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Strategic Action Fields for German Companies in Demographic Shift

vorgelegt von Guangya Su

aus

China, Jilin Provinz

Fakultät für Mathematik und Wirtschaftswissenschaften

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Amtierender Dekan: Prof. Dr. Alexander Lindner
1. Gutachter: Prof. Dr. Werner Smolny
2. Gutachter: Prof. Dr. Martin Mueller

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Abstract

Demographic shift is well known as one of the emerging trends. Policy makers, managers, and scholars have been trying to find effective strategies to prepare for and cope with changes in their working fields. Focusing on the 50+ labor force in large companies in Germany, this thesis aims to provide recommendations on how to unleash potential of an aging workforce to continuously deliver value and to ensure a long-term success of companies.

The approach employed here is to combine literature analysis and case studies to gain insight, to build a theoretical framework, and to derive recommendations. Two meta-analyses are conducted. The first one is to aggregate age-related differences which are relevant for companies. The second one is to identify potential action ideas and measures. Both are based on a multi-disciplinary literature review from diverse fields such as gerontology, biology, psychology, sociology, and business research. Furthermore, this research provides two case studies from a practical perspective. One case study is a cross-company interview survey with 22 leading companies in Germany. Most of them are DAX30 companies. It was conducted during the theory building process. The second case study is an in-depth case analysis within a globally operating German technology company. It includes a review of the company’s strategic priorities, top management interviews, an employee survey, and a baselining of workforce structure and existing measures. In addition, research techniques such as statistical data analysis, simulation, and problem-solving method of strategy project management are applied for specific sub research topics.

The first result of this thesis is a quantification and qualification of demographic trends in Germany. The aging workforce and an unbalanced labor force demand-supply in the time of digitalization have implications for large companies. Capability to create workforce transparency and future-oriented scenarios are suggested as the basis for purposeful action design. Future jobs are shifted by digitalization and therefore demand a systematic skill update for the (50+) workforce.

Secondly, this research identifies fifteen age- or generation-related differences which are relevant for large companies, covering areas of health, learning, and social implication. The top four age differences are positioned in the areas of knowledge access, communication, behavioral change, and change of personality patterns.

Thirdly, regarding the recommendation for strategic action fields, this research achieves two outcomes. From a theoretical perspective, the Managing Demography Framework with a measure catalog is developed. This management framework comprises four action fields: Workforce Composition, Productive Fitness, People Development, and
Communication and Culture, with 22 specific action measures in total. The suggestion is to apply the framework in consideration of business context, HR priorities, and evaluation criteria so that measures can be selected and customized for implementation.

Finally, from a practical perspective, this research consults the case study company to design its demography program. By applying the Managing Demography Framework for the case study company, it showcases a systematic problem-solving methodology along the situation, implication, and solution process. This approach built the capability for the case study company to create transparency and simulate future workforce scenarios. Furthermore, a baselining was conducted to analyze the relevant age difference areas, existing measures, and strategic evaluation criteria. As result, this research suggests a customized Demography Program with six selected measures. The measures can be realized in three implementation projects. The project Future Skills for 50+ equips senior employees to be fit and competitive in the time of digitalization. The project 50+ Career Boost is to enable senior employees to take actions and new job opportunities for continuous career development. The project Multi-generational Workplace is to unleash cross-generational synergies by establishing a structured tandem process and a communication campaign to explicitly value contributions of the 50+ employees and a more inclusive mindset in workplace.

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Index of Abbreviations and Terms

ADI   Age Difference Implication
ANOVA  ANalysis Of Variance
BMI   Benchmarking Implication
DAX30  Deutscher Aktien IndeX (German Stock Index 30)
DF   Degrees of Freedom
EAP   Economically Active Population
EPD   External Personnel Desourcing
EPS   External Personnel Sourcing
ES   Employee Size
EU   European Union
F   Mean squares of regression divided by mean squares for residual
FTE   Full-Time Equivalent
FY   Fiscal Year
GDP   Gross Domestic Product
HR   Human Resources
IAB   Institute fuer Arbeitsmarkt und Berufsforschung
      (German Institute for Labor Market and Occupation Research)
M&A   Merger and Acquisition
MINT   Mathematics, IT, Natural Science, and Technology
M   Measure
MRI   Management-interview Result Implication
MS   Mean Squares
NGO   Non-Governmental Organisation
Non-EAP   Not Economically Active Population
Obs.   Observations
OECD   Organization for Economic Co-operation and Development
R²   Residual square
RDT   Regression Data Table
REM/NREM   (Non) Rapid Eye Movement
RET   RETirement
Siemens   Siemens Germany (The term is used in this research only)
SIEMENS   The global organization of the company Siemens
Siemens AG   Siemens Aktiengesellschaft (as a publicly listed legal entity)
SRI   Simulation Result Implication
SS   Sum of Squares
UN   United Nations
VL   Voluntary Leave
I Introduction

1 Motivation

This research idea comes from the initial situation that many companies in Germany have been facing the demographic shift. The average age of the global population is increasing (Minniti, Kautonen, Kibler, 2017). Germany is one of the aging countries caused mainly by a births-deaths deficit (UN, 2016). The demographic shift in Germany impacts social insurance system, eldercare, schools, housing, labor force potential, and infrastructure development (Heinzl, 2017, p4).

In terms of the German labor market, the impact of demographic shift is mainly characterized by two aspects. On one hand, the decreasing share of working-age population, predicted from 66% in 2010 down to 58% in 2030, will create a gap between labor demand and labor supply (UN, 2016; Poetzsch, Roessger, 2015). On the other hand, the population shows a phenomenal aging effect due to increased longevity, declining fertility, and aging process of a large number of the Baby Boom generation (Poetzsch, Roessger, 2015; Bloom, et al., 2011, p. 1). For example, the median age in Germany is predicted to increase from 44 years in 2010 to 49 in 2030. The aging process would also lead to an increasing share of the 50+ group among the labor force. In the same period, the respective share of the 50+ population is predicted to increase from 33% to almost 40% (UN, 2016).

Demographic shift challenges government, society, and business with their assumptions of what these trends mean and require. Companies rethink every year how they define the marketplace for old people, develop products and services, and deliver customer value (Eitner, 2008). But the intrinsic challenge is stronger. It is a management issue from the people and organizational perspective, namely how a company can have the aging workforce better organized to continuously deliver promised or new value. In this sense, companies’ perception varies widely from industry to industry, company to company, and even among different job categories within the same company.

High–tech companies with a typical young workforce such as Google (median age around 30 years) is facing scarcer labor supply to fulfill their qualified jobs (Pelisson, Hartmanns, 2017). In contrast, taking a car manufacturer as example, Daimler has an average workforce age of 43 years and expects that about half of its workforce will be
over age 50 years by 2020 (Daimler-AR, 2012, p. 102; Daimler-AR, 2016). Traditional companies in such industry have been optimizing the workplace design to ensure productivity. In similar industries like energy and engineering, companies have been realizing a relatively slow-down of technical skill-update due to the aging workforce (Economist, 2010). But companies in service branch with a less “manufacturing” character, such as finance, banking, and consulting, are focusing on challenge of people-centric workplace practices. Examples are flexible working conditions, or performance-based compensation models which are independent of age, to motivate their employees for better service quality. And regarding government and public sectors, observations already show that the rapid aging workforce and the expected surge in employee retirements present an immense employer branding challenge (Blaine, 2008). In the time of demographic shift, they need to more intensively complete with attractive employers of private sector (Detemple, Duesing, Schramm, 2017, p. 8).

The common perception of companies, beyond the difference across sectors, is the importance of designing and implementing a functioning people strategy in the time of fast changing technological environment. Since the business world is perceived as a constantly changing status of VUCA - Volatility, Uncertainty, Complexity, and Ambiguity, traditional activities to drive organizational performance, like strategic planning, are viewed as mere exercises in futility (Bennett, Lemoine, 2014). In a VUCA age, unforeseen development can change the rules of the game in the space of very short time (Ito, Howe, 2016, p. 29). Technology-based future is arriving faster than companies think. This progress is going to leave behind some workers, managers, and even experts of certain jobs. In the time of digitalization, the difference between employees with only “ordinary” skill and employees with special skills becomes a crucial factor for their occupational future, since intelligent machines, robots, and other digital labors are acquiring “ordinary” skills (Brynjolfsson, McAfee, 2016, p11). Some jobs will disappear while new jobs will emerge. Digitalization leads to novel digital tools in workplace, fresh need of digitally skilled workforce, and unconventional digital jobs and roles (Manyika, 2017).

Especially when it comes to characterizing the relationship to workplace technology, it is perceived that the 50+ Baby Boomers receive little respect (Staff, 2017). But, the unique characteristic of the Baby Boomer generation, which is its sheer demographic size and scope, makes this aspect more relevant for large companies (Staff, 2017), in particular, for the traditional ones in German industry or the big ones such as DAX30. All these trends force companies to think how to prepare a workplace where all generations can effectively develop themselves to be fit for the future.
Therefore, employers and employees are increasingly interested in drawing comparisons between older vs. younger workers so that targeted measures can be developed. In fact, many companies are not sure if they really understand what these differences are and what do these differences specifically mean for their operating environment. Many assumptions about old and young workers are wrong (Gratton, Scott, 2016) or just unconscious bias. There seems to be too many myths about the 50+ employees in the media. Capturing the accurate gist will create a unique chance for companies to overtake competitors in the talent and the VUCA business environment, to unleash the full potential of an aging workforce while avoiding potential risks. Acknowledgement of these age and generational differences is a key to successfully drive digital transformations towards a future-oriented workplace (Newman, 2017). It pays to address age diversity and how it can affect companies – both positively and negatively (Braga, 2016).

Recent reports published by commercial research institutes or advisor firms do raise the interest to help companies deal with demographic shift, however, rather from a consulting service marketing point of view than recommendations based on scientific investigations. This research work enables a theoretical and empirical contribution to the subject in an interdisciplinary manner and therefore closes the gap described above. A large number of academic researchers have been investigating population pressure (Baechler, 1999; McK, 2016), resource scarcity, and armed conflict (Urdal, 2008, p. 3). Amongst the diverse aspects of demographic shift regarding society, politics, science, and economy, much effort has been giving to the implication of demography on business, marketing, and human resource management (Kohlbacher, Gudorf, Herstatt, 2010; WSJ, 2013). However, there are not many researches with an empirical depth targeting companies’ 50+ workforce with an increasing size. Indeed, the speed of increase regarding the share of the 50+ in employment is faster than the increase of the overall employed population during the last decades. For example, from 1991 to 2016, the employed persons in Germany have only increased 11% from 37 to 41 million. In contrast, the respective increase of the share of the 50+ group in the employment is 67% from 9 to 15 million (Destatis-Genesis, 2016; Destatis-FF, 2017).

2 Goal and Research Questions

This research work aims to provide recommendation on strategic actions for companies in the demographic shift. It selects the 50+ age group as the focus and the target group for operationalizable measures in people and organizational management. The business context of companies is only considered to understand the environment and causing factors for companies’ situation. Business models or specific product markets for 50+ people are not the scope of this research. In order to enable the depth of research, the scope of research is chosen for large companies in Germany. The selected
time horizon is 2030 for analysis, forecast, and action design. Having selected this focus, the goal of this work is broken down into three research questions:

1. **How can companies foresee the demographic shift in terms of the age structure development?**

   The foundation for the foresee-capability at company level is the understanding of environmental situation of demographic development, namely the population and employment trends. Firstly, analytics need to include both the economically active population change and implications in the labor market towards future. Deep-dive of demographic sub groups should be considered. For example, the increasing participation of women in the current German labor market impacts 50+ age group compositions for the long run. Secondly, large companies’ workforce situation needs to be analyzed in comparisons. Workforce development of the past would indicate a reference across companies for the future. It is conceivable that trends in the cross-company comparison may indicate some common implications for companies being similar players in the same labor market.

2. **What are the differences between older and younger employees?**

   An important category of comparisons is the differentiation of age groups in those scientific disciplines which are relevant for companies. Although the research focus is 50+ employees, younger employee group can be used as the most direct comparable “counter partner”. Certain analyses of age difference may exist in previous scientific investigations, in particular, in gerontology, psychology, and sociology and so on. They need to be critically reviewed and classified to the current context focusing on potential application in business and human resource management. Furthermore, it is supposed to find useful areas where older and younger employees do not only show difference as one would intuitively perceive, but have something in common. The top differences need to be summarized to guide companies to choose and prioritize purposeful actions.

3. **What are the areas where a company can strategically take actions to manage the demographic shift?**

   Effective preparation to cope with demographic shift requires purposeful measures. Such measures are coupled with the workforce composition and workplace conditions that a company would like to foresee for the future. The most feasible actions, however, should be managed at the organizational and system level. Assuming a scenario of future workforce age structure, it is essential to clarify how to design a strategy with smart actions, and how to ensure impactful implementation. Here, actions refer to the selected ones which are evaluated to best fit the company-specific business context. Therefore, the third
research question provides answers by displaying a management framework and how a specific demography program would look like, for example, as an application of theoretical solution in a real company.

3 Approach and Research Design

The science field of this research work is Management. Although the terminology demography is frequently used here, the major research activities and results do not belong to the Demography science which only refers to description and analysis of size, distribution, density, movement, structure, and change of population (Schimany, 2003, p. 15). Within the science field Management, the highlight of this dissertation stands for its applicability of Demography science in the practice, methodology of solution development, and the multidisciplinary triad in economy policy, strategy, and human resource management. The synergy of these three disciplines for the subject demography is a less tapped research area so far.

While answering the three questions described above, the research activities are divided to four modules. The first two modules deal with the Situation and Implication of the subject Demography and Age Difference. They build a foundation side by side to guide the following two Solution modules. Along this logic, the four modules can be interlinked in a theoretical schema illustrated in Figure 1.
The module “Demography” in Chapter II analyzes the general situation of demographic development in Germany. These analyses display various aspects which are relevant for large companies, in particular, in a quantified manner. Evaluations include population development, labor market situation, and workforce visualization of large companies from several DAX30 representatives.

These analyses also enable a top-down view by gaining strategic facts at an aggregated level. The facts are organized as an overview along the evaluated demographic trends which are relevant for companies. By mapping these trends from the population and labor market to large companies, the facts can be translated from macroeconomic (aggregated labor force demand and supply at the national level) to the microeconomic level (behavior of individuals and firms in decision-making). This process provides a solid basis to answer the research question one. It translates the implication of demographic shift from national level to the strategic management issues at company level.

In this module, the most important research method is Data Analytics focusing on quantitative investigations. It employs population statistics for mathematical calculation. Data sources are the German Federal Statistical Office, the Organization for Economic Co-operation and Development, the United Nations Statistics Division, and Annual Reports and Sustainability Reports of selected DAX30 companies. Further supporting research methods include Internet Search and Literature Review.

To complement the first module, understanding the people aspects at individual level is imperative. The purpose of the module “Age Difference” in Chapter III is to provide a bottom-up view about implications of an aging and multi-generational workforce. This module undertakes the research at the microeconomic level by a meta-analysis leveraging interdisciplinary knowledge. Goal is to explore the differences between older and younger employees, with focus on the 50+ years up to the retirement age. The investigations in this module are based on occupational aspects of aging, known as industrial gerontology. Furthermore, adult development, generation theory, health, learning capability, and social behavior theories are classified and prioritized by their applicability in practice. The module elaborates the individual level of the implications of demographic shift and 50+ age group characteristics. Therefore, it builds the extended basis to choose relevant action fields and measures. Key result of this module is a summary of age differences between 50+ and 50- people as recommendation with the most relevant ones for companies to look up.

At the schema level, the second research question is parallel to the first one. The challenge of the research question two is the broadness of scientific disciplines to be investigated. Interdisciplinary findings are supposed to be extracted from gerontology, biology, sport science, health, psychology, sociology, economics, to business admin-
istration. Therefore, this module chooses a **Literature Review** known as the **Secondary Research** method. This interdisciplinary knowledge mining process looks into existing concepts and theories in published literatures in each of the scientific disciplines mentioned above. Taking the **developmental aging theories** as the fundamental basis, this research considers both the **Deficit Model** (Salthouse, 1990, 1995) as well as the **Competency Model** (Fischer, 1991, p. 426; Lehr, 1994) to avoid unconscious bias on age difference. Beyond Germany as the geographical focus of this research, input of other countries is taken into account too, as long as they provide meaningful comparison, applicable idea transition, or contribution to applicable findings. The major source of this meta-analysis is research papers, scientific journals, books, and leading industry reports.

Once having understood the findings from the both modules above, namely from the top-down and the bottom up views on the demographic aspects, the answer to the third research question can be developed. Chapter IV and V give theoretical and practical recommendations as the solution part of this research work.

The module “**Managing Demography Framework**” in Chapter IV systematically evaluates strategies and action fields from multi-channels for **theory building**. It represents a theoretical vehicle in this research work with a knowledge transition function. This module bundles findings from the two previous modules, from further literature reviews, and abstract action ideas to a guiding management framework. It provides evaluations of actions and measures for practitioners to design strategy and implementation programs. Both theoretical and empirical knowledge are explored to enrich the results. This module develops a management tool Managing Demography Framework with a catalog of concrete **Measure** ideas. Each measure is elaborated and assigned to an **Actions Field** which aims to help companies optimize workforce composition, increase productivity, foster people development, or ensure effective communication and culture change in the demographic shift.

The measures and action fields in the module are based on the **Exploratory Research** method applying Literature Reviews and a **Case Study “Multi-Companies”**. The literature review explores theoretical ideas coping with 50+ issues from research papers, books, and professional reports. Taking the first version of the idea catalog as basis, the case study enriches the theory building by gaining further ideas from the practice. In this case study, interviews with selected companies from DAX-30 and large organizations are conducted. The interviewees are HR directors, diversity managers, corporate strategists, and experts. This is a process enabling to transform **empirical knowledge** to explicit knowledge (Nonaka, Takeuchi, 1995, p. 59). Furthermore, the case study has the function to gain practical insight to evaluate measures, for example, benchmarking,
prioritizing age differences and measures in the practice, and impact-effort ratio for expert estimation on implementation.

The module “Recommendation for Siemens” in Chapter V is to apply the developed theoretical solution of Chapter IV, the Managing Demography Framework, in practice. By modeling a forecast method for the case study company, Siemens, a simulation tool WDFSim is implemented to generate the 2030 scenarios of workforce age structure. Considering such scenarios, a systematic baselining is conducted, in terms of the company’s initial situation, employee age differences, external benchmarking, existing and potential measures. Each practical measure seizes the opportunities which can be derived from the research results of previous modules. At the end, this module gives a specific recommendation on how a customized demography program for Siemens can look like, and what needs to be done to ensure successful implementation.

Three research methods are applied in this module. First, it applies a pilot study approach from computer science and creates a Simulation tool as prototype based on demography forecast method and a series of regressions out of real workforce data. Secondly, in the case study, both qualitative and quantitative investigations are carried out for solution development. The case study includes empirical knowledge out of a top management survey, an employee survey, and several one-to-one expert interviews. Finally, this module uses Problem Solving approach of strategy project management to phrase goal, break down actions, estimate implementation timelines, and allocate resources for execution.

The dissertation ends with the Chapter VI which presents a summary of all conclusions and outlook. In this chapter, the research questions are concisely answered. After drawing together the key research results, it gives an indication of the way forward for future researches.
II Demographic Trends in Population and Labor Market

This chapter elaborates essential trends of demographic development in the German population and the labor market. It introduces the fundamental terms, metrics, and determinants for demographic shift. To identify the key trends, structured analyses of population forecasts, of the economically active population, and of the labor force demand-supply are conducted. Regarding the workforce situation of leading companies, this chapter provides a baseline on selected DAX30 workforce age structure developments during the recent years. Finally, it summarizes implications for companies in terms of relevant government policies, initiatives, and an outlook towards 2030 with consideration of the impact of technological development on the job market.

1 Definition and Borderline of Terminologies

Demography begins with populations either enumerated in censuses or followed from anniversaries, such as date of birth (Smith, 1992, p. 5). Demography is the study of human populations and the ways in which they change (Longman, 2009). “Demo” means “the people” and “graphy” means “measurement” (Merriam-Webster, 2013).

In a narrower sense, the Demography, also known as Population Science, refers to the description and analysis of size, distribution, density, movement, structure, and change of population (Schmany, 2003, p. 15). The term population can be certainly used in different application contexts. In human resource, it may refer to the entire workforce of an organization. Then the applied term Demography here can be derived as the science of measurement of the entire employee where the key subject is the quantitative demography. The qualitative aspect are the sociological factors such as education quality, crime, development, diet and nutrition, race, social class, wealth, and well being (Business-Dictionary, 2013).

Demography also refers to either population enumerated statistics or followed anniversary structure, in other words, age-specific. The concept “Demographic Aging” is the long-term transition of a “young” to an “old” age structure. A society with this type of population that is characterized by an “aging transition” is called “Aging Society” (Schimany, 2003, p. 16).
In order to product identification, measurability, and to enable actionable interpretation, there are various metrics in the context of demography, following the principle of chronologic age. Metrics provide knowledge about a situation while measuring its context-relevant status (Su, 2011, p. 378). More specifically, metrics are applied to formulate relation of numbers and give a concrete statement about application relevant topic (Goenenberg, 1993, p. 493). In human resource management, metrics are an important instrument for planning, decision processes, controlling of activities (Kohlmann, 2000, p. 130), and an important application for judgment indicating complex structure (Schulte, 1989, p. 4). Throughout this research work, several metrics are frequently used to judge age structure or its status. The use is globally valid for all analyses regarding population, employment, and workforce. Central Tendency of Age and 50+ Ratio are used to enable single point comparisons and indicate key trends. The Age Groups describe sub age structure in a simplified manner. In particular, five metrics are frequently used in this research: $\bar{X}$ (Average Age), $A_{Med}$ (Median Age), $S_{50+}$ (Share of the 50+), $Q_{50+}$ (50+ Quotient), and $G_{a,b}$ (Share of Age Groups). Detailed definitions with calculation formula are summarized in Appendix A.

When discussing demographic structure, one needs to clarify what “old” means. In general sense, there is no universal definition what is old. It depends on the application context. For this research focusing on the 50+ workforce, the most important indicator used throughout following chapters is the percentage share of the 50+ year old population. If not specified with a separate hint, the implicit numerical border of an “old” age group and “young” age group is convergent to the age of 50 years.

Statistical calculation with demographic attributes has some special characters for this research. Firstly, demographic calculation considers the time aspect with a “double feature”. On one hand, time series analysis or forecast is usually structured by time-slicing, for example, year-by-year. On the other hand, information and its interpretation about “age” are strongly influenced by actual date. For example, status of former years often-times has a certain influence on the forecasting results of following years. One example is that an 18-year-old person in 2016 turns 19 years in 2017. Both of the time “features” require special consideration for modeling, calculation, analysis, and interpretation.

Secondly, demographic factors are embedded in a lifecycle which reflects periodic population development which influences an iterative process of structural changes over time. The determinants of demographic factors include fertility, mortality, immigration, emigration, and the population structure itself (Weber, 2010). For example, in the Population Projection of the German Federal Statistical Office, three demographic determinants are used to build the basis of model calculations: (1) fertility which causes the birth-rate, number of potential mothers, and young-aged population, (2) life expectancy
which influences the number of deaths because the large birth cohorts will move into old age, and (3) net migration which mirrors the balance of immigration and emigration and influences the young, the middle-aged, and the entire population structure (Destatis, 2009). By analogy, such determinants exist in companies too. In this research, especially in Chapter V, they are characterized by revenue change which may trigger labor capacity change, service time of employees, and fluctuation in the workforce.

A further borderline of terminology is the differentiation of similar-sounding concepts between demographic issues of an enterprise lifecycle and demographic issues of managing a company’s workforce. Considering such differentiation, Business Demography elaborates enterprise births and deaths, survival rates, and the role that new enterprises can potentially play in terms of economic growth, employment creation and increasing productivity (Schroer, 2008). The object of Business Demography is enterprise. In comparison, object of this research work is about Workforce Demography issues within an enterprise, not enterprise itself.

2 The Demographic Shift

There are multi-ways to analyze demography. The fundamental understanding starts with population change over time including past and future. Explanation of such change can be gained by a systematic causal analysis with the three basic determinants: fertility, life expectancy, and migration. Furthermore, there are aspects providing status quo of a country’s demographic situation. These include statistics and breakdowns such as population size, birth rate, death ratio, nuptiality, divorce, age-specific, gender-specific and geographic categories (UN-DY, 2012). In Germany, the Federal Statistical Office explores further aspects into administrative districts, municipalities, urban and rural structure, largest cities and families, children, living arrangements, churches, and social communities (Destatis-JB, 2017, p.24). Since this research work focuses on the workforce demography for companies, analyses and breakdowns are selected for sub groups of age, gender, and migration. Finally, demand and supply situation in German labor market and workforce trends of selected DAX30 companies are evaluated.

2.1 Trends of Population Development

Germany is one of the countries where the economically active population is not synchronized with the pace of the entire population development. The Economically Active Population (EAP) is defined as all persons, employed and unemployed, who furnish the supply of labor for the production of economic goods and services during a specified time-reference period (ILO, 1982, p. 4). Germany is facing an aging population towards 2030. The population growth rate is not strong for long-term. And the proportion of
older persons has increased while that of younger persons has decreased (UN-DESA-No248, 2017).

Figure 2 illustrates the aging trend of German population development in the period from 1970 to 2030. It focuses on age structure of the population development. The age group 15 to 65 years is predicted to be a decrease of 3 percentage points from 63% down to 60%. In the same period, the median age is predicted to increase from 34 to 46 years. Germany will experience an increasing share of the 50+ populations. In the year of 2030, 46% of the population will be 50 years and older. In some federal states such as Brandenburg, Sachsen-Anhalt, and Thueringen, more than half of population is already older than 50 years (BerSt, 2015). Soon, the 50+ population is another “main stream” of society and workforce in Germany.

![Figure 2: Population Aging Trend in Germany](https://www-genesis.destatis.de/genesis/online)

*Source: Own representation based on data from GENESIS-Online Datenbank, Destatis-Genesis, 2016, at https://www-genesis.destatis.de/genesis/online, access on December 30th, 2016; Bevoelkerungsentwicklung bis 2060, Ergebnisse der 13. koordinierten Bevoelkerungsvorausberechnung, Aktualisierte Rechnung auf Basis 2015, Tab Variante 2-A D EJ, Statistisches Bundesamt (Destatis), 2017*
2.1.1 Demographic Determinants to Understand the Causes in Germany

Understanding the three determinants (fertility, mortality, and migration) helps to foresee trends of the labor market as operating environment of companies. Fertility represents the development of births. Its indicator *Total Fertility Rate* is the average number of children a woman would have during her lifetime if the conditions in the reference year were characteristic of the whole period of her childbearing years typically from 15 to 44 or 49 (UN-DY, 2012).

The total fertility rate required to replace the population depends on the sex ratio of the live-born children and the mortality conditions (Destatis-BEV066, 2017). In order to maintain the present number of population in a country, more than two children would have to be born per parental couple. A Total Fertility Rate of 2.1 children per woman is seen as the replacement rate border line (Poetzsch, 2013, p. 87). In natural development, the two children replace the previous generation when they grow up. So, a Total Fertility Rate below this replacement level, without a positive net immigration rate, would lead to a shrinking and, with a high probability in developed countries, an aging population. Both West and East Germany had a Total Fertility Rate greater than 2.1 before 1970. However, since the end of the 1990s, the annual Total Fertility Rate in Germany remained nearly constant at 1.4 children per woman until 2013. This was around 30% below the level to maintain a stable number of population (Poetzsch, 2013, p. 87). The most recent Total Fertility Rate in Germany was reported in 2016. With 1.59 per woman, it shows a slight increase in comparison with the past three years (Destatis-TFR, 2016).

In the natural population change, the balance of births and deaths is steered by two components. The one is fertility. The other is mortality which is the second determinant of the demographic shift. Mortality represents the number of deaths occurring over a certain period which is related to the population (Destatis 2009, p47). The UN uses the *Crude Death Rate* as the indicator to express average annual number of deaths per 1,000 persons. The Crude Death Rate in Germany has been increasing from 10.1 in 2007 to 10.6 in 2016. In total number, deaths of this period are 827 thousand in 2007 and 911 thousand in 2016 (Destatis-BD, 2013; Destatis-Nr.408, 2016). The most important factor influencing the Crude Death Rate in Germany is the upper-generational effect. The Baby Boomers born after the Second World War is a generation which was over proportional in the population composition and will disappear in the next years and in large number.

Considering the both determinants fertility and mortality, the trend in Germany is that the number of deaths is greater than the number of births during the past years. This fact
leads to a growing birth-death deficit, for example from -142 thousand in 2007 to -118 thousand in 2016 (Destatis-Nr.408, 2016).

Migration is the third determinant of the demographic shift. Its indicator *Net Migration Rate* is defined as the number of immigrants minus the number of emigrants over a period, divided by the person-years lived by the population of the receiving country over that period (UN-PD, 2012). It is expressed as average annual net number of migrants per 1,000 persons. During the past decades, the Net Migration Rate in Germany vacillates with highly dynamic pattern, for example, displaying a surplus of 2.0 in 2000, declining over a shortfall of -0.2 in 2009, excess of the period 2010-2015 with an average annual value of 4.4 (UN-DESA-No248, 2017) due to the refugee wave from Africa and Middle East. In 2016, 1.87 million people who immigrated to Germany exceeded the number of those who emigrated by a net immigration of 499,944 (Destatis-BuE-W, 2016, p. 7). Taking the 82.5 million population as basis, the respective Net Migration Rate was 6.0.

The level of immigration will have an appreciable influence on the level of population decline as early as 2030 onwards (Destatis, 2015, p. 22). The Federal Statistical Office predicted that the number of potential immigrations from other countries will continue to be relatively high until 2020 and is expected to stay on the level of 100 to 200 thousands per year towards 2030 (Poetzsch, Roessger, 2015, p. 40).

For the future population and age structure in Germany, the net immigration is decisive (Poetzsch, Roessger, 2015, p. 37). Considering the aging population in the domestic territory, there would be space created for young and qualified workers from outside of Germany. Data in 2016 shows that the population with migration background is indeed younger than the population without migration background (Destatis-BGMA, 2016). For example, the average age of the immigrants as they entered Germany was 23.6 years. The average age of all foreigners living in Germany is 37.6 (Destatis-JB, 2017, p. 46-47). In comparison, the average age of the entire population in Germany was 44.3, and thereof the Germans 45.2 (Destatis-BS, 2016). The populations in most of the Asian countries, Africa, and Middle East such as Afghanistan, Iraq, and Syria are young and growing over the next few decades as the immigration pipeline (Destatis, 2009, p. 33). Also new EU members, South Europe, as well as refugees from war and crisis areas contribute to the net immigration in Germany (Poetzsch, Roessger, 2015, p. 38).

### 2.1.2 Population Prediction Results - Quantitative Deep-dive

Demographic determinants show the facts and reasons about demographic shift. But for companies, meaningful assumptions and forecast are needed to navigate action options for the future. Therefore, a population projection is an adequate basis providing frames and corridors to guide economical activities. In this research, the most recent results of
the 13th coordinated population projection by German Federal Statistical Office are used as basis when discussing labor force environment for large German companies. Some assumptions are adjusted to the most recent development on the increased fertility rate, the changed life expectancy to estimate mortality, and the massive net migration during 2014 to 2017.

Table 1 shows the two selected variants of population projection which are relevant for this research. The selection criteria are the time horizon 2030, the need of a basic scenario, and the need of a scenario which is estimated as relatively realistic in terms of assumptions on current fertility data and massive immigration numbers published until 2017. The Variant 1 is the basic scenario which will be used for theoretical discussions, for example, in forecast modeling, basic comparison over time, or international benchmarking. The Variant 2-A will be used for specific calculations, for example, providing practical indicators, as quantitative input for analyses, workforce forecast and strategy design in companies.

<table>
<thead>
<tr>
<th>Variant</th>
<th>Assumptions towards 2030 concerning</th>
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<tr>
<td></td>
<td>Fertility</td>
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<tr>
<td>V1: Basic scenario and relatively old population</td>
<td>Approximately stable at 1.4</td>
</tr>
<tr>
<td>V2-A on base of 2015: Continued trend with higher immigration</td>
<td>Approximately stable at 1.5</td>
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Table 1: Relevant Variants of Population Projection

Source: Own representation based on data from Bevoelkerungsentwicklung in den Bundesländern bis 2060, Annahmen der aktualisierten Variante 2-A der 13. koordinierten Bevoelkerungsvorausberechnung, Statistisches Bundesamt (Destatis), 2015, at www.destatis.de/DE/Publikationen/bevoelkerungsvorausberechnung, Statistisches Bundesamt (Destatis), 2015, at www.destatis.de/DE/Publikationen/bevoelkerungsvorausberechnung, access on July 17th, 2017; Germany’s Population by 2060 – Results of the 13th Coordinated Population Projection, p. 27, Statistisches Bundesamt (Destatis), 2015

The 13th coordinated population projection quantifies future changes in the size and the age structure of Germany’s population (Poetzsch, Roessger, 2015, p. 5). It reveals ef-
fecteds of demographic development that can be identified from today’s perspective. Towards the year 2030, the results show following three demographic trends which are relevant for labor market and companies: (1) The size of Germany’s population will stay with no significant growth, but indicate (2) an aging trend and (3) a shrinking working-age group (Destatis, 2015, p. 6; BerSt, 2015).

The total population towards 2030 is expected to be no significant growth. The number of deaths will increasingly exceed the number of births in the population. Based on the projection Variant 2, the deficit would continuously grow towards 2030 (Destatis, 2015, p. 17). An unusually high level of immigration has prevented a decline since 2011. But for long-term after 2030, the growing birth deficit cannot be compensated by net immigration. As of June 30th, 2017, the total population in Germany was 82.7 million. The predicted total population in 2030 by V1 was around 79 million, and 82.9 million by the V2-A (Destatis, 2015).

The projection results of all variants show that there is a significant aging trend in the population towards 2030. The direct causing factors are the continuous low level of fertility rate and an increasing life expectancy.

On one side, the low total fertility rate of 1.4 to 1.6 over the last years is affected by the shrinking number of women at reproductive age due to five reasons. Firstly, the falling number of women aged 26 to 35 was the decisive factor for the declining number of births, because over 60% of children are born by this age group (Destatis-LBR, 2012). From 1997 to 2007, the number of women of this age group has been decreased and will remain fairly stable in the coming years (Kucera, Poetzsch, 2012). Secondly, the average age of mothers at birth of their children plays an important role. In Germany, more and more women have their first child after their 30th birthday. In the last 20 years, the average age at birth of the first child has increased by at least three years, that is, from about 26 years in 1985 to 31 years in 2015 (Poetzsch 2012, p. 5; Destatis-JB, 2017, p. 36). Thirdly, women of today postpone both marriage and their child birth, because of urbanization, job opportunities, or life style choice. For example, in 1985 the average age at marriage of men was 29.8, women 26.7. In 2010 these numbers turned to 37.9 and 35 (Destatis-JB, 2017, p. 59). Fourthly, there is also a tendency of increased proportion of childless women. The age cohort women, which are women born in the same period of time, of 1933 to 1938 had 11% childless women in West Germany and 9% in East Germany. These numbers changed to 22% in terms of cohort women of 1964 to 1968 in West Germany, and 16% in terms of the cohort women of 1969 to 1973 in East Germany (Destatis-GiD, 2012, p. 28). Finally, growth of small households is also a trend contributing to lower birth rate. In 2012, 75% of the approximately 40.7 million households in Germany were a maximum of two people. In 1991 this number was just
64%. The proportion of one-person households was 34% in 1991, and around 41% in 2012 (Destatis-HF, 2013).

![Figure 3: Changing Age Structure of Population in Germany from 1910 to 2030](image)

On the other side, the aging trend is also affected by the positive evolution of life expectancy, which is defined as the average number of additional years a person of a certain age can expect to live if the current mortality rates continue for the rest of that person’s life (Destatis, 2009, p. 46). Germany has witnessed a continuous rise in life expectancy for more than a hundred years. In 1970, the average age at death was 68.9 years, but 78.4 years in 2016 (Destatis-12613-0007, 2017). Newborns in 2017 even have a good chance of reaching an age of over 90 years (Zur-Nieden-212, 2017). And this trend is attributable to progress in medical care, better hygiene and nutrition, improvements in the housing situation, and better conditions of work and increasing material well-being (Eisenmenger, Emmerling 2011, p. 230) and is predicted to be continued.
Figure 3 illustrated the aging trend from 1910 until 2011, and to the projected year 2030. The shape of the age pyramid is being metamorphosed into an age torch towards 2030. In 1950, the median age of the population was 34.9. This number was 45.1 in 2013 and projected as 47.6 in 2030 in the Variant 1 (Destatis-Simulation, 2015). The $S_{50+}$ was 42% in 2013, but would be 48% in 2030 (Destatis, 2015, p. 20). The aging process is particularly reflected by the number of the 65+ age group representing the retirement population. The respective share was 10% in 1950, 21% in 2013, and will be 28% in 2030 (Destatis-Simulation, 2015). Similar trend can be assumed for the retirement population 67+ group, too.

Figure 4: Young-age, Old-age and Total Dependency Ratios

Source: Germany’s Population by 2060 – Results of the 13th Coordinated Population Projection, Figure 12, Young-age, old-age and total dependency ratios with age limits of 20 and 65 years, Statistisches Bundesamt (Destatis), 2015

The aging of the currently large middle-aged cohorts leads to dramatic shifts in the population’s age structure. The working-age population, which is individuals at the age of 20 to 64 years (Destatis, 2015, p. 6), will be significantly affected by the overall aging process. In reportable statistics until 2016, individuals in the 20 to 64 age bracket are considered to be of working age, although the term retirement age was increased to 67 years in 2012 by the German Legal Retirement Insurance. In 2013, this age group 20-64 comprised 49.2 million people. Their number will decline significantly after 2020, reaching around 44 to 45 million in 2030 (Destatis, 2015, p. 6). Three indicators in the quantitative deep-dive can reflect the economical relationship between different groups: Young-age Dependency Ratio, Old-age Dependency Ratio, and the Total Dependency
Ratio. In the case of Germany, the post-reproductive generation had been increasing in contrast to the pre-reproductive generation. The higher the population has a 50+, 65+, or 67+ proportion, the older is the population in sense of demography (Mai, 2003, p. 15). The effect of higher proportion of old people in population is the lower proportion of younger people, more importantly the working-age people. Figure 4 illustrates the Development of Dependency Ratios towards 2030.

The Young-age Dependency Ratio is the ratio of the number of people aged 0 to 19 years per 100 persons at working age (Destatis, 2009, p. 47). A higher Young-age Dependency Ratio implies that higher investment and service need to be ensured for example in education and kindergarten. In like manner, a higher ratio of Old-age Dependency which is the ratio of the number of pension age people 65 years and older per 100 persons of working age (Destatis, 2009, p47) implies higher requirements on social services such as pension insurance scheme and public health care systems. The sum of the Young-age Dependency Ratio and Old-age Dependency Ratio is the Total Dependency Ratio.

As shown in Figure 4, the Young-age Dependency Ratio in Germany had a downturn since 1980s. The reason is the end of the Baby Boomers period, but also the declining fertility. This trend was slowed down since the 1990s. The Old-age Dependency Ratio has been, however, continuously increasing due to the positive evolution of life expectancy and the aging of Baby Boomers. Around the end of 1980s, the Total Dependency Ratio had a turning point where it increased until today and is predicted to be considerably continued towards 2030. Based on the data used in Figure 4, the year 2007 was a historical year, where a transition happened from a situation in which children are dominant to another situation in which older persons are dominant. This transition shows a trend of German society from high mortality and high fertility, to low mortality and low fertility. A high Total Dependency Ratio implies that the economically active population and the overall economy face a greater burden to support and provide the social services needed by children and by older persons who are often economically dependent (UN-DR, 2006, p. 104).

2.2 Trends in Labor Market and Employment

Not every person of the population can be considered as labor force, since part of the population is not economically active. The distribution of economically active population can be classified by different perspectives, for example, employment type, personal attribute, region, industry branch, or education level. Structured analyses on these distinguishing marks help understand the labor market development in terms of demand, supply, and the purpose of government initiatives.
2.2.1 Structure and Age Related Deep-dive of the German Labor Market

Based on the result of the latest Census as of June 2017, the number of inhabitants in Germany was 82.6 million (Destatis-FF, 2017). Thereof, the Economically Active Population (EAP) was 45.9 million. This is 55.6% of the entire population as the Labor Force Participation Rate. Persons at working age who are neither employed nor unemployed are regarded as part of the economically inactive population. So, the Non Economically Active Population (Non-EAP) comprises persons who are either unwilling or unable to be employed for assorted reasons such as full time attendance at educational institutions, engagement in household duties, retirement or very old age, begging, infirmity or disablement (ILO, 1982, p. 5; ILO, UN-DESA, 2009, p. 41). With the demographic shift, the portion of EAP is shrinking in the future. While the non-EAP will respectively grow, measures of working condition improvement can help this potential labor force to enter the labor market.

Figure 5: Labor Market in Germany - Structured by EAP and Non-EAP

Source: Own representation based on data from Population Development, Demographic Change – Key Figures, Statistisches Bundesamt (Destatis), 2017, at https://www.destatis.de/EN/FactsFigures/SocietyState/Population/Population.html, access on December 30th, 2017

Figure 5 illustrates the German labor market structure described above. In accordance with definition of the International Labor Organization, any person at working age is considered employed if he/she worked for remuneration, as self-employed, or as a family worker for at least one hour in the one-week reference period. As of June 2017, 44.3 million persons in Germany were in employment, thereof about 40 million employees and 4.3 million self-employed or family workers. 1.6 million people were unemployed,
which refers to any person at working age if he/she was not employed in that period, but actively sought work over the four weeks of Labor Force Survey.

Within the employment group, 14.8 million were 50+ years (Destatis-FF, 2017). So, the $S_{50+}$ in the employment is 33%. In comparison, the 50+ years age group within the entire population was 35.9 million, or $S_{50+} = 43%$. The analysis shows that the $S_{50+}$ within the employment population is lower than the situation in the total population. The next deeper level of analysis is breakdowns of EAP and Non-EAP by different demographic sub groups. These breakdowns provide explanatory insight on socio-economic aspects such as age, gender, and migration.

*Figure 6: Trend of 50+ Share in EAP, Employment, and Unemployment*

*Source: Own representation based on data from Population Development, Demographic Change – Key Figures, Statistisches Bundesamt (Destatis), 2016, at https://www.destatis.de/EN/FactsFigures/SocietyState/Population/Population.html, access on December 30th, 2016; GENESIS-Online Datenbank, Destatis-Genesis, 2016, at https://www-genesis.destatis.de/genesis/online, access on December 30th, 2016*

*Age* is defined as the life years since the person’s birth. In operational statistic classification, it refers to the accomplishment of the full life years as of the recorded date (Destatis, 2010, p. 69). For example, if somebody was born at July 1st in 2010, and the record date was December 31st in 2011, this person is classified as 1 year old, since this person has accomplished one full life year, however, not two full life years. This definition will be consistently used during this research work, unless specific note is made.
The focus of this research work is 50+ group. Only in selected cases, 65+ will be also considered, since the participation of this age group as EAP is expected to increase in the next years, for example, back to work after the retirement. Figure 6 shows the development of the share of the 50+ group in the economically active population during the past years.

In 1991, the $S_{50+}$ in economically active population was 23%, in 2016 already 36%. The speed of increase in the 50+ group is faster than the overall increase of the economically active population. From 1991 to 2016, the economically active population increased 15% from 40 to 46 million people. The respective increase of 50+ group is 70% from 9 to almost 15.3 million people. In terms of the 65+ group, the respective increase is much stronger, with an increase of 370% from 0.3 to 1.1 million (Destatis-Genesis, 2016).

Similar tendency can be identified in the employment data. During the same period, the $S_{50+}$ within the employed population increased from 23% to 36% (Destatis-Genesis, 2016). In contrast, the $S_{50+}$ in the unemployed population shows an interplay effect with the employment trend, since one may assume that they are negatively correlated. Change of unemployment was influenced by more complex factors. Since the year 2000, the $S_{50+}$ in unemployment increased again. One possible reason is that the overall size of the 50+ group in the economically active population has increased.

Figure 6 uses data from the German Federal Statistical Office as of December 2016. Based on the data 1991-2016 and a simplified forecast Linear Approximation method, the outlook towards 2030 is provided, however, only as directional illustration. A more solid forecast has been conducted by the Germany Institute for Labor Market and Job Research. For example, the employed population in 2030 would be 42.6 million. The share of the 50 to 74 years group in the employed population in 2030 would be 16.3 million (IAB, 2016, p. 32) which is 38% of all employed persons.
The second aspect of the demographic deep-dive is gender. Gender is generally considered as distinct from a person’s biological sex which refers to an individual’s anatomy (Whitbourne, Whitbourne, 2011, p. 12). Social and cultural factors relevant to gender are important to the extent that the individual assumes a certain role in society based on being viewed as a male or female. In Germany, participation of women in economical activities has been delayed in comparison to other developed countries in the world. The share of women in EAP is expected to be significantly improved in the next years. Therefore, the following analyses show the demographic group women. Figure 7 is the first deep-dive which illustrates three inferences by age and gender breakdowns.

- Based on the data of December 2015, the major economically active age groups are the 20 to 59-year-old population. The highest EAP is the group of 40 to 50-year-old, with a percentage greater than 85% for both genders. Both the population size and the EAP size of the 50+ group are not lower than the young groups under 35 years.
One million 65+ EAP is in employment status. Although this age group has reached the retirement phase, there were 647,000 men and 390,000 women in employment status. It represents a 9% of men and 4% of women in the respective gender groups in the entire 65+ population.

Both in 50+ group and in other age groups, the share of man in employment is higher than woman. As of 2015, the Non-EAP of women is around 10 percentage points higher in comparison with men. In Germany, the participation of women in economical activities is lower than men. This gap is bigger from the age group of 30 years onwards. The 53% Non-EAP in the women population means an additional potential labor force for economical activities. Interestingly, women worked more often than men in occupations requiring a higher qualification. For example, 44% of the women in employment had such jobs, compared with 41% of the men (Koerner, Puch, Wingerter, 2012, p. 56).

Based on the prediction of German Federal Ministry for Labor and Social Affairs, there is a trend that the EAP Rate of the 50+ group will significantly increase towards 2030. The EAP Rate, also called economic activity rate or labor force participation rate, measures the participation of population in economical activities. It is defined as the percentage of EAP in population (BA, 2017, p. 30).

Figure 8 shows the development of EAP Rate from 1995 to 2030 by age groups and gender. There are two factors which contribute to this trend: the 50+ male groups and all age groups of females.

Comparing the two Male curves for 1995 and 2030, the prediction indicates that the expansion of the EAP Rate mainly occurs in the 50+ groups. In 2030, one can find an increase of 15 to 36 percentage points of employment rate in the age groups of 50 to 64 years. Also, for the 65+ group, there is a positive change of around 10 percentage points. Reasons have been discussed in early sections, for example, due to aging labor force, higher life expectancy, and better health situation.

Comparing the two Female curves for 1995 and 2030, the increase of the EAP Rate for 50+ groups during the same period follows a similar pattern as in the Male curve. The difference is that the change is expected to be larger. With this trend, the EAP Rate for the 60 to 64 years group would increase 39 percentage points, from 16% in 1995 to 55% in 2030. The second aspect which differs to the Male curves is that the increase of the EAP Rate of women does not only occur in the 50+ groups, but already starts with the 20 years group. This is because the significant increase of women participation in economical activities during
the recent years. And this trend is expected to be continued thanks to the support by a number of women initiatives in government and companies.

![Economically Active Population Rate](image)

**Figure 8: EAP Rate 1995 – 2030 - Impacted by Aging and Gender**

Source: Own representation based on data from Arbeitsmarktprognose 2030 - Eine strategische Vorausschau auf die Entwicklung von Angebot und Nachfrage in Deutschland, Tabelle A2, Erwerbsquoten nach Alter und Geschlecht (in %), Bundesministerium für Arbeit und Soziales Referat Information, 2013

There is a further gender difference regarding the age groups: atypical employment, in particular, part-time employment. *Atypical Employee* can be found in the context of the German social legislation and laid down in several volumes of the Social Code (Destatis-Nr.281, 2017). There are different types of atypical employment such as Low Pay (geringfügig entlohnte Beschäftigung) for which the wage is regularly not exceeding Euro 450 per month, working in Part-Time up to 20 hours per week, or Short-Term Employment (kurzfristige Beschäftigung) which – during a calendar year – is restricted to two months or 50 working days. The latter represents up to 50% of the entire part-time employment (Koerner, Puch, 2012, p. 15). Other types of the atypical employment include workers due to federal integration measures in the context of social insurance. In 2016, 20.7% or 7.7 million persons in employment were atypical employees (Destatis-Nr.281, 2017).
Atypical employment is an important aspect, because older employees and women employees are two of the biggest demographic groups there. The other major demographic groups are young employees under 30 years and employees with migration background (Buschoff, 2016). A further aspect of the employment type is the contractual working time. *Part-Time Employment* refers to an employment of those who are at 15 to 64 years, work less than 21 hours per week or are employees of a Part-Time Prior to Retirement (Altersteilzeit), in an education, or in a German Apprenticeship (Rengers, 2013). In Germany, 71% of employed people within the EAP had a full-time job and 29% worked in part time (Destatis-EB, 2016, p. 88). Part-time work is (still) traditionally female-dominated (Rengers, 2013, p. 7). In average, around 48% of women work in part time, while the percentage within the men is only 11% (Destatis-EB, 2016, p. 84). In both gender groups, there are persons who are in employment, but have the wish to work more hours and are available for additional work (Destatis-PR-UE, 2012). Data in 2016 shows that the share of women employees in part time decreases along the age groups from young to old. Such trends cannot be found for the men groups. As shown in Figure 9, on the male side, share of part time employees of all age groups besides of
the 65+ age group is greater than 80%. But on the female side, the share of part time employees of all age groups of 35 years and above is more than half.

As introduced in the Section 2.1.1, migration is one of the key determinants influencing demography, and becomes a more relevant aspect in demographic analysis. Being an industrialized country, Germany has experienced an increase of net immigration since decades. It is thanks to the country’s good performance during the Great Recession as the immigration rates in countries which were severely affected by the crisis particularly increased (Constant, Rinne, 2013, p. 8). On the contrary, Germany has been often classified as a typical example of a “labor recruiting country” (Chin, 2007). Recently, Germany has accepted an exceptional number of refugees, in particular, since 2015. Understanding this aspect is relevant for companies, since integration of immigrants would influence the demographic (and age) structure in the economically active population and for the long run might influence workforce composition in companies. The latest amendment to the German migration framework entered into force on August 6th, 2016. The Integration Act and its regulation aim to facilitate the integration of refugees into German society and labor market (Integrationsgesetz, 2016; VzI, 2016). Refugees who show the potential to integrate and have a good chance of staying permanently in Germany are provided with easier and faster access to integration classes and employment opportunities in the labor market (Gesley, 2016).

In the migration context, the term German is defined as following. Unless otherwise provided by a law, (1) a German according to the Basic Law is a person who possesses German citizenship or who has been admitted to the territory of the “German Reich” within the boundaries of December 31st, 1937 as a refugee, expellee of German ethnic origin, as the spouse, or descendant of such person, or (2) former German citizens who between January 30th, 1933 and May 8th, 1945 were deprived of their citizenship on political, racial, or religious reasons, and their descendants, shall have their citizenship restored. They shall be deemed never to have been deprived from their citizenship if they have established their domicile in Germany after May 8th, 1945 and have not expressed a contrary intention (GG, 2010, Article 116). The migration facts are based on reports from the residents’ registration offices.

In the same context, persons with a migrant background are those who have immigrated to today’s territory of the Federal Republic of Germany after 1949 and all foreigners born in Germany as well as all people born as Germans in Germany with at least one parent who has immigrated, or one parent born as a foreigner in Germany (Destatis-SY, 2012, p. 20; Destatis-Nr.295, 2016). This includes foreigners who are anyone, but not German with the meaning of Article 116, Paragraph 1 of the German Basic Law, the country’s Constitution, naturalized Germans, ethnic German resettlers, and descendants
of these groups (GG, 1949; AuslG, 1990). As of December 2015, 17 million people with a migrant background lived in Germany. This was 21% share of the entire population. The EAP within the population with migrant background was 8.4 million, thereof, 7.7 million in employment (Destatis-BE, 2017, p.51).

