Antecedents and Consequence of Lead Userness and the Moderating Effect of Self-perceived Age: An Empirical Study Among Elderly Air Travellers.

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Abstract

The megatrend of demographic change in terms of an ever growing, aging population and therewith the induced shift in the population's structure is globally present. Thus, of increasing interest to firms is the growing 'silver market' segment, its characteristics and its potential. As is known, firms are also faced with the need to stay at the edge of competition, more often employing external sources such as lead users to generate breakthrough innovations and creating competitive advantage. Bridging lead user theory and the silver market phenomenon, it is important to elaborate on antecedents and consequences of lead userness of Silver Agers. This study contains an empirical analysis testing principles of lead user theory and extending it by adding characteristics on a Silver Ager's cognitive structure and style which are assumed to be antagonists to the cognitive declines when individuals age. Further, as the factor age gains in importance for both the individual and societal embeddedness as people grow older – yet, it is experienced differently and subjectively by every person – a measure has been implemented that refers to the self-perception of age. The moderating influence of self-perceived age on the relationships between determinants and a consequence of lead userness is tested. For this purpose, an online survey has been developed and distributed among members of a German Senior Citizen Association. It is set in the context of air travelling, co-operating with an aircraft manufacturer and two airlines. The empirical analysis reveals that the magnitude and significance of antecedents of lead userness vary in the silver market. Whereas product-related knowledge was found to have a positive significant relationship towards lead userness, the impact of use experience as well as divergent thinking on lead userness cannot be confirmed. It was further found that higher lead userness causes a higher level of cognitive empathy, the relationship being positively moderated by self-perceived age. Overall, it can be concluded that the moderating effect of self-perceived age on the relationship between antecedents and lead userness is not significant. Its pure impact could not been verified in this study, however, in line with previous studies, people perceive themselves on average eleven years younger than they actually are.

Key words: Silver Market Phenomenon, Lead User Theory, Self-perceived Age

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List of Abbreviations

AOT	Ahead of Trend
CE	Cognitive Empathy
DT	Divergent Thinking
e.g.	exempli gratia (for example)
et al.	et alii (and others)
EUR	Euro
HBE	High Benefit Expected
i.e.	Id est (that means)
LU	Lead User(s)
LUN	Lead Userness
LUM	Lead User Method
MCAR	Missing Completely at Random
MAR	Missing at Random
MNAR	Missing Not at Random
N	Sample Size
n.s.	not significant
NPD	New Product Development
PK	Product-related Knowledge
RQ	Research Question
SEM	Structural Equation Modeling
SiMa	Silver Market
SiA	Silver Ager(s)
SPA	Self-perceived Age
Std. dev.	Standard Deviation
UE	Use Experience
UN	United Nations
VIF	Variance Inflation Factor

1 Introduction

This chapter demonstrates the relevance of the topic and triggers the motivation on why to conduct research on it by introducing the overall ideas of new product development and in particular lead user theory related to the present demographic trend of an aging population. A further objective of this chapter is to outline the overarching research goal as well as the underlying epistemology, which extends through the entire thesis. To facilitate the reader's understanding from the very beginning, key terms are defined and adapted to the context of this study.

1.1 Motivation and Relevance

Aging is not lost youth but a new stage of opportunity and strength.

Betty Friedan (1921-2006)

The megatrend of demographic change in terms of an ever growing, aging population and therewith the induced change in the population's structure is globally present. Research shows that the amount of people aged 55 and above (the silver market (SiMa)) is expected to rise from 737 million in 2009 up to two billion by 2050 (Kohlbacher and Herstatt, 2011). Already, 21 per cent of the population in developed countries is in the age group of 60 years and above, expecting a significant growth to 33 per cent in 2050 (ib.).

Often the change in the world's population in developed and emerging countries is primarily associated with challenges instead of opportunities that rarely attract the same attention. The trend of demographic change is assumed to not just have an effect at the macroeconomic level, that is for societies and politics, but also on a microeconomic level: for companies (Kohlbacher and Herstatt, 2011). On this account, established companies, in the aviation industry (exemplary and subject of analysis) in this study are faced with the trend of an aging population and their associated needs, especially when travelling. Alén, Dominguez and Losada (2012) highlight new opportunities of senior tourism as the "segments of adults over 55 years of age will increase the overall volume of tourism the most" (p.139). Confirmed by the World Tourism Organisation among the 2020 future market trend in the tourism sector is a rising number of SiA tourists (ib.).

At the same time, company growth and profitability is crucial to many in which innovation plays an essential role. Aiming to be on the edge of competition, developing breakthrough products can lead to a competitive advantage as well as robust and steady profits (Eisenberg, 2011). Olsen and Bakke (2004) state that in 90 per cent of the cases

established products are incrementally advanced thus creating new products, however a "disproportionate share of profits and sales growth frequently comes to firms who successfully introduce breakthrough products" (p.126). For years now, firms are using external sources in the process of value creation – a process that is known as the 'democratization of innovation' (von Hippel, 2005; Faullant et al., 2012). Firms are beginning to integrate external stakeholders, with consumers and users being the most important source (von Hippel and Herstatt, 1992), they will also be the focus of this study. The involvement of users at the 'fuzzy front end' of innovation is applied to enhance the likelihood of an effective and efficient new product development (NPD) process increasing the success rate while decreasing the risk of failure of new products (Olsen and Bakke, 2004). Baldwin and von Hippel (2011) state the growing importance of open collaborative innovation in relation to innovation triggered by manufacturers in various industries.

This complex idea of user integration in NPD requires an appropriate method to ease the planning and implementation. Traditional marketing research methods such as brainstorming, focus groups or conjoint analysis involve users whose "thinking is limited by their current experience and environment" (Lilien et al., 2002, p.1043). However, these methods often do not generate new breakthrough products, which in turn suggests the demand for non-traditional methods (ib.). A now common approach is the lead user method (LUM). In 1986, von Hippel established this approach starting a new era in the field of innovation management. During an internal study of 3M, the success of the LUM became apparent: "ideas generated by the [lead user] method were 41 % more novel and original (i.e. more break-through like), had 21 % higher success rate, 106 % higher market share, as well as 17 % better fit with the firm's strategic plans and functional capabilities" (Olson and Bakke, 2004, p.126). Lead user (LU) are people who show two characteristics as originally defined: they encounter needs before the bulk of a marketplace and they expect a high benefit from a solution (von Hippel, 1986). Further characteristics of LU, can be distinguished in field-related and field-independent factors (Schreier and Prügel, 2008). The former one refers to use experience, product related knowledge, the latter to technical expertise, divergent thinking or cognitive empathy.

Deriving from the findings that lead users rather than manufacturers are often the initial developers of what later become commercially significant new products and services and the fact that the elderly generation is undervalued, yet represents a great potential, not only the determinants relevant to lead userness in the silver market, but also the influence of age on lead users' characteristics is of great interest. In general, it has been suggested that people perceive themselves up to twelve years younger than their actual

age. In this context, self-perceived age is found to be a widely applied, alternative measure to chronological age reflecting an individual's self-perception through covering four dimensions (biological, emotional, intellectual and societal) (Barak and Schiffman, 1981).

In the quote at the beginning of the section, Betty Friedan presents the idea of successful aging. She is calling for a redefinition of later life as a time of growth and development instead of inevitable, mere decline. It is about exploiting the potential, capabilities and experiences inherent in the silver market segment. Thus, subject of research are elderly air travellers and firms operating in the aviation industry facing the need to adapt the flight process in the long-run to the requirements of an ever aging society.

1.2 Research Goal and Research Approach

There is an increased importance to allow the age group of 55 years and over to travel in comfort while being able to enjoy the substantial factor of wellbeing. Yet what are the needs and desires when they travel? How can managers and engineers understand the requirements of elderly people if they do not share the same age cohort? Assessing characteristics related to lead userness and addressing the impact of self-perceived age facilitates this understanding. Building on Kohlbacher and Herstatt's (2011) acknowledgement that the research on implications of the demographic change is surprisingly scarce, this thesis serves to provide further insights on opportunities the growing SiMa creates and what role age plays in this context. The thesis is an approach to the "dominant paradigm for addressing older adults' needs [...] to do things *for* them based on an understanding of aging as a growing helplessness" as Östlund (2008, p.255) pointed out but rather start to integrate and seek "ways to do things *with* them" [emphasis original] (ib., p.256).

The purpose of this thesis is to understand if the applied antecedents (use experience, product-related knowledge and divergent thinking) as well as a consequence (cognitive empathy) can extend the construct of lead userness in the silver market context with the ultimate goal of facilitating SiA integration in product development and to learn which impact a self-perceived age measurement has on the applied antecedents and consequence of lead userness.

Fundamental to the research approach and for cumulative knowledge creation is the determination of epistemology in this study, which refers to "the analysis of the origin, nature and limits of knowledge" (Bengtson, Burgess and Parrott, 1997, p.72). It is the researcher's view on what accounts for acceptable knowledge (Saunders, Lewis,

Thornhill, 2009). Further, it is to be distinguished between aspects that stress either on methods or theories. The former one emphasizes means to conduct empirical studies that lead to reliable and valid results. The latter is to report on the observations made by applying previous knowledge; underdeveloped theories may lead to "empirical generalization but little cumulative understanding" (Bengtson et al., 1997, p.72). Building on the method aspect and following the positivist research philosophy, a view that sets focus on causalities, law-like generalizations and that only an observable phenomenon can provide credible data (Saunders et al, 2009) is implicitly applied in this thesis. Accordingly, the data collection is quantitative using large, structured samples and item measurements to capture the investigated constructs (ib.).

To respond to the research goal, a predominant explanatory and predictive research approach is implied (Blumberg, Cooper and Schneider, 2008). Additionally, an empirical quantitative study is implemented preceding a deductive literature review, which serves to derive hypotheses based on established literature, which are then tested with the data collected (Saunders et al., 2009). For this purpose, a co-operation with an aircraft manufacturer and two airlines, companies representing the aviation industry, was entered. Taking a perspective of elderly, these firms have a high interest in the status quo of user satisfaction and improvement potential of aircraft equipment and design. With the objective of data collection, a co-operation with the German Citizen Senior League was established obtaining benefits by using their large database, which overall contains around 11,000 elderly people. In this context, a survey was first developed and then distributed to their members. The survey comprises three sections. Results were analyzed with a moderated hierarchical regression and then interpreted.

1.3 Structure and Definitions

The remainder of the thesis is structured into five main chapters. *Chapter 2* introduces the theoretical foundation underlying the thesis consisting of sections on the overarching topics of the SiMa phenomenon and the LU theory. Summarizing the presented facts, a conceptual framework is displayed. *Chapter 3* outlines the research question that derives from the identified research goal and research gap. It further elaborates on the hypotheses, which are to be tested in the quantitative study. The subsequent *chapter 4* delineates the methodology, introducing the data collection method and applied measurements of constructs finally resulting in a data preparation and regression analysis. *Chapter 5* discusses the findings by answering the research questions according to the hypotheses and concludes. The last *chapter 6* presents insights on the contribution

to Academia and managerial implications. Finally, limitations of the study and future research suggestions are demonstrated.

This part further serves to reference definitions and remarks of frequently used terms, which are key to the thesis at hand:

Aviation industry – a demarcation between the view of an aircraft as a product – reflecting a hardware component – and travelling by airplane representing a service undertaken by an airline is important in this context.

Lead User – labels people that show two important characteristics as originally defined: one, they are ahead of trends and experience a need before the bulk of a society and two, they expect a high benefit from an innovation made. They often not only carry need information, but also solution information crucial to remedy grievance.

Lead Userness – is attributed to a person who possesses LU characteristics.

Lead User Method – in the context of the thesis this method is understood as an innovation management tool supporting (new) product development. It involves several steps from identifying lead users to developing and testing products.

Self-perceived Age – is an alternative age measure to chronological age. It captures an individual's perception of their subjective age according to four dimensions: emotional, societal, biological and intellectual.

(Social) Gerontology – is the science of aging consisting of a biological, psychological and social component. Fundamental in this work: social gerontology, which captures the interplay of age and society. Later, a view on gerontechnology has been adopted in research investigating the relation of elderly towards technology.

Silver Market – comprises the market segment of people aged 55 and over in this work. The threshold for defining the silver market can vary across studies.

2 Theoretical Background

The aim of this chapter is it to provide the reader with the theoretical foundation essential for the remainder of this study. Accordingly, the silver market phenomenon in its various facets is discussed along with the lead user theory. Summarizing the theory, an interim conclusion is drawn resulting in the conceptual framework of the study.

2.1 The Silver Market Phenomenon

This sub-chapter elaborates the silver market phenomenon in five dimensions. First, numbers and figures are used to understand the demographic change that is taking place on a global level and which is also projected to continue in the future (European Commission, 2012). At the same time, it highlights the relevance and the scope of the silver market segment. Having this knowledge, it is important to classify and characterize this segment to demarcate it from others. To capture the full potential of Silver Agers, not only are their characteristics essential on a personal and societal level, but also how they perceive themselves. As studies have shown, the subjectively perceive age significantly varies from the chronological age (Mathur et al., 1998). For this purpose a self-perceived age measure is introduced. Despite the fact that individuals perceive themselves younger, consequences of aging cannot be neglected. Physical and psychological declines as well as societal alteration shape Silver Agers and are distinct from other age cohorts. The need of restraint elaboration is present, when aiming at collaborations with the elderly. A further concern offered is the relation of Silver Agers towards innovation, technology and new product development to contextualize the subject of analysis and its sphere of influence.

2.1.1 Demographic Change

Demography is the study of populations. It encompasses the core processes of fertility (birth), migration[1] and mortality (aging and death) used to analyze the dynamics of populations (Max Planck Institute for demographic research, 2014). These three processes can cause demographic changes in the world's human population transforming the structure of the population (European Commission, 2012). Population projections until 2050 forecast an increase of 47 per cent reaching 8.9 billion implying an annual increase of 57 million per year between 2000 and 2050 (UN, 2004).

To be more precise, this means that according to the UN's (2003) projection, the total fertility rate is expected to *decline* from 2.83 children per woman in 1995-2000 to 2.02

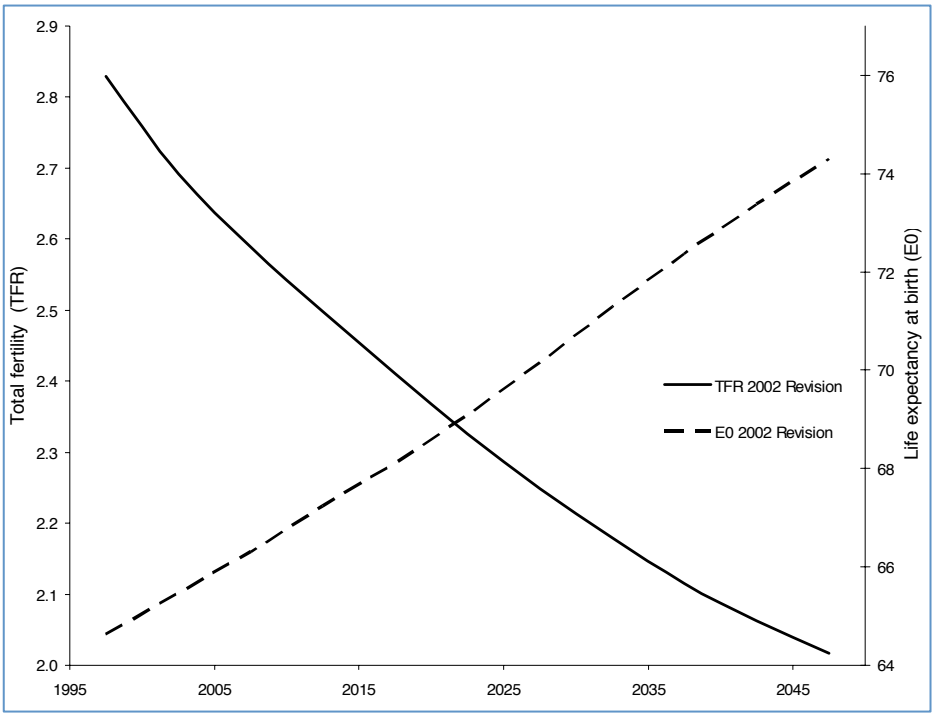
[1] The progress of migration is not further elaborated, since the focus of the thesis is set on the aging of the population.

children in 2045-2050 on a global level (→ Figure 1). Regional differences become apparent: whereas in developing regions fertility is expected to be above the replacement level (2.1 children per woman) at 2.22 children per woman until 2030-2035, it will drop to 2.04 in 2045-2050. Developed countries are already well below the level at 1.56 children per woman in 2005-2010, however expecting a rise to 1.85 children per woman in 2045-2050 (ib.).

The mortality rate, on the contrary, assuming an *increase* in life expectancy, states an annual rise in life expectancy of 0.4 years (male) and 0.5 years for females as depicted in Figure 1 (UN, 2004). Beyond that, life expectancy at birth in the EU is expected to rise from 76.7 years in 2010 to 84.6 years in 2060 for males, showing an even higher projected increase of females by 6.5 years to 89.1 years (European Commission, 2012).

The "median age — the age that divides the population into two equal halves — is used as an indicator of the shift of the population age distribution towards older ages" (UN, 2003, p.15). In Europe, the median age is expected to reach 47.7 years until 2050 indicating an increase of ten years from 2000 (ib.). In general, Europe is "the major area of the world where population ageing is most advanced" (UN, 2003, p.16). On the leading edge, Japan is projected to have a median age of 53.2 years. Germany is among the followers with an expected median age of around 50 years and therewith suitable to be used as a referencing example (Federal Statistical Office, 2006).

Figure 1: Total Fertility and Mortality from 1995 - 2050

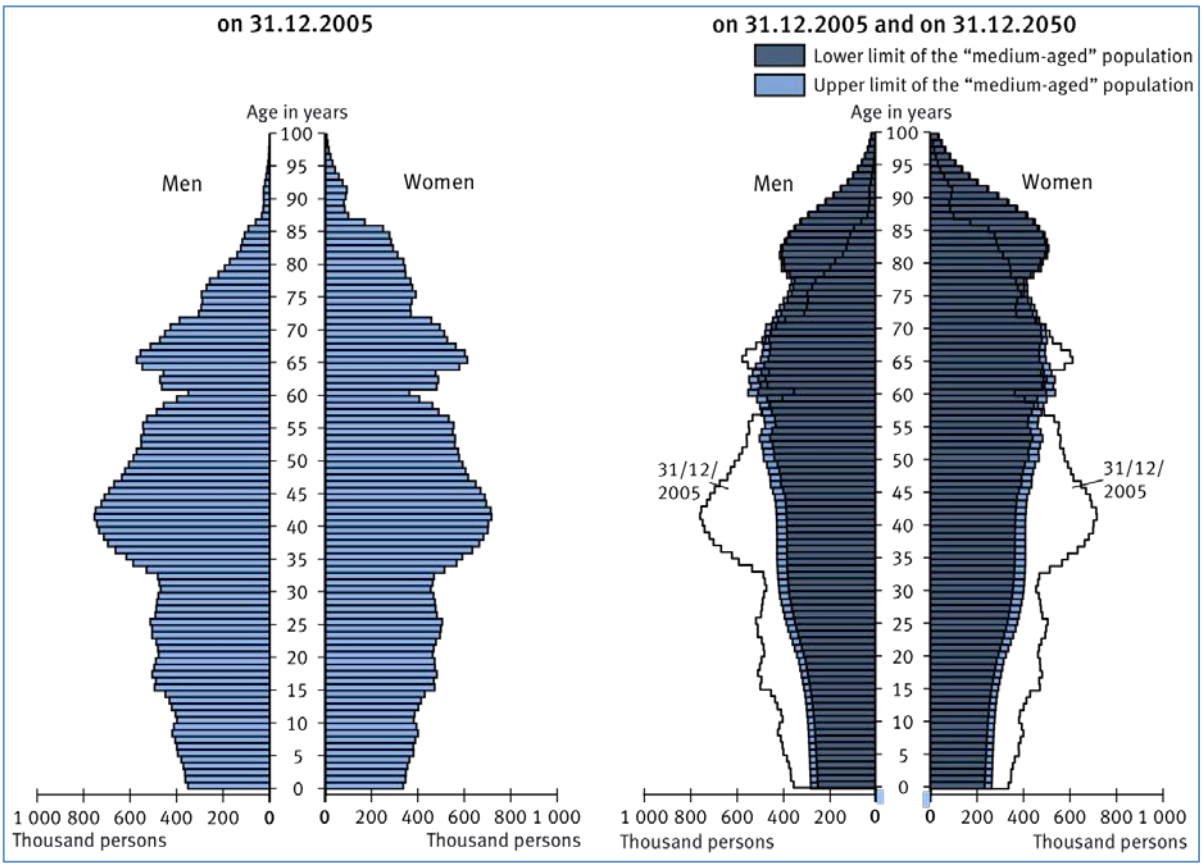


Reference: UN, 2004, p.8

Overall, this will result in a dramatic change in the age structure (→ Figure 2). Globally, the amount of people who are 60 years and above will reach 1.9 billion in 2050 (UN, 2003). In particular, in Germany the number of people aged 65 and older will grow to 23 million by 2050, while recording a birth deficit since 1972 which is expected to continue further (Federal Statistical Office, 2006). Whereas the number of under 20 year-olds will drop down to 11.5 million from today's 16.5 million. Importantly, that development also impacts the working-age population, which will further age and then shrink in the long term (ib.).

