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## ***TESIS DOCTORAL***

# ***Demographic change – Towards a framework to manage IT-personnel in times of scarcity of talent***

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**DEPARTAMENTO DE INFORMÁTICA**

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## TESIS DOCTORAL

# DEMOGRAPHIC CHANGE – TOWARDS A FRAMEWORK TO MAN- AGE IT-PERSONNEL IN TIMES OF SCARCITY OF TALENT

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Olaf Radant

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*Für meinen Opa Egon, danke für alles*

## Resumen

En un entorno en el que el crecimiento demográfico negativo es una realidad en la mayoría de los estados europeos, las organizaciones deben enfrentar necesidades incrementos de la productividad laboral y una menor disponibilidad de empleados competentes. Uno de los sectores en que la situación expuesta es más evidente es el de las Tecnologías de la Información.

Las tecnologías de la información son cruciales para casi cualquier organización en cualquier sector y para cualquier persona. En un entorno socioeconómico en continuo cambio las organizaciones y sus departamentos de tecnologías de la información deben asumir los cambios en el mercado y ser capaces de desenvolverse de una forma ágil y con una orientación al cliente sin precedentes. Para las organizaciones, y en particular para sus elementos organizacionales más relacionados con las tecnologías de la información, la productividad de los empleados es un componente clave. De esta forma, la gestión de los recursos humanos, abarcando aspectos como su selección, desarrollo y retención es un aspecto clave para las organizaciones. El reto para las organizaciones es lograr la mejora en el ámbito de los procesos corporativos incluyendo como una parte importante de los mismos la gestión de los recursos humanos. La simbiosis de disciplinas como las tecnologías de la información, la economía, la psicología y la gestión puede lograr el incremento de la lealtad de los empleados. Para los profesionales modernos, los cambios de empleador se consideran dentro de la normalidad hasta encontrar un entorno adecuado que colme sus expectativas y necesidades. Dichas expectativas no se encuentran basadas únicamente en incentivos económicos, por lo que las organizaciones deben anticipar las expectativas y alinear sus estrategias a las expectativas de su fuerza laboral.

La temática de este trabajo ha tenido repercusión en la literatura científica, sin embargo, no existe un estudio que identifique los factores que se presentan y determinan la retención de los trabajadores de las tecnologías de la información en los entornos organizacionales. Este es el objetivo de la presente tesis doctoral.

Para ello, el primer paso que se pretende dar es concretar los aspectos organizacionales que son relevantes para el estudio del fenómeno. A partir de esta identificación, el autor diseña un marco en el que las partes identificadas se encuentran conectadas. El citado marco de trabajo presenta cinco niveles. Estos cinco niveles son: los salarios, la educación y capacidad

de fuerza laboral, salud psicológica, salud fisiológica y balance de la vida laboral y profesional. Adicionalmente, el marco de trabajo presenta una aproximación jerárquica. Cada nivel presenta diferentes factores y métricas para definir y medir la situación organizacional ofreciendo oportunidades de derivar medidas para mejorar la situación. El marco de trabajo presenta 22 factores y 44 métricas. Adicionalmente, se ha desarrollado un modelo de implantación para el método propuesto.

Con vistas a refinar el marco de trabajo y su modelo de implantación, se han llevado a cabo pruebas cualitativas y cuantitativas en el seno de un departamento de tecnologías de la información perteneciente a una organización dedicada a los servicios financieros en Alemania. Se formularon y respondieron diversas preguntas de investigación en relación a ámbitos como el cambio demográfico, el estrés y los factores para el rendimiento laboral. Los resultados demuestran que el estrés está determinado por diferentes factores y que la mayoría de ellos deben ser tomados en consideración en la asignación de tareas y en el diseño de los entornos de trabajo. De la misma forma, se presentan diversos factores que incrementan la productividad laboral. Algunos de ellos como la conciliación de la vida laboral y la personal, la cultura organizacional o el salario deben ser tomados en consideración en las estrategias de gestión de recursos humanos en ámbitos organizacionales. Una estrategia de gestión de recursos humanos debe incluir adicionalmente aspectos relativos al reclutamiento, teniendo en cuenta la complementaridad con los factores anteriormente expuestos. Los resultados obtenidos también revelan que no existen evidencias de diferencias de género o de edad en la importancia de los factores de productividad o en los factores de estrés.



## Abstract

Due to an unsatisfying demographic development in most European states, companies have to solve a trade-off between a needed increase of productivity on the one hand and fewer highly skilled employees on the other hand. One of the first sectors that will be influenced by this development is the Information Technology-industry (IT).

Information technology is crucial for every company in every industry and for the people itself. In a permanently changing business environment, companies and especially their IT-departments must adapt to changes in the market and be more agile and customer oriented than ever before. To succeed in the IT sector, the productivity of employees is the key component. Therefore, the allocation and retention of these scarce resources in the best possible way is even more important. The challenge for companies is to improve the enterprise not only on the side of the organizational and process level, but to develop new strategies and approaches in human resource management. Only a symbiosis of the disciplines information technology, economics, psychology and management will enable relevant and indispensable employees to promote loyalty to the company. For a well-trained professional, frequent change of the employer, is as long associated with normality until the employees find the most suitable environment for fulfilling their needs and expectations. These expectations are no longer just based on financial incentives, consequently companies need to anticipate these expectations and align their strategies to them.

Although the topic is quite popular in scientific literature, there is not a study devoted to identify these factors in organizational contexts. This Thesis is aimed to bridge this gap.

The first step to achieve this goal is creating transparency over all parts of an organisation that are relevant to this topic. The author created a method that connects these relevant parts in one holistic framework. The framework consists of five layers. These layers are *baseline wages*, *education and employee pool*, *psychological healthiness*, *physiological healthiness* and *work live balance*. Also, the framework follows a hierarchical approach. Every layer has distinct factors and metrics to define and measure the status of the company and offers opportunities to derive measures to improve this situation. In total the framework consist of 22 factors and 44 metrics. Besides the framework, the author developed an implementation model for the proposed method.