Figure 10: EAP and Non-EAP Structured by Migration and Age


Figure 10 illustrates the $S_{50+}$ in the population with migrant background. The share of the 50+ group with migrant background is much lower than the share of the 50+ group in the entire population. Among the population with a migrant background, the share of EAP was 49% which is lower than those without a migrant background, namely 53% (Destatis-BE, 2017, p. 415). This analysis shows that a similar pattern can be found in all the age groups from 18 to 65 years. In comparison with the gender factor, the demographic group with migrant background has a relatively lower impact on 50+ EAP development, both in terms of scale and composition of employment and unemployment rate.
Towards the next decade, Germany is predicted as one of the top net receivers of international migrants. In 2020, the expected net migration rate would be 4.5, with net migrants of 1.85 million. The respective forecast numbers for 2030 are 2.4 and 1 million indicating a declining trend towards the long run (UN-DESA-No248, 2017, p. 327). Large and persistent economic and demographic asymmetries between countries are likely to remain key drivers of international migration for the foreseeable future. However, for the long-term, the gap of working age population cannot be compensated by positive net migration (Heinzl, 2017, p.23). This aspect will be discussed further in the following sections regarding the labor market.

Furthermore, Germany has its own unique distribution of industries and the respective labor force structure. The production industry remains the fundament of Germany’s economical strength and has a share of GDP of around 25% which is more than any other large industry countries in the world (McKinsey-D2020, 2008, p. 3; Destatis-GDP, 2017, p. 3). The majority works in production industries such as manufacturing, motor vehicles, construction, energy, water supply, and mining. Only a small percentage of the employed population worked in areas of agriculture, forestry, and fishing. The results of the German Survey of Volunteering show that the volunteer rate of the 50+ group was 45%. Older people seem to participate in voluntary activities more likely than younger people. Compared to the population as a whole, people of the 50+ group are particularly often engaged in fields such as culture music, leisure activities or politics and political lobbying (Destatis-OP, 2016, p. 88).

### 2.2.2 Future Labor Force Demand-Supply Analysis

Not only is the number of persons at working age declining at an increasing pace, but the age structure is also shifting. Aging and migration factors lead to deceleration in employment growth, and a long-term path to lower potential economical growth (DBB, 2017).

Figure 11 illustrates the trend of the workforce demand-supply situation towards 2030. In terms of the working age population in 2030, this analysis considers the most recent results of the 13th coordinated population prediction published by German Federal Statistic Office, taking the Variant 2-A as basis. The EAP and employment in 2030 are based on prediction by Economix with a scenario of economical policy to drive digitalization. The gap of open jobs in 2030 is based on a prediction by Prognos with the assumption if no specific measures on the country level would be implemented.
On the demand side, there were one million open jobs registered in 2015 (IAB-Stellenerhebung, 2017). If other conditions remain the same and no further measures are implemented at the national level, an expansion of additional 2.4 million job offers is predicted towards 2030 (vbw, Prognos, 2015, p. 56). In total, 46.3 million jobs would be offered which represents an increase in labor force demand, however, with a gap of 3.4 million vacant jobs.

On the supply side, the working age population in 2030 is predicted to decline by 4.2 million. A respective reduction in the economically active population until 2030 would be 900,000 which represent a decrease in supply. The environmental factors for this deficit are slow-down of the economical growth and the impact of digitalization on job market (vbw, Prognos, 2015, p. 16). A further causing factor is that Baby Boomer generation is expected to depart from the labor market in the 2020s, leaving a large and growing gap in the labor supply.
The largest groups of employed population are White Collars which are around three times larger than Blue Collar EAP. Germany's workforce is well educated and highly qualification-driven, as evidenced by higher education percentages and strike days, since the country's unified tax code and business-friendly policies are outstanding (Kuepper, 2013). In this sense, the labor supply can be structured by highly qualified and not highly qualified workers. In 2012, 31.2 million persons in employment had professional education. Therein, one third of them are Highly Qualified, whose highest professional education has a degree from a university, a university of applied science, or a successful doctoral program. 78% to 80% of those who have traditional degrees such as Diplom, Magister, Master, Doctorate and 20% to 48% of those who have a newly introduced Bachelor degree were employed with the first 12 months after graduation (BMBF-BiD, 2012, p. 137). These groups of employed men and women were, for example, managers in companies or authorities, performed scientific jobs, or worked as programmers, engineers, doctors, social scientists, teachers, technicians, physiotherapists, detective superintendents, or social education workers (Koerner, Puch, Wingerter, 2012, p. 56). Prediction shows there would be an increase of 2.5 million employed people towards 2030 (BMAS, Economix, 2016).

Two third of employed persons with professional education are Not Highly Qualified, which is defined as all persons, exclusive the highly qualified pool, with a successful Vocational Education (BMBF-BiD, 2012, p. 151) such as apprenticeship, vocational schools (Lehre, Berufsfachschule, Meister, Fachschule), or similar education (BMBF-BiD, 2012, p. 237, p. 307). This group is predicted to have a decrease of 292,000 employed people. The supply of qualified labor force will remain moderate towards 2030, and without additional measures, will not fulfill the increasing demand from the labor market. Furthermore, in the Not Qualified employed population there is a decreasing trend too. In 2030, the decrease would be 2 million people (BMAS, Economix, 2016, p. 15).

To close the demand-supply gap in 2030, Germany would need 2.4 million highly-qualified graduates as well as 600,000 not-highly-qualified workers (BA-P2025, 2011, p. 8). Recently, Germany has taken a large number of refugees, in particular, from the Syrian crisis. There is a speculation that this group might rejuvenate an aging workforce to become younger. However, it is difficult to identify the real share of highly qualified people within this group. The refugees need to be supported for years until they learn the language to perform a comparable work as the domestic workers and gain further qualifications to integrate themselves into the labor market. The missing regulations and overload of federal offices cannot give an estimation of real labor force out of this group in the near future.
In particular, engineers and highly-qualified MINT (Mathematics, IT, Natural Science and Technology) talents are and will be in special demand. In 2011, more than 110,000 persons or 15% of all highly-qualified engineers were 55-year-old. It means that in ten years, they will reach the retirement age and leave the EAP (BA-AB, 2012, p. 8-9). Since then, 40,000 engineers and 18,000 mathematic and natural science experts have retired every year. More engineering related vacant jobs are still created on top of this demand. Already in 2011, The Institute of German Economy Cologne has reported that Germany was lack of 117,000 MINT qualified persons. Urgent demand of qualified labor force is particularly in and around regions with strong economical performance like Munich, Stuttgart, and Hamburg. For example, an unemployed engineer in Baden-Wuerttemberg would have 6.4 jobs which he/she may consider to choose (Anger, Erdmann, Pluennecke, 2011). This leads to the increase of retirees who are still economical-ly active after retirement. In 2016, the retiree EAP was 1.1 million which represents an increase of 28% in comparison to 2014. 202,000 of them pursue a formal job which is registered in the German national insurance system. 900,000 of them were in a Low-Pay job. More than half of them are employed as specialist or expert (BA, 2017, 16).

Furthermore, the demand-supply situation can be structured by different job areas in the future. Towards 2030, the share of jobs in service will increase up to 75%. In contrast, jobs in production will reduce to around 23%. Same decreasing trend is predicted for agriculture down to 2%. Towards 2030, digitalization is a strong influencing factor for all sectors. Job increase is predicted in corporate service, healthcare, and social work. In terms of job types, the increasing demand is predicted in knowledge-based tasks or creativity-intensive areas such as health and social help, research, design, consulting, management and leadership, legal regulation, auditing, experiment, art, and journalist (vbw, Prognos, 2015).

### 2.2.3 Representative of DAX30 Workforce and Employers

Being the largest economy in Europe and the fourth largest in the world, Germany had 2.4 million companies as of 2015. In total, 28.4 million employees were working for these companies which generated 6.4 billion Euros annual revenue (Destatis-JB, 2017, p. 514). Large companies, which are defined as companies with more than 249 employees or with over 50 million Euros annual revenue, contributed to 67% of the total revenue of all companies and to 39% of all employed persons (Destatis-JB, 2017, p. 520). This research selects DAX30 to represent large companies in Germany. DAX30 is Deutscher Aktien IndeX (German Stock Index), similar to the Dow Jones Industrial Average in the United States, and contains the 30 largest Germany companies trading on the Frankfurt Stock Exchange. In 2016, the DAX30 companies contributed to the German economy with total revenue of 1.1 billion Euro and 3.2 million employees (Kochanski, 2016). Around 25% of the revenue and 42% of employees of the DAX30
companies are in their locations in Germany (EY, 2013). Appendix B lists the DAX30 companies with annual revenue and number of employees in Germany.

Demographic shift and lack of qualified labor force in Germany affect micro-economical drivers being companies in this country, too. Around three fourths of the DAX30 companies have broached the issue of demographic shift, thereof six for the first time until 2011. Some of them have tried to develop a demography strategy, for example, BASF, BMW, Deutsche Post, Henkel, and Linde. The impact of demographic shift is on their business markets, such as demand of products and services from customers with a certain aging trend. But more significantly, there is a big pressure perceived on their workforce structure and workplaces (Beile, 2011, p. 91). Age structure change is one of the most important statistics visualizing the development of these companies’ workforce (Jung, 2011, p. 683). Many of the DAX companies report on analyses and indicators regarding age structure in their official company reports.

**Figure 12: Change of Workforce Age Structure of Selected DAX30 Companies**

*Source: Own representation based on data from annual reports, sustainability reports, or diversity reports 2009 to 2016 of the respective companies. Workforce refers to Germany only*
Figure 12 selected four companies from DAX30 to illustrate the age structure development during the last years. The four companies are selected from different industries to be representative. All the workforce data refer to their employees in Germany. In the period of fiscal year 2008 to 2015, the insurance company shows an increase of $S_{50^+}$ in workforce by 1.3 percentage points. The other three companies show a respective change of 8 to 10 percent points. Although the total number of employees did not change in a large scale, the average age of all these four companies has increased 1 to 3 years. Some companies state that the employment lifetime is becoming longer. Employees utilize and manage this development with new teaching and learning formats geared to experience and age (DT-CRR, 2012, p. 174). All the companies assume that this average will continue to increase. The pharmaceutical company seeks for young professionals in order to meet long-term human resources needs, promote the employability of its workforce, is active in the area of employee retention including adaption of workplaces to the needs of older people, and established health management programs to maintain their ability to do their job (Merck-CRR, 2012, p. 61).

Furthermore, some companies have started to predict the future how their workforce structure would develop. As an example, Figure 13 shows such prediction of a car manufacturer. In its workforce in Germany, the proportion of employees who are 50 years or above was 26% in 2009, 30% in 2012, and 39% in 2016. This demographic trend will be accelerated by wage-tariff and statutory conditions such as retirement at the age of 67. The company can simulate the workforce development from 2009 to 2024. The estimated average age of workforce would be 47 years in 2024. The $S_{50^+}$ in the workforce was estimated to increase to over 50% in 2024 (CoC, Ems-Achse, 2015) and even higher towards 2030.

![Figure 13: Workforce Prediction of an Aging Automobile Manufacturer](source: Own representation based on data from company reports of CarCR, 2010-2017; CoC, Ems-Achse, 2015)
Further companies also communicate the age-related facts and figures. Another DAX30 company in pharmaceutical industry reported that amongst its 36,000 employees in Germany, the S50+ was 30% in 2011. The average age was 44 years and predicted to be around 50 years in 2020 (Econsense, 2012, p. 14), and higher towards 2030. All this data and comparison confirm that the aging trend has arrived in companies since years. It is imperative for companies to specifically analyze their workforce in advance to proactively prepare necessary actions.

2.3 Implication for Labor Market and Workplace

Economical shift explains what should be produced. Demographic shift explains who should produce (vbw, Prognos, 2015). The first implication of the demographic shift is the changing distribution of economical activities. Considering the increasing of S50+ in population and in companies’ workforce towards 2030, 50+ people will be one of the biggest demographic groups running the future society and economy. There is a challenge for a large number of companies to ensure young employee pipeline while retaining older employees with high productivity.

Government and companies need to reprioritize their demographic stakeholders by considering the 50+ people more and more. Transparency on workforce such as age structure, identified factors influencing the past changes, and scenarios of future development can become more relevant for decision making in such considerations and economical activities. Comparing with the past, understanding 50+ relevant issues will matter more, for example, regarding the differences between 50+ and 50- employees’ in terms of their capability, expectation, and motivation. It is conceivable that companies might use a predicting tool to simulate future scenarios of the workforce development to define the strategic direction of actions. The aging trend will also change the working modes of the last phase of an employment, the transition to retirement, the flexibility of the age border, and the potential economical activities after retirement (Schimany, 2003, p. 377).

The Federal Government has raised the Age of Retirement from 65 to 67 which came to effect in 2012 and onwards. The age of retirement for people born in 1947 is to be extended by 1 month from 2012 to 2023, then by 2 months from 2023 to 2029, and so forth. With this measure, it is expected that the annuity assurance rate will not exceed the 20% by 2020. The Retirement Benefit Level, which is defined as the average retirement benefit divided by the average income of all employed persons, should not be lower than 43% by 2030 (DBG, 2007). As a result of raising the retirement age to 67, the working-age population will grow by 1 to 2 million by 2060 (Destatis, 2009, p. 18). Furthermore, communications and researches have been activated in many public channels. Numerous networks and initiatives about demography and 50+ labor force were
launched. Appendix C provides a summary of the most active government-supporting or non-profit initiatives.

In addition, the demographic shift also creates a growth service market regarding older people in areas such as general condition for informal support to family members to avoid overloading their own economical activities, establishment of formal labor market for household activities, new financial structure of stationary accommodation and budget-side service, and quality of service conditions (Angermann, Eichhorst, 2012, p. 37-40). The Federal Employment Agency subsidizes the unemployed much more than the employed people, especially regarding the old age groups (OECD-AEP, 2005, p. 161). It questions the German social system if and how much enhancement of national insurance contribution should be realized to maintain a stable pension fund, and what would be measures to cover the increasing healthcare services. Furthermore, the aging trend will sharpen the multi-generational culture in people’s life, how to deal with the age image of other people and the self-perception in the society. The process of social aging is considered to represent the fact that people change along with or as the result of changes that occur in their environments (Whitbourne, Whitbourne, 2011, p. 10). Same implication is valid for multi-generational workforce in companies, too.

Secondly, shrinking working-age population and the growing gap of qualified workers towards 2030 require companies to assure enough workforce capacity, productivity, innovation, and affordable growth. The decreasing supply of working age population and deceleration in employment growth caused principally by aging and migration factors will amplify the shortage of skilled labor (DBB, 2017). Reversing the trend of shrinking working-age population by demographic “instruments”, for example, higher fertility and higher amounts of migration flows, is not a realistic option in the short run (Hoehn, Mai, Miechel, 2008, p. 20). For the mid-term, promoting higher employment rates of older people, is a serious supply alternative (Dittrich, Buesch, Miechel, 2011, p. 1). Extended service time of 50+ employees, balancing job and family life for both genders, and successful integration of migration workers are further areas to prevent shortage of qualified labor force (DBT-17/4784, 2011, p. 2; vbw, Prognos, 2015, p. 71). The respective indicators of working environment quality can be found in Appendix D.

Employer associations, workers’ councils, and the Federal Employment Agency have initiated some measures to facilitate labor force improvement at the national level. For example, in 2013, the federal chancellor office made a Demography Tour across almost all regions to create awareness on “Coherence in Demographic Shift”, from the Family Centre Rutheberger Rasselbande in Schleswig-Holstein to Multi-Generation House in Bavaria (DBR, 2013). Since 2012, there is a series of annual Demographic Summit events organized by the German federal government (BMI-DG, 2013). Another initia-
tive is the Qualified Labor Offensive launched by the Federal Minister for Labor and Social Affairs, Federal Minister for Economy and Technology, and Federal Employment Agency. Through qualification and stimulation measures, the individual, social and economical opportunities should be facilitated for the less economically active population such as 55+ group, women, low-qualified persons, and people with migration background. The following ten levers have been defined (BA-P2025, 2011, p. 12):

1. Reduce school leaver without completion
2. Reduce vocational education dropout
3. Reduce university education dropout
4. Increase economical participation of 55+ persons
5. Increase economical participation of women
6. Steer qualified immigration
7. Rise full time employment
8. Push education and professional training
9. Increase labor market transparency
10. Verify prepaid duties and taxes

The trend of shrinking working-age population also implies more involvement of other demographic groups which were not sufficiently tapped in labor market so far. As shown in Figure 7, 8, and 10, the participation of women and immigrants in the economical activities is relatively low. Understanding the implications from these aspects contributes to the research focus being the 50+ group workers, too. This is because working in companies with increasing share of women and immigration has relevant implication for the 50+ groups. And the women and immigration groups, there are also 50+ group as part of them.

Federal government approaches are, in particular, targeted support for women with career path, return from parental leave to job, entrepreneurship, and development to management and leadership positions (DMI-DB, 2011, p. 6). As shown in Figure 9, far before reaching their age at 50, more female workers in Germany have started to take a part-time job. One of the most important reasons is the childcare. There is a need of improved and flexible working conditions in companies, for example, for kindergarten service, family friendly working environment, and equality orientated personnel poli-
cies. To support working mothers, young family parents, and parental leave returnees, the federal government has been implementing several European Social Funds Programs such as Perspective for Return, Good Job for Single Mothers, Professionals for Day-care Centers, and More Men for Day-care Centers (DBT-17/12610, 2013, p. 2). It also supports campaigns organized by the labor unions, professional organizations, and voluntary welfare organizations to improve the social status of the occupation childcare (BMI-DS, 2013, p. 15). Enhancing the Childcare Funding Acts, a legal agreement for the availability of childcare places was introduced on July 13th, 2013. And since 2013, legal entitlement for all children under age three are has been in place. The infrastructure expansion aims at providing daycare spots for 30% of all these children (Kifoeg, 2010). Moreover, a new law about “Child Care Subsidy” was released on July 1st, 2013. Parents whose child was born after August 1st, 2012 are entitled to receive 150€ per month for the child’s 15th until the end of the 36th life month (BEEG, 2013).

Fostering women in economical activities also means acceleration of measure implementation to empower women in career development. The focus is not limited to senior women such as 50+ female managers, but for all age groups. The German Corporate Governance Code, which applied to all listed companies, integrated specific items to promote greater female representation on Managing and Supervisory Boards. It states that when appointing the Management Board, the Supervisory Board shall respect diversity and aim for an appropriate consideration of women (GCGC, 2010, p. 6-9; BMFSFJ-FQ, 2013). Since May 2015, a federal act for equal participation of women and men in management positions in the private sector and in the Federal Civil Service has been effective. The goal is to increase the percentage of positions held by women in leadership such as supervisory boards, managing boards, and the top two management levels below the managing board. Measures, achievement, and reasons for not-achieved targets are expected to be regularly reported to the public (FAoGE, 2015).

In terms of long-run pipeline, increasing highly qualified women, especially in the less-representative MINT education, is important, since Germany is and will remain one of the world leading engineering and industry nations. Political high profiles such as the German Chancellor have been explicitly communicating the sense of urgency about gender balance for the long run. Initiatives from non-governmental organizations such as Charta der Vielfalt, Chefsache Initiative, and many women networks become visibly active (Gesis, 2017).

Another important pool of skilled labor force is immigrants. This is of special interest in Germany due to the increase refugee arrivals since 2010. Asylum seekers can start working, begin a vocational education, or apprenticeship after three months of registered residence. They can participate in the professional education system from the first
day of registered residence (BMAS-IQ, 2017, p. 13). However, in contrast to labor migrants who are accepted on the basis of their economic contribution, labor market integration with refugees tends to be more challenging than other groups. Research shows that early intervention such as early access to the labor market, education, and training systems is effective practice (Degler, Liebig, 2017, p. 67).

Furthermore, a citizen of a non-EU-country, can apply for the EU Blue Card and enter the German labor market, if he or she has a German, an accredited foreign, or a university degree that is comparable to a German one, or if he or she has a working contract with a gross annual income of at least 48,800 Euro, or a job contract in the Shortage Occupation (MINT, doctors and IT-skilled workers) with the amount of 34,944 Euro. Family members of a Blue Card holder are eligible for entering Germany and for employment. After 33 months employment, the Blue Card holder is entitled for a Permanent Settlement Permit (DBR, 2012; AufenthG, 2013).

In Germany, many foreign students are willing to stay after their graduation. Many of them are already economically active during their studies. In 2012, the Federal Government amended working permission related paragraphs in the German Residence Act. For example, after successful graduation, foreign students may have 18 months to seek a job. This is six months longer than the former legislation update. Even during study, the permission-free working days of a foreign student are 120 full days, or 240 half days instead of 90 full days or 180 half days before. Family members of the highly qualified graduates are permitted to work without additional approval of the Federal Employment Agency. (Permanent) Settlement Permit can be issued after two years employment relation as long as they have a valid annuity assurance (AufenthG, 2013). Also, residence permits for those who seek for a qualified education has been improved. The seek time is one year. For residence permits, only the equivalence of working condition is to be approved. No proof of precedence is required any more.

The trend of more immigrants entering German labor market also implies the increasing importance of integration measures. For example, the German language appears as one of the most important obstacles to skilled labor migration. Recent initiatives, such as the Federal Ministry of Labor and Social Affairs campaigns, take this barrier better into account by providing pre- and post-migration language courses. Progress is being made to recruit international specialists with the new online platform “Make It in Germany” or the Federal Ministry of Labor and Social Affairs and the Federal Employment Agency campaign convincing foreign workers to take up employment in Germany. These initiatives provide immigrants with answers to important questions when they consider moving to Germany (Constant, Rinne, 2013). Furthermore, characteristics of the German education and training system must be considered. Nationally-specific and not-
well-known education system may lead to difficulties in obtaining a certificate of equivalence or a state accreditation for people with migration background (BMAS-IQ, 2017, p. 15)

Thirdly, technological development implies potential changes in several aspects during the demographic shift. New technical approach and methods using Big Data and analytics can help to increase transparency in the labor markets and demographic groups. They have the potential to accelerate matching process of jobs and qualified workers. The IAB study uses a scenario of “job market with digitalization” for 2030 and shows that the technological development will not cause a significant reduction of total number of jobs, but a change of job types. For example, in 2030, 490,000 of today’s jobs in processing industries would disappear. However, 430,000 new jobs would be created (BA-CF, 2015, p. 4). Germany is shifting from service economy to a knowledge economy with new jobs in business services, financial services, education, health, and social work (DB, 2016, p. 5). Industries with declining jobs are predicted to be manufacturing, trade, transportation, and public administration (BMBF, 2015, p. 107). Examples of new jobs are associated with updated qualifications, increased share of managing tasks (BMAS, 2013, p. 28), creative skills, and social competency (Frey, Osborne, 2013).

Technical progress such as automation and assistance systems (robotics) can help old people to excel their jobs with longer service time for companies. In addition, the changing job market caused by digitalization also means a reallocation of labor force based on age structure, gender, and migration background. Flexible working locations, flexible working time, and new concepts of life-long learning become more important for companies. An intensified high-quality education and training for young and old employees play a more important role in skill update. Digital formats such as E-Learning can provide new opportunities to facilitate learning (BA-CF, 2015). For example, the Federal Employment Agency offers the program “WeGebAU” to promote vocational qualification for the low-skilled and older employees in companies. It provides 50+ employees with the opportunity to acquire partial qualifications or catch up missing professional qualifications, without having to quit their jobs (BA-WeGebAU, 2017).

3 Summary

This chapter focused on demographic development and trends on macro level and therefore introduced the demographic key concepts. These concepts are consistently used in this thesis and include (1) the definitions of demography, age, aging, (2) the demographic metrics such as average age, median age, share of the 50+, 50+ quotient, and age groups, and (3) the three demographic determinants fertility, life expectancy, and net migration. Also, two assumptions were chosen to clarify the basis of quantitative find-
ings and trends. The first one is the selection of variants from the 13th coordinated population projection by the German Federal Statistical Office. The Variant 1 is used for forecast modeling, base lining, and benchmarking purpose. The Variant 2-A is used for the discussion on measures for practical application. The second assumption is that digitalization will influence the future job market and workplace. This factor of technical development in the demographic shift is considered throughout the following chapters. Table 2 summarizes the key results of the analyses of demographic trends in Germany.

The societal aging process is quantified in particular by an increasing median age of population, increasing total dependency ratio, increasing share of the 50+ years in population, in the economically active population, and within the employed persons. The most important causal reason is the annual birth deficit in Germany of 0.1 to 1 million persons since 1970s. This deficit is a result of the continued low level of total fertility rate of 1.4 to 1.6 per woman and a crude death rate of 10 per thousand persons per year. Although the average age of immigration is younger than the overall population, the aging trend will not be compensated by net immigration for long-term and is predicted to continue towards 2030. The societal aging process is also reflected in large companies such as DAX30 workforce. Economical activities are increasingly run by an aging labor force. Issues in human resource management about old workers should be prioritized higher due to their increasing share of the workforce. Corresponding transparency and strategies on companies’ workforce such as age structure and scenarios for future development can become more relevant for decision making.

The estimation of labor supply and demand is based on the population projection Variant 2-A by German Federal Statistical Office and the labor market prediction scenario Digitalization by Economix, vbw, and IAB. On the supply side, the decline of the 20-64 years working age population is predicted to continue for the next years. In 2030, Germany would have 4.2 million less working age population, and 900,000 less in EAP. The Non-EAP of women in Germany is higher in comparison to men. Population with migration background has a lower EAP. The current actions of bringing more women and immigrants into the labor market are still not enough to compensate for these trends.
### Relevant demographic trends for companies (50+ focus)

#### Aging population
- Increasing median age from 44 to 46 (2010 – 2030)
- Increasing 50+ (2010 – 2030)
  - of 5 percent points in population (from 41% to 46%)
  - of 4 percent points in EAP (from 30% to 34%)
  - of 3 million 50+ EAP from 12 to 15 mil. (2010-2016)
- 1.1 mil. retirees were economically active in 2016 which is 28% increase to 2014. Majority as specialist or expert

#### Increasing demand-supply gap in job market (scenario digitalization 2015-2030)
- Decreasing working-age population from 48.8 to 44.6 mil., although more women and immigrants enter labor market, in EAP from 44.9 to 44.0 million
- Increasing demand for 2.3 mil. employees, with an increasing gap of vacant jobs from 1 to 3.4 mil.
- Increasing new jobs in business service, financial service, education, health, and social work. Demand on updated qualifications, increased managing tasks, creative and social competency

#### Demographic shift is reflected in the workforce of companies
- A sample of DAX30 companies shows that the average age increase was 1 to 3 years during last 5 to 7 years with significant expansion of share of the 50+ employees
- Initiatives and first experiences to deal with demographic shift are available in governments and large companies

### Implication for companies
- Issues and solution ideas about aging workforce become more relevant in companies’ people management
- Capability to create workforce transparency and prediction is important to design purposeful actions
- Future jobs and tasks are shifted by digitalization and therefore demand systematic skill update of (50+) workforce

| Table 2: Summary of Trends of Demographic Shift |
| Source: Own representation |

There is an unbalanced demand-supply gap in the labor market. An expansion of additional 2.3 million employed persons is predicted towards 2030. There is a growing gap of vacant jobs from 1 to 3.4 million in 2030. Being influenced by technological development, the shifted jobs and new jobs are characterized by increasing service and knowledge orientation. This trend leads to an increasing labor demand on digital qualifications, increased managing tasks, creative and social competencies. Actions such as
systematic skill update for current workforce and 50+ employees become more relevant for companies.

The German government and ministries have started implementing a demographic strategy as highlighted in the Section 2.3 (see also Appendix C and D). On one side, it supports to bring broader demographic groups into economical activities. On the one hand, it tries to improve working conditions for the increasingly aging employees and old workforce groups, and future retirees. Also, leading companies such as the DAX30 are aware of creating workforce transparency, understanding the implication, and how to manage demographic shift in business environment. At the micro-economic level, one needs to explore the difference between older and younger employee groups in specific dimensions so that impact of purposeful measures can be achieved.
III The Age Difference

This chapter deals with age differences at an intra-individual and an inter-individual level. The main method employed here is literature review. The type of investigations in this research is different from the previous chapter due to two reasons. First, the investigations focus on applications from employment and human capital perspective. They mainly imply the occupational aspects of aging, known as industrial gerontology (Murrell, 1959) and have multidimensional facets (Lehr, 1981; Sterns, Alexander, 1987). The referenced facets are based on dimensions of psychology, sociology, physiology, and gerontology. Second, in each dimension the target comparison group is the 50- and the 50+. The research investigates sub fields of each dimension where age difference plays a role in job environment, individual development, and human resource management. Therefore, investigation and conclusions are specified for the areas such as adult development, generational effect, health, learning capabilities, and social behavior.

1 The Meaning of Age

Researchers in the field of Human Development use age as a shorthand way to describe processes that occur within individuals along with the passage of time (Whitbourne, Whitbourne, 2011, p. 8). Although age is recorded by time and simple mathematic method, it is more than just a numerical value. Here age means the Chronological Age or Calendar Age, which is defined by the number of life years (Brauchbar, Heer, 1993) and based on events in the universe that occur and its units. It indicates birth date and causes nothing else to occur (Jarvik, 1975). Obviously, all the numbers of age in the charts and analyses of this research work are chronological age.

In order to correctly understand the aging, a descriptive note in advance is needed. Like other descriptive features such as gender, eye color, the chronological age has a value in describing a person but cannot entirely represent the status of the body’s function, is not necessarily inherently tie to the real aging process. The numerous notes on inter-individual variability of biological, medical, physiological, and pathological processes, as well as psychological reaction and social interactions regarding age shows that the chronological age is limited for status and adjustment of the older people to their situation (Thomaes, 1983, p. 40). Therefore, gerontologists observe age and aging from a different perspective, namely how people function.
From the functional perspective, Havighurst uses the sources of developmental tasks to analyze the meaning of age, aging, and lifespan. Developmental tasks are tasks that arise from physical maturation, tasks that from personal sources, and tasks that have their source in the pressures of society (Havighurst, 1972). The Functional Age is characterized by the self-competence of the person, namely, the ability to accomplish the most important life functions (Friedrich, 2001, p. 10). Three types of functional age have been proposed and build a coherent system based on indicators of a person’s true characteristics and capabilities: biological age, psychological age, and social age (Whitbourne, Whitbourne, 2011, p. 9).

Biological Age is visibly marked by time-dependent, irreversible, and predictable changes that perform progressive loss of function of all tissues and is based on the quality of an individual’s bodily systems (Danner, Schroeder, 1994, p. 96). Popular culture has certainly caught on to the notion of biological rather than chronological age. People of same chronological age may have different biological functions (Laslett, 1995). Multitude of “biological age tests” provides people various values to estimate metrics such as life expectancy or to determine how well one will age. People have different associations when mentioning “become older” or “aging”. One may think about being prepared for bad memory ability when turning to 50 from 49 years. Another may expect to see, although not wished, more skin wrinkling on face when entering 30 from 29. The body does not change in such discrete fit and start. The references compiled by various authors regarding profiles of same age group show that different individuals may have different functions in each one above or below their average biological age (Thomae, 1983, p. 10).

Theoretically, both the numerical length of life and the biological aspect are only parts of the numerous influential variables (Lehr, 1979). Researchers suggested that cognitive aspect should be used as a basis for an explicit segmentation since it better reflects an individual's identity and behavior (Barak, et al., 1980, 1985, 1986, 1988). Because Cognitive Age is related to life events, people with similar ages may have similarities in lifestyle, health, and mental outlook (Reynolds, Rentz, 1981). The cognitive status of aging individuals determines their independence, quality of life, and further physical and psychological development (Finke, Dodds, Bublak, et al., 2010). Following closely the biology, a person’s ability to meet the cognitive demands of the environment also changes. This ability can be accurately characterized by an index of individual Age, which is based on the quality of an individual’s functioning on psychological measures, such as intelligence, memory, and learning capability (Whitbourne, Whitbourne, 2011, p. 11).
The age difference may also come from individuals’ environment instead of individuals themselves. For example, a grandparent would be more senior than a parent, although the grandparent could be younger, both biologically and psychologically, than the parent. The Social Age is the characterization of a person’s age based on occupying certain social roles (Whitbourne, Whitbourne, 2011, p. 10). Accordingly, a 40-year-old consultant with 10 years experience in a specific industry field would be more senior than one of same age but joined this industry only 3 months ago. Age is seen as a social construct by the working society, in which labor is the essential basis of their structure (Kohli, 2000, p. 232). In such environment, a central social description of age is associated with the performance of existing or declining capabilities at the job (Backes, Clemens, 1998, p. 54).

To neutrally explore and understand age difference, there should be no unconscious bias such as “older people are slower than young people”. Not only is such statement unclear and less specific, but it is also an individual perception in not-well-defined context. Difference between younger and older groups varies in scientific subject and needs to be discussed along clearly stated conditions.

There is no standard definition on which age is “old”. And there is no standard age borderline to discretely define what or who is old or young (Malwitz-Schuette, 1998). However, the chronological age is a useful attribute to help orientate a person in category “young” or “old” (Hoepflinger, 2005, p. 62), or to make the distinction among age groups. Havighurst defines the 30 to the next twenty to thirty years as the middle age group. Roux researched the social perception about age by interviewing differentiated age groups. The answers of younger interviewees state the end of “being young” is around 41, the beginning of “old” is around 62. Answers of older interviewees are respectively 53 and 68. The subjective distance between the end of young and begin of old is about 20 years (Roux, 1994). This social perception does not change in recent decades, because another study in 1946 showed similar result (Stoetzel, 1961).

Pilcher uses 50 to clearly define transition from the age stage of “full-employment” to “post-work” (Pilcher, 1995, p. 89). These research results seem to provide a meaningful basis to use 50 as an orientation to differentiate “young” and “old”. Furthermore, in areas such as economic activities, "older workers" mostly refer to 50-year-old workers (Schimany, 2003). From a professional competency development perspective, it seems to be meaningful to classify the 50-65 years employees as the group of “old” workforce (Huebner, 2001). Therefore, this research uses 50 as the orientation to differentiate younger and older employees. Table 3 summarizes the age differences based on specific definitions applied.
Table 3: Summary of Age Difference in terms of Definition

Source: Own representation

2 Difference in Life Span and Generations

The following section about age difference will investigate life span phase and developmental tasks from physiological perspective. Beyond, cohort which is a group of individuals born in the same historical period, and consequently share similar environmental circumstances at equivalent points in their maturational sequence (Schaie, 1983, p. 5), will help to understand effect of historical events on age groups. Therefore, generational aspects are also considered in this section to elaborate the basic developmental implication on age.

2.1 Age Distinction from the Adult Development Perspective

People of different ages can be grouped in four Life Phases (Pilcher, 1995, p. 89; Laslett, 1995; Backes, 2001). Along aging, they perform typical developmental tasks which arise at a certain period in their lives. The successful achievement is expected to lead to happiness and fulfillment, while failure leads to unhappiness, social disapproval, and difficulty with later tasks (Havighurst, 1972). Based on each of the life phases, sub age groups can be specifically differentiated.

In the first Life Phase, one grows up while relying on education of parents and institutions. Although the person is not greatly mature, she or he may have acquired some primary social skills while promoting certain morality standard, a set of values, and an ethical system as a guide to behavior. And by entering the secondary socialization, a person learns what is the appropriate action being a member of a smaller group or within a larger society.

The next two Life Phases are typically accompanied by employment, career or entrepreneurship, and are therefore more interesting for this research. In the phase II, one confronts new challenges and developmental tasks from the time of independence, ma-
turity, responsibility, earning, and saving. This phase is an extremely active period of life where people make a productive contribution to the society (Fulcher, Scott, 1999, p. 371). One takes new roles which are probably sampled out in this age period by sex and are significantly important for decision-making of life.

Features of the Life Phase III reflect freedom, personal interests, and self-realization. Recently, more and more researchers are interested in this so-called "Third Age" in subjects of gerontology, medicine, and sociology. People in this life phase are senior citizens or employees who typically have a strong sense of self-fulfillments. They adjust to decreasing strength and health, but highly meet social and civic obligations. A large number of people in this group exit from employment. The formal retirement is also a clearly defined life span (Schimany, 2003). In Germany, as introduced in Chapter II, it will be the 67th life year. In both developed and developing countries, and in comparison, to men, the final exit of women from employment usually occurs earlier. The construction of the welfare state for this transition to the new phase of life plays an important role for labor policies of government and companies.

The characteristics of the last Life Phase IV turns to inevitable dependence, decrepitude, and death. At the end of life, people of this age group have highly physical deficiencies and experience hopeless biological recovery of individuals, which permanently need for help. Being part of this group can be seen as symbolic of successful modern societies, because increase of life expectancy is based on an increasing social prosperity (BMFSFJ, 2002). Appendix E summarizes the four Life Phases assigned to criteria of different theories.

2.2 Cohort Differentiation

Performance or behavioral differences between 30- and 50-year-old, which can be observed at the same time, are conditionally affected, not only by age but also by socio-cultural factors, such as the manner in which the two age groups grew up (Anastasi, 1958). The German philosopher and sociologist Karl Mannheim first raised the notion of Cohorts describing the groups of people who are bound together by historical events. The Cohort Effects come from characteristics along a same birth year (Hoepflinger, 1999, p. 70), and consequently on a similar social problem. The epochal effect is determined by the epoch-specific perspectives of different generations. Both effects contribute significantly to community (Rosemayr, 2002), or to changes within a generation, which is defined as those born during a particular period and are kinship groups by parent-child relationships (Fulcher, Scott, 1999, p. 372). The experienced social and historical context determines activities and life goals of a generation (Wenzke, 2007, p. 27). The term generation has been profoundly used outside of family context. In many busi-
ness and human resource areas, generation is used to describe a cohort of employees with common historical and social background.

The World War II is a historical event which has influenced the definition of the two upper-border generations. The oldest generation of today's societies was born between 1925 and 1945 and grew up in a very challenging time with life experiences that included wars. They are called as Traditionalists or Veteran, because the political and economic uncertainty led them to be cautious, financially conservative, less change adventurous, and risk tolerant (UN-JSPF, 2009, p. 5). On the other side of the World War II, the Baby Boomers were born between 1946 and 1964, namely the cohort of the 15 to 20 years after the war. They were result of the noticeable temporary increase in the birth rate (Ryder, 1965, p. 847).

The following three lower-border generations grew up without direct influence by the last world war. Researchers published definitions on the first post-war generation by identifying different birth year boundary starting from 1960-1965 to 1976-1982 (Sayers, 2006, p. 23). It is widely believed that the years 1965 and 1980 build the boundary of the Generation X and may best reflect this generation’s characteristics (UN-JSPF, 2009). This cohort was an unknown generation with uncertain future (Ulrich, Harris, 2003, p. 5), which is related to the letter X of mathematical sense, and with huge potential and talent, therefore named as X-cellent (Bellafante, 1995, p. 62). The phrase Generation X was also attributed by author Douglas Coupland, in his book titled “Generation X - Tale of an Accelerated Culture” (Coupland, 1991) which created strong association with a rock band of an identical name. The Generation Y was born in 1980s to 1900s, and according to Oxford Dictionaries definition, it is the generation comprising primarily the children of the Baby Boomers and typically perceived as increasingly familiar with digital and electronic technology. Alphabetically following the former two generations, the post-millennial generation born after 1995, are named as the Generation Z. Although this hyper-connected generation still has a few years before they enter the mainstream workforce, it has already shown thoughtful characteristics to influence the future of societies, cultures, and workplaces (Scholz, 2012; Emelo, 2013). This research work focuses on the current 50+ group which is by coincidence the Baby Boomer generation around the year 2015.

Beyond cohort birth years and historical events, researchers instrumentalize sociological, psychological, and cultural perspectives to analyze generational difference, essentially by life experiences (Applebaum, Serena, Shapiro, 2004; Hankin, 2005; Meredith, Schewe, Hiam, 2002; Yu, Miller, 2005; Zemke, Raines, Filipczak, 2000), individual characters, core values (Mackay, 1997, p. 181), attitude on family, lifestyle, education, communication media, and dealing with money (Hammill, 2005). These perspectives
are indicative of patterns in societies, families, and workplaces, but not every person in a generation shares all of the various characteristics. Importantly, there are geographical differences since cohorts and historical events in different continents and cultures vary a lot. A national culture has a major impact on employees’ work-related values and attitudes (Robbins, Millett, Cacioppe, Marsh, 1998). Since this research focuses on Germany, its respective investigations and analyses orientate mainly the western world. More detailed explanation on the generations in Germany are listed in Appendix F. Table 4 summarizes the different terminologies based on Life Span and Generations.

<table>
<thead>
<tr>
<th>Age</th>
<th>In this research only: 50-</th>
<th>50+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life Span</td>
<td>Childhood  Adulthood Mid. Age</td>
<td>Later Maturity  Centenarians</td>
</tr>
<tr>
<td>Generation</td>
<td>2015: Gen-Z  Gen-Y Gen-X</td>
<td>Baby Boomer  Traditionalist</td>
</tr>
</tbody>
</table>

Table 4: Summary of Terminologies in terms of Life Span and Generations

Source: Own representation

3 Difference in Health

Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity (WHO, 1948, p. 100). Physical changes caused by the biological aging process influence individuals’ daily life, which in turn can modify behavior and performance in the workplace. In comparison to younger people, old people experience a number of physical changes in terms of appearance, body build, organ functions, and vital systems.

3.1 Physical Fitness

Aging, which is frequently used to shorten Biological Aging, refers to a set of changes in the human organism, the optimum after time for the reproduction occurs, the appearance of behavior, experience, and social roles (Weinert, 1994, p. 182). The aging process is understood as any positive or negative change in the adaptive capacity. It progressively reduced the probability of survival of the individual and coded in human being’s gene. 7% of the genetic information of inherited cells comes to consideration on pathological phenomenon of biological aging process (Martin, 1978). On one hand, Normal Aging or Primary Aging refers to a set of changes built into the hard wiring of the organism such as genetic coding, which progress at different rates among individuals but nevertheless are universal, intrinsic, and progressive. On the other hand, Impaired Aging or Second-ary Aging is a function of an abnormal set of changes afflicting a segment rather than the entirety of the old population (Aldwin, Gilmer, 1999). The former is deterministic, the latter stochastic (Danner, Schroeder, 1994, p. 109; Dandekar, 1996, p. 10).
From the health perspective, *Medical Age* is of relevance, too. Both the internal medicine in terms of geriatrics and psychiatry flow defines the age. Features of an aging organism from the medical perspective are (1) structure and loss of function of tissues, organs, and consequently, a decrease of the performance and capacity, (2) increase of the immobilization and decrease of psychosomatic pulses, (3) occurrence of multiple pathology, and (4) behavioral changes and increasing difficulties in adjustment (Steinhagen-Thiessen, et al., 1994, p. 124). Typical concomitants at higher medical age are multi-morbidity, suicide, and functional disorder such as depressive, paranoid, anxiety, or dementia (Haefner, 1994, p. 152-155). The biological aging has an important implication on the workplace design, for example, ergonomically improvement of workplace or adaptive production plan due to illness rate of different biological age groups. Table 5 summarizes research results of all the changes that can be significantly perceived around and after the 50 years.

<table>
<thead>
<tr>
<th>After the 50 years …</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Skin</strong></td>
<td>• Skin is less flexible with more wrinkling and discolored lentigo senilus (Whitbourne, Whitbourne, 2011, p. 65)</td>
</tr>
</tbody>
</table>
| **Muscles**         | • Weight decreases due to sarcopenia (Kostka, 2005; Ding, Cicuttini, Blizzard, et al., 2007)  
                     | • The muscular strength declines at a faster rate of 12 to 15% per decade (Manini, Everhart, Anton, et al., 2009) |
| **Bones**           | • Bone loss, mainly in bone mineral content, may imply a physical problem (Whitbourne, Whitbourne, 2011, p. 74) |
| **Sensomotor System** | • Decline of sensorimotor ability, especially for more complex environmental conditions (Birren, Cunnigham, Yamato, 1983; Lehr, 1972; Mathey, 1984) |
| **Visual Acuity**   | • Changes of lens in the eye lead to presbyopia (Saup, 1993, p. 62)  
                     | • Narrowing of the visual field of an eye (Saup, 1993, p. 64) |
| **Auditory Acuity** | • Presbycusis which influences old adults’ language ability to engage in a conversation and tinnitus (Bergman, Blumenfeld, Cascardo, et al., 1976; Murphy, Danemann, Schneider, 2006) |
| **Sleep**           | • Less sleep down to 6 hours a day (Rechtshaffen, Kales, 1968)  
                     | • Take longer to fall asleep awaken more often, and have sleep that is shallow, more fragmented, and less efficient (Fetveit, 2009) |
Functioning Organs

- Functionalities of organs decline year by year, even with a very good environment conditions (Kirkwood, 2002), in mainly 3 systems, the cardiovascular system, renal function and lung function (Franke, 1989; Anschuetz, 1989; Ilmarinen, 2000, p. 92).

Table 5: Summary of Age Difference in terms of Physical Function

Source: Own representation

First, the appearance of a person is influenced by skin which is the largest organ in the body. By the 50s, the skin shows distinctive marks of the passage of time. Later, the skin is less flexible, less elastic, and with growing wrinkling, eventually with discolored age spots which are officially called lentigo senilis. These changes are caused by the decreasing ability of elastin, undergoing collagen, less active sebaceous glands and thinning fatty layer (Whitbourne, Whitbourne, 2011, p. 65). In addition, the biological age of the old people with poorer objective health status is higher than that of the comparison group healthier (Furukawa, Inoue, Kajiya, et al., 1975; Webster, Logie, 1976). This can indicate a close relationship between the biological age and the "appearance of older people" being rather older or younger (Borkan, Norris, 1980).

Another aspect of appearance is the body size and shape which is partially determined by the body weight and changes throughout adulthood. Most people increase in their weight until the 50s, after which their weight decreases. This change is not due to reduction of fat but the muscle tissue, namely sarcopenia (Kostka, 2005; Ding, Cicuttini, Blizzard, et al., 2007). As indicated by research from cross-sectional studies, muscle strength reaches a peak in the 20s and 30s, remains at a plateau until the 50s, and decline at a faster rate of 12-15% per decade (Manini, Everhart, Anton, et al., 2009).

Estimates of the decrease in bone mineral content over adulthood are about 0.5% per year for men and 1% for women (Emaus, Berntsen, Joakimsen, et al., 2006). The process of bone loss, mainly in bone mineral content, does not generally pose a significant problem until people reach their 50 years (Whitbourne, Whitbourne, 2011, p. 74). The lifestyle factors appear to slow down the bone loss, such as resistance training (Tolomio, et al., 2008), ingesting high amounts of dietary protein (Devine, Dick, Islam et al, 2005), carotenoids (Sahni, Hannan, Blumberg, et al., 2009), adequate intake of magnesium (Ryder, Shorr, Bush, et al., 2005), calcium, and vitamin D (Dawson-Hughes, Bischoff-Ferrari, 2007).

Reduced organ function with age is noticeable in terms of loss of capacity for physical performance and decreasing sensory abilities such as seeing and hearing (Behrend, 2002). By the sensory organs vital information is recorded about the physical and social
environment such as workplace. Somatosensory system is responsible for the operations which translate information about touch, pain, temperature, and position to the nerve system. Short before the age of 50 years, the decline of sensorimotor ability can be observed, especially for more complex environmental conditions (Birren, Cunnigham, Yamato, 1983; Lehr, 1972; Mathey, 1984).

Changes of lens in eye happen already before the 50 years. Presbyopia is caused by a thickening and hardening of lens, the focusing mechanism of the eye (Sharma, Santhoshkumar, 2009). The lens is slightly yellowish. Changes in the retina, in which the receptors of sight are, begin to appear right after the 50 years. In addition, from the 50 years onwards, a narrowing of the visual field appears to limit the viewable area of an eye from the environment (Saup, 1993, p. 64). Such structural changes in the eye are assessed by doctors as normal (Plattig, 1991). And treatment for the cause of presbyopia does not exist (Woods, Woods, Fonn, 2009).

Hearing problem of older adults has mainly two forms: presbycusis, the sensory presbycusis based wear and tear of auditory receptor cells of the inner ear which leads to a restriction of hearing higher frequency ranges, and the tinnitus. The reduction of hearing ability also begins before the 50 years of men is approximately from the age 32 and of women from the age of 37 (Corso, 1977). The degree of the voice hearing loss increases with age, too. Hearing loss has an effect on the older adult’s ability to engage in conversations (Murphy, Danemann, Schneider, 2006). This is shown by research results indicating a loss of hearing for speech, a decrease in the overall word comprehension, a discrimination loss, a side to differing failure in the dichotic discrimination, and differences in the binaural summation (Bumm, Krueger, Lang, 1980). Researches show that the first impairments of background noise effects on speech understanding appear at the 50 years (Bergman, Blumenfeld, Cascardo, et al., 1976).

The functionalities of body and its organs decline even with a very good environment conditions (Kirkwood, 2002). When comparing groups of 50+ and 50- people, the change of the functioning organs is in different speed. Figure 14 shows the constraints occurring along the aging process. The x-axis refers to age. The y-axis describes the function decrease in percentage. The nine functionos selected are conduction time (Reizleitungsgeschwindigkeit), the basal metabolic rate (Grundumsatz), intracellular fluid, cardiac index (Herzindex), inulin, vital capacity, diodrast clearance, lung volumes, and PAH clearance (Franke, et al., 1989, p. 1367). There are mainly three systems, namely the cardiovascular system, renal function, and lung function which are partly very restricted after the 50 years. Especially the cardiac output decreases significantly. At the age of about 67 years, only 75% of the volume is supported on average. Due to the decreasing force, there is a remarkable decrease in vital capacity, most notably, the
breathing capacity. Under loading and pressure, older people cannot transport volume of oxygen through the airways as much as at younger age. From the age of 30 to around 67, the lung capacity decline around 50%. Over the life year after 50s, the oxygen pressure falls below 80 mm Hg in the plasma. The disorders shown are due to defined diseases which increase with age to affect the periphery vascular function of the kidneys, the heart, and the pulmonary emphysema (Anschuetz, 1989, p. 177).

![Figure 14: Age Difference regarding Organ Systems](https://via.placeholder.com/150)

Source: Franke, et al., 1989, p. 1367

Changes in various aspects of sleep behavior can affect the physical and mental health of older adults, and it is estimated that up to 50% of all adults have difficulty sleeping (Neikrug, Ancoli-Israel, 2009). The common myth about aging is that older people live with less sleep. Figure 15 shows the age difference regarding the total daily sleep time and the distribution of REM and NREM Sleep.

The REM (Rapid Eye Movement) time changes only the proportion in relation to the NREM, but always around 90-120 minutes. REM time is responsible for developing brain, consolidation of memory (Marshall, Helgadottir, Molle et al., 2006), and tonic immobility reflex resulting dreams (Tsoukalas, 2012). Therefore, the difference of young and older people regarding memory ability and dream during sleep is not quantitatively significant. The more important difference is related to the NREM (Non Rapid Eye Movement) sleep. Since NREM is more parasympathetic-dominant (Andreasen, Black, 2006), includes deep sleep and with more organized mindset (McNamara, John-
son, McLaren, 2010), the difference of younger and older people regarding deep sleep is considerably of researchers’ interest. With age, the total sleep time declines from 7.75 to 6 hours. But the proportion of the NREM time increases with age from 78% to 85%. When it is clearly proven that there is sleep duration of less than 5 hours, sleeping pills can be indexed (Anschuetz, 1989, p. 179). Indeed, older adults spend more time in bed relative to time spent in deep sleep. They take longer to fall asleep, awaken more often, and have sleep that is shallow, more fragmented, and less efficient (Fetveit, 2009). One of the implications of these differences contributes to the shift of working preference. Research shows that adults over 50 and especially 65 years tend to classify themselves as “morning” people while the large majority of younger adults classify them as “evening” people (Hasher, Goldstein, May, 2005).