To conclude, applying both fertility and mortality, the demographic change is foremost substantiated in a decrease in fertility rates as well as a significant increase in life expectancy (mortality). This progress refers to the "the aging of societies" (Max Planck Institute for demographic research, 2014) or "population aging" (UN, 2003, p.15).

Figure 2: Age Structure of the Population in Germany



Reference: Adapted from Federal Statistical Office, 2006, p.16.

2.1.2 Classification and Characteristics of the Silver Market

As stated above, a demographic shift towards a growing, aging population, 'the SiMa', has already taken place and according to projections, it will continue in the future (UN,

2003; Federal Statistical Office, 2006). Taking a closer look at the definition of "elderly", 65 until 74 year old are categorized as "early elderly" and those over 75 years old as "late elderly" (Orimo et al., 2006, p.149). The authors refer to Prince Bismarck, who set the age of 65 in order to be able to join the national pension plan in Germany. Yet not having a clear evidence of the origin of "old", there is varying classifications in literature. Some understand being old from 50 years onwards; others attribute 75 years as a threshold (Komp and Aartsen, 2013). The authors stress the classification of the importance of the term's diversity: "old age is [...] a sequence of two separate and distinct periods of life" (p.2). Baltes and Smith (2003) call these periods the third age (young-old) and the fourth age (old-old). Furthermore, authors integrate the concept of the third age in their research referring to "the age of personal achievement and fulfillment" (Laslett, 1991, p.4) and "the period when people fully or partially leave the job market, careers and the most demanding family obligations, but still live a life of relative independence from support of others" (Essén and Östlund, 2011, p.89). Therefore, the categorization is not undertaken by the chronological age as such rather according to their actual situation in life (Silvers, 1997). Kohlbacher and Herstatt (2011) define the SiMa as the entire market segment comprising people aged 50 or 55 years and older. As this is roughly the beginning of the last third according to the current life expectancy of approximately 75 years the concept of the SiMa is further adapted in this thesis applying the threshold of 55 years (Wellner, 2014). People falling in this segment are called Silver Agers (SiA).

When analyzing the household income of the elderly in Germany, a significant improvement from the past becomes apparent, reducing the old age poverty while strengthening the elderly's purchasing power (Enste et al., 2008). Enste et al. (2008) state that private consumption of the elderly is above average in Germany spending most of their income on rent. Additionally, the expenditure on health and body care, recreation and entertainment as well as culture is above average. Important to note is that SiA belong to a diverse, varied and heterogeneous market segment according to their purchasing power, personal circumstances and usage of time (Szmigin and Carrigan, 2001). Thus, the elderly "do not belong to some amorphous mass of like-minded people" (ib, p.31) rather they are "outside of mainstream consumption" (ib.). It is remarkable that the lives of the elderly has changed so dramatically compared to previous generations. They are experienced consumers, used to television, changing brands over time as well as product innovations and technological development (ib.). However, in contemporary thinking, the elderly are often perceived as 'technophobes'.

Gaining in importance is gerontechnology, a science that sheds light on old people's perception of innovation (passive receivers) and employs elderly users to test design

(Essén and Östlund, 2011). Gerontechnology analyzes the interaction of the increasing SiMa and the dynamics of technology, globalization and mass production (Bouma, Fozard, Bouwhuis, Taipale, 2007). Both are not to be seen as contradictions but rather as an intertwining complementary field where older people recognize technology as a means to an improved quality of life as well as autonomy where technology incorporates the potential to enable them to take part in society as fully adequate members (ib.). In this context, Peine, Rollwagen and Neven (2014, p.199) suggest to understand SiA as "active co-creators of technology" (→ Chapter 2.1.5 for further elaboration).

Reflecting a hidden potential and manifold opportunities, both firms and government should start benefiting from this very attractive and promising market segment rather than solely focusing on assumed burdens such as increased pension or care provisions (Kohlbacher and Herstatt, 2011; Bouma et al., 2007).

2.1.3 Conceptualization of Age

"Age, as a concept, is synonymous with time, and time in itself cannot affect living function, behavior or otherwise. Time does not "cause" anything […]."

(Botwinick, 1978, p.307)

Several *theories* explaining the process of aging have been developed, though no clear consensus is established in literature. Bengtson et al. (1997) review prevailing theories and differentiate based on macro and micro level approaches conceptualizing age. A widely applied micro-level theory is the 'social constructionist perspective' of aging that focuses on 'individual agency and social behavior within larger structures of society" (ib., p.77). Also frequently used is the 'Life Course Perspective' bridging the micro- and macro-social level of analysis. It refers to an individual's change as time passes and "attempts to reflect the life cycle in its entirety and follows for deviations in trajectories" (ib., p.80). Finally, on a macro-level the 'Age Stratification Perspective' emphasizes the "interdependence of age cohorts and social structures" as well as the "stratification by age in the society" (ib., p.81).[2]

Nevertheless, analyzing the characteristics of the SiMa raises the question on how age can be measured. The purpose of this section is to introduce an alternative *measure* to the conventionally applied chronological age, which does not merely refers to the concept of time: cognitive age.

[2] Bengtson et al. (1997) provides an extensive elaboration of the theories. Further explanation is not subject of this thesis.

Hendricks and Hendricks (1976 as cited in Barak and Schiffman, 1981) define chronological age as the number of years lived from birth onwards. Yet, though it seems like an easy to grasp concept and it is often applied in elementary steps in life (school, work, retirement), it is not without limitations as "the use of chronological age is problematic for researchers interested in age-related research, particularly research that examines the attitudinal or behavioral patterns of the elderly" (Barak and Schiffman, 1981, p.602). This is due to the fact that it seems difficult to employ behavioral variables as a predictor of chronological age. Furthermore, the authors point out that it does not consider people's own self-perception of their age (ib.). Contrarily, this self-perceived or subjective age is also called cognitive age. The non-chronological age variable, cognitive age (Barak and Schiffman, 1981; Barak, 2009), evolved from Kastenbaum, Derbin, Sabatini and Artt's (1972) conceptual framework 'ages-of-me' in which they understand age identity as a "complex bundle of "subjective" and "ideal" ages-of-me" (Barak, 2009, p.3). The researchers apply the assessment of four age-related dimensions: "emotional (feel-age), biological (look-age), societal (do-age), and intellectual (interest-age)" (ib). Critically assessing the term 'cognitive age' which originates from Barak and Schiffman (1981), in a narrow sense the word 'cognitive' or 'cognition' refers to "the mental action or process of acquiring knowledge" (Oxford Dictionary, 2014). As this does not seem appropriate considering an evaluation based on an individual's very own perception, the remainder of this thesis revives the term 'self-perceived age'. Applied in various consumer age research to explain, for example, purchasing behavior (Barak and Schiffman, 1981; Wilkes 1992; Mathur and Moschis, 2005; Patterson and Pegg, 2009; Barak 2009), Grande (1993 as cited in Alén et al., 2012), points out that self-percieved age is the "key age for segmenting the market [...] which is what sets the lifestyle by determining attitudes, interests and opinions" (p.56). Wellner (2014) found that self-perceived age, containing additional information, is a more appropriate measure than chronological age when investigating the relation of users and innovative behavior; it is adopted for the purpose of this thesis.

In general, SiA tend to perceive themselves significantly younger than their actual chronological age (Blau 1956; 1973 as cited in Barak and Schiffman, 1981). Similarly, Mathur, Sherman and Shiffman (1998) refer to the phenomenon that the new-age elderly possess a different value orientation, perceiving themselves to be about twelve years younger than their actual age. Those who feel cognitively young are more willing to test new brands, are information seekers and less risk-averse concerning buying behavior (Silvers, 1997) and are more likely to show innovative behavior (Blau 1973 as cited in Barak and Schiffman, 1981).

2.1.4 Consequences of Aging

Taking up Botwinick's predication, people age and change over the course of time. Bouma et al. (2006) define 'good ageing' as being able to "actively [select] among the many opportunities of later life and consciously living through adverse events as these occur" (p.194). Due to technical-medical progress elderly are in better overall health than decades ago reaching a high age with minor deficiencies or restrictions in mobility (Bouma, et al. 2007). However, some "inexorable and universal physiological changes" (Troen, 2003, p.3) attributed to aging cannot be neglected as time passes and selected aspects of aging relevant to the context of the study will be considered in the following section.

Researchers found that the study of aging is multidimensional which can be explained by multiple disciplines. Mathur and Moschis (2005) outline the nature of people who "age as biological beings, social beings, psychological beings and even as spiritual beings" (p.971). These dimensions are joined in the research of gerontology. Gerontology is defined as the "study of human ageing, which draws from many scientific disciplines such as sociology, economy, biology, psychology, and epidemiology " (Komp and Aartsen, 2013).

Restrictions and age-related diseases are often grounded in three facets of aging that are of biological, psychological and social nature. The former refers to a modification in „cells and tissues resulting in the physical deterioration of the biological system and its susceptibility to disease and mortality" (Mathur and Moschis, 2005, p.972). Sensory aspects such as vision (hardening of the eye lenses) and age-related hearing loss, thermal comfort and lightning effects are recognized physiological changes. Additionally, a decline of muscle power and physical endurance as well as deficiencies in mobility and difficulties in movement, respectively, can be observed (Bouma et al., 2007, p.194).

The second pillar, the psychology of aging, is related to perceptual skills such as recognition and perception of the environment, decision-making, human communication and language, respectively (Bouma et al., 2007). Additionally, memory is an important psychological factor to analyze and is to be distinguished by long and short-term memory skills. On the one hand, memory skills rise with age when considering immediate sensory memory and long term memory referred to as knowledge as well as episodic memory. On the other hand, there are skills that instead decline with increasing age such as short term working memory and prospective memory (reminding in the future) (ib.). Rapp and Amaral (1992) however state that while the memory function sometimes declines during the normal aging process, "many aged individuals show little or no mnemonic decline"

(p.340). Furthermore, research reveals that the "neurobiological effects of aging exhibit substantial individual variability" (ib.).

The third pillar, the sociology of aging, focuses on the interaction and group constellation of elderly in human communities. Medeiros, Crilly and Clarkson (2011) describe it as a decrease in the social life of elderly that can be explained by theories such as the disengagement theory, activity theory or socio-emotional selectivity theory. The first one refers to the disengagement from elderly from society and society from them likewise; the second refers to the process of declining involvement often imposed by a society's younger segments; the third one associates the shrink in social interactions with changes of personal emotional goals of older people. Though the quantity of social interactions may decline, the quality of those is what matters to SiA. However, as the age of retirement is being postponed, an opportunity for a longer active social life is given and therefore the benefits for their health can be exploited (ib.). In this context it shall be mentioned the desirability to feel and behave younger as imposed by and to integrate in today's society. This is a possible explanation for the significance of a lower self-perceived age compared to chronological age (→ Chapter 2.2.3).

2.1.5 Silver Ager, Innovation and Product Development

Szmigin and Carrigan (2000) state that despite the obvious trend of a worldwide changing demography, older consumers are still merely associated with a "limited range of medicinal, financial or disability related products, when in fact, they seek far more creative offerings" (p.506). Often the elderly are categorized by their chronological "age, social loss, physical impairment and technical illiteracy, and ascribed roles as patients, care receivers, users of assistive technologies" (Kohlbacher and Herstatt, 2011, p.16) have been adopted. Previously, the silver market's relation towards innovativeness and lead userness in particular, i.e. the elderly's possible capacity for innovation as well as how their rich life experience can be exploited in NPD received rather little attention, in research and practice (Kohlbacher and Herstatt, 2011; Östlund, 2011). Thus, it is important to obviate conventional thinking that older people are vulnerable and represent a burden to society, contrarily incorporate them in a society's social system providing a chance of positive contributions to public (Orimo et al. 2006).

Absence of mental flexibility, a lack of innovative ability and learning aptitude do not have to be considered as results of aging, but as long-term effects of product development only from a technological point of view (Glende and Backhaus, 2010; Glende and Friesdorf 2011). Rather a "mental interaction, which is based on understanding the use-

logic, is essential to prevent users' frustration and non-acceptance of new technologies" (ib., p.253). Optimizing the usability of technical products is understood as a requirement for essential economic and social changes when addressing demographic transition (ib., p.257).

To be able to identify the elderly's user needs, their integration in NPD and the implementation of their know-how as well as experience should be guaranteed. In this context, the mere assessment of chronological age is not appropriate to identify needs as also self-perceived age plays an important role (→ Chapter 2.1.3). Furthermore, Kohlbacher and Herstatt (2011) state that the dimension 'need for autonomy' which is constantly increasing with age and "correlated to social isolation and other individual drawbacks" (p.3) is suited as an overarching concept for NPD connoting that SiA can maintain their independence as long as possible. In the context of the study this refers to convey the impression of mobility and pleasing air travels. These particular products are called 'silver products' (ib.). These products, if actually meeting the needs, are expected to lead to higher sales volume of companies since the amount of SiA increases constantly implying the direct effected rise of an economy's revenues. Additionally, side effects are higher public revenues, "which may support the orientation to a knowledge-based society" (Glende and Friesdorf, 2011, p.257). The authors conclude that if the integration of SiA in NPD is linked to economic success the consequence will be the society's perception of seniors as active, vital, creative and innovative (ib.).

Peine et al. (2014) already argue to view SiA as "active co-creators of technology" rather than "parsimonious consumers with fewer means and interest in technology consumption than their younger counterparts" (p.202). Contrary to the prejudice of elderly being 'technophobes' their research suggests that elderly who have personally acquired experience with the change of technology in the past will do the same in later stages of their life. The authors call for a generation of SiA who actively consume technology and therewith a need for revision of the society's and academic understanding of SiA-technology-innovation relation (ib.). An additional approach presents Östlund (2011): In order to develop silver products, SiA needs with varying expression and nature have to be identified: observable and active, passive and inactive or latent. A suitable way to discover and explore these needs is to "involve older persons in the innovation or design process" (p.17), methods should differ according to the Silver Ager' awareness of their needs.[3]

[3] A detailed overview on appearance and methods according to the three kinds of needs see Östlund (2011, p.24).

2.2 Lead User Theory

This sub-chapter offers fundamental insights on lead user theory critical to the context of the study as elderly lead users are of interest to the study's context. The objective is to provide a definition of lead users and their nature by highlighting the benefits that can be achieved when involving them (instead of other external sources) in product development. The sub-chapter also sheds light on antecedents and consequences, which have been researched in previous studies and provides arguments for the ones applied in the thesis at hand.

2.2.1 Fundamentals of Lead User Theory

Besides the presence of the LUM within the marketing discipline that investigates the adoption and diffusion of new products (Morrison et al., 2000; Schreier, Oberhauser, Prügel, 2007), it has become particularly affiliated to the field of innovation management. A greater amount of studies thus focuses on (new) product development through lead user involvement (von Hippel, 1986; Lilien et al., 2002; Franke et al., 2006; Schreier and Prügel, 2008). As the ultimate goal of the thesis' underlying project is product development, the LUM is understood as an innovation managment tool in the following.

Whereas traditional market research methods aim at capturing needs for a broader group of users, it is found that a more comprehensive understanding of new products and services is held by only a limited number of users (Herstatt and von Hippel, 1992). The LUM, is an approach where information about needs as well as solutions from users at the leading edge of the target market (or those with similar issues) is collected (Lilien et al., 2002). von Hippel introduced the LUM in 1986, where "especially sophisticated users are drawn into a process of *joint* development of new product or service concepts with manufacturer personnel" [emphasis original] (Herstatt and von Hippel, 1992, p.214). The major differences between traditional market research methods and the LUM are twofold: 1) the respondents involved for data collection and 2) the type of information collected (Lilien et al., 2002). Gathering need information from users at the center of the target market is characteristic for traditional methods, whereas "LU idea-generation methods collect information on *both* needs and ideas for solutions from "lead users"" [emphasis original] (ib., p.1043). Particularly, the domain of the solution dimension in general and a technical background, in particular, is to be stressed and highly valuable when aiming at LU involvement in new product development processes.

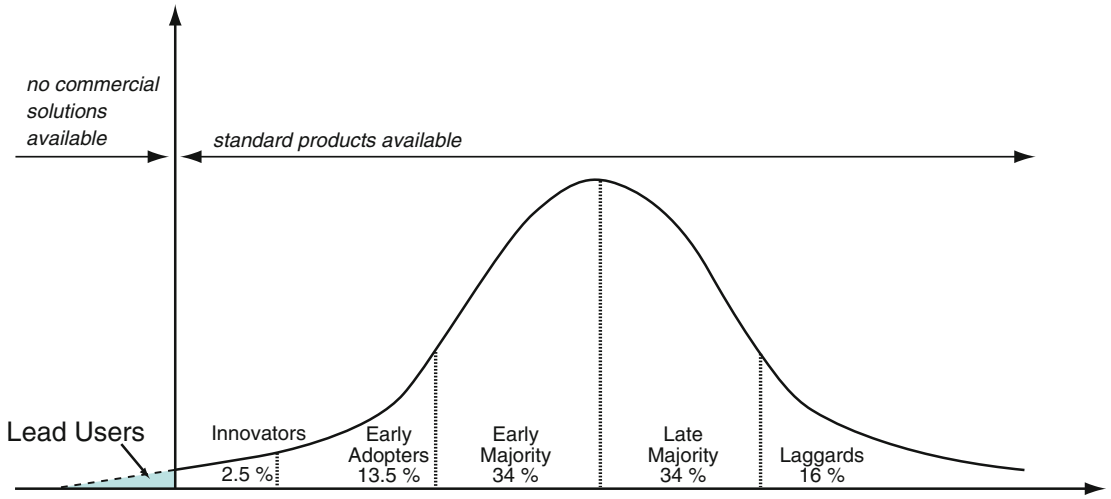
von Hippel (1986, p.796) first defined the term LU by describing two characteristics, that both have to be present and which have been widely adopted in academic studies [emphasis original]:

- "Lead users face needs that will be general in a marketplace—but face them months or years before the bulk of that marketplace encounters them, *and*
- Lead users are positioned to benefit significantly by obtaining a solution to those needs".

These two dimensions 1) ahead of trend and 2) high benefits expected have shaped the research construct of lead userness until today. The former one represents the timely aspect of the adoption process being at "the front end of the trend" (Herstatt and von Hippel, 1992), whereas the latter is linked to the motivation to innovate when significant profits from it are expected. Furthermore, it is argued that they have made real-world experience helping manufacturers to understand "the needs that the bulk of the market will soon face (ib.). The higher the expected benefit gained from a novel product, the greater is the investment in finding a solution.

Morrison, Roberts and Midgley (1999) find that "the idea of segmenting members of the population on the basis of the applications to which they put the innovation and the value of those applications to them is appealing" (p.2). The authors outline the potential of a new measure attempting to exceed the one developed by Rogers (1995) which focuses on the time of adoption assessing the behavior of individuals and their characteristics (Morrison et al., 1999). Rogers refers to innovators and early adopters who are among the first to use an innovation until, over time, the early and then late majority follows. The so-called laggards are the last consumers to adopt an innovation due to high resistance to innovation and a lengthy decision process (Rogers, 1995) often associated with the market segment of 55+ (Essén and Östlund, 2011). However, Magnusson (2003) found that both the LUM and the adoption cycle overlap, especially when seen as a marketing research tool. Helminen (2011) however stresses the clear distinction between these two concepts (→ Figure 3) by seeing LU independently, yet before early adopters evolve. This clear distinction of both concepts is adopted in this thesis. Essén and Östlund (2011) state that the limitation of both methods is the „focus on consumers who have a strong, well-developed set of needs and are keen to adopt novelty and change" (p.90).

Figure 3: Lead User Compared to Rogers' Diffusion Curve



Reference: Helminen (2011, p.30)

A LU identification and involvement in the fuzzy front end of innovation is a multi-stage process targeted at the generation of innovative new product concepts (Lüthje and Herstatt, 2004). von Hippel (1986, p.797) identified four steps of the LUM:

Step 1: Identification of an important market or technical trend
Step 2: Identification of LU who are trend leaders regarding (a) experience and (b) intensity of need;
Step 3: Assessment of LU need data
Step 4: Transform LU data to general market of interest.

Involving LU in NPD studies reveal that this leads to expected increase in sales volume, significant cost reductions, increasing development speed as well as innovation variety (Lilien et al., 2002; Magnusson 2003; Al-Zu´bi and Tsinopoulos, 2012). Additionally, the risk of failure of newly developed innovative products is reduced underlying the fact that the adoption of the product by the mass market is facilitated and the product diffusion is enhanced (Hienerth and Lettl, 2011).

Despite the benefits of the method, which are foremost mentioned in literature, Enkel, Kausch and Gassmann (2005) outline that a firm's risk management of customer integration should not be undervalued. Some disadvantages analyzed are "loss of know-how through disloyal customers, dependence on customers' views, dependence on customers' demands or personality, limitation to mere incremental innovation, serving a niche market only and misunderstandings between customers and employees" (Enkel et al., 2005, p.205). In particular, inherent in LU involvement is the risk of niche product development. However, the significant benefits, in particular regarding the proven

product development, are reason to resort to the concept of lead user in the scope of this thesis.