To refine the developed framework and implementation model, qualitative and quantitative tests were conductedn the IT-department of a financial service company in Germany.

Several research questions regarding demographic change, psychological stress and factors for employee performance were analysed and answered. The results show, that stress is influenced by several different stressors and the most of them need to be considered by companies when they allocate work or design workspaces. On the other side, there are several factors that promote employee productivity. Some of them, like work-life balance, company culture or salary are more important and should be a relevant part of every human resource management (HRM) strategy. A HRM strategy should involve proper measures for the recruiting and the development of employees because they complement each other and should be considered with the same importance. The results also show, that there is no evidence suggesting an age or gender related difference of the importance or the impact of productivity factors or psychological stressors.

## Table of content

|  |      |
|--|------|
| Resumen .....  | VII  |
| Abstract.....  | IX   |
| Table of content.....  | XI   |
| List of acronyms .....   | XV   |
| List of tables .....   | XVII |
| List of figures .....  | XX   |
| 1. Introduction .....  | 1    |
| Definition of skills shortages.....  | 3    |
| Significance of the study and the need of a framework to manage scarce resources.....                        | 3    |
| Hypothesis and research objects.....   | 5    |
| Research methodology .....   | 6    |
| Publications of the results of this thesis .....   | 8    |
| Structure of the thesis .....  | 10   |
| 2. Background.....   | 13   |
| Demographic change: skills shortages and the changes for society.....  | 13   |
| Skills shortage in IT-departments and the impact on companies .....  | 17   |
| Implementation of Lean Management philosophy in IT-departments .....   | 20   |
| Lowering the complexity with a Software as a service model.....  | 21   |
| Implementation of a functioning IT-governance.....   | 22   |
| Consolidation of IT-systems to reduce complexity of the organization.....                                    | 24   |
| Human resources management and psychological implications of the skills shortage for employees .....         | 26   |
| 3. Problem formulation and research approach.....  | 33   |
| Research problem .....   | 33   |
| Research approach.....   | 34   |
| Limitations of research .....  | 35   |
| 4. Assessment of continuing educational measures in information technologies: A view from the industry ..... | 38   |
| Approach .....   | 38   |
| Research plan.....   | 39   |

|  |     |
|--|-----|
| Execution of research .....  | 39  |
| Analysis of results .....  | 52  |
| Revisiting research questions .....  | 52  |
| Discussion of results .....  | 54  |
| 5. Development of 5-layer framework of employee productivity .....                             | 56  |
| Derivation of factors for a framework to manage employees in times of scarcity of talent ..... | 57  |
| Search strategy .....  | 59  |
| Results and Findings .....   | 64  |
| Derivation of metrics for a framework to manage employees in times of scarcity of talent ..... | 77  |
| Search strategy .....  | 77  |
| Results and Findings .....   | 83  |
| Composition of the 5-layer framework for employee productivity .....                           | 124 |
| Results and discussion of findings .....   | 127 |
| 6. Implementation plan for the 5-layer framework of employee productivity .....                | 131 |
| Initiating .....   | 133 |
| Planning .....   | 137 |
| Executing .....  | 139 |
| Monitoring and Controlling .....   | 145 |
| Risk Management .....  | 146 |
| Risk Definition .....  | 146 |
| Risk Management Process .....  | 147 |
| Risk monitoring, management and control .....  | 151 |
| Communication & project marketing .....  | 152 |
| Communication plan .....   | 153 |
| Mobilization plan .....  | 166 |
| Validation of the implementation plan .....  | 169 |
| Approach .....   | 169 |
| Research plan .....  | 169 |
| Execution of research .....  | 170 |
| Analysis of results .....  | 171 |
| Revisiting research questions .....  | 174 |

|  |     |
|--|-----|
| Discussion of results.....   | 174 |
| 7. Test and customization of the 5-layer framework of employee productivity .....                                      | 176 |
| The study – a quantitative survey with IT-professionals.....   | 176 |
| Approach .....   | 176 |
| Research plan.....   | 177 |
| Execution of research .....  | 179 |
| Analysis of results .....  | 179 |
| Revisiting research questions .....  | 191 |
| Discussion of results.....   | 192 |
| Test of the 5-layer framework for employee productivity – qualitative validation.....                                  | 195 |
| Approach .....   | 195 |
| Research plan.....   | 196 |
| Execution of research .....  | 197 |
| Analysis of results .....  | 197 |
| Revisiting research question.....  | 200 |
| Discussion of results.....   | 201 |
| Test of the 5-layer framework for employee productivity – a case study.....  | 202 |
| Approach .....   | 202 |
| Research plan.....   | 203 |
| Execution of research .....  | 203 |
| Analysis of results .....  | 204 |
| Revisiting research questions .....  | 215 |
| Discussion of results.....   | 216 |
| Customization and finalization of the framework.....   | 219 |
| 8. The use of the 5-layer framework for employee productivity – a view from different<br>roles in an organisation..... | 224 |
| The role of the CEO and or CIO .....   | 224 |
| The role of the IT-front line manager.....   | 227 |
| The role of the HR-department.....   | 229 |
| The role of IT-employees .....   | 231 |
| Concluding remarks.....  | 233 |
| 9. Research objectives revisited, limitations and final remarks .....  | 235 |
| Research objectives revisited.....   | 235 |

## Table of content

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|  |     |
|--|-----|
| Final remarks and further research activities..... | 240 |
| References .....                                   | 242 |