![Figure 15: Age Difference regarding Sleep Behavior](image)

Source: Derived from Rechtschaffen, Kales, 1968

### 3.2 Absenteeism due to Illness

Beyond changes of physical function and body systems, aging also has an important character which is recorded by the historical narrative within the lifespan and a variety of smooth transitions from norm to sick (Oesterreich, 1976, p. 24). This is the case of impaired aging introduced in the previous section. Illness can interfere with the quality of a person’s daily life or work performance, causing effects such as limitation of mobility, absence of work, anxiety, pain, and difficulties in carrying out physical and mental work.
One important difference of older and younger patients is that illness manifests more frequently in elderly or occurs in combination. Figure 16 shows the frequency in numbers of diagnoses which were observed with ambulant patients at the University Hospital of Wurzburg. While only one diagnosis was made for more than half of the 20-30-year patients, the 50+ ambulant patients had 4 diagnoses and more (Franke, 1983). Increase of connective tissue, decreased elongation, and increase in residual volume occurs frequently. Heart disease and high blood pressure may be observed more often, too (Anschuetz, 1989). Prevalence of major chronic illness is arthritis, coronary heart disease, heart attack, stroke, diabetes, and cancer (CDCP, 2010).

With increasing workforce average age in German companies, not only does the proportion of old workers with health problems increases, but the absenteeism of the workforce also changes. Absenteeism (sick employees who stay home) and Presenteeism (sick employees who go work) are typical behavior in employees’ illness case, and difference of groups appears rather by age than gender (Lohmann-Haislah, 2012, p. 137). Interestingly, older people are not sick much more frequently, they have, however, recorded significantly more sick days in case of illness (Buck, Dworschak, Schletz, 2005, p. 5). This was confirmed by evaluation results from one of the biggest national insurance company in Germany, AOK (“Allgemeine Ortskrankenkasse” General Regional Insurance). In average, the absenteeism of 50+ employees with 30 days per year is almost doubled as the 50- groups for 15 days per year. A recent investigation with 20,036 employed persons confirmed similar ratio. (Badura, Schellschmidt, Vetter, 2005).
Figure 17-A shows that the older the people are, the more they have sick days in total per year. While employees of the age group 25-34 have 9 days off per year on average, employees of the age group 55-64 sum their off-days up to 25.9. However, the phenomenon of presenteeism is not really influenced by age. In contrast, the phenomenon of absenteeism is significantly influenced by age. Furthermore, Figure 17-B compares sick employees who always go work and employees who only stay home. Here the behavior changes of both groups have a strong age factor. However, after the 55 years, percentage change of the “stay home” employees (when they are sick) is significantly higher than the percentage change of the “go work” employees.

3.3 Mental and Psychological Well-being

Both the objective and the subjective health are in close relationships with the psychological well-being (George, Landerman, 1984; Lawton, 1984). Some personal feeling, distress and abnormal behaviors cause risks to other people, and engage in behavior that is socially or culturally unacceptable (Halgin, Whitbourne, 2008).

The first type of psychological problem is mood disorders such as anxiety, depression, and schizophrenia. In age-related cases, multiple formation conditions are simultaneously active or engage with each other so that biogenetic, somatic, and psycho-reactive causes might take account of unconscious conflicts (Radebold, 1994, p. 257). People with mood disorders have less readiness to help others, for example, in team work or at production lines.
A frequently cited topic regarding mental and behavioral disorders of 50+ people is supposed to be the *Midlife Crisis* and post-midlife change. Midlife Crises describes some years before the 50 years that is marked by inner turmoil and outer acts of rebellion against the placid middle-aged lifestyle (Sheehy, 1974). Spectrum of past and future, achievements, life goals, and priorities appear to be critical questions over and over again. As consequence, changes in personality are supposed to enter into a person’s 50th life year. The prompt for this self-scrutiny would be the individual’s heightened awareness of the inevitability of death (Jaques, 1965). However, no consistent test-results show that a midlife crisis always leads to negative changes in personality or mental disorder. Many researches argue that unlucky feelings such as displeasedness in workplace, unhappy marriage, divorce, fear, and suicide do not occur during the midlife (Hunter, Sundel, 1989; Mroczek, Kolarz, 1998). In contrast, research results show that both men and women do not show an emotional instability before and after the 50 years (McCrae, Costa, 1990).

The second type of mental disorders occurs as addiction such as alcohol and substance dependency (Bruder, 1996, p. 42). Some researchers saw habit changes in old age by decreasing power strength or even triggered lack of intrinsic drive. From the 50 years onwards, some people are regrettable often an fatigue, listlessness, or lack of drive which result the force of the ego subsides as inertia of thinking, self-pity, irritability, and general loss of self-control (Bracken, 1952, p. 312). This may cause high-risk behavior such as smoking, alcohol, drug, or medicine addiction. Indeed, statistics show that the majority of adults who abuse are dependent on alcohol or illicit substance.

![Figure 18: Age Difference in Death Statistics due to Psychological Illness](https://www.destatis.de, access on December 15th, 2013)
Figure 18 shows the statistic of death cases due to mental and behavioral disorders. In 2011, Germany had 27,113 death cases in this category, thereof, 4,306 of the working-age groups from 20 to 65 years. The 50+ group has a proportion of 61.8% which is 2,663 cases (Destatis-DB, 2013).

Amongst these death cases, triggers of younger and older people are different. According to a study by Sainsbury, suicide frequency of older people is significantly correlated with social isolation, loss of the “near-standing” such as spouse, and financial crisis. In contrast, major factors of the younger group being 20-39 were disruption with human contacts and loss of jobs. Especially, psychophysical complaints pile up in the period immediately after the loss of spouse continuously to the fourth and tenth month (Stappen, 1988). Survival rate of older people in non-widowed status is higher than those in widowed status (Stimpson, Kuo, Ray, 2007). Furthermore, the health status with those who are of low income social levels differs in some respects from those of higher income levels (Blume, Hauss, Kuhlmeier, et al., 1974, p. 68). With age, the suicide rate decreased among people with higher social status, and increased with lower social status (Sainsbury, 1965; Lampert, Kroll, von der Lippe, et al., 2013, p. 2). In addition, there are further old-age-specific mental problems involving significant loss of cognitive functioning as the result of neurological dysfunction such as dementia and amnesic disorders.

### Table 6: Summary of Age Difference in terms of Health

<table>
<thead>
<tr>
<th>Age</th>
<th>Young</th>
<th>Old</th>
<th>Implication for potential action field</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Proactively address workplace design to ensure productivity fitness</td>
</tr>
<tr>
<td>Physical fitness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In this research only</td>
<td>50-</td>
<td>50+</td>
<td>Decrease of body functions and organs reduced sleep hours with change of REM/NREM</td>
</tr>
<tr>
<td>Absenteism due to Illness</td>
<td></td>
<td></td>
<td>Increase of morbidity more medical diagnoses and occur in combination more sick days in total per year</td>
</tr>
<tr>
<td>Mental Well-being</td>
<td></td>
<td></td>
<td>No difference in emotional instability</td>
</tr>
<tr>
<td>Reason for suicide frequency: Disruption with human contacts or loss of job</td>
<td></td>
<td>Loss of spouse, financial crisis, increased risk of dementia, and amnesic disorders</td>
<td></td>
</tr>
<tr>
<td>Relevant for companies</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Own representation*
Table 6 summarizes the age differences in terms of the health aspects. Regarding the 50+ age workforce, physical fitness and absenteeism due to illness are more relevant for companies. This implied that developing measures to proactively address workplace design for 50+ employees may help companies to increase productivity.

4 Difference in Learning Capabilities

Age difference aspects of this section are in the areas of individual and intellectual characteristics. Investigations regarding these personal capabilities are of applied psychology where the *Psychological Aging* is explained by two categories of theories. The first category is the *Deficit Model* of mental development which describes psychological aging as a process of loss and degradation of emotional and intellectual abilities. In this (negative) sense, age difference on the individual level is based on the assumption that aging leads to a decrease of processing resources that support cognitive performance (Salthouse, 1990, 1995). An example is the Resource Deficit Theory which claims that a general reduction in the amount of available resources with age accounts for the observable performance decline in various tasks (Crack, Byrd, 1982). However, numerous studies state that there is no general age-related degradation of abilities and skills (Backes, Clemens, 1998, p. 93). The second category is the *Competency Model* which explains that the psychological aging is less about objective conditions of the aging process than the subjective experience and interpretation by affected individuals (Fischer, 1991, p. 426; Lehr, 1994). In this (positive) sense, older people excel in experience, patience, wisdom, and breadth of view while the young are noted for energy, enterprise, enthusiasm, the capacity to learn new things, to adapt, and to innovate (UK-RC, 1949, p. 121). By considering evidence of both theories in the following sections, age differences in terms of learning-related capabilities are summarized with regards to cognitive functions, intelligence, and creative productivity.

4.1 Cognitive Functions

*Cognitive Function* includes all mental activities in close relation with information processing, memory, and communication (Myers, 2005, p. 919). Figure 19 is a Brimley Plot chart, which is used to compare the information processing speed of different age groups. The deviation of dotted diagonal line shows the extent to which older adults are disproportionately slow as the task becomes more challenging in comparison to young adults. More specifically, older adults of this study perform at similar speed on tasks completed relatively quickly by a young adult (500ms). On tasks that take longer for young adults (1,000ms) older adults take proportionately longer (1,500-2,000ms) than they do on the 500ms tasks (Sliwinski, Hall, 1998).
The phenomenon is due to the general slowing hypothesis, namely the slowdown of the entire central nervous system activity. Through slowing of central processes in the nervous system, age differences increase as tasks become more complex and processing resources are stretched more and more to their limit (Salthouse, Somberg, 1982, p. 63). This theory is also used to explain age differences in memory.

Several researchers have investigated factors which slow reaction time with age and find that older adults are particularly disadvantaged in the attention stage of information processing (Whitbourne, Whitbourne, 2011, p. 126). Based on existing theories regarding attention, age reduces available cognitive resources, the ability to tune out irrelevant information, and the ability to take context into account. In addition, disadvantages of multitasking increase progressively with age (Kramer, Madden, 2008). Finally, older adults typically have more difficulty on sustained attention tasks than younger adults (Dennis, Daselaar, Cabeza, 2007).

For certain types of learning and memory, the earlier adult years are the better time. In one experiment, Crook and West asked 1,025 people to learn a few names. On a video tape fourteen people introduced themselves by saying their names. Then these people showed up again, mentioned the cities where they are from and thus provided a visual and acoustical indication of where the memory could be associated to the name. Figure 20-A shows that all participants recalled more names after the 2nd or 3rd round, but each time young adults remembered more names than the older (Myers, 2005, p. 189; Crook, West, 1990).
Figure 20: Age Difference regarding Memory Capability in Complex Tasks

Source: Crook, West, 1990; Part, et al., 2002

According to the Neural Theory of Visual Attention, an individual’s memory capacity is characterized by two parameters. The first parameter is the visual perceptual Processing Speed. It refers to the rate of object categorization which is identified by the amount of visual information that can be processed per second. The second parameter is the visual Short-Term Memory storage capacity which is the maximum number of objects that can be perceived at one point in time (Bundesen, 1990; Bundesen, Habekost, Kyllingsbæk, 2005; 2011). The neural interpretation suggests distinct brain mechanisms underlying these two basic components. But beyond these two parameters, the Working Memory storage capacity is affected by an individual-difference approach establishing associations and dissociations between cognitive and neurophysiologic measures such as Event-Related Potentials (Vogel, Awh, 2008; Rypma, Prabhakaran, 2009). These Event-Related Potentials are based on perceptual processing speed as well as short-term memory and provides online markers of multiple independent but overlapping subcomponents of cognition engaged in one task (Luck, 2005). Figure 20-B shows that the standard score of processing speed, working memory, and short-term memory decline over the life year. The age 50 can be used as the border orientation of performance differentiation. The Z-values of the 50- individuals are obviously above and 50+ below the mean. This result shows that in complex information processing with associated elements, younger people outperform older people. Age decrements are generally more marked in tasks that require flexible processing and rely heavily on attention control.

A decrease in activity with age is typically interpreted to reflect deficient processing due to neural loss in older adults (Grady, et al., 1995; 2008). Neurophysiologic impairments
become more severe with increasing difficulty or complexity of such tasks (Craik, Salt-
house, 2000). Furthermore, the decline of working memory has an accumulative effect. 
Higher degree of task complexity causes larger age decrements. Deficits resulting from 
age-related decline in working memory span would accumulate across mental opera-
tions involved in a task (Verhaegen, 2011). Interestingly, when operations are based on 
relatively less complex, easy implicit or automatic processes, performance is often well 
preserved at older age (Jennings, Jacoby, 1993). Recent researches from functional im-
ing studies have further shifted the view on aging from a one-sided focus on decline 
to a multifaceted picture of reorganization (Fabiani, 2012; Grady, 2012).

Figure 21 shows a research of Schonfield and Robertson who asked adults of different 
ages to learn a list of 24 words. Without any guidance, the researchers asked some par-
ticipants to repeat as many words from the list as they could remember. Other partici-
pants were asked to recognize the words in a multiple-choice questionnaire. As 
illustrated in Figure 21-A, the younger participants had the better memory in terms of 
the repeating test. In recognition test, however, the researchers found no negative asso-
ciation between memory capability performance and age. Further tests have also shown 
that recognition memory performance of older adults in the early morning is better than 
later in the day. And this difference disappears when participants of the sample have a 
caffeine drink (May, Hasher, Stoltzfus, 1993; Ryan, Hatfield, Hofstetter, 2002). This 
result positively echoes the sleep habit investigation of last section that older people 
categorize themselves more as “morning” people.

![Figure 21: Age Difference regarding Memory in Less Complex Tasks](image)

*Source: Schonfield, Robertson, 1966; Part, et al., 2002*
Furthermore, brain activity with simpler tasks or less attention weight such as implicit memory shows no significant difference at younger and older age (Soldan, et al., 2008). Because processing such tasks are also associated with shorter brain response times. Thus, implicit attention guidance resulting in faster allocation of attention operates independently of age (Wiegand, 2013, p. 49). Figure 21-B shows that the standard score of implicit memory almost remain the same level with minimal decrease after the age of 50. This result might indicate memory-related task designing is crucial for productivity, that is, less selective recruitment of resources that is unrelated to performance or potentially hampers cognitive functioning (Li, Lindenberger, 1999). One typical form of complex task is multitasking. Here, the decline related to age becomes noticeable in multitask situations, for example, when driving and talking, monitoring multiple moving objects, or directing groups of diversely acting individuals (Heckhausen, 2005, p. 242).

4.2 Intelligence

Is there any intelligence difference between 50+ and 50- people? Are we less intelligent when we become older, and if so, when? For these questions, there has been a profound advance in knowledge in recent decades and thus changes of consciousness in psychological researches (Becker, 2008, p. 38; Myers, 2004, p. 191). In the age difference analysis context, intelligence, which is the ability to learn from experience, solve problems, and use knowledge to adapt to new situations, is a theoretical construct, does not really exist in reality. Intelligence is not what one has, but a result that is achieved in a certain test (Myers, 2005, p. 460).

Previous studies using the Wechsler Adult Intelligence tests showed that the performance already declines from the age of 30-35 years (Amelang, Bartussek, 2001, p. 200). Similarly, the early findings of Schaie’s first studies also indicated a negative age differences beginning at the age of around 50 years (Whitbourne, Whitbourne, 2011, p. 159).

However, findings of this category were based on cross-sectional data and ignored the developmental and generational effect introduced in Section III.2. Crucial new insights were gained with the help of longitudinal studies such as the BOLSA (Bonn Longitudinal Study on Aging) or the SLS (Seattle Longitudinal Study) of Schaie (Lehr, Thomae, 1987), namely to repeatedly test the same study-participants over long years. Figure 22-A illustrates the results from a range of verbal intelligence test, the inductive reasoning. The cross-sectional method yielded values which decreased with age. The longitudinal method yielded a slight increase in values in adulthood. The performance of the 50- and 50+ people in such tests is paradoxically different. This is because the selected study-
participants have very different generational characteristics such as different education background and intensity of jobs.

Different performance curves of the 50- and 50+ people in such tests can be observed by drilling down the indicators of next level of the concept intelligence. There are two types of intelligence. The first type is the Crystallized Intelligence which reflects the collective knowledge of a person or the vocabulary and analogies capability. Crystallized intelligence increases with age. The second type is the Fluid Intelligence which is the rapid and abstract thinking when solving unknown logical tasks. Fluid intelligence declines with age (Cattell, 1963; Horn, 1982). This comparison is illustrated in Figure 22-B. Research suggests that crystallized intelligence exhibits a stronger relationship to activity than the fluid intelligence among older employees who engage in cognitively demanding activities (Dellenbach, Zimprich, 2008).

Longitudinal estimates of intellectual difference, as shown in Figure 23, reveal an overall picture of relatively stability until the 50 years or significant decline after 60 years old (Schaie, Schaie, Willis, Caskie, 2004). It is particularly noticeable that the verbal ability even rises to at the age of about 50 years, and after a long time still very stable. A constant but very slight decline applies to the numerical ability and perceptual speed after the 30s. The ability of inductive reasoning and spatial orientation remains stable until the age of 50 and slightly decrease at the 60s. The same applies to verbal memory on an overall lower level.
It is important to remark that beyond these patterns with age, a person’s intelligence development depends on numerous factors. First, the older generations have been systematically disadvantaged in their development because of the two World Wars. In contrast, the recent generations grew up with better education and learning conditions. People with higher levels of education receive higher test scores on fluid intelligence measures (Whitbourne, Whitbourne, 2011, p. 160). Second, health status affects intelligence test score, too. Arthritis, cancer, and osteoporosis are negative conditions associated with low intelligence test scores (Schaie, 1996), as is metabolic syndrome (Akbaraly, Singh-Manoux, Marmot, et al., 2009). Third, it is possible that the cause of poorer lifestyle choices is related to poorer intellectual functioning (Elovainio, Kivimaki, Ferrie, et al., 2009). For example, cigarette smokers, obesity among men predict lower IQ score (Whitbourne, Whitbourne, 2011, p. 160). Finally, higher socioeconomic status seems to provide protection from the negative effects of aging on intelligence (Aartsen, Smits, van Tilburg, Knipscheer, et al., 2002). Phenomena of this category are visible between people from larger families and those from smaller families, or test participants from less wealthy and wealthy families (Myers, 2004, p. 191).

4.3 Knowledge Access

That the chronological age as a factor which is responsible for decline in knowledge access ability is not a major matter until the 8th decade of life (Rudiger, 1987, p. 63; Schaie, Parham, 1977, p. 649; Paulus, 1998, p. 17). Intelligence has been seen as modi-
fiable rather than simply an attribute that follows a pre-defined curve with age (Baltes, Schaie, 1976, p. 724). Old people show wisdom-related intelligence as great as younger people. However, just becoming old is not enough to be wiser (Staudinger, Baltes, 1996). The perceived reduction of certain intelligence categories regards mainly unused skills (Filipp, Schmidt, 1998, p. 458). This aspect underlines the importance of continuous learning and training.

The relationship between measures of brain activation and intelligence test score has been proven (Waiter, Deary, Staff, et al., 2010). Research suggests that the more stimulating an old person’s environment, the greater the chances of maintaining her or his intellectual capabilities (Schaie, Nguyen, Willis, et al., 2001). Regarding knowledge access, there are some significant differences between older and younger people. The capability to acquire new knowledge in old age depends on many personal characters.

Table 7 summarizes empirical evidences about both positive and negative characters of older adults in terms of learning. These characters are structured by the crystallized intelligence and the fluid intelligence.

<table>
<thead>
<tr>
<th>Knowledge Access by Crystallized Intelligence</th>
<th>Knowledge Access by Fluid Intelligence</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Older people can better learn meaningful materials</td>
<td>• Older people learn easily with structured, but not too complex materials</td>
</tr>
<tr>
<td>• Frequently, older people do not have learning strategy. They can, however, learn one</td>
<td>• The learning efficiency is dependent on individual state of health</td>
</tr>
<tr>
<td>• Older people can better leverage and benefit from experience-based knowledge,</td>
<td>• The reaction and learning process of older people is interruption sensitive</td>
</tr>
<tr>
<td>• Higher awareness about social coherency and language competency</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge Access by Fluid Intelligence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Younger people perceive and learn rather fast</td>
<td></td>
</tr>
<tr>
<td>• Younger people are more adaptive to acquire knowledge</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: Summary of Age Difference in terms of Knowledge Access

*Source: Own representation based on findings from Lehr, 2003, p. 94; Schuster, 1990, p.126; Becker, 2008, p. 30; Horn, Cattell, 1996*
Higher crystallized intelligence and fluid intelligence can enhance quality of knowledge acquisition. Research on problem solving by analyzing error frequency shows the 40-50-year-old participants made more errors than the 20-year-old. The performance is affected by people’s fluid intelligence. The younger group, for example, 15-year-old also made more errors than the 20-year-old. The 15 years may not discover the necessary learning strategy yet, while the 50s years recognizes the importance of the strategy, however, are overwhelmed by the complexity of information (Hussy, 1998, p. 115). Researchers also assessed the ability of knowledge access about health-related topics. Although prior knowledge about the topic was related to the amount of new learning that took place, people who have higher in crystallized intelligence were able to learn more independently of the amount of previous knowledge they had (Beier, Ackermann, 2005).

Age has a special “dynamic” aspect. Beyond new knowledge, quality of already acquired knowledge and skills can be improved by active learning and training. For example, if there is a wish of older people to realize the missed educational opportunities and to actively participate in extra-familial community, there is positive effect on the utilization of education and productivity deals (Wenzke, 2007, p. 28). In a study of Sparrow and Davies, the speed of servicing measures, the main effects of age, tenure, tainting level, and job complexity were significant. Training, especially if it is recent, may moderate adverse effects of age on job performance (Sparrow, Davies, 1988).

Although there is a lot of potential for training older people, 50+ employees in Germany participate in vocational training less than younger people, and as consequence are not flexible enough to take a different job (Buck, Dworschak, Schletz, 2005, p. 5). Based on result of an IAB research, only 6% of companies involve 50+ employees and even only 1% offer special education measures (Bellmann, Leber, 2004). Insufficient training activities and the absence external recruitment leads to know-how gaps in workforce. Therefore, it is essential for companies to understand the knowledge access ability of different age groups and develop targeted training programs.

4.4 Creativity

Applying intelligence and experience into work, it is interesting to find out if there is any age difference in terms of production of creative work. Figure 24 examined the total output by contributors in domains of scholarship, sciences, and arts. The peak of productivity appears before 50 years and turns to decline after the 50 years in the arts, but not so much in the science. In terms of scholarship, the creative productivity is maintained at a steady rate throughout life, with even a slight peak after 50 years (Dennis, 1966). The research of Dennis was, however, based on measures of quantity of output and did not attempt to evaluate the quality of a creative contribution.
In contrast, Lehman analyzed age effect in creative works of all fields with consideration of both the number of works produced and their quality. Lehman concluded that the peak of productivity tends to occur prior the age 50, mostly in the late 30s or early 40s, after which a steady decline begins, however, varying by discipline (Lehman, 1953). This phenomenon was later named as the “Planck Hypothesis” (Dietrich, 2004), after the brilliant German scientist Max Planck, and refers to the tendency of younger scientists to be at the peak of producing innovative ideas.

Considering different research results, age does not seem to be unambiguously related with idea creativity. For example, job control and support for creativity could moderate the relationship between age and idea creativity. Age was positively related to idea creativity under high control and negatively related to idea creativity under low control and low support for creativity (Binnewies, Ohly, Niessen, 2013).

Beyond the economic concepts, people are also productive by obtained or creating values which cannot be assigned to a measurable value, for example, peace, satisfaction, family, happy partnerships (Montada, 1996). Furthermore, changing expectations, consumer demands, dependence on material values, a different right-duty relationship, and responsibilities (Baltes, 1996) derive the differentiation of age-related issues on the next level. The social dimensions of age difference in the following section later will provide more investigations and analyses, which are relevant for issues such as personality, communication, leadership, team work, and broader implications towards task design, working environment, and innovative solution in workplace.
Table 8 summarizes the age differences with regards to learning capabilities. In terms of the 50+ workforce, changes of employees’ cognitive function require companies’ effort on workplace design so that productivity can be enhanced. Changes of crystallized intelligence, fluid intelligence, and experience-based knowledge access imply that companies need to develop measures to foster people development in terms of, more effective learning opportunities, skill update, and border job opportunities.

<table>
<thead>
<tr>
<th>Age</th>
<th>Young</th>
<th>Old</th>
<th>Implication for potential action field</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In this research only: 50-</td>
<td>50+</td>
<td>Proactively address workplace design to ensure productivity fitness</td>
</tr>
<tr>
<td></td>
<td>Cognitive functions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lower performance of speed and memory, esp. for complex tasks and multi-tasking</td>
<td></td>
<td>Foster people development in terms of broader job opportunities and skill update</td>
</tr>
<tr>
<td></td>
<td>Intelligence</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crystallized Intelligence increases Fluid Intelligence declines</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge Access</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Relatively) good at learning: also meaningless materials, learning speed, and being adaptive to acquire knowledge</td>
<td>Meaningful materials, experience-based, social coherency, and language competency</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Creativity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Peak occurs early 40s to 50s after which a decline begins, esp. in art (quantity only), less in science and scholarship</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 8: Summary of Age Difference in terms of Learning Capabilities

Source: Own representation

5 Difference in Social Behaviors

Age differences in physiological and psychological aspects refer to individuals own characters. Change within these individual characters refers to so called Personal Aging, which means ontogenetic change. In contrast, the Social Aging represents the fact that people change along with or as the result of changes in their environment, or seen by family, friends, and colleagues (Laslett, 1995). As shown in Chapter II, the increasing life expectancy and share of older population can lead to changes of individuals’ roles in the future, for example, in off-work time. Characteristics of the social age in this discipline are loss of previous social tasks, roles, group memberships, status, and importance (modernization theory), response to either redefining their own position (activity concept) or retreat from society (disengagement theory), and education of subcultures, reconfiguration of positive and negative stereotypes and economy of age by institutions (Kohli, 2000, p. 234). It is the social meaning attached to chronological age that often outweighs any intrinsic usefulness.
Social behavior can be defined as all behaviors that influence or are influenced by other members of the same species (Grant, Mackintosh, 1963; Whishaw, Bergdall, Kolb, 2007). Viewpoints of observation in this research context aim to illustrate people’s inter-personal indicators, behavior patterns, style, and interactive effect. Age difference of the social aspects can provide implications for groups that people form, such as working teams, families, communities, classes, nations, and institutions which are the ways of organizing life, job, and social activities (Fulcher, Scott, 1999, p. 4).

5.1 Personalities

Most of tasks in today’s workplace require interactions with people such as customers, suppliers, colleagues, and further stakeholders. Beyond technical skills and functional expertise, emotional intelligence is crucial to contribute to successful outcome. Individual characteristic of thinking and action patterns is termed as personality (Myers, 2005, p. 566). In terms of age difference, there are substantial overall trends when examining the scores about the personality trait. It is possible that personality can continue to grow, change, or mature throughout life (Costa, 2010). Figure 25 is an investigation of cross-sectional age differences in the Big Five personality traits (John, Srivastava, 1999). Data are from the German Socio-Economic Panel Study which is an on-going study of German households that began in 1984 age (Donnellan, Lucas, 2008).

Figure 25: Age Differences in the Big Five

Source: Own representation based on data from Donnellan, M. B., Lucas, R. E., 2008, p.14

The result of this investigation shows that extraversion and openness were negatively associated with age. And average levels of conscientiousness were highest for partici-
This trend can be interpreted that with age old adults can become less willing to engage in activities requiring external orientation of energy and readiness for new changes. Agreeableness and neuroticism were positively associated with age (Donnellan, Lucas, 2008, p. 1). Also, in other studies, increasing levels of neuroticism had been found in older people who reported frequent illnesses, cardiovascular, digestive complaints, and fatigue (Costa, McCrae, Arenberg, 1984). Furthermore, agreeableness and neuroticism show an increasing positive trend meaning that as people become older they are perceived as less likely to act impulsively (Terracciano, McCrae, Brant, et al., 2005). And the necessity to act purposefully in many different situations and to engage in conversations with different kinds of people can have contributed to greater agreeableness. Certainly, the view of this investigation needs to be verified when considering further contextual factors such as country, education, generation and so on. As people act on these tendencies, they develop visible patterns of behavior (Myers, 2000, p. 6) which affects individual actions, team work, performance, and overall atmosphere in the workplace.

1. **New Organizer / Re-organizer**: Competent people who are involved with a variety of activities
2. **Integrated and Focused**: They tend to choose their activities to achieve satisfaction by concentrating on one or two roles
3. **Successful Disengagement**: People with lower role activity and high satisfaction degree
4. **Style of Holding on to Earlier**: They stick to the activities of middle age last as long as possible
5. **Limiting Style**: They extremely limit their visible role activity as a defensive measure against aging
6. **Search Emotional Support**: They are successful in obtaining excessive emotional support from others
7. **Apathetic Old**: They show minor role activity associated with medium or low life satisfaction
8. **Disorganizer**: Their thinking and control over their emotions are affected by retrogression processes

**Box 1: Typology of the Eight Different Lifestyles at Old Age**

*Source: Havighurst, 1975*
Changes of one area of life have effects on changes in other areas. So, does for example life on job. To understand older employees in workplace, it is essential to understand their lives as a whole. Havighurst developed the typology of the relationship between the scale and type of social participation and life satisfaction. Beyond life style patterns, social status, and occupation, there are typical forms of age-related life style. Box 1 summarizes the eight different lifestyles at old age by Havighurst. A person’s life style which reflects the typical individual or collective form of organization and capability of life (Tokarski, 1993, p. 119), consciously or unconsciously act on her/his style in the workplace. Although many people are aware to differentiate work and life, the bidirectional influence exists. And balance is a general challenge today both for young and old employees.

Life satisfaction is found to decrease in mid-life and, after around the 50 years, and to increase subsequently towards retirement (Stone, Schwartz, Broderick, et al., 2010). This is known as the “U-bend” theory. After the mid-life crisis, people move towards older age and lose things they treasure such as vitality, mental sharpness, and looks. Furthermore, if continuity and intensification of social activities increase or lead to life satisfaction, old people also very much depend on the preferred lifestyle (Lemon, Bengtson, Peterson, 1972; Lehr, Olbrich 1976). A healthy lifestyle is essential to reduce the pathological age conditions and increases the probability to have higher satisfaction in the workplace. These include positive activities in the family and leisure time, building spare capacity, and slowing down negative aging process. The emphasis is about the necessity of unifying of biological, social, and mental capacity to make likely successful aging (Baltes, Baltes, 1989). The change of personality, attitude, and life styles choice also leads to feeling of wellness at work. After the 50 years, career plan, education for advancement purpose, long-term goal, power, and authority appear less important to old people. In contrast, mutual assistance, knowledge share, autonomy in the workplace, short-term goals, and appreciation become more relevant (Frerichs, 2012, p25).

5.2 Communication

As the jewel in the crown of cognition functions, the spoken and written languages, the thinking and communications represented by words and gestures differentiate the ways people interact with each other (Pinker, 1998). Table 9 summarizes the major factors which contribute to preservation and advantages in terms of age difference.
Since older adults confront declining performance in information processing and memory from the cognitive perspective, they may experience more deficits in hearing, speaking, and using language that may lead to reduced quality of communication. The deficits here mainly refer to two aspects. The first aspect refers to the possibility that language and ideas may not be expressed in desired speed, completeness, and clarity.
For example, research show that older people find more difficult in retrieval that leads to errors for spelling words they once know (Burke, 1997). The second aspect is that old people tend to use simpler sentences and less complex grammar (Kemper, Marquis, Thompson, 2001). In the practice, the second aspect of deficit can even facilitate effective communication. And the cognitive deficits can be compensated by being rich in social experiences. The compensation effect has two aspects, too. First, by the time of life years, words, knowledge, and way of organizing information and stories have been practiced and rehearsed over and over again. This is believed as the reason why great communicators can best grasp the “gist” and the punch line at their 50 and 60 years (Stine-Morrow, Miller, 1999; Titone, Koh, Kjelgaard, et al., 2006). Second, experienced or highly educated older adults have the advantage in extensive vocabularies and thus the ability to effectively orientate language and social context (Osorio, Ballester, Fay, 2009).

Another aspect of age difference in communication is the thinking and conversational pattern, style, and use of wording and media. With age, people tend to emphasize the past, implications, consequence, actions, and add more off-topic, while young people likely focus on current and future, and less repetitive (Bieman-Copland, Ryan, 2001; Trunk, Abrams, 2009). In addition, there is a generational difference in terms of communication. Baby Boomers prefer to in-person communication. The Generation X values open communication regardless of position, title, or tenure. They are supposed to be more open for virtual communication but prefer to more immediate and direct interaction. Although they both happen to use social media such as Facebook or Twitter, there is perceived boundary between private and public information. Finally, generation-specific words or wordings may create an additional communication layer which requires more explanation and time to be precisely understood.

5.3 Leadership

An essential factor for a team to define and achieve excellent result is the leadership which refers to the ability of an individual to influence, to motivate, and to enable others to contribute toward the effectiveness and success of the organizations of which they are member (House, Javidan, 2004, p. 15). Team members with different work characteristics are more effective and productive with different leadership styles (Tulgan, 2000). Knowledge and skills required by workers today have become more complex because the economy in Germany is changing from high degree of production to a mixed and modern type comprising of industrial economy, service economy, and knowledge economy. In the new economy structure, the need for traditional leadership style will disappear (Abramson, 1997). New types of leadership emerge. The leadership ability is influenced and built through the entire life experiences. Therefore, analysis on leader-
ship with consideration of generational impact is meaningful. It is important to consider different leadership dimensions and interpersonal constellations. The leadership dimensions used below is adapted from the Kouzes and Posner’s five methodologies of leadership challenge (Kouzes, Posner, 2009, p. 29). These are developing vision and tasks, seeking challenge, enabling actions and options, motivating and influencing others, and experience of value. Regarding the interpersonal constellation, a team can be observed as two aspects or role. The first aspect refers to persons who “taking the lead”. The second aspect is the group “being led” (Neuberger, 2002, p. 43). In both aspects, there are numerous differences between the Baby Boomer generation and the Generation X.

The Baby Boomers are a generation which values prosperity. The Baby Boomer leaders have a consensual and collegial style (Hammill, 2005). This leadership style are strongly influenced by their value systems built in the post World War II time. As more and more traditionalist generation exit the workforce, Baby Boomers seek the postretirement career (Jenkins, 2007). They want to feel and are largely in control today. Baby Boomers run local state, national governments, and currently rule the business world. The sense of power and purpose is important for them. Baby Boomers accept the chain of command and expect their managers to give direction and to actively lead them towards organizational goals.

Baby Boomers still hold tight to the leadership belief that the team is sacrosanct. As a result, the relationship is equally important as the solution, if not more so (LC, 2007). Baby Boomers generally distrust authority and large systems. They are more optimistic and open to change than the prior generation but are also responsible for the “Me Generation” with pursuit of personal gratification which often shows up as a sense of entitlement in today’s workplace. If you lead the generation of Baby Boomers, you need to understand that balance is a quaint idea but not really a possibility. They see the workday at least 8 a.m. to 5 p.m. This is a tension point between them and the newer generations, as they expect others to have the same work ethic and work the same hours. The earlier part of this generation followed the “bent” rules set by the traditionalists (UN-JSPF, 2009, p. 6).

Baby Boomers tend to be more diligent on the job and prefer a more stable working environment (Loomis, 2000). Their career path has been through ladders and upward mobility. They follow the career pace of “prove yourself with long hours and pay your dues” (Trower, 2009). They are however, not highly technologically savvy, nor do they generally like change (Raths, 1999).

In contrast to Baby Boomers, the Generation X has a more equality-based leadership style which fosters “challenging others” and “asking why” culture (Hammill, 2005). They naturally question authority figures and trusts own decisions more than others.
Xers are increasingly well-educated, independent, and eager to upgrade their skills in comparison to the previous generations. These characteristics lead to different leadership styles than people from other generations with less education and skills (Tulgan, 2000). People with a higher level of education tend to be more individualistic and have high self-esteem and prefer job autonomy (Rowley, 1996).

Xers tend to be more independent, self-motivated, and self-sufficient (Loomis, 2000). Therefore, they emphasize personal satisfaction and less need to be led. Xers are responsible for creating the work life balance concept. Because Xers place a lower priority on work, many company leaders from the Baby Boomer generation assume these workers are not as dedicated. However, Xers are willing to develop their skill set, take on challenges, and are perceived as very adaptive to job instability in the post-downsizing environment (Jenkins, 2007). Xers’ career path has been through lattice and plateaus. When leading Xers, people oftentimes face their request regarding career pace: “I want to know all my options now!” (Trower, 2009)

In opposition to the hard driving Baby Boomers who live to work, Xers work to live and view the world with a little cynicism and distrust (UN-JSPF, 2009, p. 6). Therefore, their leadership style considers opportunities to improve their own and others’ skills. They are loyal to their profession rather than to their employer and tend to lead a team by individualistic levers. Leaders of the Generation X know that team members have a high need for autonomy and flexibility on their jobs, and at the same time fitting their lifestyles. Additionally, Xers are technically savvy and are eager to update knowledge and application into their work. This technological capability is due to the fact that Xers grew up with rapidly changing technology and the availability of massive amounts of information (Keaveney, 1997). Understanding Xers’ technological capability may create competitive advantages to effectively lead a team to achieve surprisingly creative results.

More details of investigations are summarized in Appendix G to elaborate how these generational differences distribute and influence the leadership styles.

5.4 Team Work

*Team productivity and effectiveness* refers to achieving outcomes such as efficiency, quality, innovation, creativity, and team satisfaction (Dunphy, Bryant, 1996). Team productivity is influenced by team characteristics including its members, the type and size, and team diversity (Daft, 2002, p. 366), for example, different generations or age groups.

Team productivity with consideration of composition of different age groups was investigated through the empirical study conducted by Beck, Labucay, and Kownatka in
These finding and results were based on data of 365 employees from 14 German companies. At the beginning, participants were divided into 61 teams of around six people in each. They were tested by a 75-minute session including a management game “Mipps & Wors” as well as a questionnaire with 156 items about conflict behavior, motivation, and stress-coping. The results of hypothesis testing indicate five specific differences between older (Baby Boomer), younger (Generation X and generation Y), and age mixed teams.

- Problem-solving capability on team level – Age diverse teams differ in the problem-solving duration, creativity, and quality.

- Individual problem-solving capability – Older employees reveal longer problem-solving duration, more mistakes both in terms of frequency and total number, and lower memory performance.

- Conflict behavior – The younger an employee is, the more she/he avoids conflicts with colleagues or acquaintances. Accordingly, the expression of the conflict styles cannot be predicted by the service time in a company.

- Motivation – Older employees are motivated to maintain their social, physical, and economic security, while younger employees tend to seek power and authority and have greater desire for social contacts.

- Stress coping – There is neither in the proactive stress coping nor in the search for social support a significant difference between older and younger employees. However, they differ in the problem related stress coping. Older employees cope stressful situations by taking advantage of preferred cognitive strategies that directly aim at the stress causing problems.

Figure 26 uses a structure of the Iron Triangle (Oisen, 1971; Barnes, 1988; Weaver, 2007) to summarize the differences of team performance regarding speed, output, and quality. Observing processing time, young homogeneous teams (730.2 seconds) outperform old teams (825.9 seconds) by 13.1%. In terms of creativity measured by the number of produced statements, young homogeneous teams (68.3 statements) outperform old teams (43.9 statements) by 56%. In total, 19 of the 24, or 79.1% of young homogeneous teams found the correct solution of the game. In comparison, only 7 of the 16, or 43.8% old homogeneous teams found the correct solution. And the performance of age mixed teams is higher than old homogeneous teams, namely with 14 of 21, or 66.7% of teams. Taking the correct solution rate of old homogeneous teams as the measurement basis, the young teams outperform by nearly 79.5%.
In Beck’s management game test, the young teams outperform the old teams in the indicators duration and quantity. Other studies of last decades support findings of this category. Cobb examined relations between age, length of experience, and job performance in air-traffic controllers. Negative correlation between age and job performance were found. And there are no significant interactions between age and experience discovered (Cobb, 1968). These results were confirmed in a subsequent investigation (Cobb, Nelson, Mathews, 1973). Sparrow and Davies (1998) investigated the effects of age and job performance using a sample of 1,308 service engineers of a multinational office equipment company. The relation between age and job performance took the form of an inverted U.

However, the findings should not be interpreted as a general negative correlation between old age and productivity in all aspects. On the contrary, with age, some competencies for positive team performance are enhanced, for example, life and work experience, industry-, company- or function-specific knowledge, judgment, reliability, prudence, quality awareness, duty and responsibility, and serious attitude to work. Murrell, Powesland, and Forsaith (1962) compared young with older novice adults and young with older expert adults in the speed of operating an industrial mill. Age-related decline was observed among novice adults, but older expert workers were just as fast as young ones. Similar findings were published in a later study involving the activity of simultaneous translation (Murrell, Humphries, 1978). Giniger, Dispenzieri, and Eisen-
berg (1983) examined the variables of age and experiences as related to productivity and other variables in garment industry. Older workers surpassed the younger ones in all job categories. Experience rather than age was the main determinant of the level of performance.

Taken all the study findings together, there is no general pattern on correlation between age and performance. In considerations of the competencies listed in Box 2, older employees are better suited for certain team tasks than younger ones, and vice versa.

- Older employees tend to ease in dealing with larger master plans. They can handle both complex organizational models also perform quite well as a more extensive team schedule.
- Older employees tend to be less self-concerned in potentially stressful situations in team. This is manifested in particular if competition turns up in career promotions or sharing working resources.
- Older employees are perceived as advanced tolerance in terms of alternative action styles, on assessment of situations in terms of team decisions and their execution.
- Older employees tend to make use of energy-saving strategies in terms of decision-making and actions of team.
- There is neither in the proactive stress coping nor in the search for social support a significant difference between older and younger employees.
- Older employees tend to have better assessment on their own capabilities and limits. They make decisions and conclusions with considerations of greater caution and sober realism. Complications and confrontations are better accounted by anticipatory arrangement.

**Box 2: Competencies of Older Employee as Positive Factor**

*Source: Olbrich, 1990; Wachtler, Franzke, Balcke, 1997, p. 12*
Table 10 summarizes the age differences based on Social Implications. For the 50+ age group in team work, quality, and security are relevant. This implies the consideration of workplace design to ensure productivity. The relevant aspects of personalities, communication, and leadership for 50+ employees imply measures to enable culture change. This way values and behaviors towards an age-friendly eco-system can be established and sustainably maintained.

<table>
<thead>
<tr>
<th>Age</th>
<th>Young</th>
<th>Old</th>
<th>Implication for potential action field</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In this research only: 50-</td>
<td>50+</td>
<td>Enable culture change by addressing values and behaviors towards an age-friendly eco-system</td>
</tr>
<tr>
<td>Personalities</td>
<td>Neuroticism, extraversion, and openness declines</td>
<td>Conscientiousness and agreeableness increases</td>
<td></td>
</tr>
<tr>
<td>Communication</td>
<td>Relatively clear spoken and ability to hear each word; attempt to regain self-sufficiency</td>
<td>In simpler sentences with extensive vocabularies, grasp the “gist”, interruption sensitive</td>
<td>Ensure the “right” mix for productivity fitness</td>
</tr>
<tr>
<td>Leadership (generation-specific)</td>
<td>Gen-X: Equality-based leadership style; individualistic and autonomy Flex and work-life balance</td>
<td>Baby-boomer: Leadership with sense of power and purpose Chain of command Stable working environment</td>
<td></td>
</tr>
<tr>
<td>Team Productivity</td>
<td>Higher performance in: Quantity. Tend to avoid conflict, seek authority, desire for social contact</td>
<td>Quality Maintain social, physical, and economic security</td>
<td></td>
</tr>
</tbody>
</table>

Table 10: Summary of Age Difference in terms of Social Behaviors
Source: Own representation

6 Summary

Research on the age difference subject results in a mixed picture. The Deficit Model regarding older people focuses on loss and degradation various abilities and a decrease of processing resources that support cognitive performance. In contrast, the Competency Model regarding older people focuses on the aspects that they excel in experience, patience, wisdom, and breadth of view. Table 11 summarizes the 15 most relevant aspects of the age difference for 50+ employees, and their implication for companies in terms of potential action fields.
### Table 11: Relevant Aspects of Age Difference and Implications

**Source:** Own representation

50+ people have some significant physical changes. The most relevant aspects are reduced weight, reduced bone density and muscular strength, decreasing cardiopulmonary performance and declining functionalities of organ. These changes lead to potential risks for presbyopia, presbycusis, decreased sensorimotor ability and therefore difficulties in physical and intensive mental tasks. Older people also experience less sleep quality and respective changing schedule for their working time. Regarding illness, sickness manifests more frequently in elderly or occurs in combination. Observing absenteeism due to illness, older people are not sick much more frequently, they have, however, recorded significantly more sick days in case of illness. Regarding the changes of cognitive functions, age differences of performance increase as tasks become more complex and
processing resources are stretched more and more to their limit. The same applies to performance of memory capability. Old people show awareness of quality while maintaining social, physical, and economic security. These age differences contribute to the shift of working mode and workplace design, which help to ensure the productive fitness of the 50+ workforce.

50+ people have advantages in crystallized intelligence which reflects the collective knowledge of a person or the vocabulary and analogies capability. This learning capability increases with age. In contrast, the fluid intelligence, which represents the rapid thinking when solving unknown logical tasks, overall declines with age. Therefore, the strength of 50+ people is in learning meaningful materials, gaining experience-based knowledge and social coherency. These age differences require new thinking about training and learning measures with special focus on older employees, but also career opportunities in terms of task assignment and new job options. Therefore, people development for 50+ employees is one of the most relevant action fields companies should address.

50+ older adults are less willing to engage in activities requiring external orientation of energy and readiness for new changes. Extraversion and openness show a declining trend. They show, however, increased level of neuroticism and agreeableness, are less self-concerned in stressful situation, and have advanced tolerance and a more realistic assessment on own capabilities and limits. Older people maintain capability in verbal intelligence as well as speak and write in simpler form of communication. They have good semantic memory, can grasp the “gist” of a story they and work for larger master plans. From the generational perspective, the 50+ population in Germany was historically influenced by events such as East-West Germany, Cold War, Economic Miracle, space travel, and environmental movement. These events may lead to preference frame in sense of power, purpose, chain of command, and appreciation of stable working environment. Therefore, companies’ ability of communication and making culture change is important to create and sustainably maintain an age-friendly working environment.
This chapter elaborates structured methods for managing demographic shift. It explains a theory-building process applied in this research. This process is designed without pre-specified hypotheses to test. To ensure solid theory building, two phases of research were designed and implemented. The first phase is a holistic literature review to structure the action items of the Managing Demography Framework. This phase is mainly based on general approaches from existing theories. This solution-oriented framework focuses on HOW rather than WHAT in terms of coping with demographic challenges. The second phase consisted of strategy exploring interviews with large German companies. This empirical work extended the Managing Demography Framework by exploring more recent HOW practices from these companies. These two phases provide input and baselining for the Managing Demography theory. The central idea for such theory-building is no theory under consideration and no statistical hypotheses to accept or reject (Eisenhardt, 1989, p. 536).

The output is the Managing Demography Framework which covers four strategic action fields: workforce composition, productive fitness, people development, as well as communication and culture. The Managing Demography Framework should provide application reference while offering enough flexibility for customizing in specific use cases. Furthermore, the direct connection with leading German companies and in-depth expert interviews enhance the practical relevance of this research, for instance, by examples of how actions have been successfully executed.

1 Building from Existing Theoretical Solutions

The literature review aims to explore ideas which companies can apply as measures to implement for their own demography program. As explained in Section II.3 and Table 2, the first Action Field should be the workforce composition. Chapter III suggested further three action fields based on the age difference analyses summarized in Table 11 which are productive fitness, people development, and communication and culture. In the following sections, research findings and ideas from the literature review are collected as particular Measures. Each action field includes a measure catalogue which
comprises the core ideas for implementation. If an idea has been implemented in the
practice, an example is briefly quoted.

1.1 Action Field “Workforce Composition”

The personnel planning in business context regarding the aging labor structure was and
is primarily the workforce disposal (Morschhaeuser, 2000, p. 282). This primary charac-
ter implies that the age-focused workforce planning belongs to the first measures of
demography management. Typically, the starting point is age-related statistics which
have the function of indicating future workforce development. For example, a work-
force with average age of 50 and variance of 4 in connection to a low fluctuations rate
would expect difficulty in terms of promotion of young employees (Drumm, 1995, p.
229).

Regarding future, demographic simulations based on transparency from statistics dis-
play trend and development scenarios to enable strategic decision. The application of
such simulation in business environment may depend on the current age structure and
the age structure of the next 10 to 20 years (Koechling, 2000, p. 262). In addition, the
age-related workforce planning contributes to the solution for competency problem by
implementing principles such as assigning positions with consideration of available
qualification and age landscape (Morschhaeuser, 2000, p. 285). Recent research also
suggests define a “target age curve” to steer a balanced workforce composition in terms
of generational shift. Furthermore, for companies, different generation-specific wishes
about employer, workplace, and compensation should be independent with a majority
group (Koechling, 2000, p. 371). The future scenarios of workforce structure help to
consider this category of wishes of different generations in advance.

A further measure against an aging workforce is the externalization strategy which re-
leases job openings for younger employees (Huebner, Kuehl, Putzing, 2003, p. 29). The
externalization strategy has been implemented as management measures in large and
medium-sized companies supported by social and former legal regulations. In some
cases, this measure is also applied to achieve labor cost reduction and restructuring tar-
gets. Recruiting measure to ensure sustainable workforce development is crucial to re-
ducing the workforce aging process. For example, recruiting over-proportional younger
employees may close the gap due to a large number of foreseeable exits, in particular,
due to the Baby Boomer retirees in the next 10 years.

Further aspect of this measure includes evaluation of the cost to increase older workers’
productivity and knowledge in comparison with the cost of hiring younger workers who
do not need accommodations or additional training, but have a comparable level of
knowledge (Head, Baker, Bagwell, et al., 2006). The cost here can be interpreted as the
opportunity cost in general beyond the financial investment only. In addition, employers should periodically analyze the impact of employment conditions upon older and younger workers (Tishman, Van Looy, Bruyère, 2012, p. 18). In recent years, recruitment from more diverse pools such as women, experts from outside of Germany, and qualified refugees who entered the German labor market, become a more relevant measure. As explained in Section II.2.2.1, these talent pools in Germany have a relatively young labor force. However, in comparison to older employees, other diverse pools are associated with group-specific expectations of assignment time, for example, wishes of childcare, parental leave or return to home country (Behrens, 2000, p. 243).

*Retirees back to workforce as consulting expert* is a measure associated with older workers a higher level of knowledge and experience (Huebner, Kuehl, Putzing, 2003, p. 56). Experience is practical knowledge. It is acquired through one's own practice, not necessarily through systematic learning. Collecting experience takes time until it becomes a rich procedural knowledge (Kuda, Strauss, 2001, p. 223). Older employees may have a greater extent on knowledge and experience than younger (Plath, 2001, p. 522). Tasks and positions which former retirees possessed can be assigned to those retired experts who are still willing to work, for example, in Germany, based on a freelance contract. In Italy, The L’Incontro Initiative is a nonprofit organization which recruits recently retired maintenance workers to work as instructors in projects. A further idea of action has been implemented by the MITRE Corporation which developed a phased-retirement plan under which retirees could be recalled for up to 1,000 hours per year of work on projects that require their expertise while receiving full benefits (Naegele, Walker, 2006).

By implementing this measure, extent domain know-how of experienced experts is maintained within business operations while companies save fixed costs by flexible contractual conditions. This approach also helps to deploy new human resources and training resource, for example, by the retirees for the current employees. Recent research on manufacturing industry shows that the scope of policies and programs designed to recruit and retain employees of different ages is one indicator of organizational attention in the demographic shift (Sweet, Pitt-Catsouphes, Besen, et al., 2010, p. 28). Since recruiting focus is not necessarily the young age any more, more opportunities of job openings for reasoned experts and retirees should be made possible.