2.2.2 Antecedents and Consequences of Lead Userness

Additionally to the two characteristic of LU being ahead of trend and high benefits expected (→ Chapter 2.2.1) coined by von Hippel in 1986 a more in-depth elaboration on attributed characteristics is essential. Several publications investigate antecedents and consequences of lead userness, table 1 provides an aggregate of key variables that have been integrated in previous academic studies. This section serves to provide a further description of prevalent characteristics as well as arguments for those of interest to this thesis.

Table 1: Overview Characteristics Associated With Lead Userness

			Antecedent of Lead Userness		
Author	**Year**	**Subject of Analysis**	**field-related**	**field-independent**	**Consequence of Lead Userness**
Herstatt & von Hippel	1992	Lead User Method	Ahead of Trend, Expected Benefit		New Product Concepts
Lüthje et al.	2000	Lead Userness	Ahead of Trend, Expected Benefit, Use Experience, Product Knowledge	Technical Expertise, Extrinsic / Intrinsic motivation	Innovative Behavior
Morrison, Roberts, Midgley	2004	Leading Edge Status	Ahead of trend, expected innovation benefit		Innate innovativeness, Time of Product Adoption
Lüthje and Herstatt	2004	Lead User Method	Ahead of trend, expected innovation benefit		User Innovation
Franke et al.	2006	Lead User	Ahead of Trend, expected benefit	Community-based Resources, Technical Expertise	Innovative Behavior, Innovation Attractiveness
Schreier, Oberhauser and Prügel	2007	Leading Edge Status			Perceived Complexity, Domain-Specific Innovativeness, Opinion Leadership
Kratzer and Lettl	2008	Lead Userness		Creativity, Betweenness Centrality	
Schreier and Prügel	2008	Lead Userness	Use Experience, Consumer Knowledge	Locus of Control, Innovativeness	Product Adoption Behavior
Jeppesen and Laursen	2009	Lead User			Propensity of Knowledge-Sharing
Hienerth and Lettl	2011	Lead User		Peer Community	Innovation diffusion
Schuhmacher and Kuester	2012	Lead User	Ahead of Trend, Use Experience, Consumer Knowledge	Involvement, Intrinsic motivation, extrinsic reward	Idea quality
Faullant et al.	2012	Lead Userness	Use experience, product-related knowledge	Divergent Thinking, Openness for Experience, Task Motivation	
Al-Zu´bi and Tsinopoulos	2012	Lead User			Product variety
Schweißfurth and Herstatt	2013	Embedded Lead User	Use Experience	Cognitive Empathy	Domain-Specific Innovativeness, Opinion Leadership

Reference: Own depiction

Drawing on previous studies, lead userness has been associated with various characteristics being either antecedents or consequences to it. Schreier and Prügel

(2008), for example, investigated further possible antecedents of lead userness. The researchers classified two types of characteristics (1) field-related and (2) field-independent ones. Similarly, Wellner (2014) refers to high and less context-specific factors. Author-spanned, the former refers to being ahead of trend, high benefit expected, use experience and product knowledge. The latter incorporates among others technical expertise, motivation, innovativeness, speed of adoption and cognitive structure (divergent thinking and cognitive empathy).

Cognitive empathy is defined as "the ability to understand another person's thoughts and feelings" (Homburg et al., 2009) and refers to the ability of taking someone else's perspective while understanding their views and experiences. Schweisfurth and Herstatt (2013) confirm a positive impact on lead userness investigating embedded LU.

Divergent thinking positively relates to lead userness and is described as a cognitive style, which enables individuals to "go beyond existing patterns of solutions" and therewith have show a tendency of "innovative problem solving" (Faullant et al., 2012, p.80).

Extrinsic reward refers to financial motivators that according to Lüthje (2000, p.5) are indisputable for the performance of humans and thus users "hope to be financially rewarded for their creative work."

Intrinsic motivation is the „degree to which a person is excited by an activity and is motivated to engage in it for the sheer fulfillment of the activity itself" (Schumacher and Kuester, 2012). In a study by Kratzer and Lettl (2008) intrinsic motivation was identified as the main purpose to innovate.

Openness to experience is one of the 'Big Five' factors that account for personal traits next to neuroticism, extraversion, agreeableness and consciousness. Characteristics like open-minded, curious, flexible, intelligent and imaginative describe a person high in openness (Costa and McCrae, 1992, Feist, 1998, Faullant et al., 2012). It has often been mentioned in the context of creativity and innovation behavior as an underlying characteristic promoting lead userness (Faullant et al., 2012).

Product-related knowledge constitutes knowledge about the product architecture as well as applied technologies and material of an existing product (Lüthje and Herstatt, 2004). Several studies acknowledge the positive impact on lead userness (Franke et al., 2006).

Technical expertise refers to a deeper understanding of product architecture including know-how on techniques to produce or transform a product enabling a person to create a prototype while showing a positive relationship towards lead userness (Franke et al.,

2006). As the capability of inter-contextual application is assumed, this gained know-how does not need to be domain-specific.

Use experience is defined by frequency and duration of active product or service use. More specifically, "learning from experience" and "performance-related knowledge from primary product usage" (Schreier and Prügel, 2008, p.336) determine this construct, which positively influences an individual's level of lead userness.

Often, *innovative behavior* or concepts related to innovativeness have been analyzed as a consequence of lead userness (Lüthje, 2000; Morrison et al., 2004; Franke et al., 2006). The construct did not appear to be feasible to implement regarding hardware or service components of air travelling.[4]

To cover both field-related and field-independent characteristics, two originally introduced characteristics PK and UE are selected with regard to the former classification property. As antagonist to the in Chapter 2.2.4 explained consequences of aging such as cognitive declines, divergent thinking and cognitive empathy are chosen to cover the latter type of characteristics. The author decided to test whether these characteristics are also found to have a positive relationship with lead userness in the SiMa. It also sheds light on their relationship by exploring them in a different setting: SiA air travellers investigating an industry or service, where concrete innovative behavior as such is not feasible and implementable, respectively.

Contextualizing the applied characteristics by providing an elaborate explanation below, a framework of creative psychology is partially adopted, which Faullant et al. (2012) added as a new research field on antecedents of lead userness. Taking the theory of creativity by Amabile (1983), product-related knowledge and use experience fall into the category of domain-relevant skills in this case. They are defined as a set of response possibilities, which generate a new solution. LU are using products intensively and thus have high demands on the materials used. Lüthje (2000) states that use experience fosters creative outcomes because it impacts product-related knowledge and cognitive structures. With increasing use experience, the knowledge increase also becomes more specific enabling the user to differentiate and analyze product information (Faullant et al. 2012). Both have been positively associated with lead userness in previous research. Surprisingly, the linkage between creativity and lead userness conveyed indirectly in research applying an underlying assumption that LU are creative in order to be able to design new solutions (Simonton, 2003).

[4] An open-ended question on innovative behavior was included in the survey, yet responses given did neither provide valuable insights nor did they reveal innovative ideas.

Sticking to Amabile (1983), creativity-relevant skills refer to an individual's cognitive style that facilitates the ability to think outside the box, apply new patterns, to define problems and breakdown complexities. It further enables individuals to overcome 'functional fixedness'. This specific cognitive style and thinking pattern is referred to as divergent thinking (Faullant et al., 2012). Here too a positive relationship to lead userness has been validated.

If NPD endorses the integration of LU, a creation of innovative ideas and problem solutions is destined to arise. As the ultimate goal is to design innovative products yet to suit the majority of people, the "bulk of the marketplace" (von Hippel, 1986, p.796), it is important to be able to empathize with them. Therefore, cognitive empathy is, in this context, an important result of lead userness playing a significant role in the integration of lead users in empathic design workshops. It is assumed to foster the possibility of successful NPD meeting the needs of the majority and not merely addressing specialized niche markets.

To end with, the construct of technical expertise as an antecedent to lead userness (Franke et al., 2006; Wellner, 2014) has been excluded in the context of this study. This is due to the fact that items as, for example, proposed in Wellner's work (2014) are not suitable to be applied in the empirical field of the aviation industry when analyzing an industrial good and service market. Technical knowhow on material is very specific to a professional group and technical applications and improvements on aircrafts are impossible to conduct for an ordinary air traveller.

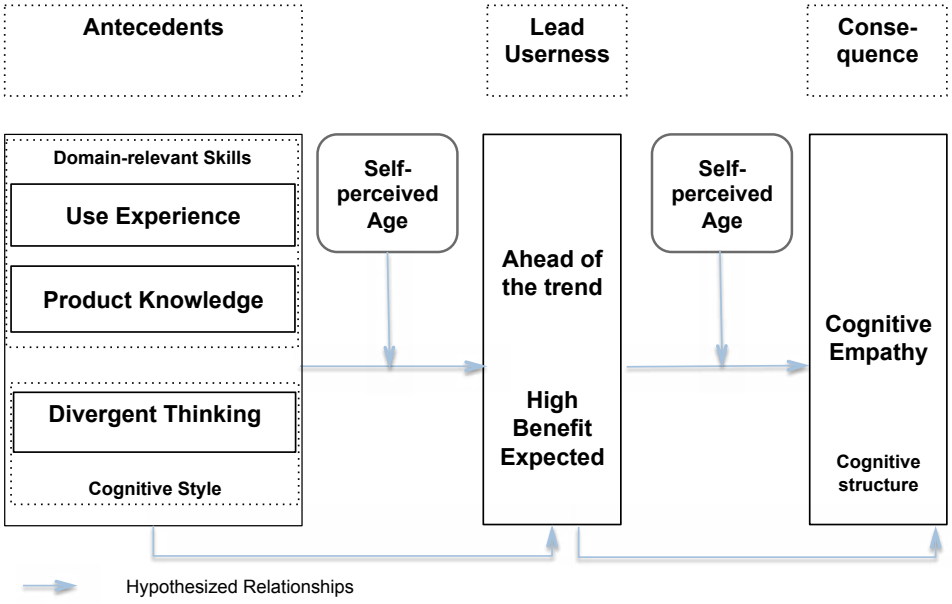
2.3 Interim Conclusion and Conceptual Framework

To summarize, this chapter introduced the demographic transition that shows a shift towards an aging population not only in developed but also in developing countries. This was followed by an introduction of the characteristics of the SiMa, which too changed over time. Prejudices about elderly are no longer found to be true, rather a SiA is agile, active and in better health having an increased spending power. Though nowadays, due to better medical care the occurrence of age-related diseases has shifted as well, consequences of aging cannot be neglected. People's aging can be attributed to a biological, psychological and sociological nature. Nevertheless, the better health conditions lead to a demand shift seeking for products that fulfill needs while encouraging their autonomy, not mere products that seem to be appropriate to one's age. In a nutshell, the silver market is a very demanding and heterogeneous one that shows great potential.

An additional measure that goes beyond the mere accumulation of years is 'self-perceived age' suggesting different perspectives on how an individual ages. As needs vary significantly across ages and the identification of the elderly's latent needs may be the key to success, one core method has been introduced. The LUM identifying people who are ahead of the trend and second who expect a high benefit from finding solutions.

Based on the theoretical foundation introduced, the conceptual framework (→ Figure 4) serves as groundwork to this study researching the antecedents of lead userness and the influence of self-perceived age on those relationships accordingly. Further, a consequence of lead userness in terms of an individual's cognitive structure and the impact of self-perceived age on this relationship is under study. These relationships are hypothesized and later tested (→ Chapter 3.2).

Figure 4: Conceptual Framework



Reference: Own depiction

3 Research Questions and Hypotheses

Linking to the relevance of the topic, this chapter assesses the existing gap in research. It is to highlight the aim of the study and how it aspires to enrich the academic body. The research questions derived are an essential element of the study guiding the study design and utilized to discuss the findings and contributions of the thesis at a later point. The developed hypotheses in this chapter are later tested with a regression analysis and an instrument to answer the research questions.

3.1 Research Gap and Research Questions

The thesis at hand is a replication but also an extension of a recent study conducted by Faullant et al. in 2012. It is replicated as it examines the same effects of antecedent variables: (1) domain-relevant skills, i.e., product-related knowledge and use experience on lead userness and (2) cognitive style, i.e., divergent thinking. However, adding another factor, cognitive empathy, to further investigate an individual's cognitive structure, extends the model tested. Faullant et al. (2012) detect that though user integration is nowadays essential in NPD, only little attention has been paid to the cognitive style of individuals involved. Additionally, applying the model to the aviation industry as well as testing the effects on the SiMa, which is just currently raising the interest of researchers, portrays a clear extension. This add-on is represented by the investigation of self-perceived age and its impact on the variables examined.

Although abundant research on lead user theory exists, little is said about LU characteristics in the SiMa. The specifications of the thesis link the silver market phenomenon and the lead user theory from an innovation management point of view. Bridging the research gap existing in literature, the impact of antecedents and a consequence on lead userness of the *elderly* is assessed with the ultimate aim to involve them in new product development. In this context, next to the often-analyzed antecedents (product-related knowledge and use experience), divergent thinking and cognitive empathy are assumed to be two essential indicators and dispositions that will facilitate the integration of SiA into NPD (empathic design workshops).

Deriving from the relevance of the topic illustrated above the following research questions (RQ) are subject to the work at hand:

RQ1 Do the antecedents product knowledge, use experience and divergent thinking have an impact on the lead userness of a Silver Ager?

RQ2 Is there a relationship between lead userness and cognitive empathy? Do Silver Ager with a higher degree of lead userness show a more distinct predisposition to cognitive empathy?

RQ3 Does self-perceived age moderate the relationship between antecedent and consequence of lead userness?

To what extend does self-perceived age impact determinants and consequences of lead userness in the Silver Market population (How strong is the moderating influence)?

3.2 Development of Hypotheses

This sub-chapter is structured according to the eight hypotheses tested in this study. A cohesive theoretical argumentation provides the reader with the comprehension of the hypotheses development. As they will be later tested and discussed, it is important to recognize what they capture, thus an explicit delineation for each on of them is carried out.

3.2.1 Use Experience

Schreier and Prügel (2008) confirm that a high level of use experience is a prerequisite for person rating high in lead userness. It is argued that experienced users are able to identify existing problems that possibly arise when using a product. These consumers often use products more intensively, beyond the common scope and its typically assumed environment. While using the product the consumer builds comprehensive tacit knowledge, which is the underlying force to be able to expand product usage beyond the ordinary and take it onto a different level. As this simple aggregation of knowledge is independent from age, a relationship between use experience and lead userness is also assumed in the SiMa. Thus, the following hypotheses derives:

Hypothesis 1 (H1): The extent of use experience is positively related to a Silver Ager's degree of lead userness.

3.2.2 Product-related Knowledge

As discussed earlier (→ Chapter 2.2.2), product-related knowledge is often found to be an antecedent of lead userness in extant literature, as its relationship to lead userness has been subject of investigation in previous studies. For example, Schreier and Prügel (2008) and Franke et al. (2006), stated that a comprehensive understanding of the

product itself is not only required to determine improvement potential but also to implement the tacit knowledge gained i.e. through use experience. Further, it is essential to translate their needs into "concrete (technical) product and service specifications in the language of engineers" (Lüthje, 2000, p.6). Extensive product knowledge also leads to the ability to recognize benefits inherent in improvements while optimizing the product at hand. Concluding:

Hypothesis 2 (H2): The level of product-related knowledge is positively related to a Silver Ager's degree of lead userness.

3.2.3 Divergent Thinking

Ulwick (2002) argued that in the context of user integration the phenomenon of 'functional fixedness' is present. It refers to the problem that integrated users are limited in their imagination to already existing solutions and do not assess challenges beyond current thought and solution patterns. Faullant et al. (2012) claim that individuals who have an appropriate cognitive style, i.e., divergent thinking disposition, are able to overcome this 'functional fixedness' and think outside the box, therewith going beyond the ordinary and well-established patterns. Further, the researchers find that those individuals apply various approaches to problem solving, more specifically persons rating high in divergent thinking have been associated with innovative problem solving. In the end they encounter solutions earlier than others leading to the following conclusion:

Hypothesis 3 (H3): The level of divergent thinking is positively related to a Silver Ager's degree of lead userness.

3.2.4 Cognitive Empathy

Often traditional market research methods detect direct needs of customers leading to incremental product changes. However, more challenging is the discovery of non-obvious *latent needs*, which users often are not consciously aware of. Nevertheless, they recognize them when they are getting fulfilled. As LU are by definition ahead of a marketplace trend encountering *concrete needs*, they realize great benefits from finding solutions or solving problems. Therewith, they collect experience in product usage before others do. Developing an ability to empathize with the majority of users is attributed to the fact that they possess precise needs and demands earlier on, and thus have already encountered the challenges the majority of customers in that marketplace still face, only at a later point in time (Schweisfurth and Herstatt, 2013). Their experience made facilitates taking the perspective of other users who just discovered these new trends, problems or

challenges.

Hypothesis 4 (H4): The level of cognitive empathy is positively related to a Silver Ager's degree of lead userness.

3.2.5 Self-perceived Age

As time passes, the aggregation of experience over the years, that is, with increasing age, is a common process. The relative advantage of use experience is to be found at younger age groups, who rapidly accumulate a comprehensive use experience in a certain field. Thus, investigating SiA and therewith advanced age cohorts, use experience does not represent a competitive advantage rather a natural process that cannot be linked to the LU component 'being ahead of trend'. The desire to be ahead of a trend also shrinks as the elderly become more risk averse over time (Wellner, 2014). A pure perception of age does not positively interfere with the yet inevitable accumulation of knowledge, which is a mere function of growing older.

Hypothesis 5 (H5): Self-perceived age negatively moderates the impact of an individual's use experience on lead userness.

Product-related knowledge is assumed to be a decreasing incremental effect, which is "more prone to obsolescence over time" (Wellner, 2014, p.55). In times of fast-changing environments and constant technological improvements and innovations, the state of knowledge, which was once relevant and up to date, can quickly become overhauled. An additional factor for the outdated knowledge is the rapid development of product and service substitutes, which the elderly may not follow or embed in their routines. Product-related knowledge is impacted by an individual's perception of age as the older they feel, behave or interact, interests shrink and the less current and advantageous know-how on (outdated) product architectures becomes.

Hypothesis 6 (H6): Self-perceived age negatively moderates the impact of an individual's product-related knowledge on lead userness.

In general, Simonton (1990) argues that the quality of any creative manner "neither increases nor decreases with age, nor does it assume some curvilinear form" (p.630). The researchers suggest that creativity is not an act correlating with time nor a mere function of chronological age. Faullant et al. (2012) define divergent thinking as a determinant of an individual's cognitive style that is linked to the study of creativity. Studying the ability of divergent thinking, in particular, McCrae, Arenberg and Costa Jr.'s (1987) findings confirm a decline in divergent thinking with age. Although the researchers note that

there are individual differences, they also discovered "systematic maturational declines in divergent thinking abilities, particularly after age 40" (ib., p.136). This phenomenon connects to the aspect of 'functional fixedness' that develops with familiarity and repetition of the same use patterns over time. Further, the "cognitive capacity and fluid intelligence of older users is lower representing a hurdle" as well (ib.). As this study explicitly examines the SiMa involving people aged 55 and above, the decline effect is assumed to be present. Referring to self-perceived age, where on average SiA perceive themselves twelve years younger, they are still above the threshold of 40 years determined by McCrae et al. (1987) in the sample collected. Thus, the researcher follows the argumentation by McCrae et al. (1987) reasoning:

Hypothesis 7 (H7): Self-perceived age negatively moderates the impact of an individual's degree of divergent thinking on lead userness.

Cognitive empathy is the ability to adopt a subjective perspective of other individuals. Therefore, "some form of active inhibitory mechanism must regulate the pre-potent self-perspective" (Bailey and Henry, 2008, p.219), whereby the concept of inhibition is understood as "stopping a response that is dominant or automatic" (ib.). However, a divergence in literature about the impact of age on cognitive empathy exists. On the one hand enhanced cognitive empathy is found at later stages in life (Happé, Winner, Brownell, 1998), on the other hand no significant age-related decline has been confirmed (MacPherson, Phillips and Della Sala, 2002). The majority of studies, however, suggests a reduction of cognitive empathy with increasing age, as is the case in the study by Bailey and Henry (2008), who argue that the process of 'normal aging' is associated with a lack in inhibitory control, leading to the circumstance that people grow less empathic with age. The age-related decline in empathy is also partially rooted in the diminishing ability to understand the mental state of other individuals (Bailey, Henry and von Hippel, 2008). According to the majority of findings, the researcher concludes that LU, as they grow older, face a decline in cognitive empathy.

Hypothesis 8 (H8): Self-perceived age negatively moderates the impact of an individual's level of lead userness on cognitive empathy.

Below figures depict the hypothesized relationships as explained above. Lead userness is understood as a combined construct with the components (1) ahead of trend and (2) high benefit expected (→ Chapter 4.2.1 for further explanation) leading to a non-distinction within the hypotheses. To facilitate the analysis and structure of the thesis as well as the reader's understanding, a distinction between Model 1 (→ Figure 5) covering the

antecedents of lead userness and Model 2 (→ Figure 6) covering the consequence of lead userness takes place.