## List of acronyms

|       |  |
|-------|--|
| BaFin | Bundesanstalt für Finanzdienstleistungsaufsicht (engl.: Federal Financial Supervisory Authority)     |
| bau   | business as usual  |
| Apps  | Applications   |
| BSI   | Bundesamt für Sicherheit in der Informationstechnik (engl.: Federal Office for Information Security) |
| CMS   | Content Management System  |
| COBIT | Control Objectives for Information and Related Technology  |
| ELTV  | Employee lifetime value  |
| ERP   | Enterprise-Resource-Planning   |
| EUR   | Euro   |
| FTE   | Full time equivalents  |
| HRM   | Human Resource Management  |
| ICT   | Information and communications technology  |
| ILT   | Instructor-led training  |
| IPMA  | International Project Management Association   |
| ISO   | International Organization for Standardization   |
| IT    | Information Technology   |
| ITIL  | Information Technology Infrastructure Library  |
| JCR   | Journal citations report   |
| KM    | Knowledge Management   |
| KWG   | Kreditwesengesetz (engl.: Banking Act)   |
| MOOC  | Massive open online courses  |
| SJR   | Scientific journal rankings  |
| SLR   | Structured literature review   |
| TQM   | Total Quality Management   |
| PM    | Project Manager  |
| PMBOK | Project Management Body of Knowledge   |

## List of acronyms

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|       |                                  |
|-------|----------------------------------|
| PMI   | Project Management Institute     |
| P-CMM | People Capability Maturity Model |
| RAT   | Risk assessment team             |
| SLA   | Service-level-agreement          |
| SOW   | Statement of work                |
| WBS   | Work breakdown structure         |



## List of tables

|  |     |
|--|-----|
| TABLE 1: VARIABLES OF EMPLOYEE PERFORMANCE.....  | 31  |
| TABLE 2: TYPES OF TRAINING AND THEIR CORRESPONDING ELEMENTS AND BENEFITS .....   | 41  |
| TABLE 3 RISKS AND MITIGATION STRATEGIES .....  | 43  |
| TABLE 4 CRITICAL SUCCESS FACTORS FOR TRAINING.....   | 45  |
| TABLE 5 MEASURES AND METHODS OF TRAINING EVALUATION .....  | 47  |
| TABLE 6 PHASES, ACTIVITIES AND DELIVERABLES OF TRAINING DEVELOPMENT .....  | 51  |
| TABLE 7: SLR FACTORS FIRST PHASE RESULTS WITHOUT FILTERING.....  | 63  |
| TABLE 8: SLR FACTORS FIRST PHASE RESULTS – DISTRIBUTION WITHOUT DUPLICATION .....  | 63  |
| TABLE 9: SLR FACTORS FIRST PHASE RESULTS.....  | 64  |
| TABLE 10: SLR FACTORS SECOND PHASE RESULTS.....  | 64  |
| TABLE 11: SLR FACTORS - RESEARCH QUESTIONS AND CORRESPONDING PAPERS .....  | 65  |
| TABLE 12: SLR METRICS - FIRST PHASE RESULTS WITHOUT FILTERING .....  | 82  |
| TABLE 13: SLR METRICS - FIRST PHASE RESULTS – DISTRIBUTION WITHOUT DUPLICATION..   | 82  |
| TABLE 14: SLR METRICS - FIRST PHASE RESULTS .....  | 83  |
| TABLE 15: SLR METRICS - SECOND PHASE RESULTS .....   | 83  |
| TABLE 16: RESEARCH QUESTIONS, FACTORS AND CORRESPONDING PAPERS.....  | 87  |
| TABLE 17: FACTORS AND METRICS FOR FUNDAMENTAL WAGES FOR HIGH SKILLED<br>EMPLOYEES IN IT-DEPARTMENTS .....  | 89  |
| TABLE 18: LABOUR COSTS PER HOUR IN EURO, WHOLE ECONOMY (EXCLUDING AGRICULTURE<br>AND PUBLIC ADMINISTRATION).....                                   | 91  |
| TABLE 19: MEDIAN GROSS HOURLY EARNINGS (EUR) AND PROPORTION OF LOW-WAGE<br>EARNERS (%), BY SEX, 2010 .....   | 92  |
| TABLE 20: THE UNADJUSTED GENDER PAY GAP, 2013 .....  | 95  |
| TABLE 21: MEASURES TO OPTIMIZE AND EDUCATE THE EMPLOYEE POOL WITH REFERENCE TO<br>UNTAPPED POTENTIAL WITHIN AN ORGANIZATION - INDICATORS VIEW..... | 98  |
| TABLE 22: MEASURES TO SUPPORT THE PSYCHOLOGICAL HEALTHINESS OF THE EMPLOYEES -<br>INDICATORS VIEW .....  | 109 |
| TABLE 23: MEASURES TO OPTIMIZE THE WORK ENVIRONMENT OF THE EMPLOYEES -<br>INDICATORS VIEW .....  | 116 |
| TABLE 24: MEASURES TO SUPPORT THE WORK-LIFE BALANCE OF THE EMPLOYEES -<br>INDICATORS VIEW .....  | 118 |
| TABLE 25: INNOVATIVE WORKING (TIME) MODELS.....  | 122 |
| TABLE 26: DISTRIBUTION OF FACTORS AND METRICS .....  | 129 |
| TABLE 27: PMBOK® PROJECT MANAGEMENT PROCESS GROUPS .....   | 133 |
| TABLE 28: RISK RANKING/EXPOSURE MATRIX .....   | 150 |
| TABLE 29: ROLES WITHIN THE COMMUNICATION INFRASTRUCTURE.....   | 154 |
| TABLE 30: COMMUNICATION NEEDS .....  | 157 |
| TABLE 31: COMMUNICATION MECHANISM AND CHANNELS.....  | 161 |
| TABLE 32: PROJECT MARKETING TOOLS .....  | 161 |
| TABLE 33: STYLE OF COMMUNICATION .....   | 163 |
| TABLE 34: MOBILIZATION ACTIVITY/EVENTS AND OBJECTIVES .....  | 168 |
| TABLE 35: DISTRIBUTION OF RESPONSES OF PARTICIPANTS REGARDING THE FIT OF THE PMI<br>METHODOLOGY.....   | 171 |
| TABLE 36: DISTRIBUTION OF RESPONSES REGARDING THE EFFORT IN TIME AND PERSONNEL<br>FOR THE DIFFERENT PHASES.....                                    | 172 |