One of the actions to cope with aging workforce refers to the task design (Morschhaeuser, 1999), more specifically, the *workforce optimization or functional exchange based on age profiles*. While different worker capacities are considered in task planning, the tactic is to change the older employees’ assignment which is not appropriate any more, for example, due to required intensity or form, to new tasks in consideration of their up-
to-date professional capability (Morschhaeuser, 2000, p. 287). The development of professional capability and career is dependent on requirements of specific occupation (Froehlich, 2002 p. 229). Therefore, redesign tasks or new assignment of function is a logical measure to increase the satisfaction and optimize work outcome of older employees.

Based on the findings of Chapter III, assignments would be at risk as old age in functions that require extreme physical strength or extensive involvement of fluid intelligence. Therefore, workload for old employees can be shifted from reduced physical requirements (Ilmarinen, 2000, p. 92) to positions which require higher recognitions and social skills (Morschhaeuser, 2000, p. 289). Jobs such as air traffic controller, neurosurgeon, and fighter pilot are ultimately the province of younger adults. A traditional pattern of assignment of older employees is administrative, supervisory, or trainer roles which match the compensatory increments in crystallized intelligence, advanced conscientiousness at ripe old age, agreeableness, less self-concern in stressful situation, more tolerance and a more accurate assessment of their own capabilities and limits.

The four approaches explored above cover ideas about how an organization’s workforce can develop in terms of size, type, experience, functional expertise, quality, and knowledge allocations. Therefore, they can be summarized as an **Action Field “Workforce Composition”**. As an interim summary, this action field has a idea catalog with following measures:

- Measure 1: age-focused workforce planning
- Measure 2: recruiting measure to ensure sustainable workforce development
- Measure 3: retirees back to workforce as experts
- Measure 4: workforce optimization or functional exchange

However, the population of qualified younger workers in Germany is neither large enough, nor growing fast enough, to make up for the older generation’s departure (Paullin, 2014). More creative measures focusing on the existing workforce, especially the increasing 50+ group within companies, need to be developed. The horizon goes beyond the workforce itself, for example, productivity or working system design. Measures of this area refer to change-able environmental and conditions which positively influence productivity. As discussed in Section III.3, there are various physical differences between younger and older employees. Companies need to address the prevention of disadvantageous productivity loss due to physical change and illness of old employees while building prerequisites of strong motivation in the workplace (OECD-AEP, 2005, p. 163).
1.2 Action Field “Productive Fitness”

Workplace design, in particular, ergonomic aspect has become more relevant for leading companies, especially in the manufacturing industries. As shown in Section III.3.1, some physical capabilities of employees decline while the age increases. This correlation has been proven by empirical studies (Laville, Volkoff, 1998). Modernization and optimization of workplace can minimize the relevance of negative effects of this aspect (Lahn, 2003; Czaja 2001) and are widely seen an investment with positive strategic return for companies (Becker, 1975).

Firstly, the basic idea is to support old employees to avoid bad postures, for example, sitting, standing, or repeating moves since the ratio of old employees with musculoskeletal illness is higher than young employees. Secondly, constructing working environment and choosing working tools should consider ergonomic requirements of old employees, for example, floors, walls, or computer screens. The third aspect is the prevention of accident, since old employees are more vulnerable and sensitive with accident than young employees. The rehabilitation of old employees takes respectively longer (Ilmarinen, 2000, p. 92). Finally, flexible working schedule should be considered, for example, the introduction of micro-breaks directly after workload peaks, since the recuperation process of old employees is significantly slower than young employees. More detailed measures to improve the workplace will be elaborated in one of the best practice interviews later in the following section.

Age-focused healthcare facility and services is an important action to cope with demographic shift (Morschhaeuser, 2000, p. 287). The healthcare-related measure includes mainly two areas: disease prevention and fitness programs (OECD-AEP, 2005, p. 163-170). Beyond traditional measures which are standard offers for employees of all age groups, this measure focus on the additional ideas which are specifically relevant for old employees. The disease prevention measure for older employees are (1) personal healthcare check to achieve early diagnosis of risks and disease, (2) personal healthcare consulting and coaching, (3) health workplace design, for example, ergonomics or air quality, (4) working time regulations, and (5) healthcare-oriented culture, leadership awareness, and communications (DAX30, 2004-2015). The UK Oil Company implemented such measure to retain older workers despite the physical demands of its workplace. It offers workplace health assessments to resolve common issues such as back pain and has on-site doctors to review existing health problems and intervene when serious issues arise. It also offers annual medical exams for 50+ employees (Naegele, Walker, 2006).

In contrast to the disease prevention measure, the fitness program refers to the support for employees to achieve a stable state of ability to perform occupations through moder-
ate-vigorous physical activity, exercise, and correct nutrition. The ideas include (1) physical, psychological, or sport trainings, for example, gym for 50+ employees, (2) rehabilitation offers, (3) company fitness studios or company frame contract with external fitness studios, and (4) food and diet consulting and rest (DAX30, 2004-2015).

**Age-focused expertise training** is vital for old employees to maintain and update competencies for better performance, both from employee performance and business performance perspectives. In Germany, the Federal Governance and leading companies have started to implement the life-long learning strategy (OECD-AEP, 2005, p. 137). The emphasis here is expertise, namely specific job skills for the 50+ employees. As mature employees, the 50+ group can be less interested in training for the sake of enhancing their resume (SHRM, Sloan, 2014, p. 20). Work requirements in today’s business context change faster than before. Technologies have been perceived to outpace organizations’ ability to understand them in time (Ito, Howe, 2016, p. 19). Update of knowledge and competencies Training is a critical component of any plan to retain or attract older workers. A successful training program should (1) be integrated into recruitment for job-skill-matching, (2) renew critical expertise, (3) adopt its approach to a clear targeted group such as 50+ employees, and (4) offer new challenges (Koc-Menard, 2009a). Healthy adults of every age can gain significant learning progress (Bergmann 2001 a, S. 22).

However, there are some differences why age is an important character in terms of expertise-related trainings. Firstly, old employees had different education background due to the fact of being born as the upper generations. One of the most important areas where old employees need to gain new knowledge is, for example, the technology which enhances the way of utilizing existing expertise in new ways. Secondly, learning specific expertise is dependent on how trainings are organized. For older employees, “learning by doing” is a key for effective training concept (Ilmarinen, 2000, p. 93). As explained in Chapter III.4.3, older people have some advantages to effectively access knowledge, when they have structured learning strategy, receive more meaningful material instead of a large part of data process tasks, and make use of experience-based knowledge. Self-control, increased learning activities, and a self-adaption of learning material can facilitate more successful training outcome from older than from younger employees (Loewe 1971, p. 95).

**Age-focused team-performance** measure aims to provide optimal environment for mixed team in terms of age. In an aging workforce, team work has been considered as one of the most important measures to increase performance of employees (Morschhaeuser, 1999). By assigning different tasks for team members of different ages and exchange experiences between them, company can achieve optimum of team work in a ratio of
workload rotation, health condition, and outcomes (Morschhaeuser, 2000, p. 290). However, there are three prerequisites. First, the tasks themselves must be heterogeneous. Second, team members should be expert for specific areas. And third, clear economic guideline is needed to avoid extreme performance pressure and to support careful planning of rotation time, necessary trainings, and fair incentives. Normally, there is a task specialization within a team. The fundamental rule of effective team work is that everyone works on the subject where she or he can do the best or fastest. This way, the team as a whole may achieve the most probable output in shortest time investment. The nature of team-performance requires planning and organization. From a short-term perspective, the most efficient task splitting for age mixed team should consider the findings summarized in Section III.6.

Companies should be aware that such age-mixed diverse teams require more synchronization, coordination, and team building activities at the beginning. A professional diversity management program focusing on the age dimension may facilitate team building and team performance. Furthermore, if there is a long-term perspective for the team structure, job rotation and qualification measures should be integrated into the task planning to achieve sustainable performance (Morschhaeuser, 2000, p. 290).

Maintaining and enhancing motivation of old employees is a prerequisite action area to enable effective people development and business performance (Morschhaeuser, 1999). Older employees have different motivational "hot buttons" than their younger counterparts. For example, opportunity for advancement may be sometimes less important than the recognition of a job well done. Motivational traits also tend to be stable, although cross-sectional data suggest that older employees tend to have lower levels of an orientation toward competitive excellence (Kanfer, Ackerman, 2000). There are two situations regarding employee motivation.

The first situation is that employees are already motivated. A positive, enthusiastic, and affective connection with work motivates an employee to invest in getting the job done because the work energizes the person. In this situation, older employees have consistently higher levels of engagement too. As discussed in Chapter III, older employees are more motivated to maintain their social, physical and economic security. More motivated employees use less health care, take fewer sick days, are more productive, have longer tenure, and create stronger customer relationships (Pitt-Catsouphes, Matz-Costa, 2009). Busch Entertainment established a Legends Ambassador Program where teams of 50+ workers were selected each year and stationed at each park to ensure quality employment and job satisfaction among their older employees (Tishman, Van Looy, Bruyère, 2012, p. 17). This is an example that an employer keeps and even leverages the positive motivation as the company’s culture.
The second situation is that older employees who have become less motivated in their existing position may seek changes or new tasks that are better suited to their capabilities or preferences (Tishman, Van Looy, Bruyère, 2012, p. 13). Engaging these employees and providing specific support should be the key to avoid negative motivation consequences. Since motivation is associated with goal engagement, the Lifespan Theory of Control (Heckhausen, 1999) suggests three levers as reference model to facilitate goal engagement and therefore motivate old employees: (1) investing behavioral resources such as time, effort, and skills into employees’ goal pursuit, (2) provide help or advice from others or third party, and (3) support volitional self-regulation to enhance employees’ commitment to a chosen goal.

The five measures explored above contribute to the well-being of a company to ensure a performing return on investment in business activities. Therefore, they can be summarized as an Action Field “Productive Fitness” with the following measure catalogue:

- Measure 5: workplace design, in particular, ergonomics
- Measure 6: age-focused healthcare facility and service
- Measure 7: age-focused expertise training
- Measure 8: motivation of old employees
- Measure 9: age-focused team-performance

1.3 Action Field “People Development”

The aging of the workforce offers employers an opportunity to re-vitalize any prior effects to advance their flexible work options, since older workers, like their younger colleagues, express a preference for access to flexible work options (Sweet, Pitt-Catsouphes, Besen, et al., 2010, p. 30). The need of higher flexibility increases with age not only because of the healthcare situation of old employees, the reason is also the eldercare in family circumstance. The goal is to proactively avoid decrease of availability, productivity, and performance due to the increased life responsibilities of old employees (Ilmarinen, 2000, p. 93). The Age-related Work Life Balance measure refers to the design of flexible working time concept (Morschhaeuser, 1999) and the flexible working place concept (ACAS, 2015, p. 7).

This measure can be implemented in at least six framework models (Fauth-Herkner, 2001, p. 13): (1) change of working time volume which is typically implemented as part time working model, (2) flexible working time distribution with which an employee may reserve hours or over hours and spend them in other days, for example, as a time account, gliding time, compressed hours, annualized hours, or term-time working, and
(3) combination of the volume and distribution models, for example, a sabbatical contract with which an employee may reduce and re-distribute working time and salary to enable several months of part-time with a constant reduced monthly salary. In contrast to the flexible working time models, flexible places of work enable older employees to spend all or part of their working time away from their employers’ workplace. This form of flexibility includes (4) home working option when employees do their job from home, either occasionally or as a permanent home working contract, (5) mobile working when employees receive instruction by phone or computer outside of office or in their vehicles, and (6) hot-desking when employees share desks with colleagues in the office (ACAS, 2015, p. 16).

Age-focused career development trainings inform what career opportunities are available for old employees. There seems to be a danger, in particular to older professionals, with regard to the problematic nature of satisfaction from professional work (Sarason, 1977, p. 235). The biggest barrier is learning activities in which there is nothing to learn so that even the learning is forgotten - but not a natural degradation of learning skills because of age (Hacker, 1996, p. 187). To emphasize the differentiation, this measure is not about expertise training to enhance working skills. For the older employees, it seems that the other goals of professional training and education are stronger than only for the job (Schmidt, 2006).

Effective training measure to facilitate career development of older employees is based on three aspects which are coupled with Behrens’ Border Theory including (1) psycho-physical border including last or carry work, special requirements to body condition such as firefighting or construction, extreme working condition such as heat, moistness or noise, night turn, requirements on extreme concentration or monotony, and time pressure, (2) obsolescent qualification or skill set, and (3) discouragement or loss of reputation (Behrens, 2000, p. 236).

Trainings can help older employees to recognize their borders so that opportunities of new areas are realistic for them take. In general, new opportunities come from a mixed workplace, for example from montage work to be master to coach junior colleagues, acquiring new qualification, or reaction to restart establishing reputations in new project or organization. The Dutch financial service company Achmea has conducted age-focused career development trainings over the life course of its employees. Career advice is provided to an employee every five years after they have almost reached 50 years of age. Older workers are given up to 10 days of paid leave to study to maintain their employability and improve their promotion or transfer chances (Naegle, Walker, 2006).
As analyzed in Chapter III, older employees have certain strength in areas which can be leveraged for their career development. In addition, research showed that mid-life professionals tend not to look back at the beginning of their careers with deep regret or with self-directed blame because they should have planned differently or should have been wiser (Sarason, 1977, p. 265). These are two examples of the reasons why companies need to provide older employees the 2nd opportunities to restart their career, especially those who did not have chance for the first phrase of their career for whatever reasons. The shape of the age-related trajectory for a given aspect of functioning depends on three major factors: (1) the biology of maturation and aging, (2) societal constraints, and (3) opportunities to expand competency in the relevant area and the accumulation of experience and expertise by the individual agent (Heckhausen, 2005, p. 241).

The process of making a career choice is the first significant confrontation with the sense of aging, involving as it does the knowledge or belief that such a decision is fateful. It is a “moment of truth” kind of problem which is influenced by numerous factors such as strength of interests, familial relationships and pressures, economic factors, love and peer relations, time perspective, and how one reads and structures the future (Sarason, 1961; Cowden, 1971). Companies may carefully address these factors while offering the 2nd career opportunities for older employees. Getting satisfactory frequency data is necessary in order to judge the degree of the “one life – one career” imperative (Sarason, 1977, p. 251). For example, periodical employee surveys based on these factors and results structured by age group may give indicators on motivational drivers of old employees in a specific business units or function. Development dialogues create the basis for a career move because individual interests or a career goal are considered. Furthermore, implicit company rules about age limits for moving up the career ladder can function as deadlines. Deviations from such “on-time” pattern require compensatory efforts on the part of the individual to overcome the obstacles associated with “swimming against the stream”, for example, returning to a full-time school program (Heckhausen, 2005, p. 243).

Companies which promote the 2nd career opportunity for older employees may consider developing an explicit age-neutral moving-up policy and support motivated old employees to build specific competencies required for new direction of jobs. Finally, this measure may make more sense for employees at 50 to 60 years rather than those who only have 2 years time until retirement.

Opening of the mobility options in companies is one of the measures to cope with demographic shift in terms of flexible employment condition (Spieker, 2000, p. 295). Here, the term mobility refers to moving from one geographical job location to another.
It is a bias that all older employees are not mobile because they have established roots in their community and equity tied up in home ownership (Tishman, Van Looy, Bruyère, 2012, p. 5). Employees with higher mobility tendencies self-select into contribution (Goda, Jones, Manchester, 2012).

A number of factors may limit job mobility among some older workers including issues such as specialized knowledge, discrimination, and training difficulties. Individually or in combination, these may influence the retention of older workers in more productive work now and in the future (NZG-DL, 2009, p. 18). Therefore, developing a systematic assignment process is the key to increase matching and the probability of job changes (Packebusch, 2000, p. 268) across locations. Regarding support on job mobility for old employees, recent researches recommend following ideas of action: (1) make financial resource available for helping sending and receiving business units to address transition cost, (2) provide knowledge about barriers, obstacles of older employees’ geographic mobility in order to facilitate targeted recruitment strategies and to reduce the searching effort, (3) raise awareness of the value of older employees’ skills and competences, in order to overcome the age bias in mobility patterns, (4) disseminate existing age management strategies and tools for older employees, such as mentoring programs and peer learning, and (5) create a social network platform for older employees for exchange of views and experiences for job change across locations (CaMEO, 2015).

Furthermore, higher education is an important mobility-enhancing factor. Compared to the reference workers with a probability of being inter-regionally mobile of 12.8% (12.3%), higher education thus leads to a 28.9% (20.3%) increase in the probability of being mobile for men (women) (Arntz, 2005, p. 17). Therefore, providing professional training to compensate the education gap can be supporting lever, too.

The measure age-related compensation and benefit is not about providing wage which is related with age, but about how to create compensation benefit for selected old employee groups. An international comparison study from the Bertelsmann Foundation provides ideas which can be summarized in three aspects. (1) The qualification-wage differentiation within age groups is to generally be increased. (2) Extension of wage based on productivity and success may change awareness of age-related to performance-related compensation system. (3) Affiliation of general obligation of minimum wage increase the probability of implementing age-neutral compensation system based on qualification, productivity, and success, in particular, in industries such as construction and manufacturing (Funk, Kleses, Seyda et al, 2003, p. 106).

Benefit for selected old employee groups create positive effect on internal and external employer branding. A typical measure of this category is award for old employees with a significant service time in company, for example, special bonus or benefit at the year
of jubilee. Age-related recruiting measure enabled by Semi- or Early Retirement provides attractive offers for old employees and generate new vacancies so that externalization of certain portion of job positions for recruitment of younger employees becomes possible (Bellmann, Hilpert, Kistler, et al., 2003, OECD-AEP, 2005, p. 93).

One implementation of adapted early retirement in Germany is the “Retirement With 63“. Since July 1st, 2014, workers who have paid the social insurance for 45 years can receive pension without any reduction (BA, 2017, p. 7). Another measure in this direction is the implementation of the German Federal Act of Semi-Retirement. By adaption of the Semi-Retirement Act, a smooth and early transition from work to retirement is made possible for the old-age pension. Under this Act, the Federal Employment Agency supports the Semi-Retirement for older workers who reduce their working hours from the age of 55, latest from the 31 December 2009 onwards, and thus allow recruiting of other unemployed workers. The Semi-Retirement for older workers itself is independent of the support of the Federal Employment Agency. For the purposes of § 3 no. 28 of the Income Tax Act, it does not matter if the Semi-Retirement takes place before the January 1st, 2010 and is funded by the Federal Employment Agency under § 4 (AltTZG, 2014, §1).

Beyond voluntary reduction of working hours by employees, many companies today still offer a company-specific program based on the expired Federal Semi-Retirement (Waltz, 2014, §1). In the practice, there are two options to implement the Semi-Retirement Act and utilize the respective support from the Federal Employment Agency. The first option is an agreement of continuous part-time of 50% of original working time, therefore also called Part Time Model, over the period of employment contract to release 50% of capacity to enable new job openings. The second option is the agreed 50% of original working time until retirement are redistributed in two phases, also called Blocks. In the first Block, working time remains unchanged, namely 100% instead of 50%. In the second Block, the old employees are released, namely 0% of working time and enter into Early Retirement. The second option is widely adapted by the majority of German companies under the label “Block Model”. In both options, employers are financially supported by the Federal Employment Agency. The baselining of the add-on financial support is 20% of the original salaries, which generate an interesting income impact for old employees. Furthermore, it is possible for the old employees to receive the payment of the Social Insurance earlier (AltTZG, 2014, §4), since the Semi-Retirement has the same legal right as the unemployment and enter the retirement earlier.

Many old employees take the Semi-Retirement offer due to the benefit generated by reduced working stress, income, and tax benefit as well as earlier receipt of Social In-
surance. Some leading Germany companies are still offer comparable compensation models for old employees, although the German Government recently does not support in such broad range any more. In UK, similar idea of this action area has been implemented too. For example, Firstgroup, a surface transportation company, has a “Flexible Decade Program” which aligns work arrangements with pension schemes, offering older workers the option of part-time work while drawing a reduced pension or continuing to work full time or part time while continuing pension contributions (Koc-Menard, 2009).

The five measures explored above cover action ideas, methods, programs, tools, processes, and systems that develop employees in professional roles and support development at the individual level in organizations. Therefore, they can be summarized as an **Action Field “People Development”** with the following measure catalogue:

- Measure 10: age-related work life balance program
- Measure 11: possibility to restart “the (2nd) career”
- Measure 12: age-focused career development training
- Measure 13: mobility management
- Measure 14: age-related compensation benefit

### 1.4 Action Field “Communication and Culture”

*Age-group-focused communications and events* which may retain an engaged workforce with different demographics of today have necessarily to emphasize employee communication (Argenti, 1996, p. 80). Such communications refer to transactions between individuals and groups in organizations at various levels and in different areas of specialization (Frank, Brownell, Dolphin, 2005). For example, age bias is one the most widely experienced forms of bias, or in some cases even discrimination, across Europe for every age group. Those in the 50+ group were most likely to see it as serious (AUK, 2011).

A longitudinal study has identified four dimensions of Age Management (Ilmarinen, 2000, p. 92), where communication related topics play a significant role: (1) awareness of age-related unconscious bias, (2) capability of team work, (3) organization of work based on individual resource, and (4) capability of communication skills. The image of old employees is only partially perceived based on scientist verification. Observations within a conglomerate showed that age-related unconscious bias is characterized by equalization of “getting older” and “declining capabilities” (Koopmann-Boyden, McDonald, 2003, p. 34). In this context, the Cornell University gave some recommen-
dations such as avoid collecting age related data by employers, age-neutral job description and evaluations, age-neutral layoffs, avoid adversely judgment on older employees because of compensation expense, and age-neutral employment (Tishman, Van Looy, Bruyère, 2012, p. 17). Valuing cross-generational collaboration and a workplace of different demographic groups is one of the most influential subjects of demographic management.

Purposeful communications of age-related issue are a powerful management instrument. Typical communication directions (Miljković, Rijavec, 2008) and activities (Croucher, 2008) in the workplace include (1) downward communication such as workforce briefings, circles, team meetings, and town hall meetings, (2) upward communication such as employee survey and management annual meetings, (3) horizontal communication such as intranet, company-wiki, company newspapers, project meetings across departments, and (4) diagonal communication such as labor unions annual location meetings, and social media platforms. Furthermore, as a special form of communication, events can be used in four types: support, celebratory, educational, and training (Lakshminarayanan, 2006).

Inter-generational exchange and collaboration is a measure to leverage the synergies of age diversity, because it provides a connected approach and richness of solution options for problem solving (Koechling, 2000, p. 371; Dutton, Heaphy, 2003). Training young employees and transferring expertise from reasoned workers to younger generations become more relevant for companies to maintain competency inside of the organization. But the other way around is important too. Reverse Mentoring is one of such ideas. Proctor & Gamble and GE both offer such programs where younger employees teach senior managers and executives who tend to be mid-career or older workers, about new technologies (Greengard, 2002, Tishman, Van Looy, Bruyère, 2012, p. 17). Reverse Mentoring is also based on the Social Exchange Theory due to its focus on dyadic relationships (Noe, Greenberger, Wang, 2002, Olian, Carroll, Giannantonio, 1993; Raabe, Beehr, 2003). From this perspective, individuals develop mentoring relationships if they perceive that the benefits outweigh the costs (Allen, 2007; Ensher, Thomas, Murphy, 2001). This aspect also explains further why senior employees should invest time to mentoring. Beyond the new technology topic is addressed by reverse mentoring, old employees may get access to learn new values, to experience a different culture, to share personalities, to identify cross-generational similarities, and to influence future leaders (Murphy, 2012).

Age-related corporate responsibility program refers to the measure where older employees and retirees are considered a valuable human capital resource (Stevens, 2010). The growing awareness of the issue of corporate social responsibility has raised the
questions about how responsible behavior of companies would impact employees’ well-being (Tamm, Eamets, Motsmees, 2010). Common types of Corporate Responsibility programs (SAGE, 2006, p. 9) include (1) corporate contributions or philanthropy, (2) employee volunteerism, community relations to innovate for new business opportunities, (3) becoming an outstanding employer for specific employee groups such as older workers or minorities, (4) making environmental or social improvements that exceed what is required by law, and (5) initiatives covering advanced workplace design for old employees.

One example is leveraging the demographic situation to tailor companies’ own corporate responsibility program and facilitate the retirement process. Retired employees are an important stakeholder and have a large store of social capital, represented by their networks inside and outside of company (Venneberg, Wilkinson, 2008). A few companies have started to assume some responsibility for what happens to former employees after they have retired and are provided by opportunities and training to prepare for a portfolio life after retirement (Grayson, Sanchez-Hernandez, 2010). For instance, the company Hewlett-Packard has developed its Encore Program with such portfolio which includes working part-time for up to one year in a NGO team, bringing highly valued skills to Hewlett-Packard as a host organization, helping Hewlett-Packard build capacity, operate more efficiently and ultimately, for a broader community impact, developing a network of contacts and resources in a new field and earning a stipend of up to $25,000 (ENC-HP, 2015).

Employee network is one of the modern organizational forms for cross-community, in particular also for cross-age, collaborations (BMFSFJ, 2008, p. 53). Age-group-focused employee networks in this research refer to the concept ERG (employee resource group) which is a group of employees who identify with others similar to themselves drawn together by characteristics that the community holds in common (Sample, Hawn, 2011). In the business context, it is also known as Affinity Group or Employee Network and has a strong voluntary character. Recent researches show that old employees who volunteer at higher levels (7 hours or more per week) in network activities reported greater levels of positive effect in comparison to non-volunteers, and this was related to their greater availability of social support from others (Pilkington, Windsor, Crisp, 2012).

Another research in Japan shows that 50+ employees with work-based social networks are apparently associated with better health status (Suzuki, Takao, Subramanian, et al., 2009). The networks’ mission was to promote the well-being of the company and develop mutually beneficial relationships between its members and the organization’s stakeholders. Furthermore, age-group-focused employee networks assist companies in fostering an environment that excels in demographic shift by serving as the common
voice for employees of different generations, removing barriers that negatively impact the success of its members, and act as internal and external advocates for their organization, thus enhancing its image to all demographic stakeholders.

There are three categories of Age-group-focused employee networks which are in particular interesting for this research work: (1) ERGs with seasoned employees as its member, for example a 50+ employee network, a Baby Boomer network, or a future retiree network, (2) ERGs of cross-generational members, and (3) ERGs with members of any characteristics but focusing on demography related topics.

In all categories of such ERG, key activities can include driving organizational initiatives that maximize the development of the group members, supporting a specific business unit to attract and retain the best talents from the group, promoting the groups leadership and development at all levels in the company, building an internal support system for the group within the company, and helping to create and sustain a diverse and inclusive working environment. And regardless the type of these age-group-focused employee networks, ERG is suggested to have a clear vision statement, official name, goals and objectives, participation criteria, leadership structure, work streams, operating principles, activity focus, strategy, and action plan. At the administrative perspective, an ERG should also have measures of success, funding & budget, documentations, infrastructure, commitment of executive support, for example from HR, management and eventually workers council (Russell, Kennedy, 2014).

A comprehensive strategy in the diversity management context can be expanded to include the more advanced elements of social marketing (Lakshminarayanan, 2006, p. 46). Age as one of the diversity dimension, age-focused branding and marketing activities provide various opportunities for company to spread positive messages. These positive messages enable a company’s reputation which refers to the evaluation by its stakeholders in terms of respect, knowledge or awareness, and emotional or affective regard (Hitt, Ireland, Hoskisson, 2003, p. 73).

One classical area of activities is to pursue age-related ranking and awards as external recognition. There are four types of recognitions: (1) dedicated age-related awards such as the AARP Best Employers for 50+ Workers, to which the positive brand of an employer is directly linked with its age-focused programs, (2) Diversity Rankings and Awards such as the DiversityInc, the Equal Opportunity Publications, or the Deutscher Diversity Preis, where age-related activities may contribute as an important diversity dimension, (3) Employer Rankings such as Universum, Great Place to Work where age-focused programs may serve as supporting reference regarding criteria like employee engagement, workplace flexibility, and (4) further rankings and awards where age-related activities can be referenced with a goal-oriented action implementation.
A further marketing aspect refers to specific publications, namely age- or generation-focused topics as key stories of the communication (Razen, Hahn, 2011, p. 270). At least two target groups are interesting for a company’s stakeholder: (1) those who is particularly interested in the company’s strategy and activities on the demographic shift topic, or (2) the 50+ groups who are interested in the company in general, for example, the company’s product, the company as a potential employer, customer, supplier, or investment target.

Depending on different target group, companies may choose the most effective channels to reach the interest of selected stakeholder by communicating topics like life situation, values, expectations, beliefs, and life styles (Razen, Hahn, 2011, p. 271). For example, the German company Deutsche Telekom has actively involved in individual initiatives outside of the company, such as the “Internet – it’s not a question of age” competition. The 50plus customer advisory council also gives the company advice when it comes to developing and introducing products and services designed especially for customers of the 50+ generation (DT-CRR, 2012, p. 174).

The five measures explored above explain platforms, frameworks, and channels to influence the way of interactions, customs, and beliefs within a company and therefore can be summarized as an Action Field “Communication and Culture” with following measure catalogue:

- Measure 15: inter-generational exchange and collaboration
- Measure 16: age-related corporate responsibility program
- Measure 17: age-group-focused networks
- Measure 18: age-focused branding and marketing
- Measure 19: age-group-focused communication and event

Measures in the four Action Fields from the literature review build the cornerstones of a theoretical framework to manage demography. These cornerstones can be improved by further findings from practice. As the next step, a case study with selected companies was conducted to enrich the theory building.

2 The Case Study “Multi-Companies”

This research part focuses on a case study with selected large companies in Germany. Goal is to identify further measures which have been considered in the practice. Furthermore, the case study provides opportunity to test the framework how practitioners in companies understand the measures identified from literatures. The case study looks into each strategy component of demographic programs in the interviewed companies,
including mission and vision statements, formulated strategy, and measure implementations. The study and analyses also enable access to the knowledge and experience as reference for measure evaluations.

2.1 Theoretical Basis of the Approach

A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. The case study “Multi-Companies” in this research is designed with no pre-specified hypotheses to test. The idea for such theory-building approach is no theory under consideration and no statistical hypotheses to accept or reject (Eisenhardt, 1989, p. 536). In the following, this case study provides exploratory input for the theory building. It copes with the technically distinctive situation in which there will be more sources of interest than existing identifications. As one result relies on multiple sources of evidence, another result may benefit from the prior development of theoretical propositions to guide knowledge collection and analysis (Yin, 2003; Hartley, 2004; Stake, 2005).

This case is built on interviews with 22 companies. The interviews were mainly conducted in 2014. Findings are organized along the strategy development processes. It looks into each strategy component of a demographic program in the participating companies, from defining mission and vision, formulating strategy, developing measures to implementing measures. The case study aims at building the theory by applying the Empirical Industry-Sociology Case Study Research Strategy (Pflueger, Pongratz, Trinczek, 2010, p. 31). The application is characterized by four distinguished features:

1. Context - The objective of the research strategy is to analyze case input in a specific context. The context of this case study is the large companies of industry and service sectors which have a significant S50+ in workforce. Input in this context is the description of workforce situation and measures of each action field.

2. Multiperspectivity - During the input collection, data and experiences of more than one interviewee group are summarized and interpreted. This case study use scalable score to evaluate situations and measures.

3. Method Combination - Research methodologies resolve comparisons across organizations. Interviews are conducted in personal meetings, via telephone, and via emails.

4. Openness - The theory building allows appropriate variants, extension of survey, and evaluations to support exploratory input. In this case study, further measures for each action field are allowed to be added by the interviewees.
2.2 Selecting and Communicating with Participants

Based on personal contacts and recommendation by colleague and business partners, 55 DAX30 and large companies were invited to participate the case study. In the first step, “request for interview” emails were sent to the respective contacts. This email included a brief introduction on the research background, the research topic, source of the contact connection, one question if the contact is open for a 45-minute interview, and a hint how the scheduling and interview would be organized. The positive response rate was 40% with confirmations from 22 companies.

Figure 27: Case Study Multi-Companies – Participation Pool

Source: Own representation based on the case study Multi-Companies

Figure 27 illustrates the composition of the companies which were involved in the case study. 59% of them are companies in industries such as Automobile, Chemicals and Pharmaceuticals, Consumer Goods and Retail, Electricity, and Electronics and Manufacturing. 41% of the companies are from service sector such as Banking and Insurance, IT, Communication Technologies, Transportation, and Logistics.

The majority is large companies with more than 10,000 employees and a significant share of the 50+ workforce. In total, the coverage of workforce base is around one million employees. The ratio of the number of companies with and without a business growth perspective is 1:1.
As a deep-dive, Figure 28 shows a summary structured by the companies’ current and future workforce development in terms of age. The majority is moving towards a workforce with higher \( S_{50+} \) in the workforce. But some companies in the Banking and Insurance sector have predicted a future scenario where 50+ employees will be the half of the workforce in ten years’ time horizon.

Multiperspectivity is enabled by interviewees from four types of functional background. 32% of the interviewees are Diversity Managers who have a responsibility for age diversity or generational diversity topic in their companies. 27% of the interviewees have HR Operation, Development, or Training responsibility. They have insight from the
employee development and training products in terms of demography management or age diversity. Another 27% of the interviewees are HR strategists who have the knowledge to discuss and share demography actions of their companies. 14% of the interviewees are from the sustainability function, since the topic demography or age diversity is assigned to sustainability management in their companies. Amongst all interviewees, 23% of them are head of department, 41% have management or leadership responsibilities, and 36% are senior experts with multi years of experience in demography management in their business environment. Figure 29 shows the composition of the interviewees.

2.3 Designing Questionnaire and the Interview

For the interviewees who agreed to participate in the case study, an appointment was arranged. Interviewees received a formal interview invitation with a three-page introduction document and the interview questionnaire.

The briefing document gives an overview about key results of the Chapter II, III, and IV including (1) demographic shift and its impact on large companies, (2) examples of relevant age difference, and (3) a catalogue of action fields where measures from the literature review had been identified.

The questionnaire is structured in three sections. The section one and two aim at collecting structural data and help interviewees to cross checks the age difference perception in their programs. Firstly, the interviewees were asked about the basic demographic situation of the interviewed company regarding the workforce situation, key metrics, and observed workforce trend. Secondly, the questionnaire addressed age differences which had been perceived in the interviewed company. Interviewees were asked to evaluate the intensity of perceived difference and to evaluate if this difference may create advantage for older or younger employees in the workplace. The focus of the interview was the section three, namely the strategy questions addressing companies’ vision, action field, and measure implementation. On one side, interviewees were asked how their companies phrased strategy and goal. On the other side, interviewees went through the measures which had been identified in Section IV.1. Finally, the questionnaire included a question for the interviewees to explain one or two most effective measures which had been or were being implemented.

There is also a definition catalog about the terminologies used in the questionnaire. For example, the term Management refers to employees who have personnel responsibilities. The term HR refers to the Human Resource department(s) which may significantly influence the design of workplace, policies, and other HR management approaches. The original questionnaire with more details can be found in Appendix H.
Each interview was designed for a conversation of 45 to 60 minutes. During the interviews, each question in the interview was explicitly emphasized for its environmental scope. Answers refer exclusively to the largest scale of the workforce in their Germany organizational units. More than half of the interviewees took the entire workforce in Germany as the scope because of their corporate or headquarter responsibility and multi-years functional experiences. Interviewees very often mentioned the challenges they had been facing in Germany as an aging society, the trend, and lack of qualified workers in the talent market.

2.4 Result Collection and Evaluation

The collection of data was not only during the interview. Especially after the interview, some interviewees could provide complementary materials. Also, some publicly available information, for example, from research institute who has a connected subject and case study with the companies, or targeted internet search based on the interviewees’ recommendation. All the original results were documented in digitized format. Quantified results were consolidated in a spreadsheet for analysis and evaluation.

The workforce data of the interview results were used to classify the companies, especially, with regards to size and workforce trend. The age differences are mainly analyzed from the quantified perspective, in terms of the average score of perception and variance. Different ranking lists are possible, for example, to provide reference for comparisons across age groups. In contrast, the evaluation on companies’ strategies and vision statements was rather qualitative. This evaluation provided insight about the logic and the desired impact areas of their measures. Analyses about the action fields and measures focused on the most important actions which were implemented in the participating companies. Furthermore, three new measures could be identified to enrich the theory building of a demographic managing framework. Finally, the interview results provided a deep-dive of six measures regarding their implementation. Each of the deep-dive description was structured by situation, implication, and action. Finally, a summary with key results was shared with all the interviewees as feedback.

3 Building from Practices – Case Study Results and Findings

3.1 The Age Perception in Business and HR Context

The first insight generated by the case study is a general perception of the demographic shift in the business situation. First, while providing an introduction of their business situation, most of the interviewees emphasized the relevance of the business situation as prerequisites to develop a meaningful demography program. Three areas of business priorities were frequently mentioned: business performance, for example, growth or
profitability which has an influence on the workforce need and resource to launch a
demographic program, industries and functions which determine the type of jobs, and cor-
porate strategies which set the priorities, framework, and future workplace conditions
for the demography management.

Secondly, the areas of age difference which are elaborated in Chapter III were evaluat-
ed. The focus is the perceived difference between 50+ and 50- employees at the work-
place of the case study companies. The interviewees specified the degree of perceived
age differences by applying a quantified scale form the score 1 “a bit difference per-
ceived”, score 2 “significant difference perceived”, and score 3 for “extreme difference
perceived”. Figure 30 lists the results with respective details of average score and vari-
ance. The consolidated evaluation from all the interviewees indicates an average score
from 0.23 to 1.50. There is almost no difference perceived regarding intelligence, men-
tal and psychological health (Ø<0.5). In terms of the convergence of perceptions, the
lowest scores (σ²<0.5) are shown in intelligence (σ²=0.18, Ø=0.23), mental and psycho-
logical health (σ²=0.36, Ø=0.57), cognitive function (σ²=0.37, Ø=0.91), and physical
fitness (σ²=0.42, Ø=0.1.32). It can be interpreted that the interviewees tend to agree on
the same perception. Furthermore, the top three aspects where 50+ employee signifi-
cantly differ from the 50- employees are knowledge access (Ø=1.50), generational char-
acteristics (Ø=1.45), and communication style (Ø=1.36).

Figure 30: Case Study Multi-Companies – Perceived Age Difference (Part 1)
Source: Own representation based on the case study Multi-Companies
Moreover, Figure 31 shows that interviewees perceived some age differences may create more advantage for 50+ employees, some for 50- employees. The most important findings are in two areas. The first finding refers to the top age differences from which 50+ employees can most benefit. These are knowledge access and leadership. Some age differences create respectively advantage for 50- employees, for example, physical fitness and cognitive functions. The second finding considered the top five advantages perceived for the two groups. Age difference in terms of knowledge access and generations were perceived as the common areas where both 50+ and 50- can most benefit from. More detailed analysis including breakdowns by industry, workforce size, $S_{50+}$, and workforce growth can be found in Appendix I.1 to I.4.

Figure 31: Case Study Multi-Companies – Perceived Age Difference (Part 2)

Source: Own representation based on the case study Multi-Companies

3.2 Defining the Strategic Goal - Demographic Vision

As core of the Managing Demography Framework, a demographic vision should be always clearly phrased to ensure value creation. This strategic vision is a statement of an organization’s unique purpose and the scope of its operations in business terms (Hitt, Ireland, Hoskisson, 2003, p. 23). Based on the vision, sub-goals of each action field are aspirations to aim at and work toward (Keegan, 1984, p. 191). These sub-goals guide measure implementation to ensure desired impact. Both the Vision and Action Fields should be closely aligned with business and HR strategies. This is because the priority, strategic framework and resources from business and HR significantly influence the priority, definition and implementation scope of the measures. In practice, aligned approach facilitates management decision and communication, because management tar-
gets are usually cascaded and broken down along the organizational structure. An aligned approach is suitable for supporting cross-organizational synergy of implementation. Furthermore, company-external factors need to be considered when designing a demographic program. Social environment such as labor market, government regulations, country-specific culture or stakeholder’s interest may elevate, but also hinder a successful program.

During the case study, interviewees were asked to state the demographic vision or goals of their companies’ program if they have one. The interviewees specified that a purposefully phrased vision is crucial to guide successful implementation of measures. However, not all the companies had a clear vision statement. Indeed, 86% of the interviewed companies have one.

![Figure 32: Case Study Multi-Companies – Vision Statements](Source: Own representation based on the case study Multi-Companies)

Figure 32 summarized the vision statements which reflect the picture of future the companies would achieve by their demographic actions. Most of the companies phrased their demographic vision as maintaining productivity and performance of their employees. Box 3 summarizes the top five statements evaluated as the most focused and visionary. A complete list of all twenty statements can be found in Appendix I.5.
1. Establish prerequisites for sustainable development of the company with focus on leadership and employee awareness and ergonomic measures while minimizing the risks of productivity, increase motivation, positive experience sharing, collaboration, and attractiveness as an employer.

2. We value a strategic guardrail of life-phase orientation. We do not align our HR products and services along age groups, but along non-chronological life-phase of our employees. We want a capable and employable workforce independent of age and gender.

3. Support business strategy by encourage dialog between different generations; by networks activities, and tandem programs.

4. Facilitate employees' environmental interests and life phase in order to keep productivity by enabling collaboration of all generations.

5. To prepare the retiree wave in ten years while maintaining performance of current workforce, we address two focus areas which are working time reduction program and apprentice hiring.

| Box 3: Statements about Vision or Strategic Goal |
| Source: Own representation based on the case study Multi-Companies |

3.3 Exploring and Evaluating Measure Implementation

All interviewed companies have considered implementing one or more measures. However, some companies have specific measures in place. The others have just planed to implement measures. Figure 33 ranks the measures which have been addressed in the case study companies. 86% of them have started with measures like workplace design, in particular ergonomics, and healthcare facility and services. More than half of the companies have addressed workforce planning, recruiting measures to ensure sustainable workforce development, inter-generational exchange, and work life balance program. Only few companies have taken or planed actions in the areas of team performance and communication.
The interviewees were asked if there are any measures in their companies, but not listed in the questionnaire yet. Three additional measures were identified:

- **Measure 20: Job rotation of old employees** which is the idea of involvement of working in different departments or in another business unit for some months. Theoretically, rotation is defined as working at different tasks or in different positions for set periods of time (Jorgensen et al, 2005, p. 1723) in a planned way using lateral transfers aiming to allow employees to gain a range of knowledge, skills, and competencies, and is also seen as an on-the-job training technique (Gomez, Lorente, 2004, p. 241; Karadimas, Papastamatiou, 2000, p. 39), and as such is known to have an effect on employee motivation (Huang, 1999, p. 75). Job rotation is position-oriented by management determining the need for a specific job to be done. With Job Rotation, an individual can be moved through a schedule of assignments designed to give that individual a breadth of exposure to the entire operation. It is a career development measure where an individual temporarily moves laterally into an established or “shadow position” which usually requires the employee to suspend his or her current job duties.

There are two forms of job rotation: (1) within-function rotation, which is a rotation between jobs with the same or similar levels of responsibility, and within the same operational or functional area, and (2) cross-functional rotation which refers to movement between jobs in different parts of the organization over a period of time. However, rather than rotating between a number of jobs that are in the same group and closely related to each other, the individual would rotate...
through a number of jobs in different departments. This measure provides the individual with developmental opportunities so that such measure can also be used by the organization to gather data about their skills, interests, and potential to indicate their next placement (Bennett, 2003; Kwame, 2012, p. 24).

Job Rotation would help old employees to update a most recent overview of important workflows, to connect with colleagues of other parts of the organization, and to identify career opportunities outside their conform zone. Depending on the situation, this measure can be implemented with different time frame, for example, functional exchange assignment for couple of months, weeks, or shadowing work for several days. Job rotation can lead directly to the accelerated development of new staff members, contribute to employees’ knowledge of the organization, its functions, and the development of social and individual human capital. It also helps to develop new relationships between the employee in the job rotation and other employees across the organization, enrich skill diversity which may support employees to meet the qualification of jobs for future career advancement (Bennett; 2003).

- **Measure 21: Age Key Performance Indicator.** One interviewee shared a further age key performance indicator which was used in his company. Beyond the age metrics $Q_{50^+}$, $S_{50^+}$, $\phi_{18.67}$, and $G(a, b)$, the company also introduced a special key performance indicator such as
  - age distribution of training participants,
  - age distribution in leadership positions, and
  - age distribution of part time employees.

In total, the company uses around 10-12 key performance indicators to steer actions and changes within the demography program. Another interviewee stated that his company has defined a target curve of age distribution in 2020 and onwards.

- **Measure 22: Jubilee.** Three of the interviewed companies explained that they have established in-person events to celebrate jubilee. In particular, old employees who have served the company for more than 10, 20 or 30 years are explicitly recognized and appreciated by an official thank you message through the companies’ communication channels. These employees may receive a one-time rearward in form of bonus, stock share, or a gift. The “rearward” part of the Jubilee idea fits into the Measure “age-related compensation benefit”, the “recognition and appreciation communication” can be part of the Measure “age-group-focused communication and event”. The Jubilee idea can be seen as a new, or a combination of existing measures.
Furthermore, one interviewee raised the topic “50+ disabled employees”, since the share of disabled employees within 50+ group is relatively higher than in other age groups. Potential measures can combine programs from the disability management, accessibility management, and age diversity management.

Figure 34 provides a selected deep-dive analysis on the ranked measures which had been implemented or planned to implement. This analysis provides two breakdowns by industries and workforce size. In the first breakdown (Figure 34-A), the average number of addressed measures per company in the Industry sector is 9.6. Most of the companies (>85%) here took action in workplace design, workforce planning, health service and recruiting. In contrast, companies in Service sector addressed 8.3 measures on average. Most of them (>75%) allocate resource to the topics like 2nd career opportunity and health services. There is also a big difference in the choice of measures. For example, 62% of the companies in the Industry sector have taken actions for expertise training, but only 11% in the Service sector. One possible reason is that the Industry sector is far more influenced by technology and technology-related expertise. The second breakdown is shown in Figure 34-B, results show that large companies had addressed more measures (Ø#=10) than middle-sized ones (Ø#=7.1). One interpretation would be the economy of scale effect that large companies can bundle resources to tackle broader spectrum of measures and make use of them.

**Figure 34: Case Study Multi-Companies – Measures Breakdowns**

*Source: Own representation based on the case study Multi-Companies*
A further finding is that Growth Companies address fewer measures than the other companies. However, both groups have prioritized their measures in same direction, in particular, regarding health service, workplace design, recruiting, and work-life balance. The difference can be found in measures such as motivation and expertise training. Here more Growth Companies took actions. Figure 35-C illustrates this comparison. Figure 35-D compares companies by three groups based on the share of the 50+ employees in their workforce: high ($S_{50+}>33\%$), medium ($20<S_{50+}\leq33\%$), and low ($S_{50+}\leq20\%$). All the companies with $S_{50+}>33\%$ had addressed measures in health service and retiree experts. In contrast, only a small portion of companies with $S_{50+}\leq33\%$ have addressed the measure retiree experts. They prefer to take actions in workplace design and workforce planning. It is considerable that three-fourths of the case study companies with $S_{50+}\leq20\%$ have addressed measures in inter-generational exchange and mobility management. One interviewee of these companies shared that there was a cultural impact from young workforce to their senior old colleagues, for example, by exchanging their experiences in business travels. This action led to a very positive atmosphere when talking about reassignment or job rotation opportunities to employees.

During each interview, there was 15 minutes reserved for a deeper elaboration of 1 to 2 measures which the company successfully implemented. Success is defined as “the goal of the respective measure has been achieved or even exceeded with impact”. The emphasis is not only the WHAT in terms of goal and results, but more importantly HOW the measure is implemented, especially regarding aspects like initial situation, project
team setup, resource allocated, work stream structure, milestones, and key facts. In following, four in-depth best practices from the case study are selected to enable a deep-dive about the HOW aspect of the measure implementation.

**Program “Demography Target 2020” – An In-Depth Best Practice of the Action Field “Workforce Composition”**

**Situation:** The Company-F is a premium manufacturer in the automobile industry. An interview was conducted with the senior expert from the HR strategy, policy, and innovation management who was responsible for the age and demography actions impacting the company’s 75,000 employees in Germany. The company is affected by the subject demography in three fields: (1) arrangement of products for an aging customer base in traditional markets, (2) analysis of sales potential regarding demographic development in relevant market, and (3) preserving the performance level and innovation of an aging workforce.

**Implication:** For the Company-F, demographic shift means potential risks due to labor cost, but also opportunities to increase unexplored productivity. Therefore, the company started a demography project to specifically look into workforce planning and demographic development based on age indicators. The goal was to forecast age structure in 10 to 15 years and identify potentials, risks, and concrete measures to cope with future development.

**Action:** The first phase of the project was to visualize age data and conduct workforce forecast. As shown in Figure 36, the age structure of the company’s workforce changes at a remarkable speed. The average workforce age in one of its plants was expected to rise from 39 in 2007 to 47 by 2017, namely 8 years older within 10 years. Similar trend was also identified when looking at the data of entire workforce in Germany. In 2011, the share of the 50+ among employees was 27%. Based on the forecast of the Company-F, this number was predicted to 36% in 2021.
The project team selected a manufacturing plant for a test of correlation between age and productivity. The test used standard questions with 100 worker–job combinations in the rear-axle department. These questions built a Work Ability Index which assesses and scores the fit between a worker’s ability and the demands of specific jobs. The findings revealed that the average productivity score decreased with age, as expected, but the variation increased. Some workers remained fully productive, while others experienced a strong decline. At the same time, the project team also studied the unique potentials of older workers in six areas: highly experienced, rich in company specific know-how, decision-making abilities, quality awareness, disciplined, and reliability and loyalty. The workforce forecast and analysis results were convincing enough to gain an explicit management support. The management team commissioned a dedicated steering committee which agreed on the implementation of demographic measures. Preserving and increasing the performance and innovativeness was the phrased goal for the next step of implementations.

As output, the project identified the productivity risk issue was one of the top priorities of the company’s demographic strategy. Two prevention potential areas were identified. The first area was recruiting which included a specific definition of the target age-curve in all new manufacturing plants in the future. The awareness of staffing targeted experienced workers, target-group orientated personnel marketing, and higher share of women. The second area was the four influence possibilities to enable workability which are (1) individual health care, nutrition, exercise, (2) qualification and leadership behavior, (3) ergonomics, individual working time flexibility, and (4) social contacts and changing tasks. A further result of this measure was a specific definition of three work pack-
ages in (1) ergonomic improvement, workplace design, work structure, (2) healthcare and prevention, and (3) leadership and motivation. A specific location of manufacturing plant was selected to be pilot organization for the implementation of the six measures within 12 months.

The Program “On-Sites Health Management” – An In-Depth Best Practice of the Action Field “Productive Fitness”

Situation: The Company-G is a leading semiconductor manufacturer producing electronic commodities with more than 10,000 employees in Germany. As a global organization, the company faces special responsibility for worldwide long-term challenges such as demographic change, climate change, and diminishing resources. An interview was conducted with an HR manager from its headquarter who has insight on the company’s demography projects, especially in the manufacturing plants such as Berlin and Regensburg (excluding affiliated companies and joint ventures). As the share of the 50+ employees in the workforce had increased over the 20% benchmark, the Company-G started to consider specific requirements of age groups in its workplace and HR policy design.

Implication: The occupational health management was seen as strategically important to minimize the risk of work-related injuries and illnesses which can result in human, environmental, and economic loss. It is also a long-term prerequisite for motivated employees. The occupational health management requires strict management discipline to ensure impact through the application and documentation of proper measures. Processes, equipment, and trainings were to be established for employees to support their tasks and performance.

Action: The first action of the Company-G was establishing key performance indicators to measure impact and improvements. In 2006, the company started to systematically use two key performance indicators (1) absenteeism, which is the absence percentage of the entire ordinary working hours, and (2) occupational accident rate which was defined as number of accidents per 1000 employees. The second action was to monitor the development of this measurement for a period and observe the 50+ specific issues. A dedicated project team was established with members from HR, workers council, company medical officer, and sparring partners from external insurance companies of their employees. The third action was the smart baselining on “health check and trends” on all the manufacturing sites by hosting series of workshops with experts from the insurance companies. These experts could provide anonymous statistics, which were precisely customized for the Company-G and the project’s need. The health data, illness record, and therapy activities were saved in a very structural way by the insurance companies.
Based on the analysis results and recommendation of the project team, following four areas of measure were implemented.

