain generally stable.

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135 Cf. Hoisl 2007, p. 21; Oberg 1960, pp. 251ff.

136 Eisfeldt 2009, p. 166. (1 – 0.03)^10 = 0.74.

137 Cf. Oberg 1960, p. 253; Adenauer 2002, p. 42.

138 Cf. Bergmann et al. 2006, p. 25. Oberg 1960 found a similar result when he separated R&D employees and engineers in his sample. While R&D employees showed the expected peak in the mid-30s, the evaluation of the output of the engineers steadily increased with age, with the age groups 51-55 and 56-60 showing the highest values. Cf. Oberg 1960, pp. 253ff.

139 Cf. Bergmann et al. 2006, p. 19.

140 Cf. Simonton 1988, pp. 252 & 262.

141 Cf. Wikipedia contributors 2013a.

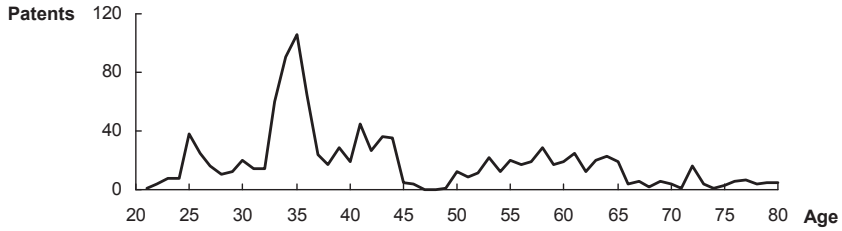

Figure 5: Number of Thomas Edison's US Patents by Age, based on Execution Date[142]

This example shows that although inventive output is typically highest before the age of 40, people are still able to develop meaningful innovations throughout their life.

2.6 Interim Conclusions

Chapter 2.1 has shown that the demographic shift impacts all countries across the globe. Western countries have already experienced a sharp increase in the share of older people as the baby boomer generation approaches retirement age. But this demographic shift should not be regarded solely as a threat to social systems. Today's elderly are healthier, better educated, and more independent than any generation before them. They demand tailored products without the stigmatization of being old. This SiMa is an attractive market for companies, but its approach remains challenging.

The underlying reasons for aging are not yet fully understood but the key effects of aging have been identified. There exist multiple explanations regarding how the physical, sensory, and cognitive changes affect the preferences and behavior of the elderly. Researchers and practitioners are now slowly acknowledging the fact that there does not exist a *typical senior*. Rather, the SiMa is more heterogeneous than younger customers. This is manifested, for example, in differences in the self-perceived cognitive age.[143]

In research studies on user innovation, data on age is rarely provided, but representatively large-N studies have shown that the phenomenon exists across all age groups.[144] The relationship of age and inventive output has only been analyzed

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[142] Own illustration. N = 1,093. Source of data: http://edison.rutgers.edu/patents.htm, accessed on June 26, 2013. Execution date is the date on which the inventor signs the application for filing at the US Patent Office.

[143] Cf. Moschis 1992a, p. 18; Backes & Clemens 2008, p. 343; Arnold & Krancioch 2011, p. 149; Sudbury & Simcock 2011, p. 196.

[144] Cf. Hippel et al. 2012; Ogawa & Pongtanalert 2011.

in the labor sciences. It has been shown, that creativity decreases past the age of 40, but this loss is often compensated with greater experience and social capabilities. These studies are, by design, limited to the boundaries of the firm and individuals above the retirement age are not included. Insights on the innovative behavior of people past the age of 60 are therefore almost not available.