|  |     |
|--|-----|
| TABLE 37: RANKING OF COMMUNICATION TYPES .....   | 173 |
| TABLE 38: RANKING OF MOBILIZATION ACTIVITIES .....   | 173 |
| TABLE 39: AGE RANGE OF PARTICIPANTS .....  | 177 |
| TABLE 40: COUNTRY OF ORIGIN OF PARTICIPANTS .....  | 177 |
| TABLE 41: GENDER OF PARTICIPANTS .....   | 178 |
| TABLE 42: PROFESSION OF PARTICIPANTS .....   | 178 |
| TABLE 43: SCIENTIFIC BACKGROUND OF PARTICIPANTS .....  | 178 |
| TABLE 44: EXPECTED SKILLS SHORTAGES IN IT-COMPANIES - ALL RESPONSES .....                                | 180 |
| TABLE 45: EXPECTED SKILLS SHORTAGES IN IT-COMPANIES - RESPONSES FROM IT-<br>EMPLOYEES.....               | 180 |
| TABLE 46: ACTUAL AND EXPECTED SKILLS SHORTAGES IN GERMANY AND SPAIN .....                                | 181 |
| TABLE 47: IMPORTANCE OF FACTORS OF EMPLOYEE PRODUCTIVITY .....   | 182 |
| TABLE 48: IMPORTANCE OF FACTORS OF EMPLOYEE PRODUCTIVITY - GENDER PERSPECTIVE<br>.....                   | 182 |
| TABLE 49: IMPORTANCE OF FACTORS OF EMPLOYEE PRODUCTIVITY - GENDER PERSPECTIVE<br>RATING 7-10 .....       | 183 |
| TABLE 50: IMPORTANCE OF FACTORS OF EMPLOYEE PRODUCTIVITY - IT-EMPLOYEE'S<br>PERSPECTIVE RATING 7-10..... | 183 |
| TABLE 51: IMPORTANCE OF FACTOR WAGES IN DIFFERENT AGE GROUPS .....                                       | 184 |
| TABLE 52: RESULTS OF ANALYSIS OF AGE AND IMPORTANCE OF PRODUCTIVITY FACTORS. 185                         |     |
| TABLE 53: RESULTS OF ANALYSIS OF AGE AND IMPORTANCE OF PRODUCTIVITY FACTORS - P-<br>TEST.....            | 185 |
| TABLE 54: LEVEL OF JOB STRESS - IT-EMPLOYEE PERSPECTIVE.....   | 185 |
| TABLE 55: LEVEL OF JOB STRESS - GENDER PERSPECTIVE.....  | 186 |
| TABLE 56: PSYCHOLOGICAL STRESSORS FOR EMPLOYEES .....  | 186 |
| TABLE 57: PSYCHOLOGICAL STRESSORS FOR EMPLOYEES - GENDER PERSPECTIVE.....                                | 187 |
| TABLE 58: PSYCHOLOGICAL STRESSORS FOR EMPLOYEES - IT-EMPLOYEE PERSPECTIVE ....                           | 188 |
| TABLE 59: RESULTS OF ANALYSIS OF AGE AND STRESS LEVEL OF EMPLOYEES .....                                 | 188 |
| TABLE 60: MOST PRESSING ISSUES FOR IT-COMPANIES OR DEPARTMENTS REGARDING THEIR<br>EMPLOYEES.....         | 189 |
| TABLE 61: FACTORS FOR THE IDENTIFICATION, ATTRACTION AND SELECTION OF EMPLOYEES<br>.....                 | 190 |
| TABLE 62: RESULTS OF THE TEST OF THE LAYER EDUCATION AND EMPLOYEE POOL.....                              | 207 |
| TABLE 63: RESULTS OF THE TEST OF THE LAYER 3 PSYCHOLOGICAL HEALTHINESS OF THE<br>EMPLOYEES.....          | 209 |
| TABLE 64: RESULTS OF THE TEST OF THE LAYER 4 PHYSIOLOGICAL HEALTHINESS OF THE<br>EMPLOYEES.....          | 209 |
| TABLE 65: RESULTS OF THE TEST OF THE LAYER 5 WORK-LIFE-BALANCE.....                                      | 210 |
| TABLE 66: IDENTIFIED MEASURES DURING THE TEST PHASE .....  | 215 |
| TABLE 67: SUMMARY OF MEASURES AND TIMESCALE FOR IMPLEMENTATION .....                                     | 216 |
| TABLE 68: METRICS THAT CONFLICTED WITH PRIVACY OF PERSONAL DATA .....                                    | 217 |
| TABLE 69: LAYER 1 BASELINE WAGES – FINAL FACTORS AND METRICS.....  | 219 |
| TABLE 70: LAYER 2 EDUCATION AND EMPLOYEE POOL – FINAL FACTORS AND METRICS ....                           | 221 |
| TABLE 71: LAYER 3 PHYSIOLOGICAL HEALTHINESS – FINAL FACTORS AND METRICS .....                            | 221 |
| TABLE 72: LAYER 4 PSYCHOLOGICAL HEALTHINESS – FINAL FACTORS AND METRICS .....                            | 222 |
| TABLE 73: LAYER 5 WORK-LIFE BALANCE – FINAL FACTORS AND METRICS.....                                     | 222 |
| TABLE 74: NUMBER OF FACTORS AND METRICS OF THE FINAL VERSION OF THE FRAMEWORK<br>.....                   | 223 |
| TABLE 75: FACTORS AND METRICS OF THE 5-LAYER FRAMEWORK FOR TOP MANAGEMENT                                | 226 |