1. The project was accompanied by an awareness campaigns including an official CEO endorsement letter in the company’s “Policy for Environmental Protection, Health Management, and Safety”, new web pages in intranet, employee workshops, and regular flyer actions in company canteens.

2. A spatially inclusive program on prevention of diseases and discomforted was implemented in all manufacturing sites. An example for such preventive examination was the health check-day for its 50+ employees, including checking the body mass index, skin fat, liver function, blood pressure, and sugar and cholesterol levels. Beyond these regularly offered treatments the Company-G offered the opportunity for vaccinations, laboratory investigations, and individual counseling based on analysis from employees’ historical data. All manufacturing sites appointed responsible doctors and adequate medical services. In addition, the Company-G also offers individual and detailed dietary advice to its employees.

3. Alternative shift model for 50+ employees in Regensburg and Berlin was implemented. Based on the project’s analysis, some 50+ employees in these two locations had difficulty in morning-shift or night-shift. The project team developed a new HR process to enable identified pairs to share and divide the shifts. Within the pairs, it is agreed that one take only the morning-shifts and the other only night-shifts.

4. The systematical approach also established the Health and Safety Committees in all manufacturing sites. In each of them, at least one committee must be established with members from employer, one member from the works council, a work doctor, an expert for the occupational health and safety function, and the health and safety officer.

As results, the total absenteeism at the Company-G decreased from 5.1% in 2002 down to 4.4% in 2013. With a decline of the occupational accident rate from 11 in 2006 down to 8 in 2012, the company was way below the industry average. Not only can this be explained by the intensive training that has been conducted by superiors and health officers, but also it was due to the increasing awareness on the age specific health management. The Company-G achieved significant employee satisfaction by the 50+ groups. Furthermore, the company could win the Occupational Health and Safety Management System Certificate from DAKKS and TUEV which contributed to a very positive brand in the external market.
The Program “Working System” – A further In-Depth Best Practice in the Action Field “Productive Fitness”

Situation: As shown in the best practice program “Demography Target 2020” of the Company-F, the average age of workers in its production plant-A was predicted to increase from 39 in 2007 to 47 years by 2017. One could recruit a significant number of younger workers while reducing older workforce by offering them an attractive early retirement opportunity. However, this was not an option for the company-F, since it would mean unaffordable cost due to national labor law and the workers councils' resistance. In addition, such option was evaluated as potential discriminatory risk which would damage the company’s image as the top employer and brand in the German market.

Implication: The aging trend and limited labor pool in this region threatened the plant’s ability to execute the company-F’s strategy of enhancing competitiveness through technological leadership and productivity. Given the labor and political conditions, the most realistic measure was the optimization of an age-friendly working system in the plant-A.

Action: In 2007, the project “Working System 2017” was launched. At one of the plant-A’s production lines, the Company-F simulated the exact workforce age composition predicting its status for the year 2017. As introduced in the program “Demography Target 2020”, the survey of the Work Ability Index gave specific input about worker’s ability and the demands of workplace design. In the simulation, five actions to facilitate healthier aging were implemented: (1) ergonomics design, (2) working structure, (3) working time structure, (4) health and prevention, and (5) management and qualification.

Firstly, with a significant communication effort, for example, one-to-one conversations with workers, the Company-F explained that the pilot production line would not be soft assignment, but subject to increase ambitious productivity and quality standards. The project team persuaded 20 workers from the production line plus 22 more with the promise that they should join the project and can move back to their original positions after one year. In October, this pilot production line was staffed from an exact mix of workers reflecting the plant’s projected age composition of 2017. Secondly, a series of workshops were organized where workers were asked to describe their aches and pains so that future changes in the production line could be documented by idea cards and ranking points. After the workshops, the project team worked with ergonomists, safety officers, and process engineers to execute the change proposals from the workers. Table 12 shows the specific improvement areas which were identified by the project.
<table>
<thead>
<tr>
<th>Action area</th>
<th>Improvement example</th>
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| Ergonomic design          | • Ergonomic workplace analyses through ABA-Tech  
• Ergonomic optimization of assembly processes and the material supply (cooperation with the Technical University Munich)  
• Creation of seating areas for the temporarily relief of the musculo-skeletal system  
• Height adjustable desks for the optimal adjustment to the body height of our employees  
• Wooden-floor for attenuation  
• Dumping for the better provision of materials  
• Positioning of the screen and font enlargement |
| Working structure         | • Development and implementation of a load based rotation plan (ideal concept „fitness course“)  
• The concept will be implemented step by step  
(employee appropriate adaption, increase of the rotation cycle, achieve a load change during the shift) |
| Working time structure    | • Late begin of morning-shift on Mondays from 4:55 a.m. to 6:55 a.m. to reduce stress when changing from night-shift to morning-shift  
• 10 minutes personal allowance as collected break  
• All measures were addressed in agreement with the employer and workers council |
| Health and prevention     | • Sensitizing about the topics age and health through the workshop „biological age“  
• Creation of individual health plans with target goals  
• Deepening individual themes (movement, nutrition, mental fitness…) through group discussions to ensure the sustainability  
• Creation of work specific compensatory exercises such as stretch and physiotherapy to provide opportunities to avoid monotonous movements and to achieve relaxation |
| Management and qualification | • Work Ability Index with individual evaluation and possibility to propose improvement suggestion regarding working environment  
• Project update events such as kick-off workshops with plant lead and workers council with regular information of project status  
• Age Management seminars for managers and master-workmen  
• Integration of employees within the optimization processes |

Table 12: Five Action Areas of the Working System Project  
Source: Own representation based on the case study Multi-Companies
The direct investment of the “Working System 2017” project was approximately €20,000 plus another €20,000 wages for improvement workshops. Impact and results were measured in following areas.

- 70 changes were identified and implemented. The impact was the increased productivity by 7% in one year. The line’s target output was increased to 500 units per shift in mid 2008 and to 530 units per shift in February 2009.
- The quality target of 10 defects per million was achieved after 3 months. Current performance stands at 0 defects.
- Absenteeism related to sick leave, maternity leave, preventive health care, and rehabilitation declined from 7% during 2008 to 2% by June 2009.
- In addition, the project achieved a company-wide health awareness initiative. During the project, the company-F organized an information day concerning personal nutrition and health management in which more than 10,000 workers in all plants of a large production location participated.
- Roll-out plan includes same or similar implementation in 7 nations locations for vehicle assembly, paint finishing line, cockpit assembly, body in white, engine assembly and dealer ship plants. In 2011 the rollout reached to 100 departments with around 4,000 associates. The best practices will be considered when building up the upcoming new manufacturing plants in South America countries.

The Program “Work-Life Integration” – An In-Depth Best Practice in the Action Field “People Development”

Situation: The Company-E is a leading manufacturer in the Personal Care and Consumer Goods industry. An interview was conducted with a senior expert from the Corporate HR who was heading a department responsible for the age and generation-related topics covering around 8,000 employees in Germany. Although the share of the 50+ employees is less than 20% in the Company-E’s workforce, the aging trend was visible. From 2009 to 2013, the share of the 50+ employees had increased 1.3% while the average age had increased up to 39.6 years. In the emerging markets in particular, the company faced the challenge that the business is growing faster than the number of experienced employees. The experienced 50+ age group is more valued than before, not only in their own locations, but also in potential growing markets outside of Germany. In addition, the company saw understanding and developing 50+ group as a clear business rationale. In 2010, 50+ people were already accounted for more than half of all
consumers spending in German market. For the Company-E, the 50+ group and women were two workforce pools with unexplored potential.

**Implication**: There is a need to counteract the fact that a significant number of employees still stagnated when taking care of family members. This was a challenge for 50+ employees due to eldercare and for women due to childcare. Therefore, the Company-E implemented the Work-Life-Balance measure to enhance motivation, productivity, and performance of its employees.

**Action**: The Work-Life-Balance project was launched in April 2012. Goal was to advance the company’s transition from a presence culture to a culture of trust and performance by incorporating work-life flexibility into the corporate culture. The project focused on Work-Life-Balance offers in four areas: flexible hours, flexible locations including home office, flexible scheduling, and working infrastructures improvement.

Beyond designing and communicating the four areas for target groups such as 50+ and women, the company realized that the breakthrough would only happen with a strong commitment of the line managers. Therefore, the project team decided to tackle this issue by launching a Work-Life-Balance Charter Initiative and a range of 360° Awareness Campaigns. The first signature on the Charter was the CEO. A personal video message was made by the Executive Vice President of HR, with a call for participation, was launched on the intranet. Sharing of personal statement was communicated to all managers. All signatories were invited to present themselves with their personal testimonial and their photograph. Followed by these actions, active discussions on work-life flexibility began to take place in management meetings.

Furthermore, HR departments provided consultation to all 50+ and women employees. More flexible working patterns were implemented through the company. In addition, on the employee side, more personal talks about work-life flexibility with decision-makers took place. Employees were facilitated to conduct a self-assessment to identify personal readiness for new tasks, job requirements, and team composition. It was promoted to use “trial periods” for flexible work arrangements if appropriate. Role models were identified in order to increase the visibility of best practice example.

As a result, all managing board members and 20% of line managers committed themselves to work-life flexibility and a culture of performance orientation. One third of them were willing to share their personal statement on a public intranet platform. A significant number of agreements on flexible working arrangements were achieved between line managers and their employees, especially with their 50+ and women employees. In addition, a positive reputation was established internally and externally. The company is the holder of the certificate “Audit Career and Family”, signatory of the
“Local Alliances for the Family”, and an ambassador company of the “Success Factor Family” of the German State Initiative.

**The Program “Value Added 50+” – A further In-Depth Best Practice in the Action Field “Productive Fitness”**

**Situation:** The Company-H is a leading service provider in reinsurance, primary insurance, and asset management. An interview was conducted with an expert from the Group HR who was heading a department responsible for the age and generation-related topics covering around 3,500 employees in Germany. This workforce population excluded the company’s primary insurance business and therefore represents the reinsurance and asset management business. For the Company-H, the share of the 50+ employees had increased from 22.3% in 2010 to 23% in 2013. The 10-year forecast indicated almost no growth of workforce in Germany, but with a significant increase of 50+ employees towards one third of its workforce.

**Implication:** For the Company-H, it was of strategic relevance to keep the pace of workforce productivity with business and society development. All the employees, in particular, the 50+ group should be supported for their life-phase related issues.

**Action:** Company-H’s actions addressed three areas.

- Flexible working hours was a key competitive factor to retain senior employees. The Company-H aimed to actively balance company interests with the individual needs of employees. Part-time schemes were implemented to ensure optimal flexibility and to help senior employees to combine family and career. The most effective offers to the 50+ employees were sabbatical and exchange of salary against additional free time.

- For 50+ employees, the company implemented specific and pragmatic measure for healthcare prevention, for example, by an offer of holistic health-checks twice per year. Cost was covered by the employer and facilitated by very easy cost expense process. Information centers were established where employees could easily receive contacts and appointments in the cities they lived.

- The Company-H has started a HR project to implement “the 2nd career and functional exchange” initiative to facilitate promotion of 50+ employees who wanted to develop themselves for new jobs and new business responsibilities.

“As result, the 50+ employees in our company were highly engaged and motivated because they perceived impact which was targeted and customized to their specific age-group”, stated the interviewee of the Company-H. The company utilized the internal
understanding of the demographic impact and first-hand experience with its own 50+ employees to support the development of two new insurance products for its Middle East market. One product was the “Integrated Healthcare” by combining know-how from both the primary insurance and reinsurance segments. The other product was the “Innovative Healthcare Management” by phone coaching as the core element for the chronically ill market.

The Program “Cross Age-Group Mentoring” – An In-Depth Best Practice in the Action Field “Communication and Culture”

**Situation:** see also The Program “Work-Life Integration”.

**Implication:** For the Company-E, the demographic situation opened up new consumer potential within the 50+ age group, but also created increasing focus on maintaining the working capacity and life-long learning of employees while avoiding potential conflicts between generations. Therefore, the company started a Cross Age-Group Mentoring program with an explicit concept of reverse mentoring.

**Action:** The Cross Age-Group Mentoring program was based on an in-house academy program which had been triggered by recruiting and branding department in HR. Since the age topic emerged as strategic relevance, the functional organization team selected a special focus on reverse mentoring element. The program takes 3 years and each year selected around 30-50 new participants based on job evaluation and succession planning. Focus was the production and supply chain positions which will be vacant in the next 3 to 5 years. The differentiating aspect to a generic talent program was that the select participants were those who pursue a functional expert career track, not management.

First, senior and junior expert participants were paired to work side by side on technical topics. They agreed on learning items and capability improvement based on their experience and new skills needed. In alignment with functional leaders, the junior experts were responsibly for design and organization of the reverse mentoring activities, in particular, with focus on the social media and emerging market relevant skills. For example, junior experts illustrated the value of being presence in LinkedIn, XING, and MicroBlog which should help connect company-internal colleagues and external business partners. Another example was the regular cultural sessions organized by junior experts to exchange business convention in emerging markets which are highly relevant for the Company-E’s business. Further activities included joint group sessions with other mentoring pairs discussing communication skills and generational experience of younger and older colleagues.
As a result, around 100 mentorship pairs were built within the first 3 years. Potential evaluation on capabilities of these expert groups was continuously measured in the employees’ Annual Performance Review. While the junior experts showed increased motivation and curiosity in transferred knowledge, significant improvement of the senior experts was shown in three areas: increased quality of work, more openness to change, enriched experience in social media communication. Participants of the Cross Age-Group Mentoring program showed stronger competitiveness when they received new assignment or responsibilities. Furthermore, a company-wide database was established to show example of “good practice” and tandem stories which were company-wide communicated.

4 Conclusion and Recommendation for Application

Based on the literature review and the Case Study Multi-Companies, a framework with all identified measures is developed. It is called Managing Demography Framework, because the theory aims to provide a management tool. Management tools, if they are used appropriately, can be powerful enablers of change and actions in companies. They can, for example, help define and execute the demographic strategy and program, engage with stakeholder and employees, and monitor performance.

As shown in Figure 37, the 22 measures are structured in 4 distinguished Action Fields targeting Workforce Composition, Productive Fitness, People Development, and Communication and Culture. 19 of the 22 measures are identified from literature review, partly extended by the case study interviews, and 3 directly from practice through the case study. Within each action field, the measures are sorted based on the ranking analysis regarding implementation frequency in practice (see also Figure 33). The measures on the top represent the most frequently implemented in the case study companies.
In the application context, the measures can be evaluated based on specific criteria. The criteria used in this research work are impact and implementation effort which are referenced from the benefit-price matrix evaluation framework in strategic management (Hungenberg, 2008, p. 205). Impact evaluations can be exercises in terms of their need for human, financial, and further resources (Leeuw, Vaessen, 2009, p. 126) such as political action or communication effort. These resources represent the effort to implement a measure. The Impact here refers to the impact at the institutional level (versus the beneficiary level) which aims at changing second-order conditions for 50+ employees such as productivity, development, or culture of a company (Leeuw, Vaessen, 2009, p. 237).
Figure 38: Evaluation of Measures

Source: Own representation based on literature review and the case study Multi-Companies

Figure 38 gives an overview how the 22 measures can be evaluated by the two criteria impact and effort. For example, M3 Retirees Back to Workforce as Consulting Expert is a high-impact measure, because successful retirees possess rich knowledge and experience (Huebner, Kuehl, Putzing, 2003, p. 56), and in many cases with key expertise of a technology, a market, or customer relationship. The evaluation on impact is high, also because having key retirees in companies will contribute to internal knowledge transfer and a role model effect for the current 50+ employees who are potential retirees in the next years. However, effort to implement this measure was estimated as quite high for two reasons. The first reason is that there is no mature legal or insurance framework in Germany to support this working model. Both companies and retiree consultants have to carry risks and administration work separately on their own. The second reason is that the absenteeism of 65+ employees, due to physical conditions as elaborated in Section III.3.2, is higher than young employees. And the consulting fee or labor cost for senior employees and freelancers in Germany can be higher than young employees, too. This estimation leads to a low ratio of cost per hour for the retiree consultants.

The criteria can be also quantified such as financial impact. Furthermore, reasoning and arguments why the impact of a measure is evaluated as high or low are essential. The same principle applies to evaluation of implementation effort. Figure 38 is one of many theoretical evaluation frameworks to help companies to select measures. Due to the diversity of situations in business, the interpretation of the framework and criteria can be
highly dependent on the specific application context. Therefore, criteria should be explicitly defined before the measures are selected.
V Recommendation for the Case Study Company - Demography Management

By applying the Managing Demography Framework of Chapter IV in the practice, this research consults the case study company, Siemens, to design its demography program. Goal is to showcase a systematic problem-solving methodology along the situation, implication, and solution process in concrete business context. The first step is to build the capability for the case study company to create transparency and generate future workforce scenarios towards 2030. This capability is based on a workforce demography forecast method and a simulation tool WDFSim which was implemented during this research. As the second step, a baselining is conducted to analyze the relevant age difference areas, existing measures, and strategic evaluation criteria. In addition, an external benchmarking and internal management survey provide findings on potential impact areas. Each of these analyses specifies a series of implications which are used as evaluation criteria to select measures for implementation. Finally, this research suggests a customized Demography Program with six selected measures which can be realized in three implementation projects.

1 The Case Study Introduction

1.1 About the Case Study Company

Founded in 1847, SIEMENS is a leading German engineering company officially registered in Berlin and Munich, with core businesses in the fields of electrification, automation, and digitalization (SWS, 2017). SIEMENS comprises Siemens AG, a stock corporation under the Federal laws of Germany, as the parent company and has subsidiaries and local legal entities in nearly all countries of the world. As of September 30th, 2017, SIEMENS had around 372,000 employees with annual revenue of 83 billion Euros (SAR, 2017, p. 2). SIEMENS has 10 reportable business divisions with their products, solutions, and services in Building Technologies, Digital Factory, Energy Management, Mobility, Power and Gas, Process Industries and Drives, Renewable Energy, Siemens Financial Services, Siemens Gamesa, and Siemens Healthineers (SWS, 2017).
The case study in this chapter is based on the company’s Germany organization, which is in line with the geographic focus of this research. As of September 30th, 2017, Siemens Germany had 115,000 employees and contributed 11 billion Euros to its global annual revenue (SAGCP, 2017, p. 40). In this research, the term Siemens is used to represent the Germany organization of the company.

The case study has received the kind support and footprint permission from Siemens AG. Since it is a publicly listed company, parts of the case study data were collected through the company’s public reports such as annual reports, sustainability reports, diversity fact sheets, or official company presentations. This data includes, for example, official revenue numbers, workforce size, and basic workforce age group breakdowns which are mainly used for analyses. Furthermore, multiple sources of data during the Case Study Siemens were employed such as workforce statistics, management and expert interviews, work documents, employee surveys, and project workshop and meetings. In this sense, parts of the case study data of this Chapter are from company internal documents which are not published. This category of numbers, statements, and examples is subject of the “Case Study Siemens” and is not explicitly cited. For respective figures and table, the “Case Study Siemens” is used as the citation source.

In terms of the company’s strategy, digitalization is perceived as the most influential trend on its future market and customer base. Since 2014, Siemens has phrased a new business strategy to achieve sustainable growth by increasing businesses around digitalization (SAGV, 2014, p. 49). Based on its strategic framework, the company positions itself across the areas of energy, automation, and industrial software and solutions. However, digitalization does not only influence the company’s business, but also its workforce and workplace. Regarding the demography program, the factor technological development plays an important role, in particular, from the following perspectives.

First, digitalization creates a new ecosystem within the case study company. While the young generation of employees is accelerating the transformation of organization towards a more self-organizing digital environment, the older employees need to adapt themselves to the speed of change. As a workplace, the new digital ecosystem can pursue decreasing human intervention to achieve a goal. For example, within global virtual project teams, interactions happen outside of physical meeting rooms thanks to the digital infrastructure such as social networks. The company embraces new leadership and management approaches to enable effective virtual team work. The digital ecosystem fosters an agile style to shorten life cycles of project work. Speedy action with experimental mindset in the more connected world becomes dominating for the daily tasks. Finally, digital platform and communications create scale-up effect for the business and
for the organization, because a digital solution can be duplicated, distributed, and widely used with decreasing additional cost per user or even zero additional cost.

The case study company provides various digital options to enable new flexible working models which are independent with working-time and working place, for example, mobile office, smart devices, remote access to company social communities. This flexible working condition improves social connectivity between colleagues. In addition, networked approaches are evolving to reduce hierarchy. And new standards regarding data and connectivity will set boundaries which challenge organizational regulation and compliance. Employees of each age group are encouraged to utilize the new ways of collaboration to co-create better results.

Echoing conclusions of Chapter II, new jobs in the case study company also shift to digital service, consulting, and social areas. These areas demand on increased leadership skills, creative, and communication competency (Wagner, 2017; Gray, 2016; Ito, Howe, 2016). In technical areas, Siemens has been creating new jobs in digital fields to prepare the future. Digital skills are seen as standard as analytics and problem solving (Muntschick, Papasabbs, Schuldt, 2016). However, the company asserts that there is a generational gap in terms of digital competencies. Creating a learning landscape that up-skills workforce in digital areas is a key issue for greater productivity. The same imperative is indeed in new digital business models such as Big Data or Open Innovation.

From people strategy perspective, the company is tapping attractive growth fields and getting those businesses that have not yet reached their full potential back on track; aims to achieve an approval rating of over 75% in its employee engagement survey in the categories leadership and diversity including age diversity (SAGV, 2014, p. 18). These goals set purposeful anchors with a potential demographic program. From the organizational development perspective, the company has defined a new strategic framework covering ownership culture, sustainable customer and business focus, and future-oriented management operating model (SAGV, 2014, p. 16). By living a culture that strengthens employees’ sense of responsibility, Siemens aims to foster employee development and integrity at the center of a company’s activity.

For the case study company, the demographic shift in Germany is one of the mega trends driving business growth (SAGCP, 2017, p. 11). The aging population builds a connection of the people topics with potential business opportunities for the company’s healthcare devices, healthcare services, and infrastructure business in general (SHAG, 2017, p. 2). The case study company needs knowledge about customer requirements based on the demographic change for new products and solution. And new workforce and competencies need to be acquired to realize the business opportunities. But the chal-
lenge becomes more from the internal perspective and how to cope with an aging workforce. The case study is designed to focus on this internal aspect.

1.2 Initial Situation and Demographic Workforce Profile

For the case study company, trying to win external talents will not compensate the upcoming Baby Boomer retiree wave and existing workforce with knowledge of outdated technologies and business. As analyzed in Section II.2.2, the trend in Germany shows a shrinking economically active population which leads to an unbalanced demand-supply gap in the labor market. Towards 2030, there is a growing gap of 3.4 million vacant jobs for qualified labor force, in particular, engineers and MINT graduates which is Siemens’ target talent group. Being a technology company and a highly service-oriented global headquarter, Siemens needs to recruit and retain talents in competition with a large number of peer companies. Therefore, developing employees internally is crucial to ensure workforce capacity and competency for the future. As initial situation, its HR strategy is to unleash the maximum potential of its people to drive business success.

Now the potential demographic program is seen as a topic which should be driven by the HR function. The HR function’s mission is to design innovative people concepts to position the company as thought leader in the internal and external market, to deliver efficient HR solutions for business needs, and to improve the organization and internal services. Key initiatives were selected for next years such as mitigate people risks through smart workforce planning, leverage diversity, scout the workforce of the future, implement attractive and powerful rewards and incentives, assess and prepare Siemens’ leaders to effectively lead, use systematic process for an effective and performance review, build next generations skills for the digital work, and provide attractive career opportunities for Key Expertise. All initiatives and daily HR operations are expected to be run by a best-in-class HR shared services and steered by HR metrics.
Siemens’ workforce in Germany has two categories of activity: drive specific local business in Germany and perform headquarter functions to steer businesses around the globe. Therefore, it is a mixture of characters of manufacturing and service. Focusing on the 50+ subject, the basic demographic profile of the workforce is structured age indicators, in particular, the Average Age, 50+ Ratio, 50 Quotient, and Age Groups. In addition, variables such as fiscal years and organizational hierarchy are important dimensions. Figure 39 illustrate the all variables and combinations to visualize a workforce profile. Since there are a large number of combinations, it is important to define the most relevant scopes of such analysis. Taking Siemens as an example, the variables are the four “age indicators”, the “fiscal year”, and the “all workforce”. This selection for this research is marked in bold boxes.

Based on this selection, a calculation result of the basic demographic workforce profile can be built as shown in Figure 40. The number of employees has changed from 132,000 to 119,000. From 2008 to 2015, the $\bar{\phi}_{18.67}$ has increased from 42 to 44 years. The $S_{50+}$ changed from 26% to 38% with a respective $Q_{50+}$ from 35% to 61%. Amongst the age group distribution, the biggest change is the shrinking share of $G_{(35, 44)}$, which declined from its weight of 32% down to 24%. Another significant change is the share of the oldest age group $G_{(55, 67)}$, which increased 10 percentage points from 11% to 21%.
Expert interviews provided some key factors of the workforce development. The change of employee total number is mainly historical and correlated with the company’s revenue and portfolio change. The retention of middle aged workforce is extremely high, since the company is one of the most attractive employers in German market. In general, employees receive professional trainings, especially during the first service years, to develop their business competencies and career enhancement. High loyalty was also because of the variety of job opportunities with the diverse businesses the company has been operating. As an expert stated, “people do not have to quit company to find a very different job or another very different industry”. In addition, improving working condition and flexible working models are important factors to retain employees.

Externally, there is a trend that shrinking young-aged labor pool has not provided enough qualified candidates for the company and that the awareness of aging population and wish of working at old age has created more opportunities for companies to hire senior employees. It is assumed that the aging workforce in Siemens will follow in the next years. To navigate different future scenarios, the capability to forecast and simulate workforce development 2030 is wished before designing strategy and actions. The 2030 view is important, since many measures need to consider the quantity perspective of employee numbers. And a desired culture change in Siemens requires years of action.

1.3 Approach, Data, and Methods

The case study employed a three-phase problem-solving approach which can be summarized as: situation, implication, and solution.
The first phase is the *Situation* phase which focuses on transparency of Siemens’ workforce demography, scope, and border of the subject demography with consideration of environmental situation and factors such as company priorities, interfaces of related subjects, and motivation of long-term direction. Therefore, analysis and forecast on workforce development towards 2030 were conducted.

The data applied in this phase was extracted from several sources. On one side, analysis needs to consider population development in Germany. The German Federal Statistical Office is the main source. On the other side, workforce data could be found from Siemens’ official reports, for example, revenue numbers, employee size and age group breakdowns. During the data extraction and consolidation process, numbers were categorized by a series of definitions. For example, history revenue numbers were consistently extracted from the latest version of reports. Employee numbers of year were consistently based on FTE (Full-Time Equivalent) of continuous and uncontinuous operations. There was no mixture of FTE and headcounts. Some supporting data for Siemens case study was based on its corporate personnel information system, which aggregates data from the national data warehouse as well as its local HR tools of personnel departments. Especially in Germany, centralized HR measurement and reporting systems were implemented a number of years ago. This approach is recognized as industry benchmark for its high standard.

Data was checked by clear definition and quality criteria. Consistency was made sure by cross-check mechanisms such as comparisons of scale and size in time series. Verification loops were conducted to investigate definitions, scope or aggregation logic. This process is not data cleaning, but data quality checking to decide whether use this data or re-acquire fresh data. The data preparation method is illustrated in Figure 41. Several key aspects are considered: data acquisition, data quality, and data preparation (Winker 2010, p. 11). The aspect of data preparation includes two separate steps data cleaning and transformation. Goal is to manage challenges of not-enough-data versus too-much-data, and with a satisfactory level of quality.
This data preparation method starts with describing data features, sources, collection process and the demographic properties. To ensure data quality, it also checks the scope, key definitions, completeness and the internal consistency of data. The cleaning step refers to the pure data level and deals with data by applying four measures: (1) remove data points with missing values, (2) correct data points with inaccurate values, for example, in wrong attributes and misspellings including meta data such as labels of data columns, (3) unify size and data unit, and (4) merge or eliminate duplicate instances. After this step, data need to be transformed into the exact input format for calculation. This step includes eliminating redundant data fields, pivot calculation, and combining data fields to desired formats. As shown in Figure 41, two output formats of the data preparation are the AT (Age Table) and the RDT (Regression Data Table). Details of defined formats can be found in Appendix J. These data were also used to conduct forecast modeling, regressions, and simulation.

The second phase of the case study was to find the relevant Implications. Implications here refer to the demographic shift from external and internal labor situation, but also age differences within the company. Beyond the identification in the summaries of the workforce simulation results and age differences, the method also includes one management survey and one workforce survey.

To receive the management perception and estimations, sixteen executives were approached to describe the challenges regarding 50+ Baby Boomers in comparison with other demographic groups. The interviewees were CEOs, CFOs, heads of HR, and senior managers who had large personnel or workforce responsibility of 100 to 12,000 employees and could therefore provide perception and estimations covering around 20% of
Siemens’ workforce in Germany. The results of this survey were summarized in 2014. They were not only used in the Implication Phase, but also for the Solution Phase of the case study. Interviewees were also asked to share existing measures in their organizations. This is a part of the measure baselining, too. Details of the survey questions can be found in Appendix K.

Furthermore, additional age-related analyses were conducted. These analyses focused on three questions which refer to the age difference areas as introduced in Chapter III: health, learning capability, and social implications. Regarding the social implication, the analysis employed data from the workforce survey results which were summarized in 2015 and included around 8,000 responses from employees in Siemens Germany. Three indicators with nine questions were used: engagement, collaboration, and leadership. Example questions of the workforce survey can be found in Appendix L.

In addition, during the implication analysis phase, findings and results of the Chapter II, III, and IV were used as foundation to conduct expert interviews. On one side, these findings and results could trigger thoughts and discussion which helped to develop solution and actions in later phase. On the other hand, experts were asked to estimate the relevance of these findings to help to prioritize subjects which should be addressed in Siemens.

The third phase of the case study is the Solution Phase where Siemens could use the outcome to implement concrete actions. The first part of the solution development was to identify and prioritize the action areas for Siemens. On one side, some of the actions might have been implemented or were being implemented. On the other side, some actions might have higher priority due to the impact areas or synergy effect with current actions of other initiatives. Therefore, benchmarking with external market, baselining of existing measures, and additional expert interviews including synergy check and evaluation were conducted. After this step, a goal statement of the demography program was phrased. The second part of the solution development was to phrase the recommendation with specific demography actions for implementation. The method focused on project management, since the recommendation aimed to provide an estimation to enable management decision making for implementation. To implement the recommendation, it is practical to break down a large program into smaller working packages. The implementation plan was phrased by applying project management approach. It included descriptions about duration, milestones, metrics to control degree and impact of implementation, resource allocation such as budget, manpower, and project team setup. At the end, the implementation plan also incorporated some identified key success factors for implementation.
2 Building Capability to Foresee Future Workforce Situation

The observation and prediction of the labor market described in Chapter II provide environmental trends for companies, but do not have a specific connection to Siemens’ situation. One of the potential action areas summarized in Section II.3 is to build the capability of creating workforce transparency and forecast to enable situational discussion and action design. This section explains the Workforce Demography Forecast for Siemens, the factors along its fluctuation chain, the modeling concept, and the simulation results towards 2030.

2.1 Introduction of the Workforce Demography Forecast

Forecasting is one of the essential goals of empirical research. It is also the bottom line of applied econometrics (Klein, 1983, p. 164), which builds the fundamentals for simulating organizations’ future workforce age structure. A forecast is a quantitative estimate (or set of estimates) about the likelihood of future events based on past and current information (Pindyck/Rubinfeld, 1991, p. 180). Forecasting is typically based on formal methods, in particular a statistical approach, employing structured data to derive a pattern or function. Forecast is not an exact statement about future, but a description of development under feasible assumption (Heinzl, 2017, p5). The purpose of a specific forecast is based on the understanding of its application in context and character, in this case, about Siemens’ workforce.

The reason for developing a forecast is because the future is perceived as uncertain. In the economic and business environment, a forecast gives a statement about the uncertain development of a situation, and with the goal to reduce such. In the UVCA world explained in Chapter I, forecast is one of the most powerful tools for researchers or managers to make rational decisions (Winker 2010, p. 291). A good forecast provides decision-makers an imaginative journey with navigable scope and scale and therefore forms an indispensable basis to increase the probability of achieving the optimal choice. From the output perspective, a forecast is distinguished by the point forecast and interval forecast. The former predicts a single number in each forecast period, while the latter generates an interval in which one can hope the realized value will lie (Pindyck, Rubinfeld, 1991, p. 180). Regarding the Workforce Demography Forecast of this research work, each of the output variables provides distinct numeric value. Therefore, they are point forecasts. However, by considering a variety of different assumptions, the Workforce Demography Forecast can give a range of scenarios, and in this case builds the capability of an interval forecast, too. The Workforce Demography Forecast will not look into these details of interval analysis.
An immediate value of forecasting is to support corporate planning where the emphasis is on trying to analyze the various influences on an organization’s well-being in such a way as to identify opportunities or threats to future success (Johnson, Scholes, Whittington, 2005, p. 20). The uncertainty of the future requires a clear understanding of the current situation and possible scenarios towards companies’ visionary future. By using Workforce Demography Forecast as a strategic instrument, the case study company may optimize the integration of its corporate strategy and people strategy. For example, such an approach supports business orientated HR strategy, initiatives and policies, which are characterized by maximizing the company’s profitability by rationally deploying human capital (Schmidt, Hagenbruck, Saemann, 2003, p. 13-14).

Results of the Workforce Demography Forecast is a baseline for strategic workforce planning including acquisition, people development, capacity allocation, release, preservation and headcount budgeting. Furthermore, corporate strategists in the case study company may also consider the Workforce Demography Forecast as input to support discussing new business models, innovative product ideas, and internal organizational transformation. The objective of the Workforce Demography Forecast, however, is not to precisely carry out future developments. It is rather intended to illustrate possible changes of workforce size and age structure under pre-defined assumptions.

The data used in the Workforce Demography Forecast is time series with a natural temporal ordering. By collecting the demographic data set from Siemens, one of the possible realizations is obtained. However, if certain conditions in the past had been different, one would have obtained another realization from this stochastic process (Wooldridge, 2008, p. 341). Therefore, demographic time series is a sequence of random variables indexed by time-slicing. Several features need to be described for the forecast in this case study. First, the data frequency of collection is annually. This implies that no strong seasonal or cyclical pattern will disturb analysis. Second, the data of last year precedes the data from this year. The past affects future. The workforce of last year is considered as explanatory variable for regressions. Third, the data itself includes demographic trend. By applying age metrics introduced in Section II.1 and Appendix A, one can proactively test the direction of movement to a certain degree.

Since the Workforce Demography Forecast in this research work is based on time-series models focusing on the prediction of explained variables beyond the estimation period, it is a typical ex ante model characterized by future orientation. In comparison to ex post, this research work uses forecasts, values of variables from past periods. Forecasting, which is conditional on knowing the value of explanatory variables in future time periods, is usually called as conditional forecast (Wooldridge, 2008, p. 646). Knowledge of independent variables of time t+1 at time t is rare, where 1 represents one
year. The Workforce Demography Forecast in this research uses the persistence of explanatory variables based on the same information set and is therefore an unconditional forecast. Explanatory variables at time t+1 are forecast first and then used to forecast the explained variable.

The demographic data set in this case study has a pre-defined age structure as introduced in Section V.1. For Siemens, the age range from 18 to 67 years is selected to reflect the average labor entrance age and the upper border the latest possible statutory retirement age in Germany. The record date of data from the German Federal Statistical Office is the end of calendar year, namely December 31st. The record date of data from Siemens is the end of the company’s fiscal year, namely September 30th. Data from the German Federal Statistical Office refers to natural person representing one potential employment. Data from Siemens refers to FTE (Full-Time Equivalent) which is a calculated unit aggregating working time of all employed contracts to one full-time employment (Scholz, 2011, p. 151) and indicates the real workload from the labor capacity perspective. As defined in Appendix J, the AT (Age Table) is a vector with 50 values ordered by 18 to 67 and is processed both in regression as sub-element of explanatory variables and in simulation as input vector. A RDT (Regression Data Table) has multi-dimensional data points, which are combined by year from 2009 to 2013 and age from 18 to 67 years.

2.2 Modeling and Implementation

The overall forecast modeling starts with identifying the fluctuation factors, which organically change the workforce demographic structure over time. A demographic unit is simultaneously exposed to several risks which will remove the unit from the observed pool (Schmidbauer, 1992). Factor-screening technique is applied to identify those factors which appear as the most relevant (Filzmoser, 2010, p. 24). As shown in Figure 42, factors are illustrated along the workforce movement (Schmidt, Hagenbruck, Saemann, 2003, p. 80) structured by sourcing and desourcing categories.

![Figure 42: Workforce Factors Identified along Fluctuation](source)

*Source: Own representation based on Schmidt, Hagenbruck, Saemann, 2003; Broeckermann, 2003, p. 455*
In line with the research focus, factors discussed here are based on the working-age population in Germany as one aspect and Siemens’ business and workforce movement as the other aspect. The latter one includes company-external factors such as business growth and mergers and acquisitions.

**Workforce Aging Factors:** Factors which contribute or lead to a workforce structures with increased average age or higher share of old employees are named aging factors. The first one is the factor “aging population” in Germany. This factor reflects the environment of the external sourcing pool for Siemens and affects the available pool for recruiting. As mentioned in Section II.1.2 and Table 1, this research uses the Scenario V 2-A of the 13th Coordinated Population Projection from the German Federal Statistic Office for calculation in the practice. In the Workforce Demography Forecast, the 18-67 years population data are selected and can be found in Appendix M.

From an employer perspective, major factors causing an aging workforce structure are related to employees leaving. If better conditions of employment are offered by other companies, employees may leave on their own. Since the labor market for recruitment is confined to junior and trainee positions (Beardwell, Holden, 2001, p. 76), in terms of demography, this group of people is characterized by younger age. In this research, this pool is defined as *Voluntary Leave*. Also, employees who are hired on short-term contracts are usually young people. As a logical consequence, *termination of short-term employment* means this young group of people will leave the company. Exits of young employee groups lead to an increasing average age in workforce, if other factors would remain unchanged.

**Workforce Anti-aging Factors:** Factors which contribute or lead to a younger workforce are named as anti-aging factors. The *External Personnel Sourcing* refers to recruitment, hiring, and head-hunting of workforce from outside the company. For Siemens, this pool is characterized by younger people. In fiscal year 2016, 67% of the new hires in Siemens were generation Y at the age of 36 years or younger. If other factors remained unchanged, adding this pool into the company over the years would slow down the workforce aging process.

Empirical data shows that the Internal Personnel Sourcing follows a similar anti-aging trend. *Internal Personnel Sourcing* refers to increasing company internal workforce capacity where labor laws permit, for example, offering tasks for more working hours, or offering contract changes from part-time to full time. Based on empirical data of Internal Personnel Sourcing pool of the past four years, the average value of the $\bar{O}_{18,67}$ is 36.7 years, with $S_{50+} = 6\%$, $Q_{50+} = 6.4\%$, $G_{(18, 49)} = 94\%$. Considering the workforce by FTE, these values indicate that for Siemens, the Internal Personnel Sourcing is an anti-aging factor.
The next factor is Retirement which represents the point at which an employee terminates her/his contract and thus completely leaves the company. In terms of workforce structure, this pool categorized by older employees leaving the company is obviously an anti-aging factor. There are also cases where employees voluntarily retire earlier. In Siemens, the average age of retirees has increased over the past four years from 61.1 to 62.3, the 50+ indicator has a minor increase from $S_{50+}=99.3\%$ to 99.9%. 

**Workforce Aging-elastic Factors:** By using an aging-elastic factor, the age distribution in workforce can be influenced and steered. One example of such factors is the External Personnel Desourcing. When companies perceive high personnel costs or redundant capacities, one of the levers is to release parts of personnel resources. Typical reasons to adopt such levers are turbulences of the economic cycle, foreseeable revenue downturn, cost reduction and restructuring programs, or even employee performance measures (Jung, 2011, p. 314). Different forms of External Personnel Desourcing can be found in practice. For example, if an employer would introduce lay-offs in Germany, a social compensation plan would need to be negotiated with workers’ council. For senior employees who are reaching retirement age, offers with reduced working time agreements, early retirement options, or early leave compensation packages can be taken into account. Furthermore, employers might try to achieve a mutual agreement with low-performance employees. This is a typical measure applied to junior employees who culturally does not match their employers or are not fast or skilled enough to performance at job. The targeted age group may differ based on distribution of the measures. Therefore, this factor is aging-elastic because of the business environment and applied HR policies.

Similarly, in challenging business situations, companies may leverage the Internal Personnel Desourcing strategy to reduce cost. This refers to reducing personnel capacity where labor laws permit, for example, cutting redundant or lower-priority tasks to achieve fewer working hours, or offering employees contract changes from full-time to part-time. However, similarly to Internal Personnel Sourcing, this factor is not always triggered by employees. By nature, there are employees who voluntarily do so, for example, for family or health reasons. The data shows that a ratio of 50+ and 50- groups in the case study company was close to 1:1. For example, $Q_{50+}$ was 46% in 2009 and 45% in 2011. Interestingly, the pool of Internal Personnel Desourcing in 2012 was of small size. It was only 2.8% of the average level of the previous three years. During this period, almost all divestiture activities were in Germany, and with almost no new acquisitions (see also Appendix K) from the German market. As a proof point, the annual revenue in years prior to 2011 shows a downturn of around ten percentage points. And right in the year before 2012, business growth was 6 percentage points and in 2012 another two percentage points (SAGAR, 2013).
Indirect Factors: There are further factors which may shape age structure in the workforce, for example, revenue change, mergers and acquisitions, or divestures. Instead of directly influencing age distribution, revenue numbers may affect the value of different factors at first. For example, if there is a forecast indicating significant business growth in the next few years, companies would prepare respective human resource capacity. Furthermore, Merger and Acquisition activities or carve-out by Divesture change workforce structure, too. Depending on the targeted business units to be merged or divested, impact on workforce age structure can occur. The difference to revenue change is that implications of these activities cannot be systematically predicted.

Demographic Workforce Modeling: A model is a purpose oriented, simplified representation of a real-world system, with reduction of complexity of such and approximations (Filzmoser, 2010, p. 24). In this research, the total workforce is abstracted to an integral system which describes flows of all influencing factors, as the basic components and their interactions with each other. This is the Workforce System Modeling. For each Workforce Factor, an empirical approach is applied to abstract the relationship between variables into a mathematical equation (Winker, 2010, p. 129), which is an Econometric Sub-Modeling. Figure 43 maps the key steps of this modeling technique.

Like any system, the demographic workforce system is a purpose-oriented, simplified representation of components and their relationship in the real-world. Considering the workforce in an organization, the basic components are Workforce Factors discussed in the sections above. Each factor behaving as a component may trigger inflows into or outflows from the entire workforce system. Thus, factors affect, and are affected by, one or some of the other factors. Figure 44 illustrates the system modeling by showing the interaction and relationship between the Workforce Factor. Assuming no change in other factors, more exits of employees would mean a deficit of workforce capacity and lead to a demanding sourcing strategy either through intensive hiring activities or working time expansion. From a system point of view, movement is intensified and revealed by increased numbers or capacity of workforce flows.
Based on this mechanism, demography is modeled with respect to workforce change. Each factor is featured by a number of employees with a typical age distribution along 18 to 67 years. The age distribution curve is affected by the factors and flows in the system. For example, workforce size in year 1 is increased by sourcing factors and reduced by desourcing factors. Depending on which factors are dominating, age distribution of the entire workforce will be changed and refreshed by calculated aggregation. As a result, this is the demographic state of the workforce for the year 2. In addition, to best reflect the real world, the model certainly considers non-Workforce Factors such as revenue and portfolio change which indirectly effect workforce.

The Econometric Sub-Modeling deals with the forecast of each individual Workforce Factor. The overall workforce state at the end of the year is the aggregated result of the changes of all factors within this year. With the available empirical data, some trends can be discovered for forecasting purposes. In comparison to other methods, such as Moving Average, the empirical results show that econometric methods can significantly improve the quality of forecasting (Smolny 1998, p. 16). Applying the top-down approach, one is able to predict the overall workforce size before looking into its age structure.

The total number of employees would be influenced by the business volume such as revenue. Variable identification is exactly the very first step of constructing an econometric model. A simple equation can be described as $ES = f(Rev)$, where $ES$ is the total
number of employees in FTE, and \( Rev \) is the annual revenue. Based on the observations listed in Appendix O, the correlation between the two variables \( ES \) and \( Rev \) can be abstracted as a linear function. More details of this process and the respective regression can be found in Appendix P.1.

The next step is to model the age distribution for this employee size. This is an aggregated calculation along the age distribution of each Workforce Factor. The basic idea is to apply regression with an age distribution. The visualization of empirical data shows that in each Workforce Factor the number of employees along age attributes follows a certain distribution function. This distribution curve is characterized and influenced by the respective employee pool. For example, taking one year as the time window, the Workforce Factor External Personnel Sourcing is typically comprised of 50-employees who were newly recruited. Younger employees will be found in the 50-pool. The curve is even centered towards a specific age.

A distribution function can be selected to reflect such situation. Figure 45 compares the age distribution curve of the External Personnel Sourcing pool separately with a Gamma distribution and with a simulated result overlaid by a Gamma distribution function plus an \( X^2 \) function of age. Based on the empirical search, the application of Gamma with \( G.\alpha = 17.5 \) and \( G.\beta = 1.6 \) best reflects the distribution. The reason for adding an \( X^2 \) function is to compensate the weight of higher age, where the Gamma function limits itself. Furthermore, distribution parameters can ideally describe the curve’s shape and scale so that employee numbers of each age group can be reflected. So, by identifying the distribution curve and configuring respective control parameters, age structure can be framed within a workforce sub-model.

![Age distribution of FTEs](image1)

![Gamma distribution](image2)

![Age distribution of Forecast](image3)

**Figure 45: Use Distribution Functions to Simulate Age Structure**

*Source: Own representation based on the Case Study Siemens*
Beyond the age-related distribution function, age-related information is also used for regression. Taking the example of the factor External Personnel Sourcing, four years of workforce, revenue or population statistics are combined with the age group from 18-67. As a result, an RDT of the previous section is constructed with 200 data points. The RDT is organized by 7 data fields: Year, External Personnel Sourcing, Revenue, Age, Gamma(Age), Square(Age) and Population in Germany. The data field Year is meta data and not used in regression.

Workforce planning is essentially influenced by businesses such as sales, production and investments (Jung, 2011, p. 113). Most of the Workforce Factors have the Revenue as explanatory variable. Assuming the full employment of an available stock capital, one can see that the growth of workforce is represented in population growth (Solow, 1956, p. 67). Labor market should be continuously considered for personnel sourcing (Jung, 2011, p. 134). Therefore, both the size and the age structure of External Personnel Sourcing are dependent on the demographic development of population in Germany. The Gamma function and X² as a compensating adjustment for older age are applied to frame the demographic structure. By similar approach, all the Workforce Factors can be described by a certain distribution function and respective parameters generated by regression method. More structured details of such regressions and sub modelings can be found in Appendix P.

A robust model is able to provide comprehensive architecture which can be implemented into a tool so that experiments can be conducted (Filzmoser, 2010, p. 21). WDFSim stands for Workforce Demography Forecast Simulator and is an implemented prototype of the WDF Model introduced in the previous section. As a scientific technique, simulation is widely used in the areas of operations research, management, and proved to be a useful and powerful tool for applications like designing and analyzing systems (Law, Kelton, 1991). The idea of prototype implementation can be found in many application areas such as engineering and computer science. Core of the prototype aspect is to test a theoretical approach through a concrete implementation, for example, a computer program. WDFSim is a static simulation. This means results of the simulation are not used to derive new simulation rules. There is no dynamic adjustment on the system level during simulation processes (Winker, 2010, p. 316). It uses the Microsoft Excel as platform to implement and perform calculations. From system architecture point of view, the WDFSim tool is comprised of 19 components organized through 3 layers. More details can be found in Appendix Q.

The implemented WDFSim tool provides Siemens a capability to forecast its possible workforce structure towards 2030. Furthermore, this research uses the simulation tool to enable scenario analysis which a strategic formulation based on the application of fore-
The results of simulation rely on the knowledge about the company’s situation, which depends on a number of internal and external environmental factors, and which cannot be distinctly estimated for long-term. Therefore, scenario analysis is useful to give a corridor, within which decision makers may think about the unthinkable (Kahn 1962), and commute to be prepared towards the future of environmental situation (Macharzina, 1995, p. 659).

While Workforce Factors follow some empirical age distribution, the non-workforce factors rather depend on organizations’ operating context. On one side, the probability of a constant revenue number over the next 15 years is low. On the other side, HR policies and measures can influence the workforce structure. By considering these two environmental factors, more scenarios can be developed to cope with the VUCA world as introduced in Chapter I.

Figure 46 outlines the nine scenarios based on assumptions on revenue changes and HR policies. In case of business growth, the forecast system functions in an expansion environment. More intensive sourcing and less intensive desourcing flows are expected, and vice-versa in a shrinking environment. The other dimension is HR policy which can be applied on the External Personnel Desourcing to interact with a dynamic focused HR strategy, or an experience focused HR strategy. Theoretically, companies may use other factors to build scenarios, for example, impact of digitalization on workforce age structure. To keep the focus of this research, further scenarios are out of the scope. Combining the Revenue Change and HR Policy on External Personnel Desourcing, nine simulation scenarios are constructed.

![Figure 46: Scenarios Based on Revenue Change and HR Policy](source: Own representation based on the Case Study Siemens)
Since Siemens’ growth area is outside of the headquarter country, the estimation of revenue growth in Germany is rather low or even decline. Therefore, the selections of the average annual revenue change are either +2% (including the compensation of the net inflation rate), or two more realistic scenarios towards 2030: 0% for no change and -2%. If the company manages to continuously grow by 2% per year, it would mean a revenue increase up to $(1+2\%)^{15} = 134\%$ in 15 years, or in shrinking case down to $(1-2\%)^{15} = 74\%$. Based on Siemens’ historical revenue analysis, these assumptions will appropriately cover a broad range of cases which constrain feasible scenario borders. The other dimension is HR policy. Here it refers to the company’s policy in terms of the 50+ group in External Personnel Desourcing pool. This assumption is important, because it is more related with revenue change. One possible policy is to double the number of 50+ employees within the EPD pool. As consequence, more old employees would leave the company. The other option is to half the number of 50+ employees within the External Personnel Desourcing pool. The impact would be keeping more old employees when cutting off jobs during restructuring activities.

### 2.3 Interim Summary – Simulation Results and Implications

First, the results of the basic scenario are generated under the assumption that workforce factors are not influenced by business environment or organizational policies. Same assumption is applied for divesture, mergers, and acquisitions causing portfolio change. It follows an annual revenue change of 0%. And no HR measures would be applied to influence the age distribution implying the theoretical zero condition. Figure 47 visualizes the result of the basic scenario.

![Figure 47: Forecast Result of the Basic Scenario – Age Structure 2010 -2030](source: Own representation based on the Case Study Siemens)
The result of the basic scenario shows a gap of age distribution with a lower representation in $G_{(31,40)}$. This is because of the labor market effect around the year 2000. At that time, a low level of young new hires joined the company due to the Dot-com Bubbles and pessimistic economic environment. Simulating the situation in 2030, when the young age group turns to middle age, the age shift may lead to resource limitation of experienced senior workers, key experts, and middle management pipeline. In comparison to the $G_{(31,40)}$ numbers in 2020, the gap of the $G_{(31,40)}$ would be 6,500 FTEs. This scenario may differ to other companies or organizations, which had more young employees around the year 2000. The second impact of this gap is its influence on the aging trend towards a younger workforce if the age distribution in the pipeline keeps the same structure as the past.