Figure 5: Hypothesized Relationships of Antecedents – Model 1

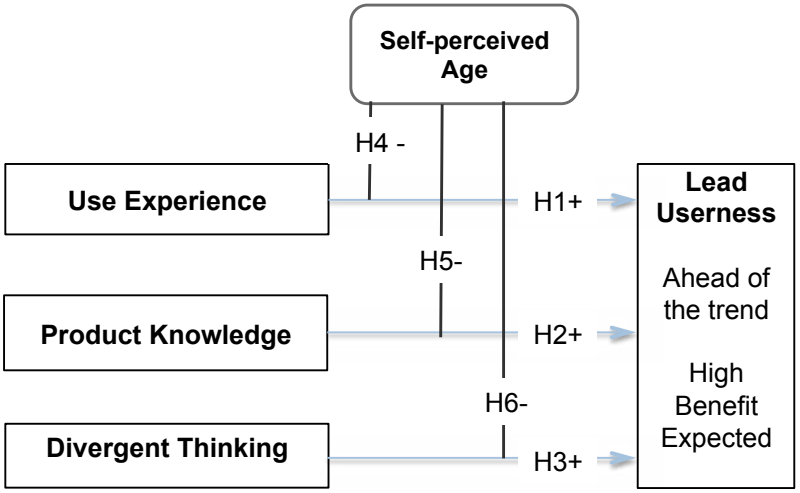


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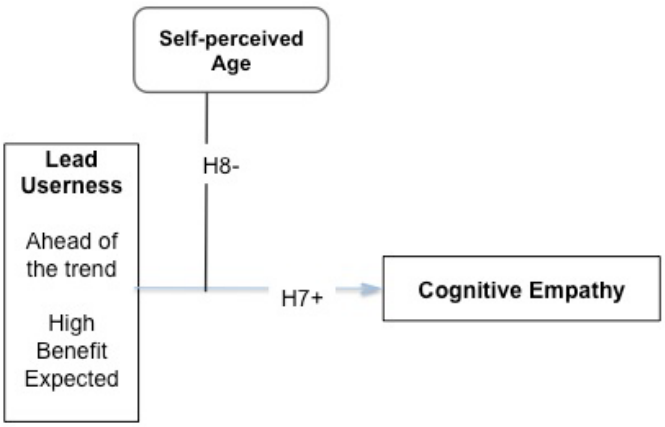
Figure 6: Hypothesized Relationship of Consequence – Model 2



Reference: Own depiction

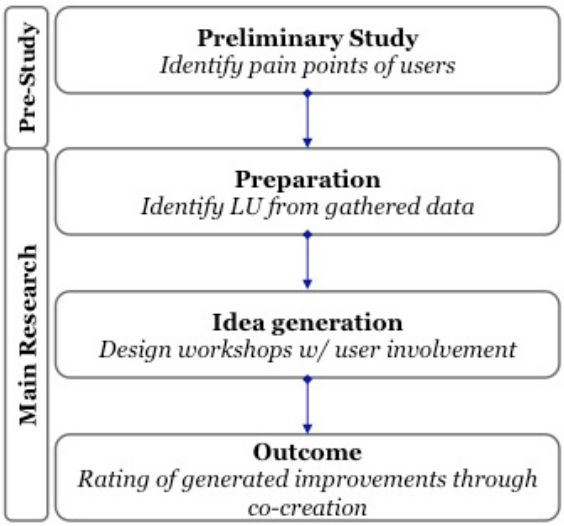
4 Quantitative Empirical Study

This chapter explains the research method utilized to test the hypotheses established in the previous chapter. The objective is to embed the thesis in its context and as an extract of a more comprehensive study conducted, to introduce the data collection procedure to understand the derived sample and dataset. To validate the model, the operationalization of applied constructs is elaborated and assessed by measures of reliability and validity. Further, the data transformation conducted to facilitate dataset use in the subsequent analysis is described. For examination and to draw conclusions, results are presented.

4.1 Context

This thesis is part of a more comprehensive study established by representatives of the aviation industry, the University of Twente and the Technical University Hamburg-Harburg. Producing a modern and innovative aircraft family, a leading aircraft manufacturer can fulfill the needs of airlines and operators, whereas airlines as customers strive to be on the leading edge while promoting sustainable travel and constant innovations and improvements. The project is set in the aviation industry, whereby the aircraft and its interior as well as according hardware are conceived as an industrial good. However, the process and the environment of travelling are understood as a service. The entire project ultimately aims at cabin innovation of aircrafts and encompasses several steps: preliminary study, preparation, idea-generation through empathic design workshops and the prototype building (→ Figure 7).

Figure 7: Process Overview



Reference: Own depiction

Due to the uncertain time frame of the project, the scope of this thesis is limited to the pre-study of the project, that is, identifying 'pain points' of the users while travelling by air and deriving from the thesis' findings to identify potential older LU suitable to participate in upcoming empathic design workshops. This pre-step is desired to initially work out if potentials for improvement from a SiA air traveller's perspective exists in the first place; the results of analysis were presented separately involving all parties receiving the approval to continue. Additionally, the findings of this preliminary study regarding the antecedents and consequence of lead userness will be used as a foundation for subsequent steps within the main research: preparing and conducting design workshops that are based on the empathic design approach involving selected SiA that scored high in lead userness in the survey and agreed to be contacted for the purpose of further research.

4.2 Data Collection and Sample

This empirical study is embedded in the aviation industry reaching out to senior air travellers in Germany, who represent the unit of analysis at an individual level. Therefore, a collaboration with the German Senior Citizens League (Seniorenliga e.V.) was formed to approach potential participants for the developed survey. Since 1994, it is a charity association that campaigns for the interests of elderly people and "has consistently been giving a clear voice to the need of elder people for social, economic, cultural and political participation" of SiA (Deutsche Seniorenliga e.V., 2014). Engaging the German Senior Citizens League has the benefits of gathering structured data from one primary source using one uniform survey. One request set by the association was to limit the duration of filling out the survey to approximately 15-20 minutes. The questionnaire was set up to meet this requirement. The association contains an email distribution list with over 11,000 registered users to which an invitation for the online survey was sent.

In general, an online survey constitutes several advantages beyond efficiency and effectiveness, such as reduced interviewer bias, greater geographic coverage and less processing errors as listed in table 2 that advocate its application. Within the first week 395 completed questionnaires were sent back. After one week, a reminder was sent to all registered users in the email distribution list to maximize the response rate yielding an additional 248 responses. As suggested in the outlined disadvantages of online surveys, the total 643 returned questionnaires result in an inadequate response rate of 5.85 per cent. As Internet concerns rise, lower response rates than usual have been reported, due

to an increasing amount of non-responses (Dillman et al., 2009; Shih and Fan, 2008). This leads to the assumption that a non-response bias is present, however several actions have been conducted to keep it at a minimum by following Rogelberg and Stanton's (2007) response facilitation approaches. These, for example, include the publication of the survey by e-mail containing information about the purpose and use of results, the design was set up carefully (→ Figure 8), survey length was manageable according to the requirements set and incentives (model aircrafts and vouchers) were provided to trigger the participation and finally a reminder note has been sent out.[5] These actions undertaken are assumed to have positively impacted the response rate.

Nevertheless, an effective response rate that is significantly higher than the observed response rate can be assumed. The reasons are three-fold: for one, e-mails might not be opened due to spam folders or unsuccessful delivery (e.g. invalid e-mail addresses). Secondly, as it is set in the specific context of air travelling not all people contacted are interested or feel addressed (e.g. non-flyers). Finally, the elderly may not be as Internet-affine and thus do not check their e-mails regularly missing the opportunity to respond in a certain time frame set by the researcher. The link to the survey was active for three weeks. The data collection was carried out in the beginning of May.

Table 2: Overview (Dis-)Advantages Online Survey

Advantages	Disadvantages
Time Efficient and Flexible	Constrained by Internet Accessibility
Interactivity without Interviewer Bias	Truthfulness Concerns
Personalized Messages and Questions	Ethical and Legal Concerns
Quick or Immediate Follow-up	Selection / Sampling Bias
Cost Effectiveness	Inadequate Response Rates
Target Sample Selection	Inaccurate Populations
Unrestricted Geographic Coverage	
Desensitize Sensitive Subjects	
Less Processing Errors	

Reference: Adopted from Chang and Vowles, 2013, pp.122-124.

When developing the questionnaire, which is defined as a set of formalized questions, the questionnaire design process introduced by Malhotra, Birks, and Wills (2012) was adopted and transferred to a ten-step online survey approach (→ Figure 8). In step one

[5] As Rogelberg and Stanton (2007) focus on organizational surveys not all of the eleven techniques are transferable.

the problem at hand has been specified including the refinement of constructs that support the assessment of the research questions (→ Chapter 2.2.2 and 4.3.1). A clear picture of the target group has been defined: air travellers above 55 years.

In step two a feasible interviewing method, for example, online survey, telephone survey, face-to-face survey or postal survey has to be chosen context-specifically. Due to the cooperation entered with Seniorenliga e.V. in advance, an online survey appeared to be the best method to reach as many members of the association as possible with limited funds and a restricted timeframe. Moreover, the management of Seniorenliga e.V. offered an online distribution of the survey link via their email newsletter increasing the credibility and authenticity (limiting truthfulness concerns, table 2).

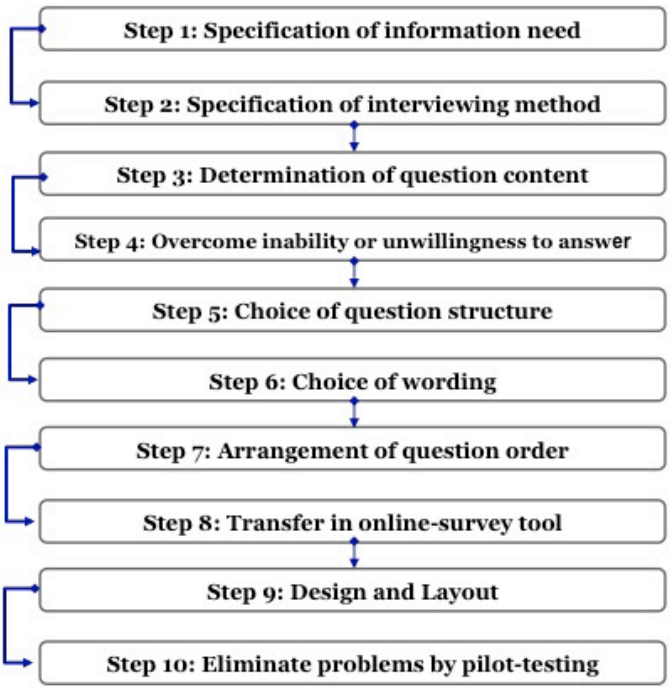
During the next step, the question content and wording has been carefully designed to keep the questionnaire as parsimonious as possible. In this context, double-barreled questions have been avoided. To overcome the inability or unwillingness to answer, the questions not only contain options like 'prefer not to say' or 'no opinion' but also aided recall questions, for example, when asking for the respondent's favorite airline or participation in frequent flyer programs (Malhotra et al., 2012). Further, questions on sensitive topics like net household income have been placed at the end of the questionnaire and response categories were provided.

In most cases structured multiple-choice, dichotomous or scale questions have been provided as suggested in step five. However, some open-ended questions were included to capture the innovative behavior of participants and offering space to articulate further thoughts and remarks throughout the survey. Step six emphasizes the wording of questions, therefore, double negation has been dismissed and rather an easy-to-grasp wording (ordinary not ambiguous words) of questions was applied. The questions retained neutrality to not leading the respondent to an answer and bias the response as a result.

The following step serves to bring the designed questions into a logic order. Thereupon, the questionnaire started with simple basic questions and the rather difficult and complex questions were placed towards the last third ending with demographic sensitive questions. The subsequent steps served to create and design the survey via an online provider called 'Surveymonkey' for which a premium account was acquired to enhance the design possibilities, which still were very limited. Finally, the pilot test, for which respondents similar to those in the actual survey were employed, facilitated the limitation of misunderstandings, misinterpretations of questions as well as verifying the time needed.

More specifically, the survey (Appendix 1) consists of 33 questions divided into three parts: 1) questions on user experience while air travelling, 2) questions on the underlying research constructs and 3) questions on the demography and classification of the participant. The first section addresses the process of travelling starting from check-in at the airport to boarding until departing the aircraft. The respondent is asked to indicate his or her satisfaction and perceived importance of the items. At the end, overall satisfaction is asked. This part serves for the identification of pain points, which will be reported to the cooperation partners and used as a starting point for potential product and service improvements. The second section covers relevant research constructs for this thesis and beyond since they may be integrated in the main research (follow-up) study at a later point in time. Finally, all other questions deliver information on the demography, flying habits and classifications of respondents that will be used to assess the sample as well as control variables.

Figure 8: Questionnaire Design Process



Reference: Own depiction, adopted from Malhotra, Birks, and Wills (2012).

Two criteria have to be fulfilled to qualify for the subsequent assessment of data. For one, the person has to be aged 55 years or above to fit the characteristic of the SiMa and secondly, they must have already travelled by air to be able to evaluate possible lacks in the procedure or improvement potential of the aircraft equipment and it is a prerequisite to identify LU in this area. Otherwise, the respondent was immediately directed towards the end to exit the survey. Additionally, the setting to receive responses of 70 per cent has

been entered to guarantee sufficient data and minimize missing values. If this criterion was not fulfilled, the respondent was kindly asked to fill out the remainder of the section.

According to Blumberg et al. (2008), a purposive sampling – a judgment sampling in particular – was conducted. This is due to the fact that implicitly, by resorting to the Seniorenliga e.V., a predetermined requirement on age was set. Although, a reminder has been sent after one week which accounted for 38.57 per cent of responses, no external impacts or changes in the procedure or questionnaire were undertaken that lead to a presumption of a significant difference in both samples (first announcement of survey via PR agency 13.5.2014; second on 22.5.2014). Therefore, the two sub-samples are treated as one in the following analysis. From the pool of responses (total sample size N=643) 259 are male and 172 female, with 212 not responding to the question on gender. The age of the participants ranges from 25 years to 93 years.

4.3 Measurement of Constructs

This sub-chapter introduces the operationalization of constructs of both dependent and independent variables. First, main constructs, which are of interest to the research, are examined based on applied scales and their internal consistency. Second, control variables, which are assumed to have an impact on the model, are introduced. Third, a reliability and validity assessment is presented.

4.3.1 Main Constructs

In general, the main constructs serve as independent and dependent variables, which are adopted in model 1 and 2. An independent variable also referred to as a predictor or antecedent, is assumed to influence the dependent variable; words like criterion, effect or consequence capture the dependent variable (Blumberg et al., 2008). The applied constructs and items in this thesis derived from previous studies with proven psychometric properties of the measures (Franke et al. 2006; Schreier and Prügel 2008; Faullant et al., 2012; Homburg, Wieseke and Bornemann, 2009), however slight adaptations were necessary to better fit to the context of flying habits and experience associated with the aviation industry. If not mentioned otherwise the original item has been adopted. Table 3 provides an overview of the constructs and the according items used in the survey. The original scales are in English, however the survey was distributed among older German citizens and so a translation was necessary. The English items were translated into German and by a second person back to English, two native speakers double-checked the wording and if required minor changes were made. Afterwards, the survey has been tested by five experts and ten German SiA, which assessed the

comprehension of questions asked and the time needed to complete the survey. As a result, next to small adjustments, examples were added in specific cases, therewith enhancing the ease of understanding for the elderly.

Use Experience

According to previous studies UE is measured formatively by two items referring to (1) duration and (2) frequency of use (Lüthje and von Hippel, 2004; Lüthje, Herstatt and Hippel, 2005; Schweisfurth and Herstatt, 2013; Schreier and Prügl, 2008). The former one is assessed by the question (1) When did you start travelling by airplane? Assuming it is more convenient for respondents to reference the year of start rather than absolute years of travelling and to avoid calculation errors, the scale provided reached from before 1960, 1961-1965, 1966-1970, … , after 2010. Whereas the latter, frequency, is captured by (2) How many times did you travel by air in the last 5 years? Answer categories range from 0-5 times, 6-10 times, 11-15 times, 16-20 times, 21-50 times to 51-100 times and over 100 times. Since the elderly may not travel by airplane each year but to still receive a representative result, a time frame of the past 5 years has been chosen. Due to the formative nature these two indicators are usually multiplied to receive the overall use experience of each individual (Prügl and Schreier, 2008). As in this study a specific target group, the silver market, is considered, it cannot be assumed that over the years of their first flight they have constantly be flying an equal amount, the result of multiplication would therefore be misleading. Additionally, different biographies (East – West Germany), flying habits and eventual forgetfulness of the target group, the change of aircraft equipment as technology evolves as well as the rising opportunities of air travelling and the development from a high end, premium to mid class product lead to the decision to include only frequency in the construct of use experience. Similarly, Faullant et al. (2012) have adopted the single-item approach to use experience.

Product-related Knowledge

To measure product-related knowledge the scale was modelled after Wellner (2014, p. 15), who adopted the measurement of know-how concerning material, product architecture and technologies by Lüthje (2000). Small adjustments to fit the context of the underlying study had to be made. The pre-test revealed difficulties and misunderstandings when asking about material know-how about an aircraft without being more precise. Thus, the original question on the material know-how was rephrased to ‘I know well, which characteristics of airline offerings and aircraft equipment are important to me’. Product-related knowledge was measured reflectively by three items on

a five-point Likert-type scale ranging from (1) 'not at all true of me' to (5) 'completely true of me' and yielded a Cronbach's alpha of 0.78.

Divergent Thinking

The assessment of divergent thinking is based on Faullant et al. (2012) defining it as "the ability to analyse problems and to go beyond existing patterns when finding new solutions" (ib., p.82). The researchers omitted one of the original eight items developed by Kreuzig (1981). No further adaptation to the scale was necessary. The remaining seven items were measured reflectively on a five-point Likert scale ranging from (1) 'not at all true of me' to (5) 'completely true of me' yielding to a Cronbach's alpha value of 0.88.

Cognitive Empathy

Cognitive empathy was measured with three items based on Schweisfurth and Herstatt (2013) building on a scale established by Homburg et al. (2009). In the context of an employee-customer interaction, they comprised merely aspects of the cognitive dimension of empathy, which is captured by perspective-taking and perceptual accuracy. Thus, they neglect empathic concern and emotional contagion reflecting the emotional dimension of empathy, as it did not show a strong influence (ib.). Minor adjustments in the wording were required, since in the prevalent study rather a user-user relationship is of relevance. The indicators resulted in a Cronbach's alpha value of 0. 813.

Lead Userness

As often mentioned in literature, lead userness is conceptualized as a two-dimensional construct (1) being ahead of trend (AOT) and (2) high benefits expected (HBE). Morrison, Roberts and Midgley (2004, p.358) show that both AOT and HBE are continuously distributed and should not be measured dichotomously. The researchers find that the two indicators are significantly correlated and "form [a] part of the same construct" (p.375). On the contrary, Franke et al.'s (2006) empirical findings suggest treating both as "conceptually independent dimensions rather than reflective items" (p.311) and therefore they argue that the dimensions "do have an independent meaning, are not inter-changeable, and cannot be merged into an index variable without loss of information" (p.303).

However, in the majority of research measured lead userness reflectively, thus treating it as a combined construct (Morrison et al., 2004; Schreier et al. 2007; Kratzer and Lettl, 2008; Schreier and Prügel, 2008, Faullant et al., 2012; Schweisfurth and Herstatt, 2013; Wellner, 2014) is also applicable to the study at hand. As lead userness has often been

measured in studies on extreme sports, where actions or achievements have been the focus (Wellner, 2014), original scales are not suitable in the context of this study. Therefore, an adjusted measurement building on Franke and Shah (2003) consisting of three indicators for AOT as well as three concerning HBE was implemented. Similar application is given in Wellner (2014). It was measured reflectively with six items on a five-point Likert scale from (1) 'not at all true of me' to (5) 'completely true of me'. A Cronbach's alpha of 0.75 has been achieved.

Self-perceived Age

Barak and Schiffmann (1981) operationalized their self-perceived age measure by defining four questions, which they designed to fit the four dimensions of personal age introduced by Kastenbaum et al. (1972). It refers to the biological, emotional, societal and intellectual age of an individual showing good psychometric propositions in terms of validity and reliability (Wilkes 1992, Auken and Barry 1995). Originally, it has been measured by indicating a *decade* the respondent perceives to belong to (e.g. I feel though I am in my 50s). By eliminating the decade indication, Auken, Barry and Bagozzi (2006) applied a more detailed scale than the ratio, replacing it with a response request expressed in *years*. On this account, self-perceived age has been measured on a continuous scale ranging from 1-99 years to be as precise as possible and to guarantee the comparability to the chronological age measured. Studies confirm that chronological age is an important predictor for self-perceived age (Mathur and Moschis, 2005). Internal consistency reliability is considerably high yielding a Cronbach's alpha of .88.