|   |     |
|---|-----|
| TABLE 76: FACTORS AND METRICS OF THE 5-LAYER FRAMEWORK FOR FRONT LINE MANAGERS .....                      | 229 |
| TABLE 77: FACTORS AND METRICS OF THE 5-LAYER FRAMEWORK FOR THE HR-DEPARTMENT .....                        | 231 |
| TABLE 78: FACTORS AND METRICS OF THE 5-LAYER FRAMEWORK WHICH REQUIRE THE COLLABORATION OF EMPLOYEES ..... | 233 |
| TABLE 79: FINAL NUMBER OF LAYERS, FACTORS AND METRICS .....   | 238 |

## List of figures

|   |     |
|---|-----|
| FIGURE 1: DISTRIBUTION OF POPULATION BY AGE IN GERMANY .....  | 14  |
| FIGURE 2: DISTRIBUTION OF POPULATION BY AGE IN SPAIN .....  | 15  |
| FIGURE 3: DISTRIBUTION OF POPULATION BY AGE IN THE EU-28 .....                                      | 16  |
| FIGURE 4: COST OF ILLNESS DUE TO DEPRESSION IN GERMANY .....  | 28  |
| FIGURE 5: RESEARCH APPROACH.....  | 34  |
| FIGURE 6 APPROACH FOR THE IMPLEMENTATION AND EXECUTION OF CONTINUING<br>EDUCATIONAL MEASURES .....  | 47  |
| FIGURE 7 SEARCH PROCESS FACTORS .....   | 61  |
| FIGURE 8: SEARCH PROCESS METRICS.....   | 78  |
| FIGURE 9: VISUALIZATION OF THE FRAMEWORK TO MANAGE RESOURCES IN TIMES OF<br>SCARCITY OF TALENT..... | 124 |
| FIGURE 10: EXAMPLE I FOR THE USE OF THE FRAMEWORK .....   | 125 |
| FIGURE 11: EXAMPLE II FOR THE USE OF THE FRAMEWORK.....   | 127 |
| FIGURE 12: MODEL OF A WORK BREAKDOWN STRUCTURE.....   | 137 |
| FIGURE 13: THE FRAMEWORK FOR THE MANAGEMENT OF SCARCE RESOURCES AS A WBS                            | 138 |
| FIGURE 14: COMMUNICATION FREQUENCY AND INTENSITY .....  | 162 |
| FIGURE 15: PHASES OF THE TEST PROJECT .....   | 203 |
| FIGURE 16: EXAMPLES OF THE USE OF THE FRAMEWORK.....  | 238 |



## 1. Introduction

In current times, IT-departments are confronted with continuous changes. They have to face new challenges faster, more goal oriented and adapt to new circumstances while maintaining a high level of productivity (Murphy, 2013). The requirements on companies will increase in the coming years due to the scarcity of various goods and resources (Booch, 2009; Smit, Scheijgrond, & Severin, 2012).

The allocation of resources is not a new issue for companies, but in the current situation it becomes more and more important (Yi-fan, Fu-quan, Shi-xin, & Di, 2013). The relevance of IT in businesses is playing a significant role for companies due to the pace of change and the automation of processes and digitalisation of the organisation. As IT skills shortages are projected to reach unprecedented levels, the increasing importance of IT human resource departments to take the right choices are essential for shaping a firm's competitive advantage (Álvarez-Rodríguez, Colomo-Palacios, & Stantchev, 2015; Holmes, 2007; van der Merwe & Barry, 2010). Employees in IT are no longer a pure support factor, but provide a valuable contribution to the results of a company (Anca-Ioana, 2013). Without a functioning IT-department, the production of goods and the provision of services is almost impossible (Dav-enport, 2013).

It is therefore important, that a company creates transparency about its needed profiles (Nilles & Senger, 2012). Standards like the IT Infrastructure Library (ITIL) (Pereira & da Silva, 2010) or the Control Objectives for Information and Related Technology (COBIT) and ISO/IEC 27002 (Sahibudin, Sharifi, & Ayat, 2008), as well as approaches for cloud governance (K. Petruch, Stantchev, & Tamm, 2011; Vladimir Stantchev & Stantcheva, 2012) and the e-Competence framework (European Commission, 2007) provide a good structure for this issue, but an accurate recording and selection of resource requirements is still needed. After transparency is created, the recruiting of identified profiles becomes a tough challenge. Because of demographic change, the market for IT professionals developed itself from a buyer's to a seller's market (Buscher, Dettmann, Sunder, & Trocka, 2009; McEwan & McConnell, 2013). This means, that applicants can choose the company based on their individual needs and expectations. The result is a steady loss of competitiveness among enterprises that are not selected by the graduates.

Hence, it is important that companies are aware of their lack of personnel and take the appropriate actions. If possible, the demand can be met through increased measures, for example, a rise of salary (Lee & Lin, 2014). Especially for smaller companies, this is often not a viable option. Therefore, organizations strive to find other options to compensate this disadvantage. This can be achieved by providing a better productivity and a more rational allocation of staff (Martensson, 2006). Another possibility is to deploy more sophisticated approaches to manage the existing personnel in IT-departments (Casado-Lumbreras, Colomo-Palacios, Hernández-López, & Soto-Acosta, 2013; Casado-Lumbreras, Colomo-Palacios, Soto-Acosta, & Misra, 2011; Konstantin Petruch, Tamm, & Stantchev, 2012; Vladimir Stantchev, Petruch, & Tamm, 2013). However, every optimization of an organization or a functioning system has its limits, especially in a fast changing environment like IT-departments (Schaefer, 2010).