Siemens’ workforce has an aging trend towards 2030, but not constantly increasing share of the 50+ workforce. Figure 48 visualizes its development. The simulation result shows an increasing average age value over the next year, for example $\bar{\theta}_{18.67} = 43$ in 2010, 45.7 in 2020, and 46.2 in 2030. However, the peak of share of the 50+ employees would occur in the year 2020 and 2021 with $S_{50+} = 45.7\%$ and then drop until 2030 with $S_{50+} = 38.5\%$. The majority of the 50+ employees in 2030 are the new hires around 2000 which is the gap shown in Figure 47. During the years right before 2030, Siemens would face an over-proportional knowledge loss carried by the 50+ employees than the past years.

Figure 48: Forecast Result of the Basic Scenario – Aging 2010 - 2030

*Source: Own representation based on the Case Study Siemens*
That Siemens’ workforce development exactly follows the basic scenario will probably not take place. It is a simplified scenario. For Siemens, nine scenarios are simulated with business change range of ±2 percent points, and a possible HR policy of conscious measures to influence the 50+ employees in External Personnel Desourcing activities.

Figure 49 summarizes the simulation results of each scenario. In 2030, the average age of the workforce would be in a range of $\bar{\theta}_{18.67} = 45.7$ to 47.7 years, with $S_{50+} = 33\%$ to 41%. Change of business growth would have a maximal impact of 0.8 years on the average age, and 1.6 percent points on share of the 50+ workforce (difference between scenario II and VIII). The respective impact by HR policy would be 0.8 years and 3.1 percent points (difference between scenario IV and VI). In the scenarios of negative business growth (VII to IX), the HR policy on External Personnel Desourcing would make a significant difference on the future workforce age structure. One finding is that the business downturn seems to speed up the workforce aging process. This can be interpreted as the negative effect of business shrinking on the workforce structure. In contrast, HR policy on desourcing shows less impact in the cases of business growth (scenario I to III). This is because the size of the External Personnel Desourcing in these cases is relatively small, since a positive business situation requires more sourcing rather than layoff measures. For example, the predicted size of the External Personnel Desourcing in the scenario III is only around 130 FTEs in 2030, whilst in the scenario VII of business downturn it is 2299 FTEs.

There are several scenarios representing the extreme cases. The case with the least share of the 50+ workforce is the scenario VII ($\bar{\theta}_{18.67} = 45.7$, $S_{50+} = 33\%$). Considering $Q_{50+} = 50\%$, the ratio of 50+ and 50- employees is 1:2. This would be the best scenario, in case Siemens builds cross-generational tandem teams. The case with minimal aging is the scenario IV. In this scenario, the company assumes no revenue change and would double the 50+ workforce in the External Personnel Desourcing pool. The average age of workforce would increase from 43-year-old in 2010 to 45.7 years in 2030 ($\Delta \bar{\theta} = +2.7$). The case with the largest share of the 50+ workforce and maximal aging is the scenario IX with $\bar{\theta} = 47.7$, $S_{50+} = 41.1\%$ in 2030.
Based on expert interviews, it is estimated that the scenario VIII is the most feasible case reflecting the forecast towards 2030. Examples of stated factors are business growth with international customers rather than with national ones, no limited effect of HR policy in the EPD measure, and the trend of lean headquarter functions in the future. Furthermore, the scenario III is evaluated as second possible case which may occur, if the company’s digitalization can create new business volume from Germany, and some HR actions can be implemented to retain more 50+ employees.

The analytics and forecast simulation results deliver several important findings. These findings are listed below as Simulation Result Implications (SRI). In the solution phase later, The SRIs can be used as evaluating criteria to select measures and design demographic actions.

- **SRI1**: There is a “moving workforce gap” towards 2030. This gap is identified as around 6,500 FTEs and caused by the low level of Generation-X new hires during the Dot-Com Bubble time around 2000. This age group (age group 31 to 40 years in 2010) is the future 50+ workforce in 2030. Implications could be a resource limitation of experienced senior workers, key experts, and middle managers in the next years.

- **SRI2**: The degree of the aging trend in Siemens’ workforce can be quantified to a range of 2.7 to 4.7 years from 2010 to 2030. The respective range of 50+
workforce increase is 3.5 to 11.4 percent points. The scenario with the highest average age in 2030 would be 47.7 years with 41.4% share of the 50+ employees. However, due to the “moving workforce gap”, the highest share of the 50+ workforce would appear in the year of 2020 and 2021 instead of 2030.

- **SRI3:** Business growth influences the age structure development. Business downturn seems to speed up the workforce aging process. In contrast, in the scenarios with business growth, HR policy on desourcing shows less impact in the cases of business growth.

- **SRI4:** The scenario VIII (2% average annual revenue decline) and III (2% average annual revenue increase and an active HR policy to retain more 50+ employees) are evaluated as the most likely situation for Siemens. The prerequisite for selecting scenario III is a successful digitalization strategy of Siemens in the market.

### 3 Analyzing the Implication regarding Age Differences

For the first time in the case study company’s history there are four generations in the workforce. Analyzing the implication regarding the company-specific age differences provides further insight and baseline to define measures. Beyond the relevant age differences found in Chapter III, additional analyses can be conducted based on Siemens’ data.

#### 3.1 Relevant Aspects of Age Differences

There are some company-specific characteristics regarding age difference in Siemens. With an average Exit Rate around 1%, employees in Siemens Germany are very loyal. Especially with increased service time, older employees can identify with Siemens very well. And as an engineering company, Siemens has employees who can identify themselves with Siemens technologies. However, employees of different generations possess different perception on technologies. For example, historical technologies which the older generations may have an emotional connection with may be perceived as obsolete at the presence. Future technologies which the young generation is excited about may not be perceived as solid or convincing before employees of different generations see concrete application. Another aspect of the engineering company is that the workforce is male dominant. The share of male employees is 78%.

A further special characteristic of Siemens is its large workforce base. In a company with large workforce, average individuals have lower visibility. Visibility can be a motivation factor for both older and younger employees. In addition, big companies have a
certain hierarchy which is not very flat in comparison with small companies or high-tech companies with a rather networked organizational structure, such as in Google or in some Technology Start-ups. Furthermore, around 70% of the 50+ employees are still exempt (Tarifmitarbeiter) employees. Over the service time, older employees may have gained certain operating practices and thought patterns how to do their tasks and drive their project topics.

Applying the finding of Chapter III, there are several aspects where age differences are especially relevant for Siemens. The first aspect is the expectation, motivation, and reward of different generations. The difference due to life span and cohort effect in Siemens is perceived as very big.

- Those of the Generation Y who join Siemens are perceived as visionary and ambitious. It is important for the young employees who join Siemens to working with smart and creative people. In Siemens as a large organization with a lot of experts and excellent colleagues, they are motivated by diverse opportunities of continuous learning, personal development, and mentoring.

- The Generation X employees in Siemens are perceived as a group who have motivation to drive topics with their own approach, to seek for growth opportunity, and to value the work life balance offers of the company.

- In comparison with other generations, the Baby Boomer 50+ generation in Siemens expects to be valued and needed by the company. Reward and official recognition are important indicators. Over the years of being Siemens employees, collegial, and loyal mentality is perceived as a common sense for them. Especially in Siemens as a technology company, 50+ employees are perceived as very open to share knowledge and experience with their younger colleagues.

In addition, engagement is seen as one of the most important internal factors for Siemens’ business success. In comparison to younger groups, the 50+ group has a very low exit rate. This situation implies that the engagement of 50+ employees is more important because high motivation over long service time is perceived as a challenge in the case study company. Identifying and implementing levers from demographic perspective has been addressed in Siemens to achieve competitiveness. Furthermore, age differences in communication style and team productivity, in terms of age-mixed setup, are especially relevant for Siemens.
3.2 Company-specific Analysis regarding Health

Beyond the areas of age difference explained in Chapter III, some Siemens specific analyses have been conducted. The first area is Health. In comparison to Table 8, Siemens has conducted diverse analyses regarding health and physical performance during 2013 and 2014. The most important findings is that the physical condition of the 50+ employees is above average of the necessary condition in German companies and is sufficient to perform their job in Siemens, although it is true that the physical condition of employees declines over the age. But the declining process is rather low. In the practice the age difference is not perceived as a barrier for the work and tasks in Siemens.

![Figure 50: Disease-related Absenteeism – Age Difference](image)

*Source: Own representation based on the Case Study Siemens*

The second area of analyses in Siemens is absenteeism. As introduced in Section III.3.2, the impact of disease-related absenteeism would require companies’ adaptive production capacity and resource planning. For Siemens, it is important to check the data if any additional measure require in terms of health for 50+ workforce. Figure 50 illustrates Siemens’ absenteeism situation in comparison to the average level of workers in Germany. The reported average disease-related absenteeism within one year was 11.3 days. This is 25.7% lower than the average disease-related absenteeism in Germany, namely 14.17 days. The age difference shows an age-related pattern. With 8.8 days, the lowest disease-related absenteeism takes place in the 20-29-year-old group. The 50-60 group is 14.2 days which is 58.9% higher than the company’s average level. However, it is almost the same level as the German average. The highest level is shown in the 60+ group with 17.8 days which double the company’s average level.

Certainly, types of functional activities imply differentiated levels of absenteeism. For example, employees in manufacturing report more disease-related off-days than those of other job functions. Since the disease-related absenteeism in Siemens is below the average in Germany, additional measures do not seem to be acute. The monitoring of the
disease-related absenteeism should be continued to prevent disease-related absenteeism and prepare alternative production capacity.

### 3.3 Company-specific Analysis regarding Learning

The Learning and Training Expert Team of Siemens uses the concept of Fluid and Crystallized Intelligence elaborated in Sections III.4.2 and 4.3 to display age differences. The experts believe that the performance of 50+ employees can be improved in both types of intelligence, in particular, by purposeful trainings. They recommend focusing on five areas of increasing capability over the aging process of employees: experience-based knowledge, problem solving strategies, factual focus and expertise, awareness of social context, and language competency. These strengths which are gained over the lifetime are estimated as more important to develop 50+ employees in Siemens.

![Figure 51: Age Difference regarding Training Time](image)

*Source: Own representation based on the Case Study Siemens*

Data of Siemens shows that there is a deficit situation about the training time for 50+ employees. The number of training hours per employee continuously declines from 30 years onwards. As shown in Figure 51, the age group of 50-54 (1,141 hours per 100 employees per year) has only half of training hours which 30-34-year group has (2,000 hours per 100 employees per year). According to training surveys, there is a low interest in participation of training activities by the 50+ employees themselves. A further factor can be the managers who offer older employees only fewer trainings, considerable development opportunities, or new assignment of tasks.

Many 50+ Baby Boomers have great expertise, however, still need to update it to be fit in the technology-driven and digitalization business activities. During the management interview, a CEO of a business unit with more than 5,000 employees shared that his 50+ employees has great knowledge on existing, or old, technology. For example, there is a challenge to help them to acquire or update the GRID technology know-how, which is
essential for business success (Appendix K, 2014). Training measures supporting 50+ employees effectively access new knowledge is identified as a highly relevant action field.

In addition, learning capability and performance at work is influenced by other factors rather than age, for example, previous tasks and responsibility, graduation background, motivation, and mindset. The individual difference within an age group can be greater than the difference between age groups.

### 3.4 Company-specific Analysis regarding Social Behaviors

The motivation and expectation of employees shift over the career development. During the case study expert interview, four aspects of age difference are identified by the experts. In terms of motivation shift, older employees in Siemens are perceived as more interested in collaborative support and knowledge transfer instead of investing time into their own people development, autonomy at work instead of promotion, short-term instead of long-term target, and appreciation instead of power and authority. The expert shared that 88% of the employees gave positive response to state that they are satisfied with the company, and the share of positive responses from old employees is 2% higher than young employees. Deeper analyses are conducted based on the data of Siemens’ employee survey. Details of the workforce survey questions are available in Appendix L. The questions and answers regarding motivation and social implication are relevant to be analyzed. Results are structured by age groups to enable comparison.

![Figure 52: Age Difference regarding Social Implication](Source: Own representation based on the Case Study Siemens)
Figure 52 summarizes answers of 8,274 employees who responded to share their perception on engagement, collaboration, and leadership in the workplace. In all categories, older employees share more positive motivation than younger employees. The oldest age group is highly engaged (above 85% positive responses). The social aspects of age difference have a strong link to personality, communication style, leadership, and team productivity. As discussed in Chapter III, older employees tend to show more conscientiousness, agreeableness, less self-concern in stressful situation, advanced tolerance, and a more accurate assessment of their own capabilities and limits. While declining performance in information processing and memory, they better leverage context information and better grasp the “gist”. That is the one of the reasons why more old employees of Siemens gave positive responses regarding collaboration.

Figure 53 shows the analysis on perception of employees in the subject collaboration on different organization levels. The distances of positive response rates between younger and older employees are respectively 3, 9.4, and 9.7 percentage points. Within their own work groups, the level of positive responses from old employees reaches 87.9%. And even regarding other business units where employees are almost completely independent with each other, the level of positive responses reaches 40%. This is also important evidence that older employees are much more aware than younger employees to maintain their social context, which enables greater team performance from collaboration and higher team productivity. Since the perception on collaboration between business units is lower than between departments and workgroups, Siemens can consider measures to unleash some potential from this perspective.

In terms of collaboration, there is also a cross-generational perspective. “Older employees in my organization see multi-ways to create value added beyond the business, for example, to help younger colleagues as a coach or mentor. The challenge is an easy-to-be-used platform or process to make the right match with mentors and mentees”, so an interviewed CFO who is leads a business unit with 12,000 employees from different age
groups. “The experienced Baby Boomer experts are the most dominant class and know-how holder. While going to disappear soon through a wave of retirements in the coming 10 years, they are willing to help transfer technology expertise as well”, emphasized a senior manager of an IT department with 1,100 employees. The threatening knowledge loss is not about generic but company-specific know-how. A large number of 50+ employees possess implicit knowledge about former generation of products or key contacts of customers, which cannot be simply supported by a digital solution. This is an area where Siemens may consider incorporating inter-generational collaboration into its digitalization strategy.

Another basis for achieving excellent result and team productivity is the motivation level. “50+ Baby Boomers are 50% to 60% of my workforce and need to be motivated by the company”, a CEO of a business unit with 2,400 employees shared.

Figure 54 shows the age group comparison of responses on engagement level. When asking if employees can fully apply their skills and abilities in their work, more than 87% of all age groups gave positive response. The distance between the youngest and oldest group is only 7.2 percentage points. The question if it would take a lot for the employees to look for another employer, the answers show an age difference with 19.7 percentage points. Regarding opportunities for personal development, less old employees gave positive response than the young ones. Here the 12.2 percentage point difference indicates that not enough old employees perceived potential for development yet.

The 50+ Baby Boomers in Siemens want to be listened to. In today’s busy schedule and fast-pace business world, they feel their colleagues and their managers do not spend enough time to benefit from their experience. They also wish to receive more attention and reward. This does not always mean higher salary or bonus, but recognition of other ways such as expertise, appreciation, or an award. The 50+ Baby Boomers would be more motivated, if they are still valued without being at higher levels of hierarchy.
As analyzed in Chapter III, there is a category of age difference between generations how they value leadership, in particular, how they lead and how they want to be led. The alignment of leadership style from Siemens and personal perspective can be compared by looking into the age difference in workforce survey results, too. Figure 55 shows a trend that old employees are dominating the leadership culture in Siemens, both in terms of understanding company goal and preferred leadership style. The distance of the goal understanding between the oldest and youngest groups are relatively low, namely 0.8 percentage points regarding company goal and 4.5 percentage points on their own organizational level. But the difference of responses to leadership styles across age groups is relatively high, namely 7.5 percentage points regarding company level and 7 percentage points regarding the own organizational level.

In Siemens, the 50+ Baby Boomers are still dominating the company in terms of leadership power. More than half the Exempt Salary Group (“Aussertarifliche Mitarbeiter” in German) employees are 50 years or older. Many 50+ Baby Boomers are assigned to bosses of younger generations. In terms of the reverse situation, the interviewees shared that the 50+ colleagues need effective support to learn new ways to interact with their young managers, for example, new communication styles and tools, awareness of new team culture to bridge generational differences.

Finally, in some relevant competencies, there is no perceived age difference between older and younger employees. The expert team evaluates these competencies as important but no specific implications for 50+ employees. These competencies are goal-orientation, systematic thinking, creativity, decision making capability, psychological attitude, and learning ability in general.

3.5 Interim Summary - Relevant Age Differences and Implications

The most of the age differences identified in Chapter III are valid for Siemens. The value added from the analyses of Section V.3 is to apply the company-specific filters for
action design. The relevant age differences are listed below as Age Difference Implication (ADI). In the solution phase later, The ADIs can be used as evaluating criteria to select measures and design demographic actions.

- **ADI1**: Age difference regarding the **physical conditions and absenteeism do not require further measures** with high priority, if Siemens can maintain the level of health and mental service for all employees. This is because the physical conditions of the 50+ group in Siemens are evaluated as sufficient to perform their job. Disease-related absenteeism in Siemens has a pattern with age difference. However, the absenteeism rate of the 50+ employees is below average in comparison with the level of workers in Germany. It wouldn’t lead to an urgent capacity problem.

- **ADI2**: **Strength of crystallized intelligence** of 50+ employees is evaluated as relevant resource and advantage for Siemens. The recommended areas of increasing capability over the aging process of employees are experience-based knowledge, problem solving strategies, factual focus and expertise, awareness of social context, and language competency.

- **ADI3**: There is an age difference in **training hours**, **but not in learning capabilities**. The training hours per employee continuously declines in the direction from younger towards older employees. Training hours of 50+ employees is around only the half of the 30-35 age group. There is potential to use appropriate trainings to enable skill-update and development measures towards future jobs. In terms of learning capability, the individual difference within an age group in Siemens can be greater than the difference between age groups.

- **ADI4**: In Siemens, the 50+ employees display a positive **motivation** towards engagement, collaboration, and the leadership culture. However, they share perception that their skills and abilities are not sufficiently applied. In terms of motivation, they wish to be heard and are willing to support cross-generational knowledge transfer. This implies potential measures to engage old employees from people development perspective.

In addition, the rest of the age differences from Table 11, in particular, the social implications are listed as further ADIs.

- **ADI5**: With age, older employees display a **personality change pattern** with a decline trend in extraversion and openness, and an increase trend in neuroticism and agreeableness. With age, older people become less self-concerned in stressful situation, more tolerant, and have a more accurate assessment of their own
capabilities and limits. The preference frame of older employees is sense of power, purpose, chain of command and stable working environment. In team work, older employees gain strength in quality rather than quantity while valuing more social, physical, and economic security.

4 Evaluating Strategic Actions Fields

To define targeted and impactful actions for Siemens, three steps of evaluation are taken. Firstly, applying the Managing Demographic Workforce framework of Chapter IV, existing measures in Siemens are identified and structured in the four Action Fields. Secondly, to identify the strategic orientation and relevant impact areas in Siemens, an external benchmarking and internal top management interview round are conducted. The results are used to filter action fields from requirement management perspective. Finally, measures are prioritized by expert criteria for implementation selection.

4.1 Baselining Existing Measures

In Siemens, some measures have been implemented or are being implemented. The baseline process provides an overview of existing measures. This overview can facilitate action selection, avoid double work, and collect the “lessons learnt” experiences for implementation. The key channels of this inventory process are expert interviews and company internal research.

Siemens has established a Strategic Workforce Planning process which is piloted in several business units. In this process, standard analyses regarding the demographic aspects of the workforce are available. As part of this process, an Age Distribution Analysis uses the $S_{50+}$ and $O_{18,67}$ as quantitative metrics to indicate retirees and illustrates breakdowns by regional locations and job roles. The planning is conducted annually by global headquarter and on demand for specific requests from business.

There is an Age-Appropriate Ergonomics practice in Siemens. For example, in one of its production plants in Bavaria, around 700 workers and an average age at 40 years perform repetitive activities every day, while having to satisfy high demands on quality and accuracy. Since these work operations can stress the body, especially the back, shoulders, arms, hands and fingers, the ergonomics measures were implemented to minimize health risks through ergonomic optimization of new and existing workplaces. As discussed in Chapter III, the functionalities of human organs and body systems decline while the age increases. In Siemens, it is the targeted ergonomic measure which ensures the physical performance of employees. The ergonomics team brought professional competence from the Technical University of Darmstadt which provided the Ergonomic Assessment Worksheet and the International Methods-Time Measurement Directorate.
The first step was to assess activities at “cycled” workplaces at which small individual components are produced in short cycles. In developing the tool, the experts scrutinized seven work systems from four different production areas by way of example. What were performed at the workplaces included measurements of cycle time, energy expenditure and distance, along with detailed analyses of posture as well as torso and arm positioning – and the employees were queried as to their general illness or ailment situation. The results of the assessments were then compared with the estimates from the experts. Moreover, training is being conducted for the ergonomics experts at the site who will be working with the assessment tool. Workshops on fundamentals and training courses for product planners and foremen, safety experts as well as company physicians are planned as accompanying measures aimed at developing awareness for ergonomics throughout the site. In the future, Siemens will incorporate ergonomic aspects to precisely define and implement ergonomic requirements, together with employees during the design phase of a workplace.

Siemens has a high standard on Health and Safety Management. This is also because the effects of demographic change – such as longer working lives – are playing a major role. In most of the German locations where the company has a manufacturing site or large number of employees, fitness zones are available. In the workplace, under professional guidance, employees can utilize a modularly designed system to plan shelving, tables, and entire work areas themselves, and then combine them. The challenge was to design the workplaces in an age-appropriate manner, so that they can still be used pleasantly even later in employees’ working lives. Also utilized for this purpose was an old-age simulation suit which enables the user to experience the limitations of old age.

Furthermore, company physicians offer consultations for health and safety matters, and provide occupational health care and services. This offer includes involvement in risk assessments, regular workplace visits and participation in health and safety inspections, provision of travel advice and vaccinations, accident first aid and ambulance service, and company integration management. With its Zero Harm Culture Toolbox, Siemens provides a number of proven suggestions, checklists and training offerings to improve the culture of safety. Templates for posters, brochures and campaigns support communication in company locations and online social platforms.

Finally, in the time of digitalization which requires more agile and speedy life cycle of tasks, maintaining, promoting and restoring mental health are the new matters of considerable ethical and economic importance. Siemens has an approach to identify, evaluate and, if necessary, remove mental health stressors at work. This approach is called Psychosocial Risk Management. It also offers a portfolio of practical local services of
information, training and advice for employees and managers. It’s called Life in Balance Portfolio.

Siemens offers a wide range of *Flexible Working Models* to meet the changing needs of its employees throughout all phases of their career. Employees including the 50+ group are able to work outside the company, such as at their home office. There is an explicit workplace policy which supports one fifth of working time from home under agreement between employee and manager. There are also modern working hour models such as flex-time, part-time work, job sharing, and sabbaticals. Flexible working models are effective instruments to support 50+ employees’ work-life balance, to support their eldercare situation, and one of the reasons of the high satisfaction score regarding engagement (Figure 52) and loyalty (Figure 54) in the workforce survey.

There were three 50+ *Employee Networks* identified.

- The Bridge Resource Group provides opportunities that empowers and prepares employees for their careers in the company and retirement after the company. The focus topic is retirement. This group is open to all employees regardless of age or experience, as its mission states: “After all, we are all future retirees”.

- The Sage Employee Resource Group promotes an awareness of the strengths, knowledge and experience of “seasoned” employees, improves the collaboration with all generations of employees, and aims to create awareness of the special interests of long tenured employees.

- The Masters Employee Resource Group recognizes long-term contributors to Siemens’ success, gives its members an opportunity to share their knowledge and experiences with entry-level personnel, thus, sustaining the company’s powerful knowledge base. Currently, this network has 150 members and is open to all employees who have an interest in knowledge sharing and is not limited by age, personal background, job function, and location.

All the three ERGs have been sustained for years thanks to the support from diversity council, transparent structure, and regular activities.

In terms of internal communication, there are four *demography specific slidecasts and eLearning* models.

- “50+ Generation” which focuses on the aging workforce and age differences.

- “Leading across Generations” which focuses on valuing generational differences and collaboration.
• “Leading Experienced Employees” which focuses promotion and leading 50+ employees.

• “In the Middle of – Chances for Experienced Employees” which focuses on the positive communication of valuing 50+ employees.

All learning materials are available online to employees. There is a company-wide campaign “In the Middle of”. To external stakeholders, Siemens communicates age-group metrics, diversity initiative, and activities through its website, annual reports, sustainability reports, and social networks such as LinkedIn and Twitter.

Applying the Managing Demography Framework of Chapter IV, Figure 56 summarizes the findings by the measure baselining process. Siemens has 6 of the 22 measures in place and therefore covers around 27% of the action fields. In order to design purposeful actions, the next step is to find out what are the impact areas for the future.

4.2 Identifying Impact Areas of Risk and Opportunities

Having analyzed the situation and part of the implication of demographic shift, it is important to identify where actions are needed. This is an exploratory approach. On one side, comparison with Siemens’ peer group is used to identify external best practices
and areas to be improved. On the other side, an internal top management interview is conducted to create a strategic picture on risks and opportunities.

As analyzed in Chapter II, there is a trend of demand-supply deficit in terms of qualified Economically Active Population in Germany, in particular, engineers and highly qualified MINT graduates. This result indicates that the degree of competition in the talent market becomes higher, and less qualified workers or experienced engineers will be available due to demographic change. In this context, competitors refer to those companies that compete with Siemens with same or similar products, projects, and services, but also those companies that compete for same or similar talents in the labor market. All leading companies need to develop innovative ideas to develop their internal workforce and talent pool and to keep themselves ahead of the curve. Therefore, comparison with pioneers in the demography management can provide relevant reference for the action design for Siemens.

The benchmarking analysis aims at analyzing differences between the own company and other companies in a systematic process (Camp, 1989). Figure 57 illustrates the benchmarking result between Siemens and two DAX30 companies which are recognized as the pioneers in the subject demography management. The evaluation was based on data of company reports and the respective expert interviews of the Case Study Multi-Companies (Appendix H).

![Figure 57: Benchmarking Demographic Status and Programs](image)

Source: Own representation based on the Case Study Siemens and the Case Study Multi-Companies
Siemens compares itself with two leading technology companies: the Company-B (automobile industry) and the Company-C (telecommunication industry). With an average age of 44, the workforce of Siemens is at the similar level as its peers B (\(\bar{\Omega} = 43\)) and C (\(\bar{\Omega} = 44\)). Accordingly, the reflected S50+ of Siemens is 38%, which is higher than the company B (S50+ = 33%). A further benchmarking point refers to the relative productivity, which is measured by revenue per employee. The Company-C is at a leading position with 316,000 Euro per FTE, and the Company-B is heading Siemens by around 15% (93,000 versus 107,000 Euro per FTE). It is to be noted that the comparison of productivity is under consideration with the revenue relationship from Germany and global. The reason that the Company-C has a higher productivity level is due to the greater proportion of Germany business, namely 41% of its global revenue. In contrast, the Germany-Global revenue ratio of Siemens is around 15%.

The benchmarking results deliver several important findings in terms of Action Field as introduced in Figure 37 of Chapter IV. These findings are listed below as Benchmarking Implication (BMI). In the solution phase later, The BMIs can be used as evaluating criteria to select action fields and measures.

- **BMI1**: Siemens is in similar pace with its peer companies in terms of Composition and Productive Fitness. In the action field “Composition”, Siemens is evaluated as middle position. The reason that the Company-B is evaluated with higher score is due to its profound Generation Management initiative with a number of specific areas, a well-know anticipatory planning on future workforce requirement, and its officially introduced age key performance indicators. In the area of “Productive Fitness”, the Company-B has applied ergonomic work station designs in the most important production lines to ensure that older employees also contribute with their skills and capabilities. It is planned to roll out this approach in all business units in next years. The company C’s highlight programs are analyzing age-related health risks and develop preventative offers based on the results.

- **BMI2**: The areas which Siemens are less innovative and not strong enough are “People Development” and “Communication and Culture”. In terms of “People Development”, the Company-C has implemented several innovative ideas. It uses Reverse Mentoring to train older employees on Web 2.0 by their younger colleagues, and provides part-time study offers for older employees. The Company-C also drives “Communication and Culture” by bringing employees and external business partners in an idea competition initiative in terms of working environment for multi-generational workforce. A well-defined 50+ Customer Advisory
Council, a 50+ Expert Forum, and a Demography Working Group have been established.

In order to identify the impact areas from internal perspective, 16 top management interviews were conducted. Details of the approach can be found in Section V.1.3 and the interview questionnaire can be found in Appendix K. Figure 58 summarizes the interview results with focus on 50+ Baby Boomer workforce.

Figure 58: Impact Areas Named by Top Executives
Source: Own representation based on the Case Study Siemens

First, interviewees were asked to name 50+ workforce related topics which they find the most urgent to address in their responsible organization. They also explained why they see these topics as risks or opportunities. Secondly, the most frequently named topics were sorted to display a perceived priority. The following statements are prioritized as the most relevant and respective topics are listed as Management-Interview Result Implication (MRI). In the solution phase later, The MRIs are used as evaluating criteria to select and prioritize measures and implementation actions.

- **MRI: Motivation.** “We need to respect the Career Lifecycle of our employees. 50+ Baby Boomers worries if they are not open for changing jobs then they would not be valuable”, stated by a CEO of a business unit with 4,500 employ-
ees. “The 50+ Baby Boomers will still stay more than ten years in Siemens. Thinking about retiring would lead to decrease of motivation and energy”, stated by a CFO of business unit with 12,000 employees. “Our Baby Boomer colleagues need challenges (different challenges in comparison with those of the Generation Y) and they need to be listened to and rewarded. The Baby Boomers hold most of the knowledge in this company, but they also need to be motivated to adapt to new situations”, stated by a CEO of a business unit with 12,000 employees.

- **MRI2**: Expertise (transfer), and new competencies are required. “At present, the Baby Boomers are the most dominant group and know-how holder. But this know-how can disappear soon through a wave of retirements in the coming ten years. They are willing to help transfer knowledge, but do not exactly know-how to do so. Actionable measures are important”, stated by a Head of IT department with 1,100 employees. “Many of the Baby Boomers have high expertise (of old technology), however, lack of new digital competency which is essential for our business”, stated by a CEO of a business unit with more than 5,000 employees.

- **MRI3**: Address impact of potential unconscious age bias. „In general, there can be a wrong perception about old employees, for example, in terms of productivity and agility. Many employees of the 50+ group do not see themselves as cost saving lever but potential for value creation with right measures”, stated by a Site CFO of a business unit with around 1,000 employees.

- **MRI4**: A contextual emphasize of the management interviews is that identifying potential is stated several times with regards to each of the generations. Further identifications regarding the Baby Boomer generation but less frequently stated by the interviewees are healthcare management, coping with mid-life crisis, exploring potential in general, career opportunities, job transfer, and benefit for senior employees.

4.3 Phrasing the Strategic Goal

Having created a baseline on Siemens’ Situation and Implications, the next step is to evaluate measures to design a customized demography program can be designed. This Solution phase focuses on phrasing a demographic vision and prioritizing measures for purposeful implementation.
The vision of the Demographic Program describes a unique desired future state of the demographic situation and is specific to the case study company. It guides the development process of demography program, and refers to all phases of implementation, execution, and in particular communications. With regards to the vision development process, the approach in IV.3.2 referenced. The input to develop the demographic vision is the result of analyses of Chapter V on the business and HR strategies, the environmental factors, and the baselining findings. Figure 59 illustrates the key results of each analysis in a logical sequence. As conclusion, the Vision Statement is unleashing the potential of 50+ employees for the successful future with digitalization.

4.4 Developing Solution - Measure Evaluation and Selection

The demography program aims to implement new measures to unleash the potential of 50+ employees. The measure catalog after the baselining analysis is reviewed (Figure 56). In total, 16 measures are considered for the potential implementation and evaluated with a score-based approach. The score of a measure is calculated by accounting the supporting or against arguments.

Four categories of argument have been developed during the situation and implication phases during the previous sections of this chapter.

- Four Simulation Result Implications (SRI)
- Five Age Difference Implications (ADI)
Two Benchmarking Implications (BMI)

Four Management-Interview Result Implications (MRI)

These implications are used either as supporting-argument or against-argument. A Supporting Argument can be translated as “This measure should be implemented because of this argument”. In the evaluation, it positively contributes to the score of a measure. Accordingly, the Against Argument can be translated as “This measure must not be implemented because of this argument”, and negatively contributes to the score of a measure. Table 13 is the result based on this evaluation method.

For example, the measure “M7 - Age-focused Expertise Training” is evaluated as a measure with the score 4. This measure should be implemented, because Siemens’ workforce has an aging trend (SRI2) and unleashed potential of 50+ employees (MRI4). The supporting argument for implementing the measure M7 is that 50+ employees gain stronger crystallized intelligence with their increasing age (ADI2), need new competencies (MRI2) for their job, but have the below-average training hours (ADI3). One argument is identified that this measure must not be implemented because in the Action Field “Productive Fitness”, where Siemens has a comparable level with its peer companies. Due to the evaluation that there are five arguments identified to support the implementation of this measure, and only one against-argument, the score of the measure M7 is 4.
<table>
<thead>
<tr>
<th>Score</th>
<th>No.</th>
<th>Considerable Measures</th>
<th>Supporting Argument</th>
<th>Against Argument</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>M15</td>
<td>Inter-generational exchange and collaboration</td>
<td>SRI1, ADI2, ADI4, ADI5, BMI2, MRI1, MRI2, MRI4</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>M12</td>
<td>Age-focused Career Development Training</td>
<td>SRI2, ADI3, ADI4, ADI5, BMI2, MRI4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>M21</td>
<td>Rotation with Old Employees</td>
<td>ADI2, ADI4, BMI2, MRI2, MRI4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>M19</td>
<td>Age-group focused communication and events</td>
<td>ADI5, BMI2, MRI1, MRI2, MRI4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>M8</td>
<td>Motivation of Old Employees</td>
<td>SRI2, ADI2, ADI5, MRI1, MRI2, MRI4</td>
<td>BMI1</td>
</tr>
<tr>
<td>4</td>
<td>M7</td>
<td>Age-focused Expertise Training</td>
<td>SRI2, ADI2, ADI3, MRI2, MRI4</td>
<td>BMI1</td>
</tr>
<tr>
<td>3</td>
<td>M11</td>
<td>Possibility to Restart “the 2nd Career”</td>
<td>SRI2, BMI2, MRI4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>M4</td>
<td>Workforce Optimization of Functional Exchange</td>
<td>ADI4, MRI2, MRI3, MRI4</td>
<td>BMI1</td>
</tr>
<tr>
<td>3</td>
<td>M22</td>
<td>Jubilee</td>
<td>ADI4, BMI2, MRI1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>M3</td>
<td>Retirees Back as Expert</td>
<td>SRI1, ADI1, ADI2</td>
<td>BMI1</td>
</tr>
<tr>
<td>2</td>
<td>M14</td>
<td>Age-related Com. &amp; Ben.</td>
<td>BMI2, MRI1</td>
<td>SRI4</td>
</tr>
<tr>
<td>2</td>
<td>M18</td>
<td>Age-focused Brand. &amp; Mkt</td>
<td>SRI2, BMI2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>M16</td>
<td>Age-related Corp. Res. Prg.</td>
<td>SRI2, BMI2</td>
<td>SRI3</td>
</tr>
<tr>
<td>1</td>
<td>M9</td>
<td>Age-focused Team Perform.</td>
<td>SRI1, ADI5</td>
<td>BMI1</td>
</tr>
<tr>
<td>1</td>
<td>M13</td>
<td>Mobility Management</td>
<td>ADI1, BMI2</td>
<td>ADI5</td>
</tr>
<tr>
<td>0</td>
<td>M2</td>
<td>Recruiting to Ensure S. Wf.</td>
<td>SRI1</td>
<td>BMI1</td>
</tr>
</tbody>
</table>

Table 13: Evaluating Measures for Implementation

Source: Own representation, based on the Case Study Siemens

Considering the evaluation result of all measures, this research recommends implementing a demographic program with the top six measures which have a score of 4 or above. This recommendation assumes that the workforce simulation result, the identified age differences, the benchmarking, and the management survey result have the same weight. It applies the methodological core of this solution development approach for Siemens.
case study. If this approach is applied in other companies, alternative implications and criteria shall be used. If some criteria are more relevant than the others, one can consider using a weighting system to assign different weights to the implications and criteria.

5 Implementing Actions - the 50+ Demography Program

Considering the practical implementation, for example from the function owner perspective in Siemens, the six prioritized measures in Table 13 are categorized in three action areas:

- Skill-update and training related: M7, M12
- Career development related: M8, M21
- Communication and culture related: M15, M19

This research recommends three Implementation Projects for the Demography Program in Siemens: (1) Project “Future Skills for 50+” to implement the 50+ focused trainings, (2) Project “50+ Career Boost” to motivate 50+ employees, and to implement platform and process for new career opportunities, and (3) Project “Multi-generational Workplace” to implement a series of communications and events for cultural change towards a more age friendly workplace. Each project comprises two or three work streams so that implementation activities can be broken down into smaller steps.

The program uses the simulation results of V.2.3 as quantitative base to estimate the total number of target group of activities, investment, and impact towards 2030. This is a relevant aspect for the projects “Future Skills for 50” and “50+ Career Boost”. The one scenario focuses core measures based on the assumption that the business volume in Germany will decline and the fluctuation of 50+ employees remain stable (see also the Scenario VIII of Figure 49). This scenario only considers digitalization as a general influencing factor for the workplace. A lean version can be implemented, if Siemens decides to start with a pilot approach with part of the organization, or simply due to resource limit. The other scenario is based on the assumptions that business volume in Germany will increase and there is a HR policy to actively retain and develop 50+ employees (see also the Scenario III of Figure 49). This scenario would systematically implement digitalization and people development measures to support new products and revenues in Germany.

Furthermore, the demography program considers the 50th life year of employees as the trigger point for actions. Employees who become 50 years (from 49 years) are considered as “new comers” in the 50+ group so that they are approached to participate in trainings and are informed about people development offers in Siemens.
The demography program is proposed to be sponsored by a Steering Committee which is comprised of the corporate head of HR, a representative CEO from business, and the corporate head of Communications. A Program Management Office coordinates the three projects and facilitates key decisions to be made by the Steering Committee. Figure 60 illustrates the program setup. Details of each project task and activities are elaborated in the sections below.

5.1 Project Future Skills for 50+

The Future Skills in this context are differentiated on one side as general working skills with focus on digitalization (M12 and M7) and on the other side as specific competency in terms of specific business technologies (M7 only). The target group which is addressed by this project is defined as employees at the age of 50 to 59 years. As elaborated in IV.1.2, effective training measures should consider the education background of old employees’ due to the fact of being born as a different generation. In addition, the effectiveness of the “training on the job” concept requires clarity about working areas of this workforce. Table 14 shows the distribution of the training target group. The majority (28 out of 36 thousand) is in non-manufacturing jobs, and with technical education background (26 out of 36 thousand). This reflects the fact that Siemens is a technology company. This is a very convincing basic factor for effective trainings on new competencies in the time of digitalization.
### Table 14: Training Target Group by Job and Education

*Source: Own representation based on the Case Study Siemens*

A further aspect elaborated in IV.1.2 is that effective learning for older employees is highly dependent on how trainings are organized. Therefore, the future-oriented training approach should consider age friendly usability, especially in the design and roll-out phase. In addition, the scenario “digitalization” elaborates examples of digital technologies which are supposed to play a promising role for industry companies. Training to introduce these topics can help 50+ employees foresee technological trend for Siemens’ future business growth. Finally, implementation time line and project execution plan are recommended.

#### 5.1.1 New Skill-set and New Ways of Working

As explained in Section I.1, intelligent machines, robots, and other digital labors are acquiring “ordinary” skills. In the future, many of the manual work and routine tasks may disappear (Brynjolfsson, McAfee, 2016). From expertise perspective, digital skills are increasingly in demand. Analytics determine decision making in the data-driven world. A “Human Cloud” appears through global networks between diverse people over digital platforms.

From the career development perspective, employees need to adapt to new ways of working so that they can do a value-added job and develop themselves further. Recruiting is shifting from degree-focused to skill-focused. Formal job profiles are disappearing and being replaced by skill sets. Since competency and skills are becoming more relevant than formal qualifications, 50+ employees have some advantages of having repeatedly gained learning experiences within the organization. What one has learned in the past is helpful. But the ability and attitude to learn continuously are crucial for the future.
Based on a consolidated view of recent researches (Wagner, 2017; Gray, 2016; Ito, Howe, 2016; Mutschick, Papasabbas, Schuldt, 2016), a selected skill-set for the future is recommended as training (M7 and M12) content. These skills are prioritized in a descend order by the relevance to 50+ employees in comparison to all employees in general.

**Agility** - As shown in III.6, Table 11, with increased age, older employees shows a decline in performance of speed, in particular, in information processing. Furthermore, stable working environment is of the preference frame by older people. However, the uncertainty and fast changing business world in the future requires organizations and individuals to cope with reaction speed and flexibility. Since the contradiction of characteristics can imply a fundamental risk for 50+ employees, the topic Being Agile is prioritized as the most important skill for the future.

Agility refers to the capability to sense expected and unexpected environmental changes, to respond more rapidly and cost-effectively than competitors, and to seize opportunities that become available due to that change, through implemented proactive competencies (Su, 2011, p. 3). In an organization valuing agility, individuals have to learn skills and mindset on demand and set aside ones that are no longer required. Agile individuals apply lean methods to increase execution speed, optimize output to actual requirement and quickly adapt to changes. The fundamental principles of an effective agility approach are people over processes and tools, working prototypes over excessive documentation, responding to change rather than following a plan, and customer collaboration over rigid contracts (Denning, 2016). Examples of agile methods and practices are Scrum, Kanban, and Lean Development. The agile mindset has many dimensions such as mental agility, people agility, change agility, result agility, self-awareness and self-reflection.

**Virtual collaboration across networks** - As summarized in Appendix F, the current 50+ Baby Boomers grow up in a time where personal interactions are perceived more accountable. The dominating mindset is quality, stability, and accountability. In contrast, the Generation-Z grows up with more virtual interactions through smart mobile devices, social media, and remote communication tools. On one side, the younger generations in Germany have broad access and interaction with diverse people in the time of globalization and fast changing world. On the other side, digitalization and fast changing business environment in Siemens require more networked organization structure and agility. Therefore, virtual collaboration across diverse groups, in terms of from different physical locations, and different generations, is estimated as one of the most important future skills for the 50+ employees.
Virtual teams are groups of geographically, organizationally, and/or time dispersed workers brought together by information technologies to accomplish one or more organizational tasks (Powell, Piccoli, Ives, 2004). Training about technical tools is the prerequisite and plays a crucial role in successful virtual collaboration. These include real-time communication tools for virtual meetings, co-creating tools for conceptual work, sharing tools for documenting and file transfer with business partners, and broadcasting tools such as webcasting, social networks, and video sharing. Virtual collaborators are to be effectively trained, in particular, in areas such as targeting communication, emotional intelligence, remote teamwork, and social networking (Ferrazzi, 2012). Furthermore, since members of a virtual collaboration are typically distributed in different location and countries, managing difference of culture, time zones, and work conventions needs to be trained.

**Critical thinking and complex problem solving** - With increased age, older employees show a trend of increase in agreeableness and in maintaining social, physical, and economic security (Section III.6, Table 11). But the trend of future VUCA business world becomes more complex. For Siemens, conscious handling of the immense load of digital information by structuring and prioritizing is relevant for driving business success. As two researches (Figure 21 and Section III.5.4) indicate, the increasing complexity of the business environment can lead to disadvantages for older employees due to a performance decline of in complex tasks. Therefore, training on critical thinking and complex problem-solving skills are important for the 50+ group.

The skill of critical thinking uses logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems. It is connected to the ability to tell when something is wrong or is likely to go wrong. The skill of complex problem solving refers to developed capacities used to solve novel, ill-defined problems in complex, real-world settings (WEF, 2016, p. 53). The new ways of working such as more agile and virtual collaboration lead to new standard in the process of problem solving. For example, flatter hierarchy and ambiguity create more space for shared responsibility. Informed, networked, and agile project members are increasingly co-creating results within the company. This new standard can be perceived as stressful for employees of Baby Boomer generation who still prefer to a leadership frame of hierarchical structure, chain of command, and title recognition (Appendix G). Trainings on up-to-date methods and techniques of analyzing situations during disruptions, determining of problems, identifying potential problems and opportunities, and decision making are recommended.

**Creativity** - As elaborated in Section III.4, Figure 24, there are no unambiguous findings regarding the age difference in creativity. However, regarding older people, previ-
ous research indicates a decrease of creative output in quantity when it refers to science and art. Since products and solutions of Siemens are mainly based on (new) technological applications, innovative output by applied science is a relevant topic.

Based on the Componential Theory of Creativity of Harvard, four components for a creative worker regardless of age are recommended to be considered as the core training content (Amabile, 2012, p.4): (1) domain-relevant knowledge, which comprises the raw ideas upon which the individual can draw throughout the creative process, (2) creativity-relevant processes which uses wide and flexible categories for synthesizing information and the ability to break out of perceptual and performance “scripts”, (3) task motivation, since people are most creative when they feel motivated primarily by the interest, enjoyment, satisfaction, and challenge of the work itself – and not by extrinsic motivators, and (4) work and social environment which stimulates creativity, such as a sense of positive challenge in the work, building teams that are collaborative, diversely skilled, and idea-focused, freedom in carrying out the work. Example of creative thinking techniques are combining or transferring idea across concepts, brainstorming, mind-mapping, reframing, envisaging, daydream, and role play (Brown, 2016; Zorana, 2016)

People management and communications in digital age - This skill area is relevant for employees at any age. For 50+ employees, this is an area where they can benefit most from their life experience. With increased age, older employees can have some advantage in interpersonal skills. For example, older employees show an increase trend in agreeableness (Section III.5.1, Figure 25), and possess extensive vocabularies, the “gist” from a story, and focus on implications and actions from a conversation (Section III.5.2 and Table 9). However, there are some new aspects in the digital time, for example, more virtual way of communication, and more agile way of interactions. Therefore, training content should combine the two aspects of people and digitalization.

People management refers to motivating, developing, and directing project members as they work, identifying the best fit candidates for the tasks (WEF, 2016, p. 53). As a core element of people management, effective oral and written communications are equally relevant for successful impressions, positioning, influence, and leadership in the time of digitalization (Wagner, 2017). In comparison with conventional people management and communication theories, the recommendation of training content for the 50+ employees is to focus on emotional intelligence to build trust in personal and virtual working environment, decision making in data-driven world, adapting to change, Managing diverse and cross cultural stakeholders, communicating effectively in social media.
5.1.2 Learning Approach

The recommendation of this research is to implement a future-oriented learning approach focusing on the aspects which indicate 50+ employees’ strength in knowledge access. The trends of future learning that Siemens should consider include the use of mobile technology, adoption of social learning tools, alignment with the company’s business and digitalization strategy, use of adaptive learning principle, and ability to measure effectiveness (Wentworth, Lombardi, 2014). Independent of the training content, applying the future-oriented learning technology itself is a training opportunity for the participants.

For the five future skills introduced above, Siemens has developed some learning modules. The recommendation is not to create new training course of these topics purely for the 50+ employees, but actively incorporate the 50+ relevant aspects into these modules to achieve learning effectiveness with the 50+ employees. For example, as shown in Table 7 of Section III.4.3, older people can more effectively learn structured and meaningful materials, have higher awareness about social coherency, and leverage experience-based knowledge. In contrast, trainings should not have too many elements of intensive information processing such as numerical exercises. For old employees, the reaction and learning process is interruption sensitive. And as shown in III.3.1, visual and auditory function of older employees may have started to decline. It is important to ensure that these aspects are considered into the design of training courses, for example, age-friendly font size, age-friendly color, and available subtitle.

Beyond the conventional in-person training, learning in digital platforms should be provided, for example, a dedicated learning webpage and a respective App for the 50+ employee. This research recommends an online space names “50+ Learning Sphere” where relevant learning course and content regarding the five Future Skills can be hosted. In addition, the recommendation of the learning approach is to implement three supporting measures to track effectiveness.

- Select a portfolio of learning modules focusing on the five future skill topics with 10 hours per year per employee. As shown in Figure 51 of Section V.3.3, the average training hours of the age group 50 - 59 is only around 10 hours per year per employee. In comparison with the age group 30 – 34 with 20 hours, the deficit of the 10 hours can be invested into the future skill related learnings.

- Roll-out this selected training portfolio to all the 36,000 employees at the age between 50 to 59 years. The train modules can be communicated as “highly recommended”, or even “mandatory”. In the future, for each year, employees who
just turned from 49 years to 50 years receive automatically the invitation to participate this training.

- Use respective metrics on training hours per employee and numbers of participants who have successfully completed the training modules to track on change. Assign the responsible CEO and heads HR as spokespersons to promote the training and review status of completion.

5.1.3 Future Business Technologies

There is an option that Siemens can decide if some further technology-focused learning courses are required for the 50+ employees. This is in particular interesting for the Scenario III (Figure 49) that the digitalization strategy is intensively implemented to drive business growth in Germany as a local market.

The objective is to equip the employees with one or two specific technology competencies for Siemens’ future business (M7 only). Competency refers to the potential for effective action in a given domain of functioning (Heckhausen, 2005, p.240). Examples of such domains and technologies are Artificial intelligence, Smart Data Analytics, Internet of Things, Digital Twins, Cloud to the Edge, Conversational Platform, Virtual and Augmented Reality, Block chain, Event-Driven, Cyber Security (Guarana, 2017; Gartner, 2017), and further company-specific technologies.

The target group would be 50+ employees in the functions which design and develop future-oriented new technologies. Considering the functional distribution of the age group 50 – 59 years, the estimation would be 28,000 employees in functions such as Engineering, Research and Development, IT, Management, Administration, and Sales. The recommendation is to launch this as least in one Business Unit which has increasing revenue growth in Germany as local market.

5.1.4 Project Execution

The goal of the project is to create an online space names “50+ Learning Sphere” where all training content in Siemens can be hosted. The training content focuses on the five Future Skills as introduced in Section V.5.1.1 and includes delivering platforms such as in-person training course, eLearning, recommended articles, news, video materials, and discussion threads through social networks. As an extended option, further training modules about business technologies can be chosen. As show in Figure 61, the proposal has a project team with four members, half million euro as budget, and can be implemented within eighteen months in four phases.
In the first phase, the target participants are analyzed. Goal is to create transparency for each organization unit how many 50+ employees they have and in which job functions and age groups. During this phase, representatives of each organization unit and job function can be identified to give requirement input. In parallel, an inventory of existing training activities for the five Future Skills can be conducted. The inventory clarifies the integration relevant aspects such as key content, length, delivering platform, technological compatibility, target group including which employees have completed the training, and project management relevant information such as content owner, copyright, and potential cost for long-term integration.

The second phase deals with requirement which content is to be offered to the 50+ employees. The recommendation is to implement an eLearning course with five modules for the five Future Skills. Each module aims to deliver a maximal 30 minutes training. In addition, an all-day in-person training course with extended content and exercises should be provided. When an employee has completed both courses, she or he will have increased around 10 personal training hours. This requirement management phase will also clarify which training content is most relevant for the participants, for example, by interviewing the topic owners and functional representatives identified during the phase one. In addition, age-specific requirements such as visual and auditory aspects are considered. Having identified the gap to be implemented, a production time plan is possible.
The phase three focuses on the production of online space “50+ Learning Sphere”, the eLearning, and the in-person training modules. For the training modules, trainers are identified company wide. The phase three is a long project phase where many stakeholders need to be coordinated. Typically, there are monthly or weekly review and approval loop. At the end, testing and pilot sessions should be carried out to ensure smooth roll-out to a large number of employees. In parallel, decision relevant stakeholders need to be aligned in advance. In Germany, roll-out training to a large group of employees requires an approval of or a formal notification to the Workers Council. Two months prior to the end of eLearning production, a heads-up notification should be sent to the management and HR heads of respective participant group.