Table 3: Operationalization of Constructs

Construct	Code	Item
Use Experience		
	UE 1	How many times did you travel by air in the last 5 years?
Product Knowledge		
	PK1	I know well, which characteristics of airline offerings and aircraft equipment are important to me.
	PK2	I use the airlines' offerings/ aircraft equipment (footrest, shades) intensively.
	PK3	I have a good overview of the available airline offerings and air craft equipment on the market.
Divergent Thinking		
	DT1	Generally, I am interested in a variety of topics.
	DT2	Logic puzzles fascinate me.
	DT3	When I come across a problem, I think it through thoroughly.
	DT4	It is easy for me to regard things from several completely different points of view.
	DT5	When I come across a problem that I cannot solve immediately, I try to find out more information.
	DT6	When faced with something I do not understand, I tend to analyse the facts.
	DT7	I want to know about everything in great detail.
Cognitive Empathy		
	CE1	I always sense exactly what other travellers expect from airlines and the aircraft equipment.
	CE2	I realize what other air travellers mean even when they have difficulty in saying it.
	CE3	It is easy for me to take the air traveller's perspective (e.g. other passengers).
Lead Userness		
	LUAT1	I usually find out about new airline offerings and aircraft equipment earlier than others.
	LUAT2	I have benefited significantly from new airline offerings and aircraft equipment.
	LUAT3	Among other air travellers, I am regarded as being 'cutting edge' (e.g. using new services like WLAN).
	LUHBE1	While air travelling, I often notice problems of the airline service (e.g. booking, service, flight) or of the aircraft equipment (comfort of seats, A/C).
	LUHBE2	I am dissatisfied with the existing airline offerings and aircraft equipment.
	LUHBE3	I have new needs which are not satisfied by existing airline offerings and aircraft equipment.
Self-perceived Age		
	SPA1	I feel as though I am...
	SPA2	I look as though I am...
	SPA3	I do as though I am...
	SPA4	My interests are mostly those of a person in his/her...

Reference: Own depiction

4.3.2 Control Variables

This section introduces variables, namely control variables, which are not of main interest to the research, however they still contribute significantly to the research model. Control variables are held constant to investigate the relationship of the main constructs introduced above in order to prevent predictors from being distorted. These control variables are mainly captured in the third part of the questionnaire, retrieving demographic data about the respondents.

In literature, there are many factors, which have been identified to have an influence, however it is not possible to include all of them in the analysis. Four are chosen as they have exposed considerable effects. First, *chronological age* is included as a control variable in Model 1 and 2. It has been measured continuously by years. Creating a binary dummy variable where 0 equals 'male' and 1 equals 'female' includes the second variable, *gender*, into the model. The examination of studies on lead userness shows that gender has not been considered as an impacting variable, while age has been. However, both variables chronological age and gender have been included in Model 2. In previous studies, gender has often been associated with cognitive empathy (Lennon and Eisenberg, 1987; Grühn et al., 2008). It is claimed that female are able to better empathize with and be more concerned for others. Third, the respondent's monthly *net income* has been measured by a ratio scale ranging from 1=< EUR 1,000, 2=EUR 1,000-2,000, 3=EUR 2,000 -3,000, 4=EUR 3,000-4,000, 5= EUR 4,000-5,000 to 6=> EUR 5,000. A seventh option 'prefer not to say' was given and has been later excluded from the analysis. The underlying assumption is that the net income significantly influences the possibility and frequency of air travels concerning the silver market. The higher the income, ceteris paribus, the more money may be spent on travelling and the more often travels may be undertaken, hence relating to use experience and product-related knowledge and ultimately lead userness. Net income however is not assumed to have an impact when analyzing the relationship between cognitive empathy and lead userness (Model 2).

As explained above no variable on technical expertise has been included in the research model, still a question on the participant's *technical background* was compiled in the survey. The question has been measured on an ordinal scale including no technical educational background, technical vocational training, technical university degree and work experience in a technical job. A dichotomous variable has been created to measure the existence of technical knowledge (0=no technical background, 1=technical background). Though no direct innovative behavior is convertible, it is argued that the

existence of an individuals' technical background provides valuable solution information and greater understanding of the overall context. It is also an essential indicator regarding the inclusion in design workshops at later stages. No impact of technical background is assumed in Model 2, which is why it is not included as a control variable.

4.3.3 Consistency and Validity of the Measures

To test for internal consistency reliability and the consistency of the measures on repeated administrations (Saunders et al., 2009), the Cronbach's alpha for all reflectively assessed items used to define the studied variables were calculated and already given above. All α- values, indicating the average correlation between items, are greater than .7 ($.75 \leq \alpha \leq .88$) and therefore above the recommended threshold (Nunally, 1978). This means that the items are acceptably reliable, supporting the quality of research. Since reliability is necessary but not sufficient for validity it is important to look at this evaluation as well.

Validity is defined as the degree to which a measure captures what it is supposed to actually assess. Several types of validity exist depending on the field of application – to name a few: face and content validity, construct validity as well as criterion-related validity (Saunders et al., 2009). In general, scales used in this survey derived from existing theories or established literature. Face validity was judged during the period of pilot testing the questionnaire while considering a layperson's perspective on the degree the measure assesses what was purposed. Content validity is assumed due to the prevalence and previous multiple applications of the measures used. The final validity to be proven in this thesis is construct validity, which is probably most relevant to scientific research. Two approaches, convergent and divergent validity yield to construct validity: All pertained items relate to the same constructs, no cross-construct relation has been examined (ib.). For this purpose, the cross-construct correlations (→ Table 4) for each item have been computed providing evidence that overall items attributed to one construct converge on the same construct (considerably high inter-correlation), whereas items measuring different constructs show significantly lower inter-correlation (discriminant correlation). As a result of confirmed convergent and divergent validity, confidence that the applied measures capture the theoretical framework is given.

Table 4: Cross-Item Correlation Matrix

	LU 1	LU 2	LU3	LU4	LU5	LU6	PK1	PK2	PK3	UE1	DT1	DT2	DT3	DT4	DT5	DT6	DT7	CE1	CE2	CE3
LU 1	1																			
LU 2	.680	1																		
LU3	.635	.521	1																	
LU4	.238	.168	.257	1																
LU5	.179	.096	.163	.542	1															
LU6	.144	.105	.164	.420	.568	1														
PK1	.337	.306	.257	.317	.171	.195	1													
PK2	.240	.204	.256	.282	.250	.214	560	1												
PK3	.492	.480	.407	.257	.187	.179	.577	.454	1											
UE1	.177	.164	.187	.141	.013	.000	.149	.189	.293	1										
DT1	.158	.145	.131	.217	.106	.101	.276	.185	.220	.067	1									
DT2	.167	.121	.169	.134	.139	.119	.193	.154	.187	.033	.540	1								
DT3	.116	.086	132	.172	.115	.084	.237	.105	.176	.026	.506	.482	1							
DT4	.121	.066	.166	.198	.145	.156	.208	.112	.171	-.019	.523	.455	.507	1						
DT5	.138	.123	.127	.114	.42	.112	.327	.125	.219	-.038	.535	.451	.528	.643	1					
DT6	.160	.130	.184	.119	.086	.104	.268	.198	.162	-.056	.498	.445	.481	.664	.718	1				
DT7	.75	.007	.102	.048	.059	.123	.157	.055	.091	-.032	.456	.342	.456	.500	.541	.580	1			
CE1	.299	.194	.330	.195	.186	.227	.237	.207	.308	-.024	.192	.259	.223	.301	.256	.287	.293	1		
CE2	.308	.179	.251	.254	.201	.196	.181	.139	.204	.020	.218	.302	.250	.310	.287	.347	.293	.597	1	
CE3	.187	.100	.215	.219	.281	.204	.200	.186	.178	.035	.305	.318	.273	.413	.328	.386	.308	.492	.631	1

Reference: Own depiction, SPSS Output

4.4 Data Preparation

To identify the observations to be included in the further analysis a process of data preparation and data cleansing is followed. First, the questionnaires received are checked, followed by editing, coding and transcribing the data. Finally, data cleansing is conducted and the data is check for the necessity of statistical adjustment.

Checking the questionnaires for completeness is essential while discussing reasons of missingness and its implications. In general, "missing values are the results of omission while collecting the data" (Müller and Freytag, 2003, p.7). The reasons explaining incomplete data sets in relation to randomness exist in literature: Missing Completely at Random (MCAR), Missing at Random (MAR) and Missing Not at Random (MNAR) (Kline, 1998). The former one shows the highest degree of randomness providing "no underlying reason for missing observations that can potentially bias research findings" (Musil, Warner, Yobas and Jones, 2002, p.816) e.g. by accidentally skipping a question. MAR shows some degree of randomness, whereas the lack of information on a variable can be described by other variables of the data set (Hair, Black, Babin and Anderson, 2010). MCAR refers to non-random or systematic missingness attributed to the actual value of the variable. It is the most problematic as they can "affect generalizability of research findings, and may potentially bias parameter estimates" (Musil et al., p.817).

Three techniques to treat missing data are described in literature: deletion, augmentation (e.g. parameter estimation through maximum likelihood) and imputation (e.g. mean substitution). Deletion is referred to as the most simple approach, after all (single) imputation is "often worse than data deletion in terms of parameter estimation" (Nakagawa and Freckleton, 2008, p.595). Therefore, the instrument of deletion has been implemented in this work.

It appeared that 56 cases did not fulfill the age requirement of being 55 years and older to be counted for a SiA. From the remainder, 206 cases were below the threshold of 70 per cent survey completeness (MCAR). This requirement was set before hand to guarantee the greatest outcome possible. Therefore, all cases showing missing values of 30 per cent or higher yielded to a case wise deletion. The method of pairwise deletion was applied throughout the analysis to the remainder of missing values. Among them are 12 cases, which were dismissed due to the fact that the respondents have not flown yet. Moreover, the analysis of outliers showed eleven cases with data anomalies e.g. semantic or syntactical anomalies (Müller and Freytag, 2003) leading to the ultimate sample size of N=370, which is used for subsequent data analysis.

The second step consists of renaming and recoding variables. A scheme of denomination was developed to clearly mark all items belonging to theoretical constructs, demographics and the pain point analysis. Additionally, some new variables were created being the mean value of constructs as well as the interaction term of predictor and moderator to implement in the regression equation. As aforementioned dummy variables regarding gender and technical background were implemented. Further, the 'no opinion' or 'prefer not to say' answering option was marked as a missing value to get excluded when calculating means. The overall procedure from editing, coding and transcribing was undertaken specifically in all of the 122 items.

4.5 Data Analysis Method

This section is composed of the statistical method applied for hypotheses testing as well as the assurance of the underlying premises of a linear regression model.

As a multivariate analysis method, a modification of regression analysis is applied to test the aforementioned hypotheses. In general, this method is a structure-testing technique requiring the dependent and independent variable to be metric (Backhaus, Erichson, Plinke, and Weiber, 2000). It is used to investigate a relationship between one dependent and one or more independent variables (Graham, 2008).

One objective of the study is to detect effects of an independent variable on a dependent variable which may depend on the presence and magnitude of a third variable, the moderator. In line with the research approach to also *predict* a phenomenon, a moderated hierarchical regression is employed (Aguinis and Gottfredson, 2010). Overall, moderated regression is an appropriate method that is often used in management and social sciences also supporting the research goal and dissolving the research questions in the underlying study. It allows a regression analysis to become more flexible through the possibility of identifying non-linear relationships and capturing contingencies quantitatively. Above all it is appropriate, as the interaction term hypotheses take "boundary conditions" into account, that way they are considered as more mature (Aguinis and Gottfredson, 2010, p.784) and superior than simply comparing correlation coefficients (Stone-Romero and Anderson, 1994).

The moderated hierarchical regression is a stepwise process: Instead of entering all variables concurrently, first the control variables, second the predictors and finally the interaction terms (product of independent variable and moderator) are introduced into the model. The latter is modeled as an additional independent variable (Irwin and McClelland, 2001). That way an investigation of the effect of each control and

independent (moderator) variable on the dependent variable can take place. As explained in chapter 3, self-perceived age is considered to function as a moderator. That is why all independent variables of interest are multiplied with this variable producing the interaction term.

The analysis conducted is based on the research framework (→ Figure 4) from which two conceptual models derived. Regarding *Model 1* that contains 'lead userness' as the dependent variable a single hierarchical equation model, including control variables (chronological age, technical background and net income) is performed (equation (1)). The complete equation constitutes the constant a_o, the respective regression weight or coefficient of the variables β_i and ε_i denotes the error term. In a second step an equation containing the predictors (use experience, product-related knowledge, divergent thinking and self-perceived age) besides control variables is compiled (equation (2)).

(1) $\boldsymbol{Lead\ Userness = a_o + \beta_1 Age + \beta_2 TB + \beta_3 NI + \varepsilon}$

(2) $\boldsymbol{Lead\ Userness = a_o + \beta_1 Age + \beta_2 TB + \beta_3 NI + \beta_4 UE + \beta_5 PK + \beta_6 DT + \beta_7 SPA + \varepsilon}$

In the final step, the interaction term of predictors and SPA as a moderator (equation (3) derived from the general expression as used in Preacher, Curran and Bauer, 2006, p.438) is added to the model to test for H2, H4 and H6. The complete model reads as follows:

(3) $\boldsymbol{Lead\ Userness = a_o + \beta_1 Age + \beta_2 TB + \beta_3 NI + \beta_4 UE + \beta_5 PK + \beta_6 DT + \beta_7 SPA + \beta_8 UE * SPA + \beta_9 PK * SPA + \beta_{10} DT * SPA + \varepsilon}$

Similarly, in *Model 2* a *simple* regression analysis is employed including lead userness as the independent variable and cognitive empathy as the dependent variable. It is controlled for age and gender (equation 4). Equation (5) is used to test H7.

(4) $\boldsymbol{Cognitive\ Empathy = a_0 + \beta_1 Age + \beta_2 Gender + \varepsilon}$

(5) $\boldsymbol{Cognitive\ Empathy = a_0 + \beta_1 Age + \beta_2 Gender + \beta_3 LUN + \beta_4 SPA + \varepsilon}$

The regression equation (6) expressing the interaction effect of H8 includes the focal predictor lead userness, the moderator variable self-perceived age as well as the product of both and is as follows (ib.):

(6) $\boldsymbol{Cognitive\ Empathy = a_0 + \beta_1 Age + \beta_2 Gender + \beta_3 LUN + \beta_4 SPA +}$

$$\beta_5 LUN * SPA + \varepsilon$$

As means of analysis the SPSS tool is used. The last issue is to cover and test the assumptions that underlie a linear model as listed in table 5 (Malhotra et al., 2012; Greene, 2003; Backhaus et al., 2000). The results of the four assumptions, which a researcher should always examine (Osborne and Waters, 2002), are presented below.

Table 5: Assumptions Linear Regression Model

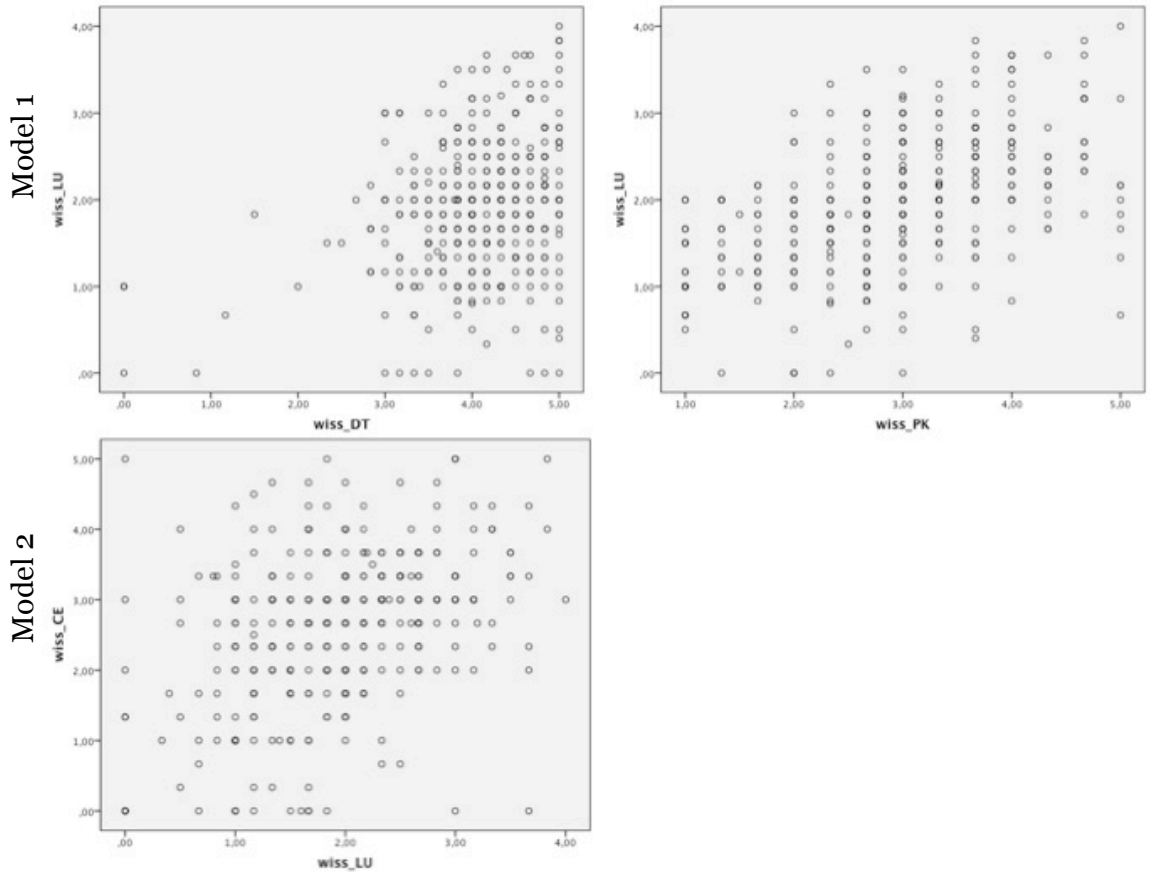
	Assumption	Violation of assumption	Consequences
1	Linearity of parameters	Non-linearity	Biased estimators
2	Linear independence of regressors	Multicollinearity	Poor estimation of regression coefficients
3	Exogeneity	Endogeneity	Inconsistent / Biased estimator
4	Homoscedasticity of error terms	Heteroscedasticity	Inefficiency
5	Independence of error terms	Auto-correlation	Inefficiency
6	Normal distribution	Non-normal distribution	No Application of statistical tests possible

Reference: Own depiction, adopted from Greene (2003), p.16.

Assumption 1: This assumption implies a linear model, which incorporates all necessary variables. Relevant variables have been identified and derived from existing literature. However, it is not feasible to include or capture all underlying parameters since it is either too complex or costly to implement or variables are simply unknown. Creating scatter plots visually assesses the first assumption of linear parameters; a linear relationship between predictor and dependent variable is visible in both model 1 and model 2.

Assumption 2: The second assumption tests if the predictors are highly correlated. Therefore, collinearity statistics are calculated producing a variance inflation factor (VIF) that indicates the increase in a variable caused by non-orthogonality to other variables in the model researched (Greene, 2003). Saunders et al. (2009, p.463) suggest that if VIF is greater than ten, multicollinearity is present. In this case (→ Table 6), no evidence of multicollineartiy is given as VIF does not exceed two in model 1 (highest score on chronological age, but still $1.917 \leq VIF \geq 2$). The assessment for model 2 includes the control variables, lead userness and self-perceived age as multicollinearity could be assumed regarding chronological and self-perceived age. Still, the VIF is below two and therefore it can be concluded that multicollinearity is not present (→ Table 6).