One further option is to attract applicants with other measures to compensate them for their financial loss. This can be achieved with innovative work-time-models and an improved work-life-balance (Kalliath & Brough, 2008; Viswanathan & Kumaran, 2013). Satisfied employees are the most valuable and productive asset of a company and especially of the IT-sector (Colomo-Palacios, Casado-Lumbreras, Misra, & Soto-Acosta, 2014; Messersmith, 2007; Pandey & Sharma, 2016; Rethinam & Ismail, 2007; Sageer, Rafat, & Agarwal, 2012).

An additional challenge for IT-companies and IT-departments is the need to recruit within the Generation Y. This is a moniker for the specific group of individuals born from 1978 to 1994, who have barely known a world without cell phones, cable TV and the Internet (Kian, Yusoff, & Rajah, 2013). Their demands and expectations have a profound effect on academics, work environments and companies (Pramod & Bharathi, 2016). Members of the Generation Y are pushing changes on all fronts of the society (Sheahan, 2005). Understanding this trend is the key to adapt to the critical change of the economy (Holley, 2008). This generation of possible employees is unlike other generations, a segment of employees which is considered to be in need of focused attention and has unique and challenging expectations like participation in companies' decision making and a better work-life balance (Shatat, El-Baz, & Hariga, 2010a).

In order to meet the expectations of the employees and simultaneously the goals of the company, new and innovative work models must be developed. The challenge is, to solve the conflict between a more open culture, a higher degree of temporal flexibility and potentially more leisure for the employees, while maintaining or increasing productivity.

As the skills shortage is becoming an ever-increasing challenge for every industry and even more for IT-departments, given that IT is personnel-intense (Casado-Lumbreras, Soto-Acosta, Colomo-Palacios, & Ordóñez de Pablos, 2011; Colomo-Palacios, 2012). Therefore, the allocation of these scarce resources in the best possible way is even more important (Aral & Weill, 2007; Friebe & Raith, 2010). The challenge for companies is to improve the enterprise not only on the side of the organizational and process level, but to develop new strategies and approaches in human resource management (Buller & McEvoy, 2012). Only a symbiosis of the disciplines information technology, economics and psychology will enable relevant and indispensable employees to promote loyalty to the company (S. Evans & Manager, 2013). For a well-trained professional, frequent change of the work place, is as long associated with normality until they find the most suitable environment for fulfilling their needs and expectations (Institute for opinion survey Allensbach, 2014). These expectations are no longer just based on financial incentives, consequently companies need to anticipate these expectations and align their strategies to them (Guinn, 2013; Institute for opinion survey Allensbach, 2014). The proposes *5-layer framework for employee productivity* aims to closes current gaps and offers an opportunity to companies to analyse risks and threats to derive strategies to mitigate these risks.

### ***Definition of skills shortages***

Skills shortage is not a new phenomenon (Ashworth, 1985), but surprisingly there is not a general definition for the term (Franken, 2012). However, all available definitions are pointing in the same direction:

*“A shortage of skills is a source of aggravation to firms and, when acute, is likely to hamper the quality and quantity of their output”* (Richardson, 2007).

Others follow a similar approach and define skill or labour shortages as a situation when:

*“the demand for skilled workers of a particular specialization exceeds the supply of professionals with this same specialization that are available to the prevailing market conditions and ready to take up employment.”* (Shah & Burke, 2005; Veneri, 1999).

### ***Significance of the study and the need of a framework to manage scarce resources***

The investigation of the relationship between the productivity of a company and the employed staff is as old as economics itself. It starts with the writings of Jean Baptiste Colbert



on mercantilism in the 17th Century (Blaich, 1973), Adam Smith in the 18th Century (Smith, 1863) and F.W. Taylor in the age of the industrial revolution (Taylor, 1911). During this time, labour developed from a pure factor of production to a relevant factor for organizations.

Marx described in his work in 1844 that the exploitation of workers and the interests of society have an irreconcilable relationship to each other (Marx, 1844). The development and self-determination of the working population in the context of evolving civil rights also led to a further development of the people themselves. At the beginning of the economic development, they were only operational factors. In Europe these days, they become an important knowledge source and therefore irreplaceable in many areas of the company (Saraswathy, Thamaraiselvan, Senthilarasu, & Sivagnanasundaram, 2011).

Productivity is generally defined as the relation between input and output but is not a ratio for the profitableness of a company or department (Voigt, 2016). Already in the 80's of the last century, researchers recognized, that productivity in software development depends on the manpower and its skills (Kemerer, 1986; Pyster, 1982). Businesses and consumers expect software with more functions, delivered faster. Because of the demand for more software, companies have the need to not only increase production capabilities, but also to produce more output with the available resources (Murphy, 2013). Nowadays, this challenge is even more complicated to conquer. New developed programs or systems have thousands of lines of source code. However, this increased size is often inversely proportional to the time until it's released. Productivity in software departments is measured by several factors, for example the lines of code or the implemented functions which are described as function points (Tan et al., 2009). In summary, because of the missing personnel on the market due to the demographic change, companies need to produce more with less employees (Radant, 2014a).

More interesting than the question for a definition is clarification of the existence of a skills shortage. In research, opinions differ on the topic, whether there is a skills shortage or not (Buscher et al., 2009; Franken, 2012; Lenton, 2003). It is a fact, under a *ceteris paribus* clause, that for example in Europe the demographic change will lead to a population decline of 4.9% until the year 2060 (Germany -21%, Italy -5.2%, Spain 8.2%) (Federal Center for political education, 2011). But for some it is a non-relevant factor in the short-term future (Brenke, 2010). For others it might become a regional or industrial sector issue (Koppel & Plünnecke, 2009) and for a third party it is already an essential risk for the industrial countries' wealth (Dombrowski, Schulze, & Zahn, 2009; Winkler & Zander, 2007). Therefore, it

is a mutual consent that skills shortage is a considerable factor for politics and the economy in future (Mitesser, 2012). Similar indications can be found in other European countries.