Assuming that both the online space and the learning modules are developed, deployed, and successfully tested, the phase four aims to roll out the training product to its target participants. Each 50+ employee receives the invitation with description of purpose, how to access the trainings, and contact details for feedback. In parallel, management and employee communications events should accompany the roll-out to promote the training offers. Regular reporting and reminders are useful instruments to check progress.

The recommendation is also to ensure continuity over the next years for these training activities. On one side, based on the simulation results of Section V.2.3, there would be yearly 2,000 to 4,000 employees (Scenario VIII) entering the 50-age group from the 49 age group, and 3,000 to 4,200 in the Scenario III. This is a significant group in both scenarios. With this quantity basis, the project team and estimate the annual cost of hosting the online space. And each organization should estimate the respective budget to train their 50+ employees. On the other side, there might be new Future Skills or business technologies relevant for the 50+ employees. The online space and training courses can sustainably support 50+ employees with updated content. Over the year, effectiveness can be measured by metrics and feedback of participants.

5.2 Project 50+ Career Boost

The project “50+ Career Boost” aims at improvement of motivation and career opportunities for the 50+ employees. This project is implemented by applying a pilot approach. It is recommended to be implemented in one of the business units named FA (anonymous abbreviation) with around 7500 employees. This selection at the business level is representative, because a successful implementation can be rolled out to other business units in the future.

The target group is employees at the age between 50 to 59 years who are not in the Exempt Salary Group (“Tariflicher Mitarbeiter” in German). This group has been stagnant
for whatever reasons from the career track or could have missed the “perfect” age to grow with their peer groups. It can be the case that they just did not prioritize career in the early life phase and is interested again in investing more energy into their job. But if they are willing to restart the career after the 50 years, this demography program can provide them some unique opportunities. The size of this target group in the selected business unit is around 1,200 employees. Identifying and increasing their motivation (M8) and new job rotation opportunities (M21) are the levers to unleash the potential of these employees.

5.2.1 Watch and Rotation
In Siemens, there are many talent programs for young employees. 50+ employee as an explicit target group for career development is a new approach. However, the practice and many conceptual elements of a talent programs can be adopted for the 50+ target group. The recommendation is to maximize the reuse of an existing talent program practice and focus on one of the most successful program elements in Siemens: rotation assignments.

As shown in Section III.5.1, with age, openness of old employees shows a declining trend. Since job rotation only requires employees to suspend his or her current job duties over a period, it secures the original job of the rotating employee. This aspect can motivate older employees to come out of their comfort zone to take new challenges. And as explained in Section IV.2.4 regarding the Measure 20, job rotation offers some unique benefits such as enriching the skill and knowledge, facilitate relationship of employees, and gain cross-organizational understanding for the 50+ employees.

The implementation has two key aspects: (1) create Watch-Lists of 50+ employees with motivation for job rotation. The names on each watch-list should be based on personal wish and commitment from the yearly performance review round or from an on-demand conversation between the employee and his or her manager; (2) assignment of 18 months cross-functional rotation. When a vacancy is considered into the rotation job positions pool, the participants of the “50+ Career Boost” participant employees have a preferred visibility for the hiring manager of this vacancy. The most important criterion for hiring decision is that the candidate must come from a different function. This “rotation” character ensures that the participating 50+ employees must come out of his or her comfort zone to take new challenges. So, the declining trend of openness can be effectively addressed by measures on the process level.

5.2.2 Role Models Campaign
There is an option that Siemens can decide if a 50+ Role Models communication campaign should be launched. This is interesting for the scenario that the digitalization strategy should be profoundly implemented to drive business growth in Germany. As
explained in Figure 46, this scenario is based on a HR policy which tries to reduce the fluctuation of 50+ exits. Role modeling communication can scale up the motivation impact in the 50+ workforce so that more 50+ employees can be developed new job positions.

The role models are the 50+ employees who have successfully made a job change during last years or finished the 18-month job rotation. These colleagues are the most authentic persons to refer to their personal stories to motivate other 50+ employees. The key message is that it is possible in Siemens to realize new career opportunity after long “no promotion” career period. The core idea is to interview these colleagues and share their success stories and motivate their peer 50+ employees to be open for job changes. In the time of digitalization, the audience of these stories is to be encouraged to use the digital platforms. Therefore, interview videos should be available in the company’s internal social platforms.

5.2.3 Project Execution

The prerequisite for this people topic is to have a commitment from the top management and Workers Council for their support. Since the entire senior management group will be the one who promotes their 50+ colleagues in the Exempt Salary Group. One key performance indicator is to be established to track their awareness, for example, the number of senior managers who have established the 50+ Watch-List. Another key performance indicator is the number of effective job changes of 50+ colleagues. The project leverages (1) the hiring managers who define and place candidates in vacant job positions, (2) a job rotation process and overview on the business unit level, and (3) the catalyst effect of 50+ role models who have successfully made a job change or promotion. The pilot is proposed to be implemented for a two years time horizon in three phases.

Figure 62 illustrates the project structure. It is proposed to establish a project team with two work streams. The Watch and Rotation work stream coordinates the design and development of the 50+ matching process. The Communication work stream is responsible to organize matching roundtables, identify the ambassador and role models, and implement campaign. Overall, the project cost is estimated for 50,000€ which is budgeted by the company’s headquarter plus prepared rotation cost estimated as €5,000 per employee move in average which the respective Business Unit should agree to cover. If the first patch is designed for up to 100 participants, the financial support by the business unit would be at a maximal level of half million.
The first step is to create the transparency of the “rotation sponsor” pool. This is all the senior managers except the managing board members and the respective HR business partners. These people know exactly when and where job openings are planned. Ideally, they know about the pipeline situation for most of these openings. They should be the first target group which is engaged to know and support this project. Each of them creates a Watch-List of their 50+ employees who are considered for potential job rotations. This group of managers should also support this project by taking part in role model interviews and further communication. The project team should have received an overview of 50+ employee profiles and the available vacancies for job rotation of the entire business unit.

In the second phase, several roundtable sessions shall be organized for the hiring managers and HR business partner to discuss the watch-list of potential candidates. The recommendation is to select three candidates from the watch-list for one vacancy position to ensure a certain level of successful match. After these sessions, the respective HR business partners can consider an agile methodology to enable short check loops for successful matches until the respective 50+ employees sign the interim job rotation agreement for job rotation. In a separate thread, employees of this business unit who have participated a previous job rotation are invited to be the ambassadors and to share their experience. In addition, the project team can share selected researches results, practice of other companies, and resources about the benefit of a successful job rotation.
The third phase can start during the 18 months job rotation period until the 3 months after the first patch. According to feedback of 50+ employees and the hiring managers, the concept can be improved. During this phase, successful 50+ participants can be identified as role model to share their personal stories in interview videos. Communication about these videos can be released regularly, for example, on quarterly base. This communication is not limited to the pilot business unit. It can be scaled up to the entire companies to motivate 50+ employees in terms of career development. And Siemens can decide if a roll-out of this approach to other business units makes sense.

5.3 Project Multi-generational Workplace

The Project “Multigenerational Workplace” aims to increase the awareness of working in Siemens as a more age friendly workplace for all generations. This project has two aspects of emphasis. Firstly, it should create a realistic picture of older employees, neither a generic negative nor positive association between aging and capability. Potential biases about 50+ employees should be made aware and impact of biases should be minimized in the organization. Strengths and opportunities for 50+ employees should be made visible. This is the task of implementing the measure M19. Secondly, the potential of inter-generational exchange should be unleashed, in terms of knowledge transfer, support each other, and mixed skill set for more creativity. This is the task of implementing the measure M15. Two selected work streams are recommended to drive implementation: (1) addressing unconscious bias and (2) establish a system for reverse mentoring. In addition, a third work stream of (3) communication and event covers both measures M15 and M19 as enabler for long-term cultural change towards 2030.

5.3.1 Unconscious Age Bias

As explained in Section III.4, both the “Deficit Model” and the “Competency Model” theories have their assumption based on contextual observations. And research result of IV.1.4 shows that age-related bias is characterized by equalization of “getting older” and “declining capabilities”. The implication for older people is observed from biases with regards to ageism. It describes unjustifiable prejudice towards older people in terms of (a) how we feel about different age groups, (b) what we think about different age groups, such as the stereotypes and beliefs held about them, and (c) how we behave towards different age groups (Butler, 1969; Abrams, Swift, Lamont, et al., 2015, p.5).

Literature has found that the perceptions about older people as a group are more negative compared with perceptions about young or middle-aged adults (Crockett, Hummert, 1987; Lutsky, 1980). Perceptions about older individuals, however, tend to be as positive as perceptions about younger adults. In a study of Lexical Decision examining the effects of automatic and controlled processing in terms of response time, findings show that both younger and older adults demonstrated strong stereotype activation for elderly
stereotypes, but relatively weak activation for young stereotypes (Chasteen, Schwarz, Park, 2002). Analysis out of the Harvard Implicit Association Test data shows that unconscious or implicit preference for younger people is the highest (Chopik, Giasson, 2017). Since age related biases may lead to poor people decisions for the 50+ employees (and for young employees), Siemens is convinced to consciously addressing unconscious bias for unleashing the positive contribution of the generational diversity in workforce, and for decision making with higher quality for long-term.

Unconscious Bias is an implicit pattern of thought that people are unaware of. It happens automatically and is triggered by human brains making quick assessments of situations and people (Sparks, 2014; Staats, 2014). Current explanation from the neuroscience is that humans have at least two cognitive systems. The System One involves conscious, controlled, an effortful processing of stimuli and produces explicit beliefs and attitudes. The System Two responds to stimuli by rapidly, effortlessly, and automatically applying implicit knowledge, beliefs, attitudes, and skills that have been stored, through repeated exposures, in long-term memory (van Ryn, Saha, 2011, p. 995). The human brain encounters roughly 11 million bits of information every second. The conscious mind handles no more than 40 to 50 of these information bits, with one estimate as low as a mere 16 bits (Ross, 2008). In order to enable quick assessments, the unconscious minds processes information by using stored shortcuts. These shortcuts are based on people’s background, cultural environment, and personal experiences, but can lead bad decisions which require conscious mind of human brain.

One example of unconscious bias is the halo effect which is the bias resulting from an attribute that spills over to another attribute (Thorndike, 1920; Lin, Yang, Liou, 2009), such as age being a personal or group attribute in the workforce context. Age stereotypes related to older employees can overshadow other attributes of them. Commonly held perceptions are that older people would be lack of creativity. They would be unable to learn new skills, unproductive, a burden on family and society (Hummert et al., 1994; Swift, Abrams, Marques, 2013). Unconscious characteristics are also attributed specifically to older workers, including inflexibility, poor adaptability, resistance to change, cautiousness, low trainability and poor computing (Chiu et al., 2001; Magd, 2003; Abrams, Houston, 2006) and social media skills. However, there are also positive stereotypes that define older people as wise, generous, friendly, moral, experienced, loyal and reliable (Hummert et al., 1994; Swift, Abrams, Marques, 2013). “The Unconscious Bias topic is important for our company. When we make people decisions, we have to look at whether they bring their experiences, not what do they look like … We can actually have a very neutral discussion about what is the quality of people they will bring in board”, stated by the head of HR of Siemens.
The recommendation is to implement an initiative to address (age) unconscious bias. It should include campaigns about unconscious bias in the key communication channels of Siemens including social media, and a dedicated training portfolio. Since active awareness interventions can sometimes reduce implicit bias, but the effects of such interventions are often temporary (Dobbin, Kalev, 2016), communications and trainings must be thoughtfully designed with research in mind and understanding of its limitations (Emerson, 2017). Therefore, this research also recommends embedding structural measures in the people decision processes (Emerson, 2017) which will have the most sustained impact on bias mitigation and, thus, foster a more inclusive multigenerational workplace.

5.3.2 Inter-generational and Reverse Coaching

The Inter-generational exchange and collaboration (M15) is evaluated in Siemens with the highest score, as shown in Table 13. Many researches also suggest that, under the appropriate conditions, positive contact between members of younger and older age groups, can foster social harmony and reduce prejudice (Pettigrew, Tropp, 2006; Abrams, Swift, Lamont, et al., 2015, p.19). In terms of expertise transfer, cross-training employees can reduce the possibility that only one or two individuals possess critical organizational knowledge (SHRM, Sloan, 2014, p. 7). The emphasis of this work stream is the systematic coaching for Siemens with (1) structured concept, (2) dedicated resource allocation, and (3) guided monitoring process to ensure impact.

Firstly, as shown in Figure 40 of Section V.1.2, the 50+ quotient in Siemens is 61%. For one 50+ employee, there is more than one 50- employee available for a potential mentorship. The concept is to structure the mentoring activities by business units. Each business unit should setup one Reverse Coaching Program with at least 50 pairs. The coaching relationship is suggested to be 18 months, and a subject of mutual agreement over the time. Activities focus on know-how topics which are relevant for the future. The young employees have the active role as a coach, for example, identifying 50+ coachees, schedule meetings, and report key results to the sponsoring managers. The 50+ experts take a role of coachee and have the assignment to share their expertise from a specific functional aspect with the young colleague. In addition, the 50+ coachee defines which topics they would like to learn from their young coach. The young coaches have the assignment to conduct state-of-the-art research on technology, methodology, product, market or further aspects, and reverse coach their 50+ coachee.

Secondly, the business unit management and HR ensure the allocation of time and financial resources for coaching activities. An agreement of reserved working time is the key so that working on the coaching of employees is considered as part of the work. Annual budget needs explicitly clarified so that organizational topics, for example cost for meeting rooms, cannot be a barrier.
Thirdly, HR should be responsible for the overarching support. In particular, this support includes building the coaching pair, definition of selection criteria for coach and coachees, explanation of concept, expectations and process, monitoring the progress of the program, and organization of the business unit wide exchange meetings. Results of the both coaches and coachees are presented in annual management meeting of respective business unit. Selected highlight results are proposed to be presented in the companywide 50+ Summit (see also the communication and event work stream below).

5.3.3 Communication and Events

The projects and work streams above drive people development related actions from which the 50+ employees and the company might directly feel the impact. However, there are two reasons why professional communication activities are needed for the Demography Program. On one side, both the management and employees need to understand the demographic shift, its impact, the age differences, and the importance of Siemens’ actions. On the other side, the projects and work streams need to convince cross-organizational partner colleagues to have the actions implemented. It is proposed to be a collaboration project with co-leadership by the Communication department and selected Employee Resource Groups (ERG) as shown in Section V.4.1. It is a work stream in which the 50+ Employee Resource Groups can create an authentic visibility being role models themselves. The Communication department can provide professional advice and resource support.

Communications by the top management are imperative to regularly ensure the awareness about the importance, priority, and (interim) results of the Demography Program. The target group of these communications is all employees. This category of communication focuses on coordinated management messages by the Steering Committee members and management of involved business units. Platforms to deliver these messages can be recorded panel discussions, video statements, articles, or employee town hall meetings. The communication activities also include campaign work, especially regarding the roll-out of the trainings “Future Skills for 50+” and “Unconscious Bias”. Also communicating the 50+ role models and coaching results require professional support.

Finally, this research work recommends an annual Demography Summit with three core features: (1) celebration of demography related project and work stream results within the company, (2) high profile speakers and thought leaders to inspire the organization for new action ideas towards 2030, and (3) recognition of contribution of successful employees, project leads, community leads, and supporting project partners. Siemens can even consider setting up a Demography Award, for example as one of the award categories in the existing business award, HR award, or communication award, to visualize the celebration and recognition. By collecting and evaluating the applications to
such award, Siemens can receive an overview of actions across all its organizations and create synergy implementing future actions.

5.3.4 Project Execution

The prerequisites of this project are the commitment of support from employee networks, Workers Council and top management. Especially, the understanding and commitment of the Workers Council is crucial, since involvement of the ERG members into the project shouldn’t be misunderstood as abuse of employees’ working hours. It is an opportunity of visibility for the involved employees who contribute to this project.

Three key performance indicators will be used to measure the success: (1) number of the participants who have completed the unconscious bias training, (2) number of coaching pairs, and (3) number of key communications. Key communications refer to a large audience, for example, more than 100 active participants, or senior management teams who have a responsibility of more than 100 employees. Figure 63 illustrates the project structure.

![Figure 63: Demography Program - Project “Multi-generational Workplace”](source: Own representation)

The first six months of this project is the development phase. It begins with buy-in of the key stakeholders explained above. In all the three work streams, the respective concepts are developed. Key experts are interviewed to provide input and subject-matter ideas. For example, the work stream “Inter-generational and Reverse Coaching” should design a structural selection process including defined criteria, identification approach, mutual agreement template, and guidance for activities. Some first communications can
start, for example, a top down communication regarding the importance of the Demographic Shift and its implication for Siemens.

The second phase of project is the execution of concepts. In the “Unconscious Bias” work stream, the script of eLearning is transformed into digital output and deployed in a learning platform. The training concept is introduced to the trainers who are certificated to run such training for Siemens. A training portal is to be launched so that employees can book and organize training schedules. In the work stream “Inter-generational and Reverse Coaching”, each business unit takes the agreed concept and starts identifying coachees and coaches. Agreements are signed and consolidated overview across business units can be created by the project management from the company level. In the next 18 months, coaching meetings and activities are organized. The work stream “Communication” supports not only the other two work stream of this project, but also overall communications of the entire Demography Program. These include the “Future Skill for 50+” training roll-out, the job rotation matching results, the 50+ role model stories. As more tangible results may have been available over the first year, the first 50+ Demography Summit can take place within this phase.

In the next project phase, the produced Unconscious Bias training is rolled out. At least, all the 110 thousand employees (including managers) in Germany should receive the invitation via email to participate the eLearning. Furthermore, employees can book in-person trainings to deep-dive this topic with dedicated discussion, exercises, and develop actions how to cope with unconscious age bias. For long-term towards 2030, this training should be integrated into the training portfolio for new employees. Measures on system level such as standardized selection approach in employee performance evaluation, development opportunities, and promotion can be implemented to more effectively reduce the impact of age biases. From the work stream “Inter-generational and Reverse Coaching”, lessons learnt of the first batch should be considered to improve the concept. Communication team engages successful coaching pairs to increase the motivation of 50+ employee participation. In positive case, further batches can be rolled out with broader pool. Continues communication with inspiring stories should be ensured until the end of the Demography Program.

5.4 Conclusion

The goal of the Demography Program was to unleash the potential of 50+ employees within Siemens. Specifically, the program focuses on trainings, people development, and cultural change measures. As the core of this program, the three implementation projects were derived by a clear logic chain from situation and implication to the solution in terms of positive impact. Each project aims to close potential gaps in Siemens specific action fields.
At the organizational level, the project “Future Skills for 50+” addresses the skill gap of the 50+ workforce in terms of the current skill set and the required skills and competencies of future job in the next years (see also MRI2), in particular, towards a more digitalized workplace and new business potential with trend technologies. At the individual level, the skill gap can change from a time aspect along the life year (SRI2) and employees’ service time in company. This type of gap is rather perceived from the business requirement perspective. Furthermore, the roll-out of the training measures will close the training hour gap per 50+ employee (ADI3, MRI4) in Siemens and the gap of their unexplored crystallized intelligence (ADI2, ADI5). These two areas of gap are rather perceived from the human resource perspective. Successful implementation of the two measures M7 and M12 can have positive impact on the following areas of people development and culture change (BMI2).

- Gaining the top-5 skills, Agility, Virtual Collaboration, Critical Thinking and Complex Problem Solving, Creativity, and People Management and Communication will help 50+ employees feel more confident to work in the future business world. It can also positively change the mindset of employees towards the new ways of working, in particular, with greater openness for a more agile, virtual, solution-oriented, creative, and social-centric working style.

- The skill update including the chance to gain insight on Siemens-relevant future technologies will open new job and development opportunities for 50+ employees. Also the existing skills of older employees can be used in new business areas, and therefore create cross-domain knowledge synergies. This way, HR can even discover an additional talent sourcing channel for vacant positions.

- If the training reaches a critical percentage of the overall workforce of Siemens, a cultural change towards life-long learning might be triggered, which can positively affect all employees. A future-oriented learning culture helps Siemens to motivate its employees to seize new business opportunities, to feel proud of being proactively connected to this future-oriented organization, and even to create a positive learning competition among employees with a self-learning mindset.

The project “50+ Career Boost” specifically addresses the matching gap (MRI1, ADI4, MRI4) between qualified but stagnant 50+ employees who are still interested in personal growth and job offers. This gap can become more problematic when the job offers require fast placements with existing Siemens experience and fresh view from another functional perspective. This project also aims to help make the qualified labor force gap (SRI2) smaller because Siemens is facing an aging population in Germany and more competitive talent market. The project can also close certain gaps in knowledge transfer (MRI2) across job functions and a motivational gap (ADI3) at the personal level in terms
of “moving out of own comfort zone” and “feeling safe without the risk of losing the job”. Successful implementation of the two measures M8 and M21 can positively impact the following areas of people development and culture change (BMI2).

- The Watch-Lists of motivated 50+ employees can create transparency and an additional segment of talent pool for the pilot business unit. Such a talent pool is one of the most important recruiting channels within Siemens. Since the identified 50+ employees are part of a watch list, the negative impact of rejection of a job application of them becomes lower.

- Since the 50+ watch lists build a talent pool, the brand of talent programs in Siemens will not only center on young employees anymore. 50+ employees may feel more valued and included in terms of access to broader job offers. Furthermore, the 50+ role models campaign can make the value of job rotation more explicit. Both aspects can significantly increase the motivation of 50+ employees in terms of career development and therefore contribute to the company’s success.

- The job rotations are likely to facilitate knowledge transfer within the pilot business unit, especially from the cross-functional perspective. Experiences and expertise of 50+ employees can create synergies between departments. This might reduce the extra effort of organizing cross department workshops and trainings. With roll-out of this approach to further business units, Siemens may benefit from cross-business unit synergies, too.

The project “Multi-generational Workplace” considers the workforce gap of Generation X in Siemens with around 6,500 FETs (SR1). This gap can create a generational loss in terms of knowledge, human resources, and talent pipeline. The project establishes structured process to address the gap of generational knowledge transfer. In addition, it also copes with the emotional gap between younger and older employees, in terms of expectations on applying their skill and motivation for a career perspective (BMI2, MRI1). Successful implementation of the two measures M15 and M19 can have positive impact on the following areas of people development and culture change (BMI2).

- The roll-out of unconscious bias trainings, measures in HR processes, and communication campaigns enable a more inclusive culture. Consciously addressing unconscious bias by managers and employees will enhance people decision making in Siemens.

- By establishing a systematic reverse coaching approach, one can expect a more effective knowledge transfer between generations. The expected impact for 50+
employees can be learnings on new technology, new social trends, and new ways of working from the younger generation. For younger employees, life experience, obtaining a broader perspective on job tasks and strength of interpersonal skills of older colleagues can be one of the most useful learnings.

- The communication measures and the annual Demography Summit can create positive impact on visibility of the topic Demographic Shift, its importance, and outcomes of the Demographic Program. In addition, it creates a company-wide communication platform to value impactful action and to value 50+ experts, leaders, and 50+ employees with development potential.

The Demography Program is an ambitious initiative which is supposed to have high impact on Siemens’ culture and 50+ employee development. However, a solid plan is only the first step towards successful results. The program has combined characteristics of change management, communication and marketing, human resource, and corporate projects. The recommendation is to focus on the following five key success factors to foster a high-impact implementation.

- Top management support and participation in steering committees is the most critical success factor. The commitment of top management involvement at the beginning of the program has a signaling effect that the demographic topic is of high relevance for the company. It helps to get additional stakeholders on board, allocate resources, and helps to receive support of further experts and managers in the later implementation phases.

- The selection of experienced program and project managers with proven track record is important in order to deliver expected outcomes. Since the program has a national scope with several projects and work streams, there are a lot of interconnections. Experienced project managers can lead the teams with clearly defined responsibilities and fair consensus-building skills in case of conflicts arising. Further criteria for choosing project managers include ability to focus on the overall program goal and structure working packages for the program team members, communication capability, and competency to command authority naturally both internally to team and externally to implementations partners.

- Effective communication is a key for the Demography Program in both the setup phase and the implementation phase. During the implementation, multi-level communication is needed such as towards external stakeholders, internal management level, workforce level, and project level. Professional communication differentiates target groups. It has an appropriate balance of being not too detailed, but clear and specific enough for a message. Effective communication
can keep stakeholder engaged and project teams motivated, and, thus, can lead to efficient actions and fruitful outcomes.

- Monitoring by measurable indicators is crucial to keep projects on track. Appropriate transparency can help all project managers and teams to gain the big picture in the middle of task execution. Well-defined indicators and consistent monitoring processes increase efficiency of project work and can significantly contribute to high quality results.

- In the age of digitalized and connected business world, synergy mindsets and collaborations are important catalysts for success. The synergy mindset supports a common goal on company level. Effective collaboration can facilitate exchange of information flows and resource efficiency, for example, with other companies’ demography initiative or other HR projects.
VI Conclusions

This research work tried to provide German companies with recommendations in the time of demographic shift. In following, its key results are summarized by answering the three research questions which were starting point at the beginning.

The first question (How can companies foresee the demographic shift in terms of the age structure development?) refers to the capability of companies to understand the implication of the demographic trends at the macro level.

The aging trend was identified and displayed by the following indicators. Firstly, the median age of population in Germany is predicted to be 46 years in 2030. This is two years older in comparison to the 44 years in 2010. Secondly, in the same period, the share of the 50+ population is predicted to increase from 41% to 46%. Thirdly, there is a strong gender factor influencing the demographic shift in Germany, because the women’s participation in economical activities has been increasing during the last years. The current women workforce will enter the 50+ group in ten to fifteen years, too. In terms of the 50+ Economically Active Population Rate in the entire population towards 2030, the expansion in female group is predicted to be stronger than the male group.

The aging trend leads to some changes in the labor market, in particular, an increasing gap of the unbalanced demand-supply situation in terms of qualified workers. Forecast indicates a gap of vacant job offers up to 3.4 million in 2030, while the Economically Active Population is slightly shrinking. Therefore, companies are expected to experience an increasingly competitive “war for talent” in the German labor market and should see 50+ employees as a more important internal labor capital to develop.

The average workforce age of large companies, represented by a sample of DAX30 members, has increased 1 to 3 years during the last five to seven years, indicating a significant increase of the share of the 50+ employees. In the time of digitalization, many of the future jobs did not exist in the past and new jobs will emerge, in particular, with an increasing trend in business service, financial service, education, health, and social work. Companies will look deeper into age related issues in terms of updated qualifications, increased managing tasks, creative and social competencies in their workforce.

These trends directly influence companies’ HR and people strategy which requires systematic action design in advance. This implies that companies need to rethink about the
age-related workforce development, working conditions, potential knowledge loss due to a large number of upcoming retirees, future-oriented skill set for the digital age, and a more inclusive culture towards the multigenerational workplace. The implication is also that companies need to be capable of creating transparency on workforce composition and forecast. This is the first and the most basic strategic field as recommendation so that further actions can be designed effectively.

For the second research question (What are the differences between older and younger employees?), 15 key differences between the 50+ and 50- employees were identified, in particular, with regards to health, learning capabilities, and social behaviors.

The differences of health status are characterized by physical fitness, absenteeism, and mental well-being. 50+ people have some significant physical changes with increasing age. The relevant aspects are reduced weight, reduced bone density and muscular strength, decreasing cardiopulmonary performance, and declining functionalities. These changes mean some potential risks for presbyopia, presbycusis, decreased sensorimotor ability, and therefore some difficulties in physical and intensive mental-tasks. Older people also experience less sleep quality and respective changing schedule in terms of their working time. Regarding illness, sickness of older people occurs more frequently in combination. Observing absenteeism, older people do not manifest absence more frequently than younger people due to illness. They have, however, recorded significantly more sick days in case of an illness. These age differences contribute to the shift of working mode and workplace design, which can help to ensure the productive fitness of the 50+ workforce.

In terms of learning, 50+ people have advantages in crystallized intelligence which reflects the collective knowledge of a person or the vocabulary and analogy capability. This type of learning capability increases with age. In contrast, the fluid intelligence, which represents the rapid and abstract thinking when solving hitherto unknown logical tasks, declines with age. Therefore, the strength of 50+ people lies in learning meaningful materials, gaining and applying experience-based knowledge, and social coherency. Regarding the changes of cognitive functions, age differences of performance increase as tasks become more complex and processing resources are stretched more to the limit of older people. The same applies to performance of memory capability. These age differences require a new approach of training and learning measures for the 50+ employees, but also career opportunities in terms of task assignment and new job options. Therefore, people development for 50+ employees is one of the most relevant action fields companies should address from this perspective.
In the area of social behaviors, with age, older adults are perceived as less willing to engage in new challenges or in activities requiring external orientation of energy. Extraversion and openness follow a declining trend. However, with age, adults show increased levels of neuroticism and agreeableness, and are less self-concerned in stressful situation, have advanced tolerance, and a more accurate assessment of their own capabilities and limits. In terms of communication, with age, older people maintain capabilities in verbal intelligence as well as speaking and writing in simpler form. They have good semantic memory, can grasp the “gist” of a story and work for larger master plans. Older people are perceived as more interested in quality awareness while maintaining social, physical, and economic security. From the generational perspective, the 50+ population in Germany was historically influenced by events such as East-West Germany, Cold War, Economic Miracle, space travel, and environmental movement. These events may lead to certain preference-frame for power, purpose, chain of command, and appreciation of stable working environment. Therefore, companies’ ability of communication to and making culture change involving each of the generation groups is important to create and sustainably engage an inclusive multigenerational workforce.

Since the research focus is the 50+ group, some age differences are filtered out based on the degree of difference perceived by case study companies and importance for practical implementation. The top relevant Age Differences regarding 50+ people with age are:

- **Knowledge about historical or generational events** which the younger people did not have a chance to experience due to their late birth years. Some of these events may have influenced people’s thought pattern, value system, and behaviors. Being aware of this generational aspect is helpful to achieve effective expectation management in the workplace.

- **Decreasing physical conditions** which can lead to increased duration of absenteeism in the workplace, although older people are not more often ill.

- **Increasing crystallized intelligence** with strength in experience-based knowledge, problem solving strategies, factual focus and expertise, awareness of social context, and advanced language competency, but some **disadvantages in fluid intelligence** such as speed and memory.

- **Personality change pattern** with a declining trend in extraversion and openness, but increased levels of neuroticism and agreeableness. With age, older people become less self-concerned in stressful situation, more tolerant, and have more realistic assessment on own capabilities and limits.
The answers of the first two research questions built the cornerstones of the recommendations for Germany companies in demographic shift. The answer to the third research question (What are the areas where a company can strategically take actions to manage the foreseeable demographic shift?) is provided from both theoretical and practical perspective. Based on several literature reviews and two case studies, a Managing Demography Framework was developed. Applying this framework, a specific Demography Program was recommended for the case study company.

The answer from a theoretical perspective centers on the Managing Demography Framework with 22 Measures in 4 Action Fields. The most relevant measures are characterized by their relatively high impact expectation and their relatively low implementation complexity in practical application context.

The Action Field “Workforce Composition” copes with people analytics with regards to the aging labor structure. Five measures are identified for this action field. The most relevant measure is the workforce planning reflecting companies’ workforce development in terms of age-related demographic groups and competencies, since transparency is the basis to evaluate potential impact of further measures from a quantitative perspective. This measure includes, in particular, forecast and simulations of age structure development scenarios towards future. Workforce factors, which are influenced by business grow and employee fluctuation, are the essential elements to be considered during such workforce planning process.

The Action Field “Productive Fitness” explains five measures identified for 50+ employees and their working conditions to achieve greater productivity. The most relevant measure for companies is the age-focused expertise training. Such training includes at least two critical components. The first component aims to update the future-oriented skill set and mindset of 50+ employees, in particular, in terms of workplace in the digital age. This aspect can be also part of people development trainings. The second component offers employees opportunities to renew their critical expertise, in particular, regarding selected technologies which enhance the way of utilizing existing expertise in new ways or which are supposed to drive new businesses. In addition, learning methods and delivery approach should consider age-specific learning effectiveness such as education background of older generations, structured learning strategy, more meaningful material instead of heavy data processing content, and experience-based knowledge.

The Action Field “People Development” includes six ideas to offer career opportunities, to unleash the career potential of 50+ employees, and to enhance performance of old workers. From the application in terms of 50+ target group, job rotation of older employees is the most relevant measure for German companies. Involvement of working in different departments or in another business unit for some months can be very effec-
tive in the practice. For older employees, job rotation is more realistic to participate than
deciding to quit the current job to take a risky new job, because age difference findings
suggest the (job) security aspect for older employees as an important factor to support
moves and changes. This unique aspect with access to new job opportunities without
potentially losing the previous job aims to facilitate decision making of 50+ employees
to develop further and to gain broader organization-specific knowledge, new skills, and
new competencies. Therefore, it is also seen as an on-the-job learning and development
measure, too.

The Action Field “Communication and Culture” addresses values and behavioral var-
ables to improve organizational development towards a more age-friendly eco-system.
Among the six measures in this action field, age group focused communication and event
is evaluated as the most relevant measure for German companies. In the context of
demographic shift, this measure focuses on awareness of (age-related) unconscious bias,
interactions in team work, capability of communication skills of 50+ employees, and
mindset and adaptability towards new ways of working in the future workplace where
diversity of generations and inclusiveness become more relevant for the long-term suc-
cess of companies.

The answer from a practical perspective is demonstrated by a specific application of the
Managing Demography Framework for the case study company. For this company, the
research conducted a series of workforce analyses including a workforce forecast 2030
with 9 scenarios. This was done by a modeling method Workforce Demographic
Forecast with workforce data, and by simulations out of its implementation, namely the
WDFSim tool. As result, two scenarios were evaluated as the most likely for the case
study company, with a predicted average age in the range of 46.4 to 47.1 years in 2030
and a respective share of the 50+ employees in the range of 38.3% to 40.2%. In both
scenarios of the case study company, the simulation result displayed a moving gap of
around 6,500 Gen-Xer employees in the aging workforce.

Furthermore, company-specific age difference analyses, a management survey, an ex-
ternal benchmarking with peer companies, a workforce survey, and a measure inventory
were conducted to reflect the demographic situation and implications for the case study
company. The result of these analyses showed that in comparison with younger em-
ployees the 50+ workforce in the case study company displays a more positive motiva-
tion towards engagement, collaboration, and its leadership culture. The company values
the strength of crystallized intelligence of older people and is aware of their personal
interest.

The case study company has some first experiences in the implementation, since exist-
ing measures in the case study company already cover around 27% of the measures in
the Managing Demography Framework. The perception is that there is no urgency to address the action fields “Workforce Composition” and “Productive Fitness” in terms of physical condition of older employees. The potential areas for improvement are mainly in the action fields “People development” and “Communication and Culture”, in particular, with regards to deficit training hours of 50+ employees, cross-generational know-how transfer, new competencies for the future, awareness of a more inclusive culture, and the potential exploration to support the 50+ career development.

Based on these evaluation results, six measures were prioritized as the most relevant for the case study company as the next step. This research work recommends a new Demographic Program with three projects to implement them. Each project implements two measures. All project execution plans were created with concrete goal description, organizational scope of impact, key performance indicators, roles and responsible, budget, and orientation time line.

The project Future Skills for 50+ implements the measure age-focused career development training and age-focused expertise training to equip 50+ employees to be fit in the time of digitalization. The implementation starts with identification of the 28,000 target participants who are non-manufacturing employees at the age of 50 to 59 years. In addition, the target group also considers 2,000 to 4,000 employees annually who turn from 49 to the 50 years. This research recommends training content with focus on five skills for the future of work: agility, virtual collaboration across networks, critical thinking and complex problem solving, creativity, and people management and communication in digital age. For employees of selected technical functions, training about future business relevant technologies can be offered. The training content should be delivered by multiple platforms including a 30-minute eLearning module, an in-person training option, and an online space the 50+ Learning Sphere where all training content and communication materials are available for easy access. By using the two key performance indicators, number of participants who have completed the training, and the total training hours, the project can measure its reach-out and impact on a year over year basis towards 2030.

The project 50+ Career Boost implements people development measures in one business unit of the case study company as a pilot. The target group within this business unit is around 1,200 employees at the age between 50 to 59 years who are not in the Exempt Salary Group (“Tariflicher Mitarbeiter” in German). Identifying and increasing their motivation and new job rotation opportunities were selected as the measures to realize their career boost. This project creates watch-lists of 50+ employees who have motivation for career development and establishes an eighteen-month cross functional assignment program. The impact can be measured by the number of supportive senior
managers and the number of job changes of 50+ employees. Furthermore, participants who have successfully made a job change or finished the eighteen-month job rotation should be mentioned in a 50+ role model campaign. This campaign aims to spread the visibility of this program and to motivate further 50+ employees to join, and thus, the campaign can enable sustainable pipeline of future participants and vacancy jobs for the next years. The successful pilot implementation and campaign are the basis for the roll-out of this approach in further business units in the company.

The third project Multi-generational Workplace is a change management project with focus on implementation of the measures age-focused communications and event and inter-generational exchange. This research recommended an initiative of consciously addressing unconscious age bias, for example in a form of continuous trainings and communications, to foster more inclusive culture and better decision making. Furthermore, each business unit should setup a structured reverse coaching program with at least 50 pairs and an eighteen-month coaching relationship. Business unit management teams and HR ensure the allocation of time and financial resources for sustainable coaching activities. The recommendation also includes a cross-project communication thread for the overall demographic program implementation and an annual demography summit to motivate the entire company to make achievements visible. This communication work stream should have a co-leadership by the Communication department and selected 50+ Employee Resource Group leads being role models themselves. Key performance indicators of this project are the number of participants of the unconscious bias training, the number of coaching pairs, and the number of key communication activities.

The inference that companies need to implement specific actions to cope with the demographic shift, for example applying the Managing Demographic Framework of this research, was rooted mainly in two key facts. The first fact is the increasing share of the 50+ group in Germany population and in companies’ workforces. The second fact is that older employees have some age-related differences in comparison to other demographic groups. For the case study company, the selected six measures were based on its specific business situation and workforce composition. At least the following four questions can raise extended thought on further research.

First, how can the approach of this research be applied to provide recommendations to other companies or organizations? The case study company of this research is a large technology company. On one side, the composition of the workforce in the case study company has a certain job characteristic related to technologies. The situation, implication, and solution for organizations of other sectors such as service or government administration may require a different demography program, for example, with more
focus on areas of recruiting, consulting skills, or innovative working schedules. On the other side, for small and medium-sized enterprises, the dynamics of workforce fluctuation, motivation of employees, and workplace conditions are not always comparable with large companies. The workforce in the case study company has a relatively high share of employees with formal educations (38% with university degrees, 52% with vocational training qualifications, and only 10% without any formal qualifications) and a relatively low share of manufacturing worker (around 20%). This composition character positively influenced the application of the Demography Program with a significant proportion of learning activities and change management. Companies with a different level of educational background in workforce might experience other challenge when implementing training activities, for example, with motivation of technology topics or training method.

Second, what would other demographic groups in the German population influence the demographic shift and the respective demographic issues in companies? The current immigrant situation in Germany, in particular with regards to the refugee waves, will have certain impact on demographic development of the population, and in mid-term, in the labor market and employment. It should be of interest for employers to understand the characteristics and trends of this potential workforce pool. For long-term, there might be implications on workforce age effect. Similar perspective should be explored in the women workforce, too. The trend in Germany that government and companies support for women participation in business and job activities becomes very strong. Measures regarding gender diversity have been implemented many companies. Gender related issues can play a stronger role in demography management, for example, gender difference including 50+ women and 50+ men, impact of gender quota on mindset in management and company culture, and gender relevant working models.

Third, what is happening outside of Germany as one of “oldest” countries? Cross-country comparisons on age difference and demographic trends can provide important qualifications of the finding of this research. One can imagine that integrating demography related research results and practices from other aging countries such as Japan and Canada. Furthermore, new aging countries may face new demographic challenges. China, for example, used to be considered as a country with a typical “young” workforce. During the past years, however, China has become an aging country due to its specific situation such as the One Child policy of the past years and speedy economical growth affecting marriage decisions and fertility. Measures of Chinese governments and companies can be a highly interesting research subject for the next years.

Finally, how can the trend of digitalization impact demographic shift? Digital technologies and a potential digital labor force, for example robots can fundamentally change
how companies operate their business activities. It is a challenge already now to analyze
deeper associations between digitalization and demography, such as identification of
skills needed for future jobs or impact of increasingly intelligent machines in the work-
force planning. Further research may keep identifying more insights, new action fields,
and measure ideas to cope with demographic shift. This is the most uncertain change the
current society faces, and therefore, one of the most exciting areas for further research
activities.

The only constant thing is change, fairly true in terms of new academic findings, busi-
ness world, and private life. Both employees and companies cannot avoid change. The
question is simply whether they want to passively follow and react to change, or,
whether they want to sense and proactively address central changes in order to adapt
faster or even benefit from changes. The demographic shift has been described exten-
sively and given no major societal disruptions is certain to happen. Organizations
should use the following next years to prepare for it and take innovative actions. An
organization which in two decades says that it did not anticipate the demographic
change would be a ridiculous one.
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# Appendix A - Aging Indicators and Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Unit</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>For economically active population, $l = 20$, $h = 64$</td>
<td></td>
<td>$n = \sum_{j=l}^{h} Total_of_Persons_j$</td>
</tr>
<tr>
<td>For workforce in companies, $l = 18$, $h = 67$</td>
<td></td>
<td>$n = \sum_{j=l}^{h} Total_of_Persons_j$</td>
</tr>
<tr>
<td>Total number of population (workforce): $n = \sum_{j=l}^{h} Total_of_Persons_j$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central tendency of age</td>
<td></td>
<td><strong>Average</strong>&lt;br&gt;The arithmetic mean age of all people between $l$ to $h$ years</td>
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<tr>
<td></td>
<td></td>
<td>$\phi_{l,h} = \frac{\sum_{j=l}^{h} a \times Total_of_Persons_j}{n}$&lt;br&gt;Equation 1: Metric “Average Age”</td>
</tr>
<tr>
<td>Median</td>
<td></td>
<td><strong>Median</strong>&lt;br&gt;The midpoint of age that separates the younger half from the older half</td>
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<tr>
<td></td>
<td></td>
<td>$a_{Med} = a_{\frac{l+h+1}{2}}$, if $n$ is odd</td>
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<tr>
<td></td>
<td></td>
<td>$a_{Med} = \frac{1}{2}(a_{\frac{l+h}{2}} + a_{\frac{l+h+1}{2}})$, if $n$ is even</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equation 2: Metric “Median Age”</td>
</tr>
<tr>
<td>Share of the 50+</td>
<td>%</td>
<td><strong>Share of the 50+</strong>&lt;br&gt;The percentage of employees aged 50 or older</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$S_{50+} = \frac{\sum_{i=50}^{h} Total_of_Persons_i}{n} \times 100%$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equation 3: Metric “Share of the 50+”</td>
</tr>
<tr>
<td>50+ Quotient</td>
<td>%</td>
<td><strong>50+ Quotient</strong>&lt;br&gt;The ratio of employees aged 50 or older in comparison with 50 or younger</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$Q_{50+} = \frac{\sum_{i=50}^{h} Total_of_Persons_i}{\sum_{j=l}^{h} Total_of_Persons_j} \times 100%$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equation 4: Metric “50+ Quotient”</td>
</tr>
<tr>
<td>Age Groups</td>
<td>%</td>
<td><strong>Age Groups</strong>&lt;br&gt;The percentage of employees of a specific age group</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$G_{(a,b)} = \frac{\sum_{a}^{b} Total_of_Persons_i}{\sum_{j=l}^{h} Total_of_Persons_j} \times 100%$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Equation 5: Metric “Age Group”</td>
</tr>
</tbody>
</table>

Source: Own representation
### Appendix B – DAX30 Companies in Germany

<table>
<thead>
<tr>
<th>Company</th>
<th>Prime standard industry group</th>
<th>Employees Germany (in ‘000)</th>
<th>Employees worldwide (in ‘000)</th>
<th>Revenue Germany (in Bil. €)</th>
<th>Revenue worldwide (in Bil. €)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volkswagen Group AG</td>
<td>Manufacturing</td>
<td>239.9</td>
<td>533.0</td>
<td>38.5</td>
<td>192.7</td>
</tr>
<tr>
<td>Deutsche Post AG</td>
<td>Communications</td>
<td>167.0</td>
<td>428.1</td>
<td>16.7</td>
<td>55.5</td>
</tr>
<tr>
<td>Daimler AG</td>
<td>Manufacturing</td>
<td>165.1</td>
<td>275.1</td>
<td>19.4</td>
<td>114.3</td>
</tr>
<tr>
<td>Deutsche Telekom AG</td>
<td>Communications</td>
<td>119.4</td>
<td>229.7</td>
<td>23.8</td>
<td>58.2</td>
</tr>
<tr>
<td>Siemens</td>
<td>Industrial, electronics</td>
<td>119.2</td>
<td>370.0</td>
<td>11.1</td>
<td>78.3</td>
</tr>
<tr>
<td>BMW AG</td>
<td>Manufacturing</td>
<td>72.1</td>
<td>105.9</td>
<td>12.2</td>
<td>76.8</td>
</tr>
<tr>
<td>Deutsche Lufthansa AG</td>
<td>Transport aviation</td>
<td>67.8</td>
<td>117.0</td>
<td>7.8</td>
<td>30.1</td>
</tr>
<tr>
<td>ThyssenKrupp AG</td>
<td>Industrial, manufacturing</td>
<td>63.8</td>
<td>168.0</td>
<td>14.6</td>
<td>47.0</td>
</tr>
<tr>
<td>BASF SE</td>
<td>Chemicals</td>
<td>52.4</td>
<td>113.3</td>
<td>15.7</td>
<td>78.7</td>
</tr>
<tr>
<td>Continental AG</td>
<td>Manufacturing</td>
<td>49.2</td>
<td>169.6</td>
<td>8.2</td>
<td>32.7</td>
</tr>
<tr>
<td>Deutsche Bank AG</td>
<td>Banking</td>
<td>46.2</td>
<td>98.2</td>
<td>12.1</td>
<td>33.7</td>
</tr>
<tr>
<td>Commerzbank AG</td>
<td>Banking</td>
<td>42.9</td>
<td>53.6</td>
<td>n.a.</td>
<td>18.3</td>
</tr>
<tr>
<td>RWE AG St</td>
<td>Energy</td>
<td>40.0</td>
<td>70.2</td>
<td>27.4</td>
<td>50.8</td>
</tr>
<tr>
<td>Bayer AG</td>
<td>Pharmaceuticals &amp; chemicals</td>
<td>35.8</td>
<td>111.8</td>
<td>4.8</td>
<td>39.8</td>
</tr>
<tr>
<td>E.ON SE</td>
<td>Energy</td>
<td>31.7</td>
<td>72.1</td>
<td>56.8</td>
<td>132.1</td>
</tr>
<tr>
<td>Allianz SE</td>
<td>Insurance</td>
<td>30.0</td>
<td>144.1</td>
<td>27.9</td>
<td>72.1</td>
</tr>
<tr>
<td>Fresenius SE &amp; Co. KGaA</td>
<td>Medical</td>
<td>25.8</td>
<td>86.2</td>
<td>4.2</td>
<td>19.3</td>
</tr>
<tr>
<td>Munich Re AG</td>
<td>Insurance</td>
<td>23.6</td>
<td>45.4</td>
<td>14.6</td>
<td>52.0</td>
</tr>
<tr>
<td>SAP AG</td>
<td>Information technology</td>
<td>16.7</td>
<td>64.4</td>
<td>2.4</td>
<td>16.2</td>
</tr>
<tr>
<td>Merck KGaA</td>
<td>Pharmaceuticals</td>
<td>10.9</td>
<td>38.8</td>
<td>0.9</td>
<td>10.7</td>
</tr>
<tr>
<td>K+S AG*</td>
<td>Chemicals</td>
<td>10.1</td>
<td>14.4</td>
<td>0.6</td>
<td>3.9</td>
</tr>
<tr>
<td>Henkel AG &amp; Co. KGaA Vz</td>
<td>Consumer goods</td>
<td>9.3</td>
<td>46.6</td>
<td>2.3</td>
<td>16.5</td>
</tr>
<tr>
<td>Company</td>
<td>Sector</td>
<td>Revenue (M€)</td>
<td>EBITDA (M€)</td>
<td>EBIT (M€)</td>
<td>ROA (%)</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>--------------------</td>
<td>--------------</td>
<td>-------------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>Infineon Technologies AG</td>
<td>Manufacturing</td>
<td>8.5</td>
<td>26.7</td>
<td>0.9</td>
<td>3.9</td>
</tr>
<tr>
<td>Fresenius Medical Care AG &amp; Co. KGaA St</td>
<td>Medical</td>
<td>8.5</td>
<td>169.3</td>
<td>0.3</td>
<td>11.0</td>
</tr>
<tr>
<td>Lanxess AG*</td>
<td>Chemicals</td>
<td>8.1</td>
<td>17.2</td>
<td>1.5</td>
<td>9.1</td>
</tr>
<tr>
<td>Linde AG</td>
<td>Industrial gases</td>
<td>7.4</td>
<td>62.0</td>
<td>1.4</td>
<td>15.3</td>
</tr>
<tr>
<td>Beiersdorf AG</td>
<td>Consumer goods</td>
<td>5.7</td>
<td>16.6</td>
<td>1.3</td>
<td>6.0</td>
</tr>
<tr>
<td>Adidas AG</td>
<td>Clothing</td>
<td>5.6</td>
<td>46.3</td>
<td>0.7</td>
<td>14.9</td>
</tr>
<tr>
<td>HeidelbergCement AG</td>
<td>Building</td>
<td>4.2</td>
<td>52.0</td>
<td>1.1</td>
<td>14.0</td>
</tr>
<tr>
<td>Deutsche Boerse AG</td>
<td>Securities</td>
<td>1.6</td>
<td>3.7</td>
<td>0.6</td>
<td>2.1</td>
</tr>
</tbody>
</table>

Source: Own representation based on data from EY, 2013; DAX 30 Annual Reports. Sorted by number of employees in Germany. *As of 2016 update, replaced by new DAX30 members Vonovia SE and ProSiebenSat.1 Media AG
## Appendix C – Initiatives regarding 50+ Labor Force in Germany