Figure 9: Scatter Plot Showing Linear Relationships



Reference: SPSS Output

Table 6: Collineartiy Statistics

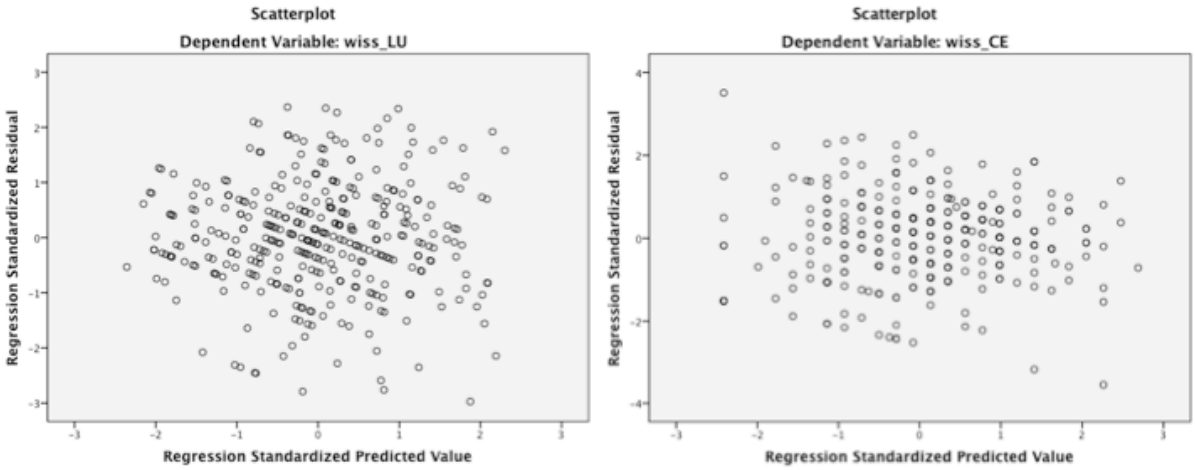
	Model 1			Model 2	
	Collinearity Statistics			Collinearity Statistics	
	Tolerance	VIF		Tolerance	VIF
Product-related Knowledge	0.810	**1.235**	Lead Userness	0.985	**1.015**
Use Experience	0.925	**1.081**	Chronological Age	0.517	**1.935**
Divergent Thinking	0.855	**1.170**	Self-perceived Age	0.532	**1.880**
Self-perceived Age	0.526	**1.901**	Gender	0.954	**1.048**
Chronological Age	0.522	**1.917**			
Gender	0.801	**1.249**			
Net Income	0.799	**1.251**			
Technical Background	0.972	**1.029**			
Dependent Variable: Lead Userness			Dependent Variable: Cognitive Empathy		

Reference: Own depiction, SPSS Output

Assumption 4: Homoscedasticity refers to a constant variance of the error terms over all levels of the predictor. However, if the variance changes heteroscedasticity is present. The overall goal is to minimize the difference between estimated and observed value by

applying the method of least squares. Several tests, for example, the Breusch-Pagan test or Goldfeld-Quandt-test can be used for mathematical diagnosis; alternatively, plotting the residuals to visualize the facts is possible. These scatterplots (→ Figure 10) show randomly scattered points, which do not seem to increase or decrease on average with fitted values. Therefore, it can be concluded that assumption 4 is fulfilled.

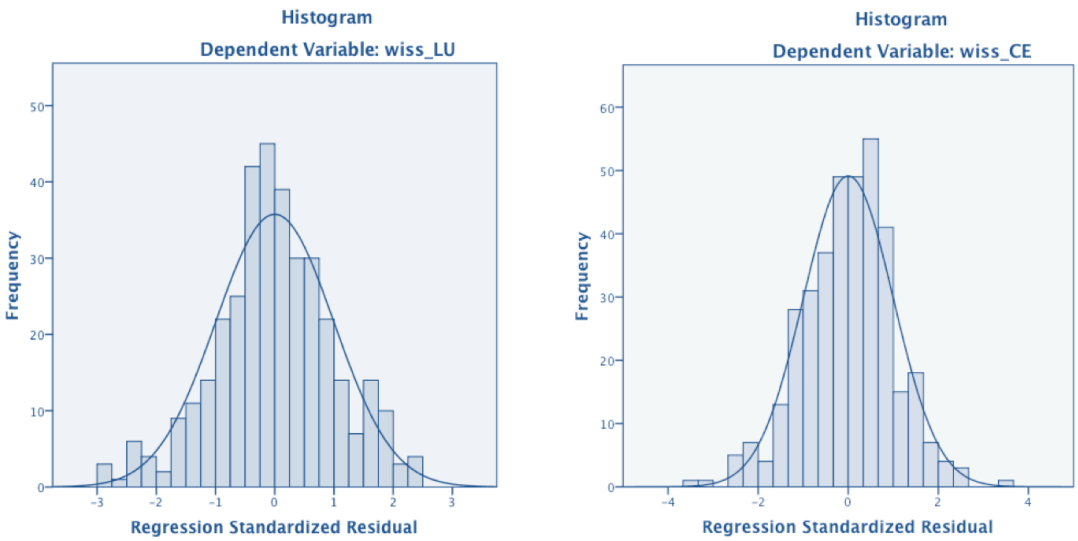
Figure 10: Homoscedasticity of Error Terms



Reference: SPSS Output

Assumption 6: Finally, it is checked if the error terms are normally distributed. Several mathematical tests for examination exist, for example, Shapiro-Wilk-test or the Kolmogorov-Smirnov-test. In this case, a histogram serves for visualizing a (non) normal distribution and will be used in the following.

Figure 11: Normal Distribution of Dependent Variable



Reference: SPSS Output

Following Greene's (2003) process of relaxing "the more restrictive assumptions of the model including [...] normality of the disturbances" (p.65), he states that normality of the residuals is not essential for accomplishing distributional results needed to allow hypotheses testing (ib.). Figure 11 shows the (non-normal) distribution of residuals of the dependent variable of Model 1 (lead userness) as well as Model 2 (cognitive empathy). Applying the central limit theorem[6] and provided that the regressors are "well behaved" (ib., p.67), it can be argued that the "asymptotic normality of the least squares estimator does not depend on normality of the disturbances" (ib.).[7] Thus, the interpretation of results can be conducted unrestrictedly.

Completing the data preparation and verifying the assumptions, no further transformation was necessary connoting that the proceeding to the next step, a descriptive and statistical analysis of the data is realizable.

4.6 Results

This sub-chapter serves to delineate both the results of the descriptive and statistical analysis. The descriptive analysis provides insights on sample characteristics comprising means, standard deviations and correlations. The statistical analysis outlines the determination coefficient and regression weights to be able to assess the model's significance and its meaningfulness. These analyses are essential to elaborate on the aforementioned hypotheses and to discuss the research questions accordingly.

4.6.1 Results of Descriptive Analysis

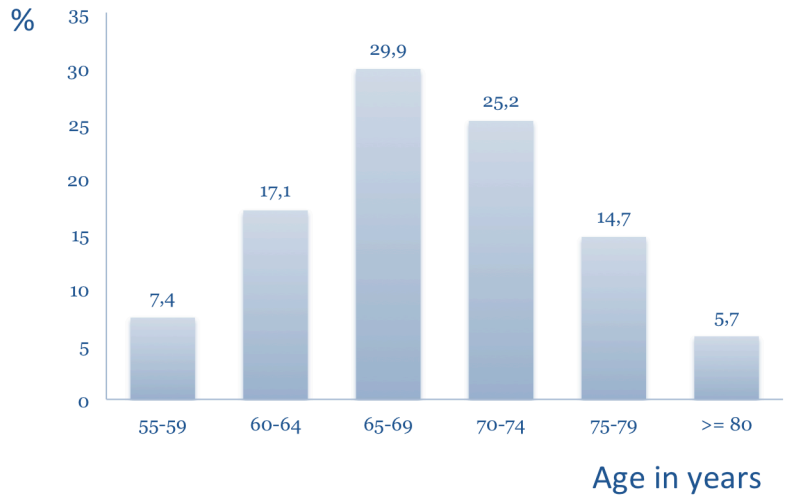
This section serves to present the results oft he descriptive analysis of the data collected, which mainly refers to the introduction of sample characteristics. It further deals with the introduction of means, standard deviations and correlations.

As figure 12 shows, chronological age is normally distributed. All age groups are present, ranging from 55 to 93 years with the median age being 69 years. Moreover, a significant increase from the age cohort 60 to 64 year olds and 65 to 69 year olds becomes apparent. 29.9 per cent of responses, almost one third, is collected from the 65 to 69 year olds, still the age cohort from 70 to 74 represents 25.2 per cent. 231 respondents are male whereas 139 are female. This sample is suitable to analyze the SiMa and roughly reflects proportionally a society's age distribution as discussed in Chapter 2.1.

[6] The central limit theorem says that provided a large sample size from a population, the average of observations follows a normal distribution over time.

[7] Asymptotic distribution is „ a distribution that is used to approximate the true finite sample distribution of a random variable" (Greene, 2003, p.1084).

Figure 12: Age Distribution of Sample



Reference: Own depiction

Self-perceived age of the respondents, introduced earlier as a measure of a respondent's subjective age perception, is analyzed as well as its correlation to chronological age. Barak and Schiffman (1981) computed self-perceived age by building the average of the four age dimensions. Enquiring the exact year of a respondent's subjective age perception, a midpoint value determination, for example for the decade given and selected as usually measured, is redundant. Table 7 presents the computed correlation of the self-perceived age dimensions and chronological age. All correlations are significant at the 0.01 level. The correlation coefficient further provides a direction of a relationship, which all show a positive tendency. Further, it can be seen that chronological age is strongly correlated to the biological dimension of self-perceived age. This suggests that the actual age has a strong impact on how individuals perceive their biological condition – their state of health. A somewhat weaker yet positive relationship is present between chronological age and intellectual age.

Additionally, the analysis indicates a median self-perceived age of 59 years and a mean of 58.48 years. Looking at each dimension specifically, the mean of 'interest age' is lowest (56.05 years), followed by 'feel age' with a mean value of 57.63 years. The sample's 'do age' yielded a mean of 58.74 years. The highest mean value resulted in the 'look age' with 61.52 years signalizing the lowest gap to their chronological age. In line with previous studies (Barak and Schiffman, 1981; Wellner, 2014), the results reveal that on average people perceive themselves around 11 years (mean value = 10.61) younger than their actual chronological age. This is proven due to the resulted negative value when subtracting the chronological age from the mean of the four self-perceived age dimensions. It has to be kept in mind, when critically assessing the self-perceived age

measure, that an inherently biased value can be expected due to the above-discussed reason – infected by societal desirability age perception is positively bias wishing for an active, healthy and socially integrated stage of life.

Table 7: Correlation Self-perceived and Chronological Age

Construct	Mean	Std. dev.	N	1	2	3	4	5	6
1 chronological age	69,09	6,73	370	1	0,694**	0,750**	0,677**	0,449**	0,564**
2 self-perceived age	58,48	8,1	370		1	0,831**	0,871**	0,850**	0,887**
3 biological SPA	61,52	7,44	370			1	0,765**	0,547**	0,636**
4 emotional SPA	57,63	9,8	370				1	0,583**	0,671**
5 intellectual SPA	56,05	10,75	370					1	0,726**
6 societal SPA	58,74	9,64	370						1

**. Correlation is significant at the 0.01 level

Reference: Own depiction, SPSS Output

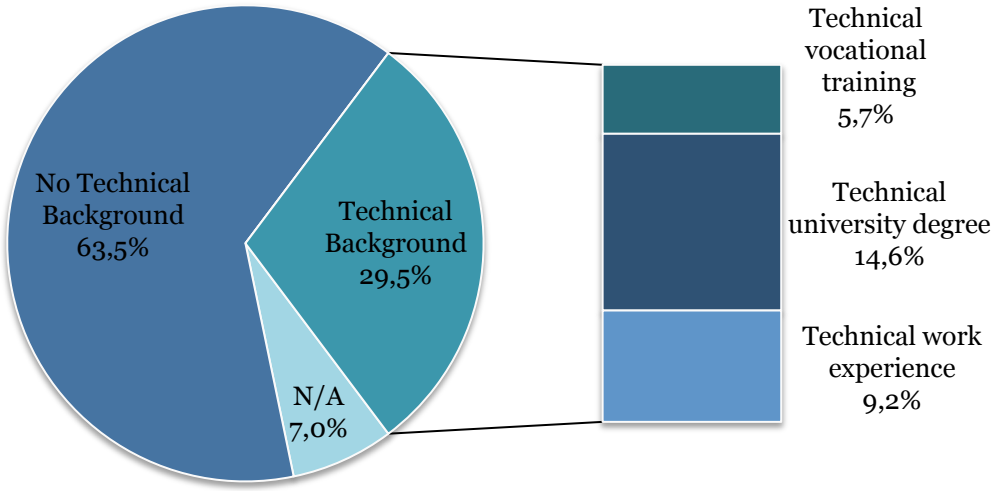
The net household income per month is an important variable to assess, since this indirectly reflects a SiA's possibility of travelling by air. As the sample's main reason for air travelling is vacation followed by visiting family and friends, a self-financing of travels can be assumed. Figure 13 is based on a sample size of N=249, 121 preferred not to reveal their net household income. 24.9 per cent have a net household income per month between EUR 2000 and EUR 3000. A net household income of more than EUR 5000 is indicated by 3.5 per cent. More specifically, 246 respondents answered the question on their share of disposable income, which is the portion of the net household income left after mandatory spendings like rent. Interestingly, the greatest share of respondents, 16.2 per cent, have about 21-30 per cent disposable income and 16.5 per cent refer to more than 40 per cent disposable income. This is confirms statistical findings, that SiA hold the highes share of discretionary income, "known to be buyers of premium products" (Szmigin and Carrigan, 2001, p.24). All in all, a relatively high share of the respondent's household net income is disposable and therewith facilitating frequent air travelling in old age though it is cost-intensive.

Figure 13: Income Distribution of Sample

Reference: Own depiction, SPSS Output

Additionally, the majority of the respondents[8] (63.5 per cent) do not have any kind of technical background gathered (→ Figure 14). Overall, 29.5 per cent do have a technical background, which can be divided in technical vocational training, technical university degree or technical work experience. Technical university is represented most with 14.6 per cent, followed by work experience in a job with technical specifications (9.2 per cent) and lastly technical vocational training (5.7 per cent).

Figure 14: Technical Background of the Sample



Reference: Own depiction, SPSS Output

[8] N=344

Table 8 summarizes the means, standard deviation and correlations. The Spearman Rank correlation coefficient has been computed for all correlations with use experience, technical background, net income and gender, due to the fact that these variables are not metric. All other correlations have been calculated using the Pearson correlation coefficient. The mean of divergent thinking is highest amounting to 4.07, which is considerably high taking the underlying Likert-Scale from 1-5 into account. It is followed by product-related knowledge with a mean of 2.86. Next to product-related knowledge, cognitive empathy shows the highest standard deviation (1.0609) indicating a fairly high range of this variable. The mean of lead userness is well below the other variables (1.89), a lower standard deviation (0.7729) indicates that the data is not as widely scattered.

The correlation coefficient indicates a direction of a relationship between two variables. Product-related knowledge, use experience, divergent thinking and cognitive empathy all show a significant positive relationship with lead userness. This confirms results found in extant literature and follows the argumentation provided in chapter 3. This effect is highest for product-related knowledge ($r=0.519$; $p=0.01$). A correlation coefficient of $r=0.394$ at the 1 per cent significance level confirms the positive relationship of cognitive empathy towards lead userness. Further, a positive significant relation between cognitive empathy and divergent thinking is present, which may be substantiated in the fact that both variables resort to an individual's cognitive style or structure and thus positively correlated. In line with the previous argumentation, is the negative, moderate yet significant relation between self-perceived age and cognitive empathy stating that as self-perceived age increases, the cognitive ability to empathize decreases. This tendency is also confirmed for the variable of chronological age. As already proposed above, chronological age and self-perceived age are strongly correlated ($r=0.694$; $p=0.01$) meaning that as people grow older the self-perception of their age increases as well. It has already been discussed in the assessment of the underlying regression assumptions (→ Chapter 4.5) that no multicollinearity is present.

As a side effect, the correlation shows that gender (male) positively correlates with technical background implying that rather male have a greater technical experience. Besides not yielding a significant correlation, it is surprising that product-related knowledge and technical background are not strongly correlated ($r=0.008$). The reason may be that technical expertise can be either very domain-specific or range to very general and thus not always knowledge on a specific product or service can be implied. Finally, use experience and net income show a positive significant relationship ($r=0.137$; $p=0.05$), supporting the aforementioned argumentation that with increasing net income of a household use experience, namely enhanced frequency of air travelling, increases.

Table 8: Descriptive Statistics and Correlation Overview

	Construct	Mean	Std. dev.	N	1	2	3	4	5	6	7	8	9	10
1	Lead Userness	1,8935	0,7729	358	1	0.519**	0.173**	0.253**	0.394**	-0.077	-0.108*	0.042	-0.002	-0.019
2	Product-related knowledge	2,8615	0,9579	349		1	0.253**	0.301**	0.295**	-0.184**	-0.157**	.162*	-0.050	0.008
3	Use Experience	8,9352	9,6199	355			1	0.006	0.059	-0.044	-0.076	0.137*	-0.043	-0.037
4	Divergent Thinking	4,0665	0,7264	358				1	0.450**	-0.074	-0.044	0.151*	-0.029	0.027
5	Cognitive Empathy	2,5438	1,0609	358					1	-0.165**	-0.150**	0.069	0.011	0.047
6	Self-perceived Age	58,48	8,0992	370						1	0.694**	0.053	0.136**	0.017
7	Chronological Age	69,09	6,7342	370							1	0.038	0.196**	0.1
8	Net Income	2592,37	1175,824	339								1	0.060	-0.087
9	Gender (male)	0,623	0,4853	370									1	0.367**
10	Technical Background	0,2946	0,4659	370										1

** correlation is significant at the 0.01 level (2-tailed). * correlation is significant at the 0.05 level (two-tailed)

Reference: Own depiction, SPSS Output

4.6.2 Results of Statistical Analysis

To conduct a regression analysis, the general model has to be defined first (→ Figure 5 and 6) followed by the estimation of parameters. The equations (1-5) built above for testing the hypotheses are estimated applying moderated hierarchical regression models and to test for interaction effects. The author controlled for age, net income and technical background in model 1 and both age and gender in model 2.

When interpreting regression results two main issues need to be considered (Saunders et al., 2009): (1) Which predictors are significantly related to the dependent variable and what direction do they indicate? (2) Do all predictors combined significantly related to the dependent variable and how strong is the relationship? Therefore, attention is set on the evaluation of regression weights and the determination coefficient R^2 in the following.

Assessing *Model 1*, which incorporates hypotheses H1 to H6, the moderated hierarchical regression results for lead userness are displayed in table 9. Overall, 26.42 per cent of the variance of lead userness can be explained in Model 1. Including the independent variables in block 2, they significantly add to the variance explanation ($\Delta R2 = 0.264$), whilst adding the interaction term only contributes very little ($\Delta R2 = 0.007$). The F-statistic is significant for the second block resulting in a conclusion that not all null hypothesis (estimate equals zero) can be rejected.

In the first block control variables are entered, followed by the predictor and moderator variable and subsequently the third block contains the product of predictor and moderator. The parameter computed for use experience is not significant. Therefore, H1 has to be rejected. The analysis reveals that product-related knowledge is positively and significantly related to lead userness ($\beta = 0.495$; $p=0.001$). Hence, H2 can be accepted. The estimated parameter for divergent thinking is not significant, thus H3 stating a positive relationship of divergent thinking to lead userness has to be rejected. Similarly, none of the interaction terms are significant. The interaction term of product-related knowledge ($\beta = -0.419$), use experience ($\beta = -0.012$) and self-perceived age is negative whereas the interaction term of divergent thinking and moderator yields a positive regression weight. H4, H5 and H6 concerning the interaction effect have to be rejected.

Table 9: Model 1- Regression Results Lead Userness

Block	Coefficient	Estimate	t-value	p-value	adj. R^2	F-statistic
	Intercept	2.637	5.897	<0.001***		
1						
Control variables	Chronological Age	-0.087	-1.542	0.124	0.009	0.959
	Net Income	-0.037	-0.662	0.509		
	Technical Background	0.009	0.162	0.871		
2	Self-perceived Age	0.026	0.388	0.698	0,264	28.072***
Predictor	Product-related knowledge	0.495	9.212	<0,001***		
	Divergent Thinking	0.015	0.285	0.776		
	Use Experience	0.066	1.309	0.191		
3						
Interaction Term	DT x SPA	0.656	1.411	0.159	0,007	1.043
	PK x SPA	-0.419	-0.992	0.322		
	UE x SPA	-0.012	-0.029	0.977		

Significance Level: *p<0.05; ** p<0.01; ***p<0.001. N=317

Reference: Own depiction, SPSS Output

Model 2 explains 17.5 per cent of the variance of cognitive empathy; results of the regression analysis are consolidated in table 10. The second block enhances the explanation of variance by 15.1 per cent. The change in R^2 equals 0.012 when including the interaction term. Nevertheless, McClelland and Judd (1993) found that even very small changes in the determination coefficient can be meaningful. The F-statistic for the three blocks included in this model is significant. Hence, the null hypothesis that estimates equal zero can be rejected.

The coefficient of lead userness is positive ($\beta = 0.381$) at the 0,001 per cent significance level indicating a positive relationship between lead userness and cognitive empathy. Therefore, H7 can be accepted. The coefficient of self-perceived age is negative ($\beta = -0.116$) and not significant, whereas the interaction term lead userness x cognitive age is significantly positive ($\beta = 0.811$) at a level of 0.05 per cent. Therewith the strength of the relationship between lead userness and cognitive empathy depends upon cognitive age. As the regression weight is significant and positive, their relationship is more positive at high moderator values. H8 has to be rejected since a negative moderation was hypothesized. The interaction graph (→ Figure 15) serves to illustrate the relationship between the independent and dependent variable at high and low values of the

moderator.