Strong organizations can be defined by the fact that they can react flexible and agile to any market or stakeholder needs in a short time (Yukl & Mahsud, 2010). Maturity models like the People Capability Maturity Model (P-CMM) are process orientated and rather complex regarding implementation and execution or have a different focus like corporate governance (Alonso, Verdún, & Caro, 2013; Soltani, Joneghani, & Bozorgzad, 2011). Also, it should be noted, that most maturity models are based on a collection of best practices that are not always suitable for a company. Further, these models define a certain development path and possible more benefiting paths can be overlooked rather easily.

Process weaknesses and process requirements can be identified, but solutions to fulfil the requirements are usually not suggested. For example, it is described in the CMMI specifications, what to do to achieve a higher maturity level but there is no statement made as to how this can be achieved. As described, maturity models certainly serve as a guide to improve the process, however, the steps between the individual maturity levels are often too large. The variety of requirements that must be fulfilled for the change from a maturity level to the other, often exceeds the resources and the budget of a process management initiative (Kamprath, 2014). Therefore, companies need a holistic approach to manage scarce resources flexibly and target orientated.

Human resource management is a complex issue itself and the complexity will rise further in the upcoming years (Radant, Colomo-Palacios, & Stantchev, 2016b). HRM strategies need to include the different expectations when it comes to age, gender or the arrangement of work- and private life.

### ***Hypothesis and research objects***

The novelty of this research work lies in the alignment of different measures to gain productivity within the organization and among the employees in times of scarcity of talent. The framework will provide companies with a step by step work plan and a holistic approach for an optimization of the organization. The main research contributions are focused on filling the gap between organizational and employee development with concurrent measures for the binding of personnel. Also, it will include measures of psychological healthiness

### ***Hypotheses***

- H<sub>1</sub>: The skills shortage will affect the productivity of employees in every part of the organization and in particular information technologies.
- H<sub>2</sub>: Without a significant change in HR-policies, companies will not have the power to retain talented employees in times of scarcity of talent.
- H<sub>3</sub>: The expectations of employees regarding their work life differs vastly in regards to their age and gender.
- H<sub>4</sub>: The raise in psychological diseases needs to be addressed by the companies with the help of different working models and an adjustment in their leadership philosophy to keep their employees healthy.

To test these hypotheses, several research questions were developed.

### *Research objects*

1. Identification of the psychological and physiological needs of the different workforce generations.
2. Identification of gaps regarding the perception of different generations in expectations for their companies and management.
3. Definition of a framework for companies to raise transparency for the management physiological of their personnel in times of demographic change which also includes psychological and issues. The framework has to include all relevant factors that influence the productivity of employees in times of scarcity of talent.
4. Development and validation of an implementation plan that allows companies of every size to conquer the effects of demographic change, lower retention rates and retain productivity.

These research questions will be answered in different parts of this dissertation and revisited in total in the last chapter.

### ***Research methodology***

The research method for this study will follow the design-science paradigm for Information Systems which seeks to extend the boundaries of human and organizational capabilities by creating new and innovative artefacts (Hevner, March, Park, & Ram, 2004).

The design-science approach follows seven guidelines.

#### *Guideline 1: Design as an artefact*

“Design-science research must produce a viable artefact in the form of a construct, a model, a method, or an instantiation”.

The author proposes to identify and describe a framework for the management of IT-personnel in times of scarcity of talent. This will provide companies with a tool to increase performance due to a stronger alignment of the companies’ strategy, organizational measures to gain productivity as well as needs and expectations of the employees.

### Guideline 2: Problem relevance

“The objective of design-science research is to develop technology-based solutions to important and relevant business problems”.

IT-personnel is crucial for the development of companies. Because of the demographic change, employee turnover will become more important and should be minimized as much as possible.

### Guideline 3: Design evaluation

“The utility, quality, and efficacy of a design artefact must be rigorously demonstrated via well-executed evaluation methods”.

The design of the framework for managing scarce resources will be verified in an expert consultation (CIOs of companies, IT experts and Senior Partners of consultancies). Furthermore, an implementation project for the developed framework will be conducted. Results of the expert consultation, as well as practical experience of the pilot project will be used to optimize the results.

### Guideline 4: Research contributions

“Effective design-science research must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies”.

The novelty of this research work lies in the alignment of different measures to gain productivity within the organization and the employees in times of scarcity of talent. The framework will provide companies with a step by step work plan and a holistic approach for an optimization of the organization. The main research contributions are focused on filling the gap between organizational and employee development with concurrent measures for the binding of personnel.

### Guideline 5: Research rigor

“Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artefact”.

The proposed framework for managing scarce resources will be developed under consideration, analysis and modification of existing standards and with the aim of proposing new standards if necessary. The rigorous methods for the evaluation will be based on a two-step approach: a survey followed by expert consultation meetings considering latest research.

### *Guideline 6: Design as a search process*

“The search for an effective artefact requires utilizing available means to reach desired ends while satisfying laws in the problem environment”.

The design of the framework for managing scarce resources will be undertaken incrementally and iteratively by considering new research work and expert knowledge as well as established standards and practical experience of pilot projects. The framework will also consider workforce laws in the respective region of implementation.

### *Guideline 7: Communication of research*

“Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences”.

This work is intended to be distributed on scientific journals, international conferences and book chapters, as well as published by the Universidad Carlos III de Madrid in partial fulfillment of the requirements for the PhD programme in “*Ciencia y Tecnología Informática*”.