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Goal and highlight</th>
<th>Host or hosting partners</th>
</tr>
</thead>
</table>
| Experience is Future (www.erfahrung-ist-zukunft.de) | ● Goal: Service and counsel portal about opportunities and perspectives of an aging society  
● Highlight: experience reports and interviews, federal government events | Federal Government |
| Bundesverband 50 Plus (www.bundesverb and-initiative-50plus.de) | ● Goal: national wide representation of the life attitude of 50+ by implementing projects  
● Highlight: representation in every state, open membership for all 50+ people, high profile ambassadors, broad partnership with political bodies and companies, provide award and conference events, sub initiatives with dedicated partner organizations such as “Academia 50+”, “Media 50+”, “Better Life 50+”, “Life Joy 50+”, “Life Spirit 50+”, “Magazine 50+”, “TV | Federal Parliament, Federal Antidiscrimination Office, German Association of Towns and Municipalities |
| Perspective 50+ | ● Goal: Activate employability of older people for labor market  
● Highlight: Specific matching of employers and 50+ job applicants in 63 regions | German Federal Ministry for Labor and Social Affairs |
| DDN – The Demographic Network (demographic-network.com) | ● Goal: Non-profit network of companies for companies  
● Highlight: Service for companies and HR professionals, Demographic Wiki | German Federal Ministry of Education and Research |
| Demographic Chance (www.demografische-chance.de) | ● Goal: Communication and research portal to increase awareness  
● Highlight: International best practices on demographic shift, conferences, demographic campaigns | German Federal Ministry of Education and Research |
| **Demographic Tools**  
(www.demowerkzeuge.de) | • Goal: Encourage transfer projects  
• Highlight: 20 selected in practice proven approaches, methods and tools; public relation and marketing for demographic shift |  
| **Economic Factor Age**  
(www.wirtschaftsfaktor-alter.de) | • Goal: Enhance life quality of older people and strengthen economical growth and employment  
• Highlight: Expertise interview, research paper, sub initiatives and projects | German Federal Ministry of Family, Senior, Women and Youth |  
| **Forum Demographic Shift of the Federal President**  
(www.forum-demografie.de) | • Goal: Increase awareness and support concepts and recommendations for action  
• Highlight: Annual conference, research papers | Federal Government, Bertelsmann Foundation |  
| **IT 50+**  
(www.it-50plus.org) | • Goal: Improve the employability of older people, facilitate resettlement of unemployed IT experts, design competency and develop extended IT training system  
• Highlight: IT training and certification, conferences | Federal Association for Information Technology, Telecommunications and New Media, Industrial Union of Metal |  
| **Senior Expert Service**  
(www.erfahrung-ist-zukunft.de) | • Goal: support companies, organizations and local authorities in solving technical, economic or organizational problems by providing retired expert assignments  
• Highlight: since 1983, SES has carried out over 25,000 assignments in more than 160 different countries, covering more than 50 industry sectors | Foundation of German Industry for International Cooperation |  
| **Demography Portal**  
(www.demografie-portal.de) | • Goal: Enable a bearing consensus to develop the political demographic strategy  
• Highlight: Framework of Information, conversion and action; network of all states and municipalities, research and events | Federal Institute for Population Research |
| Peta 50 Plus (www.peta50plus.de) | • Goal: Information service for senior people and their life design  
• Highlight: Blogs focusing on healthcare, leisure, diet, and travel | Private association headquartered in PETA USA |
|---|---|---|
| Active Retirement (www.aktive-rentner.de) | • Goal: Spread interest of retirees and senior citizens  
• Highlight: magazines and forum | Private initiative |
| States initiatives | • Bavaria: Demography Guideline (demographie-leitfaden-bayern.de)  
• Berlin: Demographic Shift Berlin (www.stadtentwicklung.berlin.de/planen/demografischer_wandel)  
• Brandenburg: Demographic Shift Brandenburg (www.demografie.brandenburg.de)  
• Hessen: Demography in Hessen (stk.hessen.de/initiativen/demografie-hessen)  
• Nordrhein-Westfalen: Demography Active (www.arbeit-demografie.nrw.de) (www.mgepa.nrw.de/alter)  
• SARland: Demographic Shift SARland (www.SARland.de/demographie.htm)  
• Sachsen: Demographic Shift in Sachsen (www.demografie.sachsen.de)  
• Sachsen-Anhalt: Demographic Shift Brandenburg (www.demografie.brandenburg.de)  
• Thüringen: Service Agency Demography | | 

Source: Internet research, NGOs, and German governmental websites
## Appendix D – Working Environment Quality in Germany

<table>
<thead>
<tr>
<th>Indicator of working environment quality</th>
<th>Situation/Trend (If no year is specified, it refers to 2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vacation</strong></td>
<td>- Average number of vacations days taken were around 31 since 2001</td>
</tr>
</tbody>
</table>
| **Working time**                       | - Less hours from 38.4 hours/week (1991) to 35.5; Full time employed persons worked 41.9 h/w and part time 18.1 h/w  
- 13% of the full time employed persons worked 48 h/w; Thereof, the older the persons are, more hours they worked; For example, only 10% of 25-34 year old employed persons worked more than 48 h/w, but 17% of 55-64 year old  
- Working in evening/night has increased from 15% (1992) of all employed persons to 27%, working at weekend from 20% (1992) to 27%; Thereof, almost 50% are entrepreneurs and freelancers  
- 36% of employed persons benefited Flexible Working Time mode |
| **Staff away sick**                    | - Less sick days from 12.7 (1991) per year to 7.9 (2007) |
| **Accident**                           | - 2400 of 100,000 employed persons (2008)  
- Fatal accidents dropped down from 3,7 (1994) per 100,000 employed persons to 1.6 (2008) |
| **Working Relationship**               | - 54% of employees of the former West German states, and 37% of the former East Germany states are covered by Collective Labor and Wage Agreement  
- There were 17.3 stoppage days due to strike in 1993, 8.8 in 2002 and 12.3 in 2006, however 0.5 in 1998, 0.5 in 2005, 0.7 in 2009 and 1.9 in 2011 |
| **Duration of employment**             | - Almost 50% of all employed persons have worked for their current employer for longer than 10 years, 20% for 5-10 years; This trend has not been changed since last 15 years  
- Only 9% of all employed persons have fix-term work contract  
- 2.3% of all employed persons worked at Labor Leasing companies |
| **Insurance** | • 86% of employed persons are of Statutory Health Insurance, 1% no insurance; 9.5% of employees and 46% of entrepreneurs and freelancers are of Private Health Insurance  
• 84.6% have an Unemployment Insurance  
• 77% have a Statutory Pension Insurance; 4% Private Pension Insurance, plus public servants in addition |
| **Work life integration** | • 73% of all parents were employed persons; 91% of all fathers were actively employed persons, while 57% of mothers  
• More children, less employed: 75% of parents with 1 child are employed; only 51% of parents with 3 or more children are employed  
• 93.8% of employed fathers have full time contract; Only 34% of employed mothers worked full time |
| **Gender Equality** | • Share of women at work has increased from 42% (1991) to 46%  
• Women at management was 30%, 0.4% increase per year since 2005  
• Women are more economically active in office and service jobs, for example, 67% of office administration and support jobs are assigned to women  
• Women earned 23% less than men, also with the same qualification |
| **Training** | • 5% of all employed persons had a professional advanced training during last month |
| **Satisfaction and Motivation** | • 88% of all employed persons are satisfied with their current working condition  
• 84% believe their tasks make sense  
• 69% receive support or cooperation from colleagues; 67% found good friendship with colleagues  
• 47% received support from their manager; The younger the person is, the more frequently they receive support. Only 44% of the 45+ year old employees feel the support from their manager  
• 8.9% of employed persons feel discriminated; the most frequently reason was age (5%), sexual attention (2%), nationality (1.5%), gender (1.3%), religion (0.9%), background (0.8), disability (0.6%) |
| **Health hazard** | • 11% of employed persons felt physical and time stress (2007), thereof, 17.6% were university graduates and 16.9 were managers  
• Top complains: 6.1% about difficult posture and carrying heavy stocks; 2.3% noise and vibration, 2.2% dust, smoke, chemicals, steam and gas |

*Source: Own representation based on data from German Federal Statistical Office*
## Appendix E – Distinction of Age Groups and the Developmental Tasks

<table>
<thead>
<tr>
<th>Life Span</th>
<th>Age Range</th>
<th>Distinction outside Workplace</th>
<th>Job-related &amp; Non-job-related Developmental Tasks</th>
<th>Distinction in Workplace</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase I: time of dependency, immature, education and socialization</td>
<td>Birth till 6</td>
<td>Early Childhood and Infancy</td>
<td>Learn physical functions and survival skills, psychological development, build wholesome attitudes toward oneself, acquire science and social knowledge</td>
<td>Educational preparation of basic knowledge and skills for job</td>
</tr>
<tr>
<td></td>
<td>6-13</td>
<td>Middle Childhood</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13-18</td>
<td>Adolescence</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19-29</td>
<td>Early Adulthood</td>
<td>Develop conscience, morality, a set of values and an ethical system as a guide to behavior, start an occupation, prepare for or start family life</td>
<td>Enter the workplace as young professional or Yuppie (Young Urban Professional)</td>
</tr>
<tr>
<td></td>
<td>30-50</td>
<td>Middle Age</td>
<td>Help teenagers to become happy and responsible adults, achieve adult social and civic responsibility, satisfactory career achievement, develop adult leisure time activities, relate to one's spouse as a person, accept the physiological changes of middle age, adjusting to aging parent</td>
<td>Experienced employee</td>
</tr>
<tr>
<td>Phase III: personal interest, post-work and post-parenting</td>
<td>50+</td>
<td>Old</td>
<td>Adjust to decreasing strength and health, death of spouse, establish relations with one's own age group, meet social and civic obligations</td>
<td>Senior employee</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>60-67</td>
<td>Later Maturity or Young-old</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>68-84</td>
<td>Old-old</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phase IV: dependency on others and deficit</td>
<td>85+</td>
<td>Oldest-old</td>
<td>Retirement, reduced income, establish satisfactory living quarters</td>
<td>Retiree</td>
</tr>
<tr>
<td>100+</td>
<td>Centenarians</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>110+</td>
<td>Super-centenarians</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Appendix F – Distinction of Generations in Germany

<table>
<thead>
<tr>
<th>Generation (Germany)</th>
<th>Born Cohort</th>
<th>Historical Experience</th>
<th>Individual Characteristics</th>
<th>Mindset of Workplace and Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Traditionalist</strong></td>
<td>1925 to 1945</td>
<td>Great Depression, the World War II, East-West Germany</td>
<td>Past-oriented, military influenced and disciplined, top-down approach, averse to risk, long-term focus, formal education not standard, traditional family, pay cash, put money away</td>
<td>Loyal, hard work as obligation, can-do attitude, high dedication and sacrifice, respect for rules, honor, duty before pleasure</td>
</tr>
<tr>
<td><strong>Baby Boomer</strong></td>
<td>1946 to 1965</td>
<td>East-West Germany, Cold War, Economic Miracle, TV, Rock and Roll, sexual revolution, space travel, environmental movement</td>
<td>Higher risk orientation and midterm focus, think consequent in advance, education perceived as birthright, nuclear or disintegrating families, buy now, pay later, saving is important in life</td>
<td>Career-minded, high priority on professional success, team orientation, personal gratification, involvement, question authorities, work efficient, desire for quality, sense for environment, grow up with personal interaction, telephone, Postal</td>
</tr>
<tr>
<td>Generation X</td>
<td>1966 to 1980</td>
<td>Berlin Wall, EU expansion, women's liberation, Chernobyl, .com bubble, PC and internet, Terrorism, BRIC (Brazil, Russia, India and China) economy</td>
<td>From families with latchkey kids with early independence, resilience and adaptability, have no shared heroes, carpe diem, higher risk orientation and midterm focus, think consequent, education is a way to achieve own life goals, cautious on (financial) resource</td>
<td>Skepticism, competitive, cynical, fun, informality, self-reliance, innovation, pragmatism, technoliteracy, eliminate the task, work to live, sustainability: strong sense for the environment, taught to question authority, grow up with personal interaction, mobile phone, email</td>
</tr>
<tr>
<td>-------------</td>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Generation Y</td>
<td>1981 to 1994</td>
<td>Social Media, iPhone, consumer economy, Obama and Merkel Effect, Diversity, Financial Risk, globalization, sustainability</td>
<td>Encouraged to make own choices, risk aversion, rather short focus, standard education with a significant expense, merged families, often sheltered childhood, earn money to spend it</td>
<td>Unconventional, realistic, confident, flexible, diversity, social, mobile, multi-tasking, expects to influence the terms and condition, loyalty but faster disengagement and attrition, grow up with social media</td>
</tr>
<tr>
<td>Generation Z</td>
<td>From 1995</td>
<td>Globalization, Digital Native, hyper-connected, eMobility</td>
<td>Highly mobile, life with agility, comparative self-confident, individual, non-cash financial environment, non-stop present in social networks</td>
<td>Virtual meeting as usual, stronger interest-orientate task choice, value knowledge sharing, grow up with social media, virtual environment</td>
</tr>
</tbody>
</table>

*Source: Own representation based on data from Hammill, 2005; Jenkins, 2007; UN-JSPF, 2009; Yu, Miller, 2005; Zemke, Raines, Filipczak 2000; Mackay, 1997; LC, 2007; Trower, 2009*
# Appendix G – Leadership Difference of Baby Boomers and Xers

<table>
<thead>
<tr>
<th>Leadership Aspect</th>
<th>Generation</th>
<th>Leading</th>
<th>Being led</th>
<th>Research</th>
</tr>
</thead>
</table>
| General leadership / following Style | Baby Boomer | • Consensual  
• Collegial  
• Highly competitive  
• Wants to feel control and manage | • Thrives on excellent relationship in team  
• Hierarchical and resistant to change  
• Accepts the chain of command  
• Formality | • Hammill, 2005  
• LC, 2007  
• Sabattini, Warren, Falk, Castro, 2010 |
| | Xer | • Challenges others  
• Leads by asking questions, e.g. why  
• Entrepreneurship | • Questions authority  
• Eschews hierarchy  
• Not always has to ask others for permission  
• Prefers to be led under a relationship-oriented style  
• Reason to follow is not because of expertise, but own perspectives  
• Trusts own decisions more than others  
• Relies on peer group | • Armour, 1997;  
• Hammill, 2005  
• Keaveney, 1997  
• Levin, 2001  
• Nagle, 2001  
• Tulgan, 2000  
• Yankelovich, 2000 |
| Develop vision and tasks | Baby Boomer | • Sense of power | • Clarity of the purpose  
• Expects direction towards organizational goals | • LC, 2007  
• Raths, 1999 |
| | Xer | • Focus on outcome, not necessarily processes | • Appreciates honesty  
• Eliminates the task  
• Self-reliance  
• Wants structure and Direction | • Hammill, 2005  
• LC, 2007  
• Loomis, 2000 |
<table>
<thead>
<tr>
<th><strong>Seek challenges</strong></th>
<th><strong>Enable actions and options</strong></th>
<th><strong>Motivate and influence others</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Baby Boomer</td>
<td>Xer</td>
<td>Baby Boomer</td>
</tr>
<tr>
<td>• Status and individuality are vitally important</td>
<td>• Leads where effective, profitable and responsible</td>
<td>• The spirit of “victory”</td>
</tr>
<tr>
<td>• Believes in champion</td>
<td>• Pride and recognition</td>
<td>• Important to explain the value added to the team</td>
</tr>
<tr>
<td>• LC, 2007</td>
<td>• Abrams, 2011</td>
<td>• “I/we am/are valued”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• “I/we am/are needed”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Step by step promotion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Diligent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Loves to have face time meetings</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• “Call only at work”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Measures hours spent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Values options, decision and the plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Expects a contingency plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Title recognition</td>
</tr>
<tr>
<td></td>
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<td>• Fast</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
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<td>• Measures hours spent</td>
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</table>

**References:**
- Abrams, 2011
- Hammill, 2005
- Shu, 1998
- LC, 2007
- Sabattini, Warren, Falk, Castro, 2010
- Yu, Miller, 2005
- Loomis, 2000
- Loomis, 2000
- Yu, Miller, 2005
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<th></th>
<th>Xer</th>
<th>Baby Boomer</th>
<th>Xer</th>
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<tr>
<td><strong>Experience value</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Xer</strong></td>
<td>• Enjoy your work – <em>carpe diem</em></td>
<td>• Self-motivated and self-sufficient</td>
<td>• Abrams, 2011</td>
</tr>
<tr>
<td></td>
<td>• • Instant gratification</td>
<td>• • Quick promotion</td>
<td>• Hammill, 2005</td>
</tr>
<tr>
<td></td>
<td>• • Financial reward, plus freedom and non-monetary reward</td>
<td>• • Work-life balance</td>
<td>• Yu, Miller, 2005</td>
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<tr>
<td><strong>Baby Boomer</strong></td>
<td>• Loyalty</td>
<td>• Workaholics</td>
<td>• LC, 2007</td>
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<tr>
<td></td>
<td>• Relationship-building skills as critical for success</td>
<td>• Works efficiently</td>
<td>• Loomis, 2000</td>
</tr>
<tr>
<td></td>
<td>• Steady and Rhythmic</td>
<td>• Crusading causes</td>
<td>• Raths, 1999</td>
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<tr>
<td></td>
<td>• Personal fulfillment</td>
<td>• Sense of ego</td>
<td>• Yu, Miller, 2005</td>
</tr>
<tr>
<td></td>
<td>• Win and quality</td>
<td>• Not technology-savvy</td>
<td></td>
</tr>
<tr>
<td><strong>Xer</strong></td>
<td>• Everyone is the same</td>
<td>• Invests loyalty in people, career goals, not companies or the job</td>
<td>• Keaveney, 1997;</td>
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<tr>
<td></td>
<td>• Loyalty must be earned, and continually renewed</td>
<td>• The way of working is from themselves, not predetermined</td>
<td>• Loomis, 2000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Cynicism, pragmatic</td>
<td>• Tulgan, 2000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Admire a close family member than a cultural or political icon</td>
<td>• Yu, Miller, 2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Craves knowledge</td>
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Appendix H – Interview Questionnaire
Case Study Multi-Companies

Since the interview focuses on pure content, the name of your company and you as interviewee will remain anonym in my dissertation.

Questionnaire

About the Interview

<table>
<thead>
<tr>
<th>Interviewee (anonym)</th>
<th>Prefilled</th>
<th>Company, to which the population of this interview refers to (anonym)</th>
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<td>Prefilled</td>
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<tr>
<td>Functional title (anonym)</td>
<td>Prefilled</td>
<td>Date</td>
<td>xx.xx.2014</td>
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</table>

Explanation of scope and definitions
*Please always refer to the Germany organization of your company
*Please always refer to your perception or experience in your company with largest scale your could specifically observe during last years
*Management refers to employees who have significant personnel responsibilities
*HR refers to your Human Resource department(s) which may significantly influence the design of workplace, policies and other HR management approaches

1. Situation and trend

   Pls select with “x”

   a. [__] >10,000
   b. [__] 2,001 – 10,000
   c. [__] 501 – 2,000
   d. [__] ≤500

2. Share of the 50+ employees

   a. [__] >40% of all employees
   b. [__] >1/3 of all employees (and ≤40%)
   c. [__] >20% of all employees (and ≤1/3)
   d. [__] ≤ 20% of all employees

3. Estimation of 10-year-trend on workforce

   a. [__] Strong growth (>50% absolute number of employees based on the current year)
   b. [__] Trend of moderate growth (0-50%)
   c. [__] Almost no growth
   d. [__] Shrinking

4. Estimation of 10-year-trend on the share of the 50+ employees

   a. [__] >50% of all employees in 10 years
   b. [__] >40% of all employees (and ≤50%)
   c. [__] >1/3 of all employees (and ≤40%)
   d. [__] >20% of all employees (and ≤1/3)
   e. [__] ≤ 20% of all employees

5. In which areas do you perceive the impact of demographic changes

   Multi-choices possible, pls select with “x”

   a. [__] Age-related Workforce Composition
shift in Germany to your company?

b. [__] Productivity

c. [__] People Development

d. [__] Company Culture

e. [__] Others, pls specify________________

II. Age difference observed in the workplace

50+ and 50- employees show difference in the areas below. Please evaluate your observations based on your company’s workforce and workplace situation (e.g. mark an “x” next to the respective choice on the left AND right side):

<table>
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<th>Degree of difference</th>
<th>Difference</th>
<th>Benefit direction</th>
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<tr>
<td></td>
<td></td>
<td>For benefit of young employees</td>
</tr>
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<td>0=no difference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1=a bit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2=significant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3=dramatic</td>
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### Life Span and Cohort Effect

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<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Life Phase and their roles</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>b. Generation</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>c. Others, pls specify</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
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</tbody>
</table>

### Difference in Health

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<td>2</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Physical Fitness</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>e. Absenteeism due to Illness</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>f. Mental &amp; Psychological Well-being</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>g. Others, pls specify</td>
<td>++</td>
<td>+</td>
<td>0</td>
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</table>

### Difference in Learning Capabilities

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<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
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<tr>
<td>h. Cognitive Functions (memories, reaction speed etc.)</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>i. Intelligence</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>j. Knowledge Access</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>k. Creativity</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>l. Others, pls specify</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
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</table>

### Difference in Social Implications

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<td>0</td>
<td>1</td>
<td>2</td>
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<tr>
<td>m. Age-specific Personalities</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>n. Communication Style</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>o. Leadership Style</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>p. Team Productivity</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>q. Others, pls specify</td>
<td>++</td>
<td>+</td>
<td>0</td>
<td>+</td>
<td>++</td>
</tr>
</tbody>
</table>
III. Action fields

1. **Strategy**
   a. What is your company’s strategy to cope with demographic shift?
   
   ________________________________________________________________

   b. What was/is the defined vision (or goal) of this strategy?
   
   ________________________________________________________________

2. **Area of measure**
   To deal with challenges of demographic shift and 50+ age differences, measures of following areas are in place (or have been implemented, or already planned):

   Multi-choices possible, pls select with “x”s

   **Age-related Workforce Composition**
   a. [ ] Age-focused workforce planning
   b. [ ] Recruiting measure to ensure sustainable workforce development
   c. [ ] Retirees back to company as experts
   d. [ ] Workforce optimization or functional exchange based on age profiles
   e. [ ] Others, pls specify________________

   **Productivity**
   h. [ ] Motivation of older employees
   i. [ ] Workplace design, e.g. ergonomics
   j. [ ] Age-focused healthcare facility/service
   k. [ ] Age-focused expertise training
   l. [ ] Age-focused team-performance
   m. [ ] Others, pls specify________________

   **People Development**
   n. [ ] Age-related Work Life Balance program
   o. [ ] Age-focused career development training
   p. [ ] Possibility to restart “the (2nd) career”
   q. [ ] Mobility Management to facilitate old employees working in different locations
   r. [ ] Age-related compensation benefit
   s. [ ] Others, pls specify________________

   **Company Culture**
   t. [ ] Inter-generational exchange/collaboration
   u. [ ] Age-related corporate responsibility program
   v. [ ] Age-group-focused communication and event
   w. [ ] Age-group-focused networks
   x. [ ] Age-focused branding and marketing
   y. [ ] Others, pls specify________________

   ________________________________________________________________

3. **Best Practice Measures**
   Based on your selected measures, can you more specifically introduce two measures, which you perceive/believe as the most effective?
a. Most effective measure 1:
   i. What was/is the goal?
      _________________________________________________________________
      ...
   ii. How did/do you implement such measure?
      ______________________________________________________________
      ... 
   iii. What was/is the outcome or impact?
      _________________________________________________________________
      ...

b. Most effective measure 2:
   i. What was/is the goal?
      _________________________________________________________________
      ...
   ii. How did/do you implement such measure?
      ______________________________________________________________
      ... 
   iii. What was/is the outcome or impact?
      _________________________________________________________________
      ...

Ideally, please briefly talk about the key aspects / fill the yellow answer text field, and share the respective documents to guangya.su@uni-ulm.de. Since the interview focuses on pure content and knowledge, the name of your company and interview partner will remain anonym in my dissertation. And all information will be only used in the PhD research context.

I very much appreciate your time and support on this interview! Thank you!

Source: Own representation based on the case study Multi-Companies
# Appendix I – Key Demographic Situation of the Case Study Multi-Companies

## I.1 Perceived Age Differences in the Workplace - Comparison by Industries

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*Source: Own representation based on the case study Multi-Companies*
### I.2 Perceived Age Differences in the Workplace - Comparison by Workforce Size

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<tr>
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<td>Difference</td>
<td>Benefit for 50-</td>
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<td>σ²</td>
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*Source: Own representation based on the case study Multi-Companies*
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Source: Own representation based on the case study Multi-Companies
### I.4 Perceived Age Differences in the Workplace – Comparison by Share of the 50+ Employees

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Source: Own representation based on the case study Multi-Companies
I.5 Vision Statements

1. To ensure sustainable workforce capability and balanced exits due to age, we (the case study company) aim to
   - reduce the risks of the age structure in our existing locations in the period of old age staff turnover. At new locations we recruit people with a more balanced age structure,
   - obtain performance of the company's workforce despite aging, by ergonomics management, health management, and training,
   - increase productivity and inclusiveness of teams through training of managers in dealing with various age groups of employees, and
   - receive loyalty, motivation, and employer attractiveness in all age groups of employees through flexible work structures and new work environments.

2. Maintain the long-term capability, productivity, and performance of employees by improving healthcare and prevention, work organization and design, personnel policy, training and qualification, leadership and collaboration, and employee self-motivation.

3. Establish prerequisites for sustainable development of the company with focus on leadership and employee awareness and ergonomic measures while minimizing the risks of productivity, increase motivation, positive experience sharing, collaboration, and attractiveness as an employer.

4. We value a strategic guardrail of life-phase orientation. We do not align our HR products and services along age groups, but along non-chronological life-phase of our employees. We want a capable and employable workforce independent of age and gender.

5. Support business strategy by encourage dialog between different generations; by networks activities, and tandem programs.

6. Facilitate employees' environmental interests and life phase in order to keep productivity by enabling collaboration of all generations.

7. To maintain long-term employability of workforce, we implement the Center of Expertise in order to develop demography related concepts and programs, enhancement of health management, and focus on flexible workplace models and work-life offerings.

8. To maintain high motivation, healthy workplace, and attractive employer
9. We drive generation management based on HR Development.

10. Leverage talent development, recruitment, and mentoring to provide an inspiring diverse team.

11. Position the company as a top employer for top talents worldwide by pursuing strategic workforce planning, recruiting of (vocational) trainees, and strengthening the employer attractiveness to win the race for talents.

12. To maintain fitness, secession plan, and knowledge transfer we regularly review organization, financial, and people situation in order to enable demographic goals.

13. To maintain a healthy and productive workplace, we address numerous areas of demographic topics.

14. To keep employees and the company competitive, we value performance and cultural change from the management and employee awareness perspective.

15. To prepare the retiree wave in 10 years while maintaining performance of current workforce, we address 2 focus areas which are working time reduction program and apprentice hiring.

16. In terms of globalization and future internationalization of the company, we want to keep our growth pace while recruiting new talents. Therefore, we invest in further education programs for all kinds of positions within the company. Recruiting is more focused on social media.

17. To be attractive employer, we drive diversity integrity and work-life balance.

18. To ensure sustainable company with flexible workplace, we leverage talent pipeline of three generations and the fit of old age group, physical and mental health, and learning.

19. To maintain an innovative workforce, we regularly review facts and figures to steer training, productivity, and culture measures

20. To be a top employer, increase employee satisfaction and share of women, our strategy 2020 focuses on 3 areas: economy, ecology, and HR

Source: Own representation based on the case study Multi-Companies
Appendix J – Data Structure of Age Table and Regression Data Table

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Source: Own representation
Appendix K – Management Interview on Demographic Shift

1. Which are the top 3 most important topics regarding workforce within your organization?

2. In the time of demographic shift, which of the following topic(s) seems to affect strongest your business? What are the major challenges in terms of demographic shift?

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3. What is the approach of your organization to meet these challenges? Have any initiatives been taken? (Programs, measures, networks? Contacts of key leaders?)

4. Would you be interested to join/support Siemens Generation Think Tank community? Or nominate someone of your team instead of yourself?

5. What kind of actions would you see from this community?

Source: Own representation based on data of the Case Study Siemens
Appendix L – Workforce Survey with Age Group Breakdowns

Engagement

- **Skills**: I fully apply my skills and abilities in my work
- **Loyalty**: It would take a lot for me to look for another employer.
- **Career Development**: I believe I have the opportunity for personal development and growth in Siemens

Collaboration:

- There is good cooperation between work groups
- There is good cooperation between departments
- There is good cooperation between business units

Leadership

- I have a clear understanding of the goals and objectives of Siemens as a whole
- I have a clear understanding of the goals and objectives of my organizational unit
- The management style in Siemens encourages employees to give their best
- The management style in my organizational unit encourages employees to give their best

Source: Own representation based on data of the Case Study Siemens
## Appendix M – Population 2009-2030 in Germany

### M.1 Population data 2009 – 2016 by age 18 - 67

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Source: Census database, Retrieval No. 12411-0005, Destatis, German Federal Statistical Office, 2017

Source: German Federal Statistical Office, 2030 projection variant 2-A, at https://www.destatis.de,
access on November 30th, 2016
Appendix N – Selected Portfolio Change of the Case Study Company

Acquisitions

<table>
<thead>
<tr>
<th>Initial consolidation</th>
<th>Country</th>
<th>Company</th>
<th>Employee Size</th>
<th>Revenue per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q4 2011</td>
<td>Germany</td>
<td>SIS DE</td>
<td>28000</td>
<td>€ 850 m</td>
</tr>
<tr>
<td>Q2/2011</td>
<td>Germany</td>
<td>Areva NP France</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Q1/2011</td>
<td>Germany</td>
<td>GIG GmbH</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
<tr>
<td>Q2/2010</td>
<td>Germany</td>
<td>Draeger Medical AG</td>
<td>n.a.</td>
<td>€ 250 m</td>
</tr>
<tr>
<td>Q4/2009</td>
<td>Germany</td>
<td>Fujitsu Siemens</td>
<td>n.a.</td>
<td>€ 6.6 b</td>
</tr>
<tr>
<td>Q4/2008</td>
<td>Germany</td>
<td>Siemens Enterprise Comm.</td>
<td>17600</td>
<td>€ 3.2 b</td>
</tr>
<tr>
<td>Q4/2008</td>
<td>Germany</td>
<td>Siemens Home &amp; Office Communication Devices GmbH &amp; Co KG</td>
<td>2100</td>
<td>€ 792 m</td>
</tr>
<tr>
<td>Q3/2008</td>
<td>Germany</td>
<td>Wireless Modules</td>
<td>450</td>
<td>€ 250 m</td>
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<tr>
<td>Q1/2008</td>
<td>Germany</td>
<td>Siemens VDO Automotive AG</td>
<td>53000</td>
<td>€11.4 b</td>
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<tr>
<td>Q4/2006</td>
<td>Germany</td>
<td>Dematic</td>
<td>4000</td>
<td>€ 800 m</td>
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<tr>
<td>Q3/2006</td>
<td>Germany</td>
<td>Product Related IT-Service</td>
<td>5000</td>
<td>n.a.</td>
</tr>
<tr>
<td>Q1/2006</td>
<td>Germany</td>
<td>Mobile telephones</td>
<td>6000</td>
<td>n.a.</td>
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</table>

Source: CWS, 2014
## Divestures

<table>
<thead>
<tr>
<th>Initial consolidation</th>
<th>Country</th>
<th>Company</th>
<th>Employee Size</th>
<th>Revenue per year</th>
</tr>
</thead>
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<tr>
<td>Q3/2005</td>
<td>Germany</td>
<td>Sinitec</td>
<td>11000</td>
<td>n.a.</td>
</tr>
<tr>
<td>Q3/2011</td>
<td>Germany</td>
<td>Siteco Lighting GmbH</td>
<td>1250</td>
<td>€ 220 m</td>
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<tr>
<td>Q1 2010</td>
<td>Israel</td>
<td>Solel Solar Systems</td>
<td>500</td>
<td>n.a.</td>
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<tr>
<td>Q3 2008</td>
<td>ES</td>
<td>BJC</td>
<td>380</td>
<td>€ 54 m</td>
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<tr>
<td>Q3/2008</td>
<td>USA</td>
<td>Morgan Construction Company</td>
<td>1100</td>
<td>230 m</td>
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<tr>
<td>Q1/2008</td>
<td>USA</td>
<td>Dade Behring</td>
<td>6300</td>
<td>US$1.7 b</td>
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<td>Q3/2007</td>
<td>USA</td>
<td>UGS Corp.</td>
<td>7400</td>
<td>US$1.15 b</td>
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<tr>
<td>Q1/2007</td>
<td>DE</td>
<td>Stock Siemens G Kuhnle, Kopp &amp; Kausch</td>
<td>1400</td>
<td>€ 270 m</td>
</tr>
<tr>
<td>Q2/2007</td>
<td>DE</td>
<td>Diagnostics (Healthcare)</td>
<td>5400</td>
<td>€ 1.43 b</td>
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<tr>
<td>Q4/2006</td>
<td>USA</td>
<td>Diagnostic Products Corporation</td>
<td>2500</td>
<td>US$ 481 m</td>
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<tr>
<td>Q2/2006</td>
<td>RU</td>
<td>Power Machines</td>
<td>13000</td>
<td>US$662 m</td>
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<td>Q2/2006</td>
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<td>Electrium</td>
<td>700</td>
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<td>Q1/2006</td>
<td>USA</td>
<td>Wheelabrator Air Pollution Control Inc.</td>
<td>150</td>
<td>US$ 175 m</td>
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<td>Q4/2005</td>
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<td>Q4/2005</td>
<td>USA</td>
<td>Robicon Corp</td>
<td>470</td>
<td>US$ 117 m</td>
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<td>Q4/2005</td>
<td>DE</td>
<td>Flender Holding GmbH</td>
<td>6700</td>
<td>€ 1.012 b</td>
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<tr>
<td>Q3/2005</td>
<td>USA</td>
<td>CTI Molecular Imaging</td>
<td>1000</td>
<td>US$ 402 m</td>
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<tr>
<td>Q1/2005</td>
<td>Denmark</td>
<td>Bonus Energy A/S</td>
<td>750</td>
<td>€ 300 m</td>
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<td>Q4/2004</td>
<td>USA</td>
<td>US Filter Corp.</td>
<td>5800</td>
<td>US$ 1.2 b</td>
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<td>Q4/2004</td>
<td>NL&amp;USA</td>
<td>US Trench Elec Holding B.V., Netherlands</td>
<td>1800</td>
<td>€ 250 m</td>
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<tr>
<td>Q3/2004</td>
<td>USA</td>
<td>Chrysler Elektronikwerk</td>
<td>2000</td>
<td>US$ 1 b</td>
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*Source: CWS, 2014*
## Appendix O – Total FTE and Revenue of the Case Study Company

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<th>Year</th>
<th>Revenue (Million Euros)</th>
<th>Employee Size (FTE)</th>
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<td>FY01</td>
<td>19144</td>
<td>174300</td>
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<tr>
<td>FY02</td>
<td>18102</td>
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<td>FY03</td>
<td>17100</td>
<td>170000</td>
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*Source: SAGAR, 2001-2013*
Appendix P – Workforce Factors: Regression and Distribution

P.1 Employee Size

Econometric modeling

\[ ES = \alpha Rev + \beta + \varepsilon \]

where,

\( ES \) = Employee Size by total number of employees in FTE,
\( Rev \) = annual revenue in million Euros.

Equation 6: Regression Sub-Model on “Employee Size”

<table>
<thead>
<tr>
<th>Regression result</th>
<th>Selected regression statistics</th>
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<tbody>
<tr>
<td>( ES = 33786 + 7,748 Rev )</td>
<td>( \text{Obs} = 12, R^2 = 96.4%, DF.\text{Reg} = 1, DF.\text{Res} = 10 )</td>
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<tr>
<td>( \text{F} = 267.98, \text{Significance F} = 0.00000151% )</td>
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Regression Statistics

<table>
<thead>
<tr>
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<th>Value</th>
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<td>Multiple R</td>
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<tr>
<td>R Square</td>
<td>96,40%</td>
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<tr>
<td>Adjusted R Square</td>
<td>96,04%</td>
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ANOVA

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<th>MS</th>
<th>F</th>
<th>Significance F</th>
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<td>6569406764</td>
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Coefficients

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291
P.2 External Personnel Sourcing

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<th>Econometric modeling</th>
<th>Distribution(s) applied</th>
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<tr>
<td>$EPS = \alpha_1 Rev + \alpha_2 Age + \alpha_3 \text{Gamma}(Age) + \alpha_4 Age^2 + \alpha_5 Pop + \beta + \varepsilon$</td>
<td>$F.dis = \text{Gamma}(Age) + Age^2$</td>
</tr>
</tbody>
</table>

where

$EPS$ is the External Personnel Sourcing in FTE,
$Rev$ is the revenue in million Euros,
$Age$ is the specific age (group),
$Pop$ is the predicted population in Germany in number of people.

**Equation 7: Regression Sub-Model on “External Personnel Sourcing”**

<table>
<thead>
<tr>
<th>Regression result</th>
<th>Selected regression statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>$EPS = 0.015Rev + 15.1Age + 6160\text{Gamma}(Age) - 0.164Age^2 + 0.00006Pop - 509.59$</td>
<td>$Obs = 200 \quad R^2 = 83.93%$</td>
</tr>
<tr>
<td></td>
<td>$DF. Reg = 5, DF. Res = 194$</td>
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<tr>
<td></td>
<td>$F = 202.69$</td>
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<tr>
<td></td>
<td>$Significance F = 5.35E-75$</td>
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</table>

**Regression Statistics**

| Multiple R | 0.916149 |
| R Square | 0.83932899 |
| Adjusted R Square | 0.83518798 |
| Standard Error | 52,8416548 |
| Observations | 200 |

**ANOVA**

<table>
<thead>
<tr>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>$F$</th>
<th>Significance F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
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### Coefficients

<table>
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<tr>
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<th>Coefficients</th>
<th>Standard Error</th>
<th>tStat</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
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<td>-509,585801</td>
<td>98,5042907</td>
<td>-5,17323455</td>
<td>5,7137E-07</td>
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<tr>
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### P.3 Internal Personnel Sourcing

**Econometric modeling**

\[ IPS = \alpha_1 Rev + \alpha_2 ES.of.PY + \alpha_3 Age + \alpha_4 \text{Poisson}(Age) + \beta + \epsilon \]

where

- \( IPS \) is the External Personnel Sourcing in FTE,
- \( Rev \) is the revenue in million Euros,
- \( ES.of.PY \) is the employee size of previous year in FTE,
- \( Age \) is the specific age (group).

**Equation 8: Regression Sub-Model on “Internal Personnel Sourcing”**

\[ IPS = -0.0134 Rev + 0.0016 ES.of.PY + 0.007 Age + 2341 \text{Poisson}(Age) + 150.99 \]

**Distribution(s) applied**

\( F.dis = \text{Poisson}(Age) \)

\( P.mean = 35.5 \)

**Regression result**

- \( Obs = 200 \)
- \( R^2 = 89.97\% \)
- \( DF.Reg = 4, DF.Res = 195 \)
- \( F = 437.14 \)
- \( Significance F = 3.87E-96 \)
**Regression Statistics**

- Multiple R: 0.94850876
- R Square: 0.89966887
- Adjusted R Square: 0.8976108
- Standard Error: 18.946681
- Observations: 200

**ANOVA**

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<th>MS</th>
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<th>Significance F</th>
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**Coefficients**

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<td>X Variable 1</td>
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<td>X Variable 4</td>
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<td>67.9388929</td>
<td>34.4636013</td>
<td>7.0015E-85</td>
<td>2207.42956</td>
</tr>
</tbody>
</table>

**P.4 Voluntary Leave**

**Econometric modeling**

\[
VL = \alpha_1 \text{Rev} + \alpha_2 \text{ES.of.PY} + \alpha_3 \text{Age} \\
+ \alpha \text{Beta(Age)} + \beta + \varepsilon
\]

where

- \(VL\) is the Voluntary Leave in FTE,
- \(Rev\) is the revenue in million Euros,
- \(ES.of.PY\) is the employee size of previous year in FTE,
- \(Age\) is the specific age (group).

**Distribution(s) applied**

\[
F: \text{dis} = \text{Beta(Age)} \\
B \alpha = 1.8, B\beta = 4
\]
### Regression result

\[ VL = -0.0088\text{Rev} + 0.0148\text{ES.of.PY} - 6.89\text{Age} + 783\text{Beta(Age)} + 203.89 \]

### Selected regression statistics

- \( \text{Obs} = 200 \)
- \( R^2 = 87.08\% \)
- \( DF.\text{Reg} = 4, DF.\text{Res} = 195 \)
- \( F = 328.45 \)
- \( \text{Significance } F = 1.98E-85 \)

### Regression Statistics

<p>| | |</p>
<table>
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<tr>
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<tr>
<td>Multiple R</td>
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<tr>
<td>R Square</td>
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<td>Adjusted R Square</td>
<td>0.86810763</td>
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<td>Standard Error</td>
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<tr>
<td>Observations</td>
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### ANOVA

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### Coefficients

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<th>P-value</th>
<th>Lower 95%</th>
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<tr>
<td>Intercept</td>
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<td>0.3007917</td>
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<td>0.58132747</td>
<td>-0.0030646</td>
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<td>0.02260003</td>
<td>0.07360011</td>
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<td>1163.07486</td>
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P.5 External Personnel Desourcing

<table>
<thead>
<tr>
<th>Econometric modeling</th>
<th>Distribution(s) applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>$EPD = \alpha_1Rev + \alpha_2ES.of.PY + \alpha_3Age + \alpha_4Age^2 + \alpha_5\text{Beta}(Age) + \beta + \varepsilon$</td>
<td>$F.dis = \text{Beta}(Age) + Age^2$</td>
</tr>
</tbody>
</table>

where

- $EPD$ is the External Personnel Desourcing in FTE,
- $Rev$ is the revenue in million Euros,
- $ES.of.PY$ is the employee size of previous year in FTE,
- $Age$ is the specific age (group).

**Equation 10: Regression Sub-Model on “External Personnel Desourcing”**

<table>
<thead>
<tr>
<th>Regression result</th>
<th>Selected regression statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>$EPD = -0.0088Rev + 0.0148ES.of.PY - 6.89Age + 0.079Age^2 + 783\text{Beta}(Age) + 203.89$</td>
<td>$Obs = 200$</td>
</tr>
<tr>
<td></td>
<td>$R^2 = 53.79%$</td>
</tr>
<tr>
<td></td>
<td>$DF.Reg = 5, DF.Res = 194$</td>
</tr>
<tr>
<td></td>
<td>$F = 45.16$</td>
</tr>
<tr>
<td></td>
<td>$Significance F = 8.87E-31$</td>
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</table>

**Regression Statistics**

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<tr>
<td>Multiple R</td>
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**ANOVA**

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<th>MS</th>
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<th>Significance F</th>
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<td>Residual</td>
<td>194</td>
<td>55754,0753</td>
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<tr>
<td>Coefficients</td>
<td>Standard Error</td>
<td>t Stat</td>
<td>P-value</td>
<td>Lower 95%</td>
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<tr>
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<td>---------</td>
<td>-----------</td>
<td></td>
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<tr>
<td>Intercept</td>
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P.6 Internal Personnel Desourcing

**Econometric modeling**

\[
IPD = \alpha_1 Rev + \alpha_2 ES.of.PY + \alpha_3 Age \\
+ \alpha_4 \text{Gamma1}(Age) + \alpha_5 \text{Gamma2}(Age) + \beta + \varepsilon
\]

where

*IPD* is the Internal Personnel Desourcing in FTE,

*Rev* is the revenue in million Euros,

*ES.of.PY* is the employee size of previous year in FTE,

*Age* is the specific age (group).

**Distribution(s) applied**

\[
F.dis = \text{Gamma1}(Age) + \text{Gamma2}(Age)
\]

\[
G.\alpha_1 = 17.5, G.\beta_1 = 2,
G.\alpha_2 = 145, G.\beta_2 = 0.4
\]

Equation 11: Regression Sub-Model on “Internal Personnel Desourcing”

**Regression result**

\[
IPD = -0.0365 Rev - 0.0096 ES.of.PY - 0.1584 Age \\
+ 3766 \text{Gamma1}(Age) + 1713 \text{Gamma2}(Age) + 386.6
\]

| Multiple R | 0.58642849 |
| R Square   | 0.34389837 |
| Adjusted R Square | 0.32698854 |
| Standard Error | 68,0831639 |
| Observations | 200 |

Regression Statistics

\[
Obs = 200
R^2 = 34.39%
DF.Reg = 5; DF.Res = 194
F = 20.34
Significance F = 2.68E-16
\]
### ANOVA

<table>
<thead>
<tr>
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<th>F</th>
<th>Significance F</th>
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<td>20,3371799</td>
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<td>Residual</td>
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### Coefficients

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<th>Lower 95%</th>
</tr>
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<tbody>
<tr>
<td>Intercept</td>
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<td>6,10233147</td>
<td>5,573E-09</td>
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### P.7 Retirement

#### Econometric modeling

\[ RET = \alpha ES.of.PY + \alpha_2 Year + \alpha_3 Age + \alpha_4 Beta(Age) + \beta + \epsilon \]

Where

- \( RET \) is the number of retirees in FTE,
- \( Year \) is the fiscal year,
- \( ES.of.PY \) is the employee size of previous year in FTE,
- \( Age \) is the specific age (group).

\[ F.dis = Beta(Age) \]

\( B.\alpha = 40, B.\beta = 4 \)

#### Equation 12: Regression Sub-Model on “Retirement”

\[ RET = -0.0014ES.of.PY - 6.37 Year + 0.13 Age + 670 Beta(Age) + 12816.39 \]

\( Obs = 200 \)

\( R^2 = 26.21\% \)

\( DF.Reg = 3, DF.Res = 196 \)

\( F = 23.2 \)

\[ Significance F = 6.75E-13 \]
**Regression Statistics**

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<th>Value</th>
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<td>R Square</td>
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<td>Adjusted R Square</td>
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<td>Standard Error</td>
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**ANOVA**

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<th>Significance F</th>
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<td>559080,811</td>
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**Coefficients**

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<th>t Stat</th>
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<th>Lower 95%</th>
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<td>Intercept</td>
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**P.8 Termination of Short-Term Employment**

**Econometric modeling**

\[ TSTE = \alpha_1 Rev + \alpha_2 ES.of.PY + \alpha_3 Age + \alpha_4 Beta(Age) + \beta + \varepsilon \]

**Distribution(s) applied**

\[ F.dis = Beta(Age) \]

\[ B.\alpha = 1.4, B.\beta = 4.5 \]

where

- \( TSTE \) is the terminated short-term employees in FTE,
- \( Rev \) is the revenue in million Euros,
- \( ES.of.PY \) is the employee size of previous year in FTE,
- \( Age \) is the specific age (group).

**Equation 13: Regression Sub-Model on “Termination of Short-Term Employment”**
<table>
<thead>
<tr>
<th>Regression result</th>
<th>Selected regression statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>( EPD = 0.0039 \text{Rev} + 0.002 \text{ES.of.PY} + 1.0192 \text{Age} + 1815 \text{Beta(Age)} - 104.97 )</td>
<td>( \text{Obs} = 200 )</td>
</tr>
<tr>
<td></td>
<td>( R^2 = 63.93% )</td>
</tr>
<tr>
<td></td>
<td>( \text{DF.Reg} = 4, \text{DF.Res} = 195 )</td>
</tr>
<tr>
<td></td>
<td>( F = 86.41 )</td>
</tr>
<tr>
<td></td>
<td>( \text{Significance F} = 4.18\text{E-42} )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regression Statistics</th>
</tr>
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<tbody>
<tr>
<td>Multiple R</td>
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<tr>
<td>R Square</td>
</tr>
<tr>
<td>Adjusted R Square</td>
</tr>
<tr>
<td>Standard Error</td>
</tr>
<tr>
<td>Observations</td>
</tr>
</tbody>
</table>

### ANOVA

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<th>MS</th>
<th>F</th>
<th>Significance F</th>
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<tr>
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<td>86695,6662</td>
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<tbody>
<tr>
<td>Intercept</td>
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<td>0.00058415</td>
<td>-164,189589</td>
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<tr>
<td>X Variable 1</td>
<td>0,00389412</td>
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<td>0.10337978</td>
<td>-0.00079926</td>
</tr>
<tr>
<td>X Variable 2</td>
<td>0,00202213</td>
<td>2.2953083</td>
<td>0.02277948</td>
<td>0.00028465</td>
</tr>
<tr>
<td>X Variable 3</td>
<td>1,01923075</td>
<td>3.99757483</td>
<td>9.073E-05</td>
<td>0.51639314</td>
</tr>
<tr>
<td>X Variable 4</td>
<td>1815,02238</td>
<td>9.23423246</td>
<td>4.4601E-17</td>
<td>1427,37842</td>
</tr>
</tbody>
</table>

*Source: Own representation based on the case study Siemens*
Appendix Q – Architecture and Algorithms of WDFSim

Q.1 The Simulation Tool – WDFSim (screen shot)

Q.2 WDFSim System Architecture
### Q.3 Four Steps Calculation Approach in the WDFSim Tool

1. **Estimate workforce size required**
2. **Estimate change of each Workforce Factor**
3. **Aggregate workforce (workforce of last year + change size)**
4. **Adjust new workforce size to size of required**

### Q.4 Aggregation Equation of the Employee Size

\[ ES(a,y) = ES(a-1,y-1) + IPS(a,y) + EPS(a,y) + IPD(a,y) + EPD(a,y) + VL(a,y) + RET(a,y) + ESTE(a,y) \]

where, 
- \( ES \) = Employee Size by total number of employees in FTE,
- \( IPS \) is the Internal Personnel Sourcing within one year in FTE,
- \( EPS \) is the External Personnel Sourcing within one year in FTE,
- \( IPD \) is the Internal Personnel Desourcing within one year in FTE,
- \( EPD \) is the External Personnel Desourcing within one year in FTE,
- \( VL \) is the Voluntary Leave within one year in FTE,
- \( RET \) is the retirees within one year in FTE,
- \( a \) is the age index \( C (18, 67) \), and \( y \) is the year index \( C (2013, 2040) \).

Equation 14: Aggregation Equation of Employee Size

### Q.5 Algorithm of Workforce Factor Calculation – Example of EPS

\[
\begin{align*}
\text{IF} & \quad 0.015Revy + 15.1Agea + 6160\Gamma(Agea) - 0.164Agea^2 \\
& \quad + 0.00006Pop(a,y) - 509.59 < 0 \quad // \text{pre-validation of extreme case} \\
\text{THEN} & \quad EPS(a,y) = 0 \quad // \text{no recruiting} \\
\text{ELSE} & \quad EPS(a,y) = 0.015Revy + 15.1Agea + 6160\Gamma(Agea) - 0.164Agea^2 \\
& \quad + 0.00006Pop(a,y) - 509.59 \quad \text{END} \quad // \text{where age index a C (18, 67), year index y C (2013, 2040)}
\end{align*}
\]
Q.6 Algorithm of Workforce Factor Calculation – Example of RET

\[
\text{IF } \frac{\text{Sum of RET}_{y-1}}{\text{Sum of ES}_{y-1}} < 0.5\% \quad \text{// pre-test if retiree ratio to 50+ employee pool of last year is already smaller than the lower border 0.5%}
\]

\[
\text{THEN } \text{RET}_{(a,y)} = \text{RER}_{(a,y-1)} \times \frac{\text{Sum of ES}_{y-1} \text{Required}}{\text{Sum of ES}_{y-1} \text{Required}}
\]

\[
\text{ELSE IF } -0.0014\text{ES}_{(a,y-1)} - 6.37\text{Year}_y + 0.13\text{Age}_a + 670\text{Beta(Age}_a) + 12816.39 < 0 \quad \text{// pre-validation of extreme case}
\]

\[
\text{THEN } \text{EPS}_{(a,y)} = 0 \quad \text{// no retirees}
\]

\[
\text{ELSE } \text{RET}_{(a,y)} = -0.0014\text{ES}_{(a,y-1)} - 6.37\text{Year}_y + 0.13\text{Age}_a + 670\text{Beta(Age}_a) + 12816.39
\]

\[
\text{END} \quad \text{// where age index } a \in (18, 67), \text{ year index } y \in (2013, 2040)
\]

Q.7 The Algorithm of the Scenario Variable – Example of EPD

\[
\text{FOR } (a=18; a<=67; a++) \quad \text{// Calculation without consideration of scenarios}
\]

\[
\text{EPD}'_{(a,y)} = -0.0088\text{Rev}_y + 0.0148\text{ES}_{(a,y-1)} - 6.89\text{Age}_a + 0.079\text{Age}_a^2 + 783\text{Beta(Age}_a) + 203.89
\]

\[
\text{END} \quad \text{// where age index } a \in (18, 67), \text{ year index } y \in (2013, 2040)
\]

\[
\text{// Differentiation of scenarios based on HR policy}
\]

\[
\text{IF } \text{HR Policy} = 1 \quad \text{// Double 50+ group}
\]

\[
\text{THEN } \text{EPD}_{(i,y)} = \text{EPD}'_{(i,y)} \times 2
\]

\[
\text{EPD}_{(j,y)} = \left(1 - \sum_{a=51}^{67} \text{EPD}'_{(a,y)} / \sum_{a=18}^{50} \text{EPD}'_{(a,y)}\right)
\]

\[
\text{ELSE IF } \text{EPD}_{(i,y)} = \text{EPD}'_{(i,y)} / 2
\]

\[
\text{EPD}_{(j,y)} = \left(1 + \sum_{a=51}^{67} \text{EPD}'_{(a,y)} / \sum_{a=18}^{50} \text{EPD}'_{(a,y)} \times 2\right)
\]

\[
\text{ELSE } \text{EPD}_{(a,y)} = \text{EPD}'_{(a,y)}
\]

\[
\text{END} \quad \text{// where age index } i \in (51, 67), j \in (18, 50)
\]

Source: Own representation based on the case study Siemens