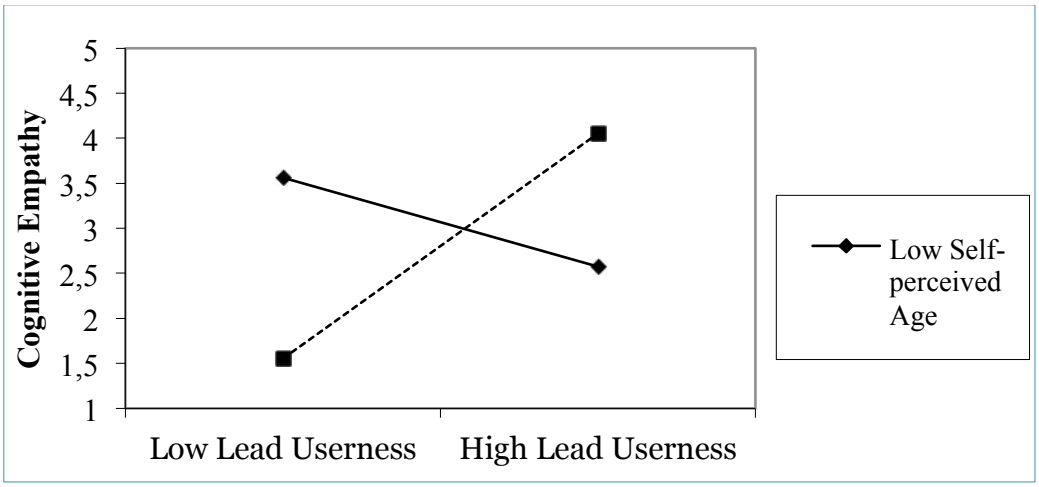
Table 10: Model 2 - Regression Results Cognitive Empathy

Block	Coefficient	Estimate	t-value	p-value	adj. R^2	F-statistic
	Intercept	4.209	7.333	<0.001***		
1	Chronological Age	-0.159	-2.965	0.003**	0,019	4,419*
Control variables	Gender (male)	0.044	0.827	0.409		
2	Lead Userness	0.381	7.831	<0.001***		
Predictor	Self-perceived Age	-0.116	-1.734	0.084	0,166	32,222***
3						
Interaction Term	LUNxSPA	0.811	2.281	0.023*	0,175	5,204*

Significance Level: *p<0.05; ** p<0.01; ***p<0.001. N=358.

Reference: Own depiction, SPSS Output

Figure 15: Interaction Graph - Model 2



Reference: Own depiction, SPSS Output

5 Discussion and Conclusion

This study aimed at both verifying existing research on characteristics of LU in the silver market and expanding the research field by focusing on a Silver Ager's cognitive style and structure as an impact on and result of lead userness. This thesis further proposed to broaden the understanding of an individual's self-perceived age and its impact on determinants and consequences of lead userness. On the basis of the three established research questions in chapter 3, the empirical findings will be discussed in the following. For this purpose, table 11 consolidates the hypothesized and actually resulted findings of the empirical study undertaken. Nevertheless, the discussion and interpretation of results should be done with caution due to biases (e.g. non-response bias, common-method bias) this study is confronted with and limitations of the study design (→ Chapter 6.3).

Table 11: Summary of Hypotheses

	Relationship	Hypothesized	Resulted
H1	UE-LUN	+	n.s.
H2	PK-LUN	+	+
H3	DT-LUN	+	n.s.
H4	PK-SPA-LUN	-	n.s.
H5	UE-SPA-LUN	-	n.s.
H6	DT-SPA-LUN	-	n.s.
H7	LUN - CE	+	+
H8	LUN- SPA- CE	-	+

Reference: Own depiction

RQ1 Do the antecedents use experience, product knowledge and divergent thinking have an impact on the lead userness of a Silver Ager?

This research question can be answered by examining the hypotheses H1, H2 and H3, which test the relationship between the determinants use experience, product-related knowledge and divergent thinking (Model 1). Overall, the results demonstrate that a considerable amount of the variance on lead userness can be explained by the above-mentioned variables (26 per cent).

H1 investigates the relationship between *use experience* and lead userness, which is rejected. Contrary to the findings of published academic studies, suggesting that use experience has a significant positive impact on lead userness (Faullant et al., 2012; Schreier and Prügel, 2008; Franke et al., 2006), the regression weight in the study at

hand was not significant, though a positive tendency is indicated by a weak positive correlation coefficient. Wellner (2014) found that the impact of use experience on innovative behavior shows a non-linear effect when investigating the SiMA resulting in a decrease of its impact with size. That means, as use experience increases, its positive impact on innovative behavior diminishes. This is due to the fact that use experience accumulates as time passes, i.e. older users have gained more use experience on average, consequently leading to less of a competitive advantage (ib.). An additional explanation is the effect known as functional fixedness, which has been associated with the silver market population (→ Chapter 3.2.3) and that narrows the view on and use of products or services and the ability to think outside the box (Simonton, 2003) – which in return can limit use experience as years go by. However, Lüthje and Herstatt (2004) question the relevance of functional fixedness regarding lead users in age-independent considerations, yet it may increase in importance analyzing SiA due to routine behaviors and familiarity collected over the years.

The relationship between *product-related knowledge* and lead userness is tested in H2. As this hypothesis can be supported, product-related knowledge is shown to have a positive impact on lead userness in the silver market. This is in line with previous findings researching other, not specifically restricted, age cohorts. Thus, it can be confirmed that a Silver Ager's knowledge on product architecture and materials as well as technologies used to design an existing product is related to lead userness. Wellner (2014) mentions the relative trend advantage (lead user component 'ahead of trend') that has a strong influence on the dissatisfaction with products on the market due to the fact that "products must fulfill the high standards of a trendsetter and must additionally cater to the added requirements that come with age" (p.169). Product-related knowledge may has several effects: For one, it leads to the ability to identify restrictions of product usage earlier on and secondly, it can be applied to identify alternative products to fulfill the same needs. The author additionally states the dimension of free time and financial funds of the elderly that facilitate to opt for alternative products.

H3 analyzes the relationship between *divergent thinking* and lead userness, which could not be accepted. This variable sheds light on the concept of creativity of the elderly as an antecedent to lead userness. Therewith, the creative potential of the elderly in the domain of air travel linked to an individual's level of lead userness could not be proven. Due to the nature of this construct, which has been adopted from the research field of creative psychology, several more in-depth ways to measure it exist in literature. Therefore, next to a theoretical explanation, a methodological scrutiny is discussed.

Research findings diverge: On the one hand, the usefulness of divergent thinking tests has already been questioned in the past by analyzing its face validity (Sternberg, 1985). Furthermore, it has been found that "some divergent thinking tests, administered under some conditions and scored by some sets of criteria [are valid] in some domains" (Harrington, 1981, p.447 as cited in Reese, Lee, Cohen and Puckett, 2001). On the other hand, a great amount of studies demonstrated construct validity of tests applied and therewith their usefulness. In psychology literature, three divergent thinking abilities exist: originality, fluency and flexibility (Reese et al., 2001; Jaquish and Ripple, 1984). Indeed, originality has been identified as a distinct dimension of divergent thinking (Goff, 1992). Exemplary, 'word association' and 'alternate uses' tests can be performed to assess divergent thinking variables (Reese et al., 2001). Though construct validity is present in the study at hand, a more detailed test (rather than a mere scale measurement) of divergent thinking abilities and treating its dimensions separately may lead to significant, meaningful results and better reflect the construct's psychological nature.

A theoretical explanation – similar to the explanation on use experience – can be traced back to the issue of functional fixedness SiA might be faced with. The elderly are more prone to restriction to think outside the box. SiA are then limited to find solution patterns that are beyond the current or ordinary, and vary to the ones experienced in the past. An essential role plays the circumstance of getting stucked in rigid routine behaviors and resting on familiarity as human beings are creatures of habits: elderly users may quickly become content with the present situation. It is important to notice, that this study examined a very specific age cohort and industry contrary to the study pursued by Faullant et al. (2012) in which this effect was found to be significantly positive.

Quite possibly, studies relating to lead userness have been replicated and adjusted in the past yielding similarly insignificant results that have not been published (referring to the file drawer problem). That is, studies conducted might never be reported as they may contain deviating, divergent results other than commonly published. In this study, the absence of significant impacts might be rooted in the homogeneous profile of the sample as well as the selection of the sample and the data collection process. Concluding, this research question can partially be answered positively as product-related knowledge shows a significant positive impact on lead userness among SiA.

RQ2 Is there a relationship between lead userness and cognitive empathy? Do Silver Agers with a higher degree of lead userness show a more distinct predisposition to cognitive empathy?

Taking a closer look at H7 supports the evaluation of the second research question. As the regression weight is positive and significant, H7 is supported. The moderately positive coefficient relegates to the indication, that as the level of lead userness increases, *cognitive empathy* increases as well. The explanation of the relationship between lead userness and cognitive empathy can be rooted in the following: LU, as defined in section 2.2.2, expect high benefits from an innovation and thus feel the need to solve a problem; they are also ahead of trends (second characteristic) in a marketplace, thus facing this need before the bulk of a population does (von Hippel, 1986). As the majority encounters this problem at a later time, lead users are able to take their perspective and empathize with them. Learning effects and the confrontation with similar problems at an earlier time facilitates this cognitive ability in the silver market population. This is in line with Schweisfurth and Herstatt's (2013) findings, who investigate this relationship in the context of employees and embedded lead users.

Summarizing, it can be assumed that there is a significant relationship between lead userness and cognitive empathy of SiA indicating that higher lead userness leads to a higher level of cognitive empathy.

RQ3 Does self-perceived age moderate the relationship between antecedent and consequence of lead userness?

To what extend does self-perceived age impact determinants and consequences of lead userness in the Silver Market population (How strong is the moderating influence)?

This research questions seeks to identify whether self-perceived age moderates the influence of determinants and consequences of lead userness. To respond to the third research question, H4, H5, H6 and H8 are examined. Apart from H8, testing the influence of self-perceived age on the relationship between lead userness and cognitive empathy, none were significant.

The effect of *use experience* and *product-related knowledge* on lead userness moderated by self-perceived age has not been proven to be significant. The magnitude of the regression weight is little and correlation coefficient is moderately negative. A reason might be that travelling is one of the activities impacted by rising age. The older a person feels and behaves (dimensions of self-perceived age) and the more constraints he or she

has, the less he or she is driven to undertake the exertions of travelling by plane. In this specific context, since air travelling is not a routine day-to-day activity, the impact of use experience and domain-specific know-how on lead userness decreases with age.

Despite the often physical and mental constraints that occur with age (→ Chapter 2.1.4), some characteristics contradicting and challenging those are especially found to be relevant if the ultimate process step is new product development involving SiA. In this context, the role of divergent thinking and cognitive empathy was highlighted. It has been argued, that with rising age the cognitive structure is reduced, unvaried monotonous thinking occurs and being trapped in thinking patterns of previous times is common. Investigating *divergent thinking,* a possible explanation for the insignificance of the parameter (92.5 per cent that the parameter value occurred by chance alone) and the possible range it may can take lies in the characteristic of divergent thinking, which is rooted in creative psychology and individual creativity. In the past, more research has been conducted on creativity and age, however "the presumed relation of creativity to divergent thinking implies that the age difference should be similar" (Reese et al., 2001; p.491). In this context, Simonton (1990) states that the quality of any creative manner "neither increases nor decreases with age" (p.630). Creativity itself does not correlate with time. McCrae et al. (1987) stress the existence of individual differences, which does not allow for generalizing within an age cohort instead it depends on personal development.

Reese et al.'s (2001) results indicate a curvilinear relationship of age towards fluency and flexibility (as two dimensions of divergent thinking). Before it declines, divergent thinking abilities peak at middle aged (40-50). The mean of self-perceived age in this study is 58.48 years signifying diminishing abilities of divergent thinking. As the authors examined four age groups, which implies a greater age range, significant main effects were achieved. The insignificance of results can be rooted in the limited age range of the study focusing on respondents, who are 55 years and over (as it is with all other investigations of moderating effects). Overall, controversial results on the impact of age on creativity and divergent thinking in particular are present in literature, whereas in the specific context of air travelling no relationship could be verified.

Though the moderating effect of self-perceived age on lead userness and *cognitive empathy* is significant, it is contradicting to the negatively hypothesized relationship in chapter 3.2.5. Therefore, H8 has to be rejected. Seeking an explanation, another approach on empathy with increasing age is adopted. Although the author argued theoretically that cognitive empathy resulting from lead userness declines with rising

(subjective) age perception, the statistical analysis did not confirm this. Rather, as SiA grow and perceive themselves older, the relationship between lead userness and cognitive empathy is more positive. Here, too, the reason of the insignificant result can be two-fold: the study design (only 55+) and the measurement of the construct. A simple three-item approach to cognitive empathy has been chosen, whereas a more comprehensive experimental setting such as implemented by Maylor, Moulson, Muncer and Taylor (2002) would provide deeper insights. Furthermore, none of these studies on cognitive empathy and related concepts were specifically tested in the context of the LU theory. The findings are mostly based on "cross-sectional studies rather than longitudinal research" resulting in "limited systematic knowledge about the development of empathy across the adult years" (Grühn et al., 2008, p.754).

Adopting a theoretical perspective, the existence of divergence in literature as mentioned before contributes to the explanation: While the researcher decided to follow the path on declines in cognitive empathy with rising age, Happé et al. (1998) and Maylor et al. (2002) argue that there is an improved theory of mind[9], an overlapping concept with cognitive empathy, as age increases. Given that their argumentation provides a reasonable explanation in the study's context, it could be concluded, the older someone perceives him- or herself, the more empathic he or she becomes. Transferring this to the field of lead userness, it may be the case that as self-perceived age increases, needs and desires of the older LU become more homogeneous, more specific, more situation and product specific, and more restricted in the context of air travelling. Due to the presence of functional fixedness that decreases with rising age because of declining creativity (Simonton, 1988), the spectrum of empathizing narrows down as well and the ability of empathy is no longer all-embracing but rather particular. Leveraging on Bailey and Henry (2008), a more thorough study on cognitive declines (cognitive empathy, perspective-taking and theory of mind as related concepts) among lead users as they grow older is needed to investigate this line of argument.

Concluding, Wellner (2014) neither found a moderating influence of chronological nor of self-perceived age in the context of elderly user innovators. Therewith, confirming partially the negligibility of the moderator effect, which has been tested in this study. In this specific context, self-perceived age strongly moderates the relationship between lead userness and cognitive empathy whilst the other moderating influences are not significant. The insignificance of the interaction effect may be rooted in the following: It is possible that the moderator effect is gradual and that assessing the total effect over a

[9] Theory of mind refers to a person's „abilitiy to attribute mental states (Maylor, Moulson, Muncer and Taylor (2002, p.465).

greater period of time might demonstrate a difference between early and late adulthood, namely a wider age range (Wellner, 2014). Further, it is argued that differences between age cohorts may go off within one specific group which, following researchers on the silver market phenomenon, would be the 50s (ib., Kohlbacher and Herstatt, 2011). In this study, the moderating effect was only tested at one point in time based on a sample including elderly from 55 years and over, the age difference and the perception of age (as SiA perceive themselves on average eleven years younger, standard deviation of approximately eight years) shows a small dispersion and age range. To cover a wider age range, a more comprehensive research is necessary.

The conclusions drawn have to be valued with caution as the low but expected to be present nonresponses bias can "undermine the *actual* generalizability of the collected data" [emphasis original] (Rogelberg and Stanton, 2007, p.196). In the specific context of this study researching air travellers in the silver market – a sector of industry that has not been investigated until now – determinants and consequences of lead userness in the silver market were chosen to reflect side effects of aging as well as compulsory antecedents based on established literature. No threshold, for example, when declines start or when behavior and interests change, is set by nature. As the factor age however gains in importance for both, an individual and for societal embeddedness as people grow older (yet it is experienced differently and subjectively by every person) a measure has been implemented that refers to the self-perception of age. Although it seems like an essential and easy-to-grasp concept, it may not be that straight-forward. Its pure impact could not be verified in this study. Not surprisingly, people perceive themselves younger than they actually are: the self-perceived age measure is inherently biased tending to follow a (self-imposed) societal and medial pressure.

6 Contribution and Implications

The final chapter extracts the contribution relevant to academia by linking it to previous research as well as the managerial implications and precise recommendations of the study underlining the relevance and timeliness of the topic. Although, the research is conducted thoroughly, limitations are analyzed as outcomes of the regression analysis should be construed carefully. Finally, future research suggestions, especially, concerning the framework of the entire project, are outlined.

6.1 Theoretical Contribution

This section elaborates on the study's contribution to academic research. Firstly, it enriches the research on LU theory by providing profound insights on the determinants and consequences of lead userness. Secondly, the research field around the SiMa phenomenon is addressed.

In the beginning, it was emphasized that this study understands the LUM as an innovation management tool approaching (new) product development. Kohlbacher and Herstatt (2011) point out that despite the relevance and significant implications of the demographic change only scarce research in business studies exists, and more specifically there is a lack in empirical research. This quantitative study bridges the gap between the often independently researched fields on the consequences of aging conjunct in the field of Gerontology and the scope of innovation management.

The author argues to include variables of cognitive style and structure to enhance the understanding of the lead user concept and therewith extent existing studies. In this context the chosen antecedents and consequences were aligned with declines occurring with age. Faullant et al. (2012) called for validation in other industrial contexts; their findings on divergent thinking, based on Amabile's theory of creativity, as an important determinant of lead userness in the silver market was not particularly confirmed in the context of this study. This empirical study further investigates the cognitive structure of an individual, providing new insights on a considerable field-independent consequence of lead userness in the silver market. Lead userness has been proven to positively impact cognitive empathy, a factor that should be considered when research is bound at investigating new products, which aim at satisfying needs of a majority.

This study has shown that findings of previous studies on established determinants of lead userness (e.g. use experience) could not be transferred to the context of the silver market per se. The impact of product-related knowledge however has been *confirmed*.

Therefore, it is suggested to carefully and individually choose the determinants of lead userness – relating to an industry and the particular subject of analysis – as previous findings do not allow for generalizing findings across all age cohorts and industries. In the past, SiA have just been another segment within a sample, which, especially in organizational studies, did not exceed the age of 65 (retirement) and are not construed to investigate the mere phenomenon on the SiMa. Due to the timeliness of the topic and the findings that are distinct from non-age related studies, research solely focusing on the SiMA segment and its impact is advisable. Hence, do not lump them all together as differences due to age can be meaningful. However, it is conceivable that other influencing and contingency factors beyond age exist when considering the SiMa. Finding the SiMa segment to be very heterogeneous in general, physical power and mental capabilities, social status and wealth incur interest (Wellner, 2014).

6.2 Managerial Implication

After introducing the theoretical contribution, impacts of the study for managers operating in the area of innovation management in the aviation industry and for airlines representing an industrial goods sector or service as well as specific recommendations are compiled in the following section.

Overall, the thesis provides findings to educate managers on how to deal with the demographic change and demonstrate a way on how to adapt to new product development making use of the studied cognitive factors of the elderly. In practice, planning and implementing an NPD project involving multiple parties requires a careful allocation of resources, especially time, funds and human resources. Lehnen, Ehls and Herstatt (2014) state that, although the LUM has a clear position in academia, its "implementation into management practice is ambiguous" (p.2) and still not anchored in practice at all. This study is a step forward to utilize the potential inherent in SiA by assessing appropriate factors related to lead userness.

Empathy is a concept known in various fields of research e.g. international business, pedagogy, sociology or psychology; it also deserves an embedded place in innovation management. That is why it is important that mangers realize the relevance of empathy, how it is affected by an individual's level of lead userness and to ultimately better understand their customers, increasing the realization of their needs. Having the knowledge that lead userness drives cognitive empathy in the silver market, helps to better understand the scope of users to be involved when seeking empathic co-creators. The identified LU who are integrated in the NPD process may reduce the risk of product

failure due to their specific characteristics (→ Chapter 2.2.1). As the results of the study expose, only product-related knowledge was found to drive lead userness in the silver market. Still, a positive relationship of cognitive structures like divergent thinking ability and cognitive empathy towards lead userness was shown. Concluding, three main recommendations for managers can be drawn:

1 Not all prevalent characteristics of lead userness seem to be as relevant in the detection of LU in the silver market as in an age-independent allocation.

2 Individual creativity characteristics are important to reflect when Silver Ager LU are to be identified.

3 When seeking individuals with high cognitive empathy, the level of a Silver Ager's lead userness is to be kept in mind as a significant determinant.

6.3 Limitations and Future Research

Even though the research design has been set up carefully and is based on previous, well-established literature, this thesis is not without limitations, which are demonstrated in this section. Corresponding suggestions for future research on this topic are provided.

Research Design

Since a regression analysis only proves the existence of a relationship but not causality, which often is longitudinal or cross-sectional, a more comprehensive investigation would round off the research. The study is based in Germany, thus no general conclusion across cultures can be drawn. Depending on the construct examined, *cross-cultural* similarities or disparities have already been detected in previous studies. A cross-cultural study among American and Chinese identified differences of divergent thinking abilities (Jaquish and Ripple, 1984). However, studies on the topic of self-perceived age did not identify differences in nationality belonging and therewith show cross-cultural generalizability (Barak, 2009; Auken et al., 2006). Possibilities to broaden the research horizon are to transfer and repeat the study with other nationalities therewith identify potential differences across nationalities of empathic LU. Also, when interpreting the results, one has to keep in mind that the underlying *context* of the research is the aviation industry with the focus on the user experience of SiA air travellers. Hence, a very specific field of industrial goods and service, respectively, is examined that does not fulfill all common characteristics as proposed in standard works such as Schreier and Prügel

(2008). The findings of the thesis cannot be applied to other branches. Implementing a *longitudinal* study would especially facilitate the examination of the impact self-perceived age has on LU characteristics. That way, it would not be a comparison across age cohorts, but rather a treatment of the self-perceived age development for each person over an extended period of time.

Data Collection and Sample

The data collected was based on an email distribution list of a Senior Association, to which the elderly can subscribe in form of a newsletter. Concerning the distribution of survey invitations, the researcher relied on the PR agency of the association, which only allowed contacting the entire community without any possible differentiation (e.g. age). Due to the dependence on the database of the Senior Association, a split into sub-samples was not feasible in order to avoid further bias (Dillman method). Therefore, the sorting to fulfill the criteria of 1) being 55 years or above and 2) experience with air travel had to be done ex post possibly enhancing the bias. Additionally, results could be more powerful and significant if a wider age range was considered in the sample, which would have lead to stronger pronounced and distinct differences across age cohorts allowing to draw comparisons among them.

In this context, a *same-source* and *common-method bias* is possibly present which is caused by the fact that all measures for the dependent and independent variables are collected from the same source and method (this means one person answered questions on both variables in one survey). As a result, it is likely that the correlation coefficients as well as the regression weights are inflated. Since this study involved elderly respondents, it is assumed to face a *non-response bias* from which however a great portion can be reduced to passive non-response, as "the vast majority of nonresponse can be classified as being passive in nature" (survey mislaid, forgot about it, did not receive it etc.) which Rogelberg and Stanton (2007, p.20) do not find to create bias. Additionally, the deletion of cases rather than imputation of values in the context of data preparation has been implemented due to the fact of bias reduction. Nevertheless, its existence cannot be fully eliminated as case deletion can cause bias as well.

Integration and Measurement of constructs

Although, the decision on the integration of constructs as well as their measures is based on a thorough literature research, a mere assessment of some constructs via Likert-type scales might not be sufficient enough. As mentioned in the discussion (→ Chapter 5), assessing psychological constructs like divergent thinking and cognitive empathy on a

more experimental (face-to-face) basis may lead to more meaningful results. As specialized studies on these constructs show, there are different dimensions to each of them that might be better assessed in a personal environment (instead of an online-survey). For example: As Sleeswijk Visser and Kouprie (2008) point out, empathy consists of an affective and cognitive component, which both should be balanced to maximize the outcome. Thus, "empathic responses are formed by a combination of thoughts (i.e., cognitive aspects) and feelings (i.e., emotional aspects)" (Grühn et al., 2008, p.754). This thesis only tested for the cognitive component on the part of the user, which yielded significant results. An additional study integrating the second component in the research model is suggested to fully capture the extent of the empathy construct and to further enhance the understanding of the lead user construct.

Retrospectively, the measure of use experience as a single-item construct could be more precise by either asking the respondents to indicate the number of flights on a continuous scale or to provide a Likert-type scale that might reduce biased responses and facilitates the regression analysis. Considering the choice of moderator, its influence is questionable, since the effect is infinitesimal. However, McClelland and Judd (1993) state that, depending on the context, even a small change in R^2 caused by a moderator can be meaningful. Contrary, Jaccard and Turrisi (2003) argue that a moderator variable is appropriate when the interaction effect significantly contributes to the explained variance of the model in the third block. The implemented moderator self-perceived age only shows limited significant results. Thus, sticking to the 'age variable' it is to consider including other age measure like functional age (Anstey, Lord and Smith, 1996) or chronological age, which may lead to different findings in upcoming studies. Including the variable 'age difference' as a moderator, i.e. chronological age minus self-perceived age, did not significantly other results in this study. However, as learnt above a mere segmentation of the heterogeneous silver market segment according to their age or the perception of their age may not capture its full extent. Therefore, a moderator variable representing a somewhat more behavioral or societal approach might be suitable.

Regarding the measurement of lead userness, the researcher has chosen to not treat AOT and HBE as two distinct dimensions of lead userness. Therewith, following the approach of Morrison et al. (2004). The inter-item correlation matrix (→ Table 4) however shows that overall items associated with AOT converge as well as items measuring HBE highly correlate (opposed to Morrison et al.'s (2004) findings). Applying the alternative of Franke et al. (2006), namely measuring lead userness with AOT and HBE as two conceptually independent dimensions, might enhance the understanding of the components in the study's context.

Data Analysis

The author applied a moderated hierarchical regression analysis. Therefore, the conceptual framework was divided into two models for hypotheses testing. An alternative approach that could be implemented is structural equation modeling (SEM) useful to study complex models with many latent variables and hypothesized relationships (Hair et al., 2010). That way, the model does not need to be split. Compared to a linear regression, SEM does not ask for a normal distribution assumption. Not all variables are normally distributed as aforementioned, yet the central limit theorem was applied to allow interpretation of the results. SEM can further handle smaller sample sizes as well as formatively measured constructs such as use experience.

Future Research Suggestion

Another aspect of the future research notion lies in the main research body (→ Figure 5) of the entire project. The project will be continued identifying the impact of the antecedents and the consequences of lead userness researched in this study. In general, it is to be investigated how the quality of empathic design workshop outcomes can be improved. Thus, it is important to realize the possible impact of LU and their essential characteristics when integrating users in empathic design. Schuhmacher and Kuester (2012) conducted a study researching the "quality of submitted ideas in idea contests" (p.429) and assumed that "ahead of trend, dissatisfaction, use experience, consumer knowledge, involvement, intrinsic motivation and an extrinsic reward" (ib.) impact the quality significantly. The extraordinary intrinsic motivation of LU has been the topic in many studies (Bilgram, Brem and Voigt, 2008; Kratzer and Lettl, 2008; Faullant et al., 2012; Schuhmacher and Kuester, 2012). Beyond intrinsic motivation, the role of rewards triggering participation in co-creation is significant and cannot be neglected, though its effectiveness is not yet clear in research (Ryan and Deci, 2000; Füller, 2010). It has thus not been further considered in this thesis. However, it is interesting to include when it actually comes to the user involvement in the project's design workshops. Moreover, it is said that LU create more novel, innovative ideas (Lilien et al., 2002; Franke and Shah, 2003), which could promote their involvement in empathic design. A proposition to be investigated could be as follows:

Proposition 1: Silver Agers high in Lead Userness are more suitable for integrating and more willing to participate in NPD processes through empathic design workshops.

In empathic design studies, the focus is often set on the design team composition and their abilities (Kouprie and Sleeswijk Visser, 2009). It is argued that empathy on the part

of the designer enhances the outcome (ib.). Little is said about the characteristics of (lead) users participating in such workshops. As empathic design is a user-centered design approach, not only the characteristics and skills of the design team members but also the participant's characteristics should be of great importance, since they provide the essential input. Now, if not only the designer but also the LU shows a great amount of empathy, i.e. the users ability to empathize with other users, the success of the product is increased significantly, thereby reducing the risk of market failure. Caused by the fact that LU already experienced problems and encountered difficult situations earlier than others and "faced needs that will become general in a marketplace" (Schuhmacher and Kuester, 2012), LU are able to take the perspective of other users thus producing prototypes fulfilling the needs of the majority of users in a particular market. Therefore, the users to be involved in the process should be selected carefully leading to the following proposition.

Proposition 2: Elderly LU who also score high in cognitive empathy contribute substantially to the outcome of empathic design workshops leading to prototypes suitable for the majority of users.

The workshop design can leverage on the thesis' findings by involving elderly LU with different characteristics, i.e., on the basis of a differentiated involvement of LU groups, who scored high and others who scored low in cognitive empathy. Thereby, the so far only theoretically formulated proposition can be tested empirically to connect both LU theory and empathic design. It is a first step to identify and leverage the potential of Silver Agers, to work *with* them instead of working *for* them and to be able to consequently co-create silver products customized to the needs of the target group.

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Appendix

Appendix 1: English Questionnaire

Introduction

Thank you for taking 15 minutes to answer this questionnaire by Hamburg University of Technology.

With this survey we wish to explore what experiences you have encountered with your air travels: From buying a ticket to entering the airplane to leaving the airport.

What is good already and what can be improved?

We raffle off 10x 20 EUR/USD Amazon vouchers among all participants who completed the survey!

All data is evaluated anonymously and strictly confidential. If you want to participate in the prize draw, please enter your email address at the end of the survey.

Thank you for participating and good luck with the prize draw!

***1. What is your country of origin?**

***2. What is your age?**

***3. Have you ever travelled by plane?**

- [ ] Yes
- [ ] No, please specify the reasons:

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Appendix 1: English Questionnaire contd.

Your flying habits

***4. When did you start travelling by airplane?**

- Before 1960
- 1961-1965
- 1966-1970
- 1971-1975
- 1976-1980
- 1981-1985
- 1986-1990
- 1991-1995
- 1996-2000
- 2001-2005
- 2006-2010
- After 2010

***5. How many times did you travel by air in the last 5 years?**
Please count each round trip as 1 time.

- 0-5 times
- 6-10 times
- 11-15 times
- 16-20 times
- 21-50 times
- 51-100 times
- > 100 times

***6. What is the main reason for your air travels?**

- Going on holiday
- Visiting friends/family
- Going on business trips
- Other (please specify)

***7. What is the average flying time of your air travels (one-way)?**

- Less than 3 hours
- 3-6 hours
- 7-12 hours
- More than 12 hours

***8. What is your favourite airline?**

- Air Canada
- AirTran Airways
- American Airlines
- Delta Airlines
- Express Jet
- JetBlue
- United Airlines
- US Airways
- SkyWest Airlines
- Southwest Airlines

If other, please specify:

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Appendix 1: English Questionnaire contd.

***9. When was your last flight with your favourite airline?**

- ○ Before 2008
- ○ 2008
- ○ 2009
- ○ 2010
- ○ 2011
- ○ 2012
- ○ 2013
- ○ 2014

10. Do you participate in a frequent flyer program?

- ☐ No, I do not participate in any frequent flyer program.
- ☐ Yes, Air France/KLM Flying Blue
- ☐ Yes, Airberlin topbonus
- ☐ Yes, British Airways Executive Club
- ☐ Yes, Lufthansa Miles & More
- ☐ Yes, in other freqent flyer programs:

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Appendix 1: English Questionnaire contd.

Your evaluation of airline offerings and aircraft equipment

***11. In which carriage class do you travel with your favourite airline ([F8]) most of the times?**

- Economy class
- Business class
- Economy comfort class
- First class

***12. Overall, how satisfied are you with user friendliness (easy to access and easy to understand/use facilities and services) and comfort of your last flight ([F9]) with your favourite airline ([F8])?**

- Completely dissatisfied
- Mostly dissatisfied
- Neither dissatisfied nor satisfied
- Mostly satisfied
- Completely satisfied
- No opinion

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Appendix 1: English Questionnaire contd.

***13. Please indicate how satisfied you are in regard to the following points from booking until before boarding the aircraft.**
Please rate by referring to your last flight ([F9]) with your favourite airline ([F8]).

I am...

	Completely dissatisfied	Mostly dissatisfied	Neither dissatisfied nor satisfied	Mostly satisfied	Completely satisfied	No opinion
...with the flight information provided by the airline (e.g., fares, flight delays)	○	○	○	○	○	○
...with information and offering of services/features for elderly people	○	○	○	○	○	○
...with the booking process through the airline's website	○	○	○	○	○	○
...with the booking process through call centers	○	○	○	○	○	○
...with the booking process through travel agencies	○	○	○	○	○	○
…with getting from my residence to the airport	○	○	○	○	○	○
...with the check-in and baggage acceptance	○	○	○	○	○	○
…with finding my way through the airport	○	○	○	○	○	○
...with pre-departure services for people with disabilities and reduced mobility (e.g. provision of wheelchairs)	○	○	○	○	○	○
...with the convenience of the security	○	○	○	○	○	○
...with the premium lounge of the airline	○	○	○	○	○	○
...with the public lounge around the gate	○	○	○	○	○	○
...with handling of disruptions/delays	○	○	○	○	○	○
...with the boarding process (entering airplane) and the airline service at the gate	○	○	○	○	○	○

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Appendix 1: English Questionnaire contd.

***14. Overall, how satisfied are you with the steps from booking until before boarding the aircraft?**
Please rate by referring to your last flight ([F9]) with your favourite airline ([F8]).

- Completely dissatisfied
- Mostly dissatisfied
- Neither dissatisfied nor satisfied
- Mostly satisfied
- Completely satisfied
- No opinion

***15. Which areas do you consider as most important?**
Please rank the following items on importance.

	Very unimportant	Unimportant	Neutral	Important	Very important	No opinion
Flight information provided by the airline (e.g., fares, flight delays)						
Information and offering of services/features for elderly people						
Booking process through the airline's website						
Booking process through call centers						
Booking process through travel agencies						
Getting from my residence to the airport						
Check-In and baggage acceptance						
Finding my way through the airport						
Pre-departure services for people with disabilities and reduced mobility (e.g. provision of wheelchairs)						
Convenience of Security						
Premium lounge of the airline						
Public lounge at the gate						
Handling of disruptions/delays						
Boarding process (entering airplane) and airline service at the gate						

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Appendix 1: English Questionnaire contd.

***16. Please indicate how satisfied you are in regard to the following points from boarding the aircraft until getting to the final destination.**
Please rate by referring to your last flight ([F9]) with your favourite airline ([F8]).

I am with...

	Completely dissatisfied	Mostly dissatisfied	Neither dissatisfied nor satisfied	Mostly satisfied	Completely satisfied	No opinion
...the carry-on stowage	○	○	○	○	○	○
...the pre-departure service and the safety instructions	○	○	○	○	○	○
...the seat comfort and personal space	○	○	○	○	○	○
...the sanitary facilities in the plane	○	○	○	○	○	○
...the lighting in the plane	○	○	○	○	○	○
...the sign-posting in the plane (seats, sanitary facilities)	○	○	○	○	○	○
...the air conditioning in the plane (temperature, air circulation, humidity)	○	○	○	○	○	○
...the food selection	○	○	○	○	○	○
...the beverage selection	○	○	○	○	○	○
...the flight attendants' services	○	○	○	○	○	○
...the entertainment system	○	○	○	○	○	○
... the deplaning and baggage claim	○	○	○	○	○	○
...getting from the airport to my final destination (e.g., traffic connection)	○	○	○	○	○	○

***17. Overall, how satisfied are you with the steps from entering the plane until reaching your final destination?**
Please rate by referring to your last flight ([F9]) with your favourite airline ([F8]).

- ○ Completely dissatisfied
- ○ Mostly dissatisfied
- ○ Neither dissatisfied nor satisfied
- ○ Mostly satisfied
- ○ Completely satisfied
- ○ No opinion

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Appendix 1: English Questionnaire contd.

***18. Which areas do you consider as most important?**
Please rank the following items on importance.

	Very unimportant	Unimportant	Neutral	Important	Very important	No opinion
Carry-on stowage	○	○	○	○	○	○
Pre-departure service and safety instructions	○	○	○	○	○	○
Seat comfort and personal space	○	○	○	○	○	○
Sanitary facilities	○	○	○	○	○	○
Lighting	○	○	○	○	○	○
Sign-posting (seats, sanitary facilities)	○	○	○	○	○	○
Air conditioning (temperature, air circulation, humidity)	○	○	○	○	○	○
Food selection	○	○	○	○	○	○
Beverage selection	○	○	○	○	○	○
Flight attendants' services	○	○	○	○	○	○
Entertainment system	○	○	○	○	○	○
Deplaning and Baggage Claim	○	○	○	○	○	○
Getting from the airport to my final destination (e.g., traffic connection)	○	○	○	○	○	○

***19. From the above mentioned areas, have you taken any measures for yourself to improve your flight experience/comfort? Do you see improvement potential in the above mentioned areas?**

If so, please describe your idea/s briefly in 2-3 sentences.

○ No

○ Yes, please specifiy:

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Appendix 1: English Questionnaire contd.

Your experience with air travel and your personal characteristics

The following three questions deal with your personal characteristics, airline offerings, and aircraft equipment.

By airline offerings we refer to all services the airline is in charge of, e.g. check-in procedures, pricing system, catering and other services board.

By aircraft equipment we refer to all "hardware" aircraft cabin equipment, e.g. seat comfort/seat layout, air conditioning.

***20. Please indicate to what extent the following statements apply to your experience with air travels.**

	Not at all true of me	Slightly true of me	Moderately true of me	Very true of me	Completely true of me	No opinion
I usually find out about new airline offerings and aircraft equipment earlier than others.	○	○	○	○	○	○
I have benefited significantly from new airline offerings and aircraft equipment.	○	○	○	○	○	○
Among other air travellers, I am regarded as being 'cutting edge' (e.g. using new services like WLAN).	○	○	○	○	○	○
While air travelling, I often notice problems of the airline service (e.g. booking, service, flight) or of the aircraft equipment (comfort of seats, A/C).	○	○	○	○	○	○
I am dissatisfied with the existing airline offerings and aircraft equipment.	○	○	○	○	○	○
I have needs which are not satisfied by existing airline offerings and aircraft equipment.	○	○	○	○	○	○

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Appendix 1: English Questionnaire contd.

***21. Please indicate to what extent these statements apply to you.**

	Not at all true of me	Slightly true of me	Moderately true of me	Very true of me	Completely true of me	No opinion
Generally, I am interested in a variety of topics.	○	○	○	○	○	○
Logic puzzles fascinate me.	○	○	○	○	○	○
When I come across a problem, I think it through thoroughly.	○	○	○	○	○	○
It is easy for me to regard things from several completely different points of view.	○	○	○	○	○	○
When I come across a problem that I cannot solve immediately, I try to find out more information.	○	○	○	○	○	○
When faced with something I do not understand, I tend to analyze the facts.	○	○	○	○	○	○
I want to know about everything in great detail.	○	○	○	○	○	○
I always sense exactly what other travellers expect from airlines and the aircraft equipment.	○	○	○	○	○	○
I realize what other air travellers mean even when they have difficulty in saying it.	○	○	○	○	○	○
It is easy for me to take the perspective of other people (e.g., other passengers).	○	○	○	○	○	○

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Appendix 1: English Questionnaire contd.

***22. Please indicate to what extent these statements apply to you.**

	Not at all true of me	Slightly true of me	Moderately true of me	Very true of me	Completely true of me	No opinion
In general, I am the first in my circle of friends to test a new airline offering when it is introduced to the market.	○	○	○	○	○	○
Compared to my friends I have undertaken a lot of air travels.	○	○	○	○	○	○
In general, I am the first in my circle of friends to know new airline offerings or aircraft equipment.	○	○	○	○	○	○
I know well, which characteristics of airline offerings and aircraft equipment are important to me.	○	○	○	○	○	○
I use the airlines' offerings/ aircraft equipment (e.g., footrest, shades) intensively.	○	○	○	○	○	○
I have a good overview of available airline offerings and aircraft equipment on the market.	○	○	○	○	○	○

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Appendix 1: English Questionnaire contd.

Personal data

23. Please make an assessment of your age.

I FEEL (emotional) as though I am in my…	
I LOOK (biological) as though I am in my…	
I DO (societal) as though I am in my…	
My INTERESTS (intellectual) are mostly those of a person in his/her...	

24. Do you have physical or mental deficiencies (e.g., reduced mobility, age-related hearing loss) that influence your flight comfort?

- ○ No
- ○ If yes, please specify

25. Please indicate your gender.

- ○ Male
- ○ Female

26. Please indicate your family status.

- ○ Single
- ○ Divorced
- ○ In a relationship
- ○ Widowed
- ○ Married
- ○ Other, please specify

27. Please indicate your monthly household net income. (optional)

- ○ Less than 1000 USD/month
- ○ 1000 - 2000 USD/month
- ○ 2000 - 3000 USD/month
- ○ 3000 - 4000 USD/month
- ○ 4000 - 5000 USD/month
- ○ More than 5000 USD/month
- ○ Prefer not to say

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Appendix 1: English Questionnaire contd.

28. Which proportion of your monthly household net income can be used at your free disposal (not already planed elsewhere)? Please indicate as percentage. (optional)

- ○ <5%
- ○ 5-10%
- ○ 11-20%
- ○ 21-30%
- ○ 31-40%
- ○ >40%
- ○ Prefer not to say

29. What is your highest level of education?

If other, please specify:

30. Do you have a technical educational background or worked in technical jobs?

- ☐ No
- ☐ Yes, technical vocational training (e.g., mechanic)
- ☐ Yes, technical university degree (e.g., electrical engineering)
- ☐ Yes, worked in technical job (e.g., in manufacturing)

Other (please specify)

Appendix 1: English Questionnaire contd.

Thank you for your participation!

***31. We would like to conduct telephone interviews (15 min) with selected participants to gain additional background information. Please indicate if you would be available for a telephone interview.**

- ○ No, I am not interested at all.
- ○ Yes, I am interested in a follow up interview. My email address for contact is:

***32. Thank you for answering the survey. To show our gratitude, you have the opportunity to enter the sweepstakes. Leave your email address in case you win.**

- ○ No, I am not interested at all.
- ○ Yes, I am interested in the sweepstakes. My email address is:

33. Here is some free space to leave comments and feedback to the questionnaire or the topic in general.
Thank you.

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