### ***Publications of the results of this thesis***

The research in this thesis shows, that there is a need to counteract the current challenges regarding demographic change, employee management and the different expectations of the several generations of the workforce. It also proposed a framework to manage resources in times of scarcity of talent to counteract these problems from an organisational standpoint. To justify the research, several articles were published in different journals.

The following list shows the different publications, indexes and impact factors.

#### **Journal papers with JCR impact factor**

- Radant, O., Colomo-Palacios, R., & Stantchev, V. (2016). Assessment of Continuing Educational Measures in Software Engineering: A View from the Industry.

Trends in Software Engineering for Engineering Education, 32(2), 905–914. Impact factors 2016; JCR 0.582; SJR: 0.31)

### **Journal papers with SJR impact factor**

- Radant, O., 2014. Demographic Change: The Reasons, Implications and Consequences for IT Departments. *Int. J. Hum. Cap. Inf. Technol. Prof. IJHCITP* 5, 41–54. (Impact factor 2016; SJR 0.377)
- Radant, O., Colomo-Palacios, R., Stantchev, V., 2014. Analysis of Reasons, Implications and Consequences of Demographic Change for IT Departments in Times of Scarcity of Talent: A Systematic Review. *Int. J. Knowl. Manag.* 10, 1–15. doi:10.4018/ijkm.2014100101 (Impact factor 2016; SJR:0,24)
- Radant, O., Colomo-Palacios, R., & Stantchev, V. (2016). Factors for the Management of Scarce Human Resources and Highly Skilled Employees in IT-Departments: A Systematic Review. *Journal of Information Technology Research (JITR)*, 9(1), 65-82. doi:10.4018/JITR.2016010105 (Impact factor 2016: SJR 0.12)

### **Conferences**

- Radant, O., Colomo-Palacios, R., & Stantchev, V. (2015). Demographic Change: Towards a Framework to Manage IT-personnel in Times of Scarcity of Talent. In *Proceedings of the 3rd International Conference on Technological Ecosystems for Enhancing Multiculturality* (pp. 623–630). New York, NY, USA: ACM.  
<https://doi.org/10.1145/2808580.2808676>

### ***Structure of the thesis***

The aim of this thesis is to develop a holistic approach for companies to manage scarce resources. This thesis is divided in nine different chapters. The first three chapters will outline the problem area and formulates the state of the art of the research. Chapter 4 evaluates the actual standards in employee education in information technology and proposes a standard approach for this topic. The results of chapter 4 serve as a foundation for the development of the *5-layer framework for employee productivity* in chapter 5. Chapter 6 presents an implementation plan for the proposed framework. Chapter 7 describes the different test methods the author used and the customization of the framework. Chapter 8 describes the use of the framework from different views of an organisation. In chapter 9, the research objects will be revisited and final conclusions are drawn.

The following is a detailed description of the individual chapters.

#### **Chapter 1: Introduction**

The first chapter outlines the significance of the study and describes the need for a new holistic method to manage personnel in times of demographic change. Also, the research methodology, current work and preliminary results as well as the structure of the thesis is introduced.

#### **Chapter 2: Background**

The second chapter states the actual state of the art in this area of research. It describes the development of the population in Germany, Spain and Europe in a whole. Also, the effects of the demographic change on IT-organisations will be described. Initial measures to improve the organizational part of the IT-department will be discussed. The third part of this chapter addresses the increasing psychological implications of the skills shortage for employees.

#### **Chapter 3: Problem formulation and research approach**

The third chapter is devoted to the research problem and the methods and approaches to solve it. Specific and measurable objectives will be formulated to operationalize the research objects. Also, limitations on the validity will be presented and discussed.

#### **Chapter 4: Assessment of educational measures in information technology**

Besides the analysis of the state of the art, this chapter is one of the foundations for the later development of the *5-layer framework for employee productivity*, since effective and efficient education of employees is one of the most important challenges that companies have to solve in the future. This chapter evaluates the actual training measures for IT-employees and the corresponding challenges, problems and potential improvements. Also, a methodology for the implementation and execution of training measures in information technology will be presented.

#### **Chapter 5: Development of 5-layer framework of employee productivity**

In this chapter, the methodology of a structured literature review will be used to develop the *5-layer framework for employee productivity*. With the help of two different structured literature reviews (SLR) 22 factors and 44 metrics are identified to manage personnel with a holistic approach. These findings are representing the main result of this dissertation.

#### **Chapter 6: Implementation plan for the 5-layer framework of employee productivity**

Since the presented method offers several possibilities for organisational change, the author describes in this chapter a possible approach for the implementation of the framework. This approach includes also measures for the monitoring and controlling of the derived measures and examples for the marketing of the framework. Also, the implementation plan is validated in a qualitative test.

#### **Chapter 7: Test and customization of the 5-layer framework for employee productivity**

The test of the framework is divided in three different parts. The first part is a quantitative survey with 391 employees from different companies and hierarchy levels with or without an IT background. The second part is a qualitative validation of the results of chapter 5. Three experts with different backgrounds were interviewed and the validity of the results as well as possible improvements of the framework have been discussed. The third part is the test of the framework under practical conditions in a German company. The results of this phase are used to adjust the framework if needed.

#### **Chapter 8: The use of the 5-layer framework for employee productivity – a view from different roles in an organisation**

In this chapter, the use of the framework is described from the view of different stakeholders and from the view of employees which are influenced by the framework. These groups of



persons or employees are the CEO and or CIO, IT-front line manager, IT-employees and the HR-department.

### **Chapter 9: Research objectives revisited, limitations and final remarks**

In the final chapter, the results and research objects of the thesis will be revisited. Also, the limitations of the research will be discussed. Besides that, possible future research activities are described and final conclusions and remarks are stated.

## 2. Background

This chapter describes the background of this research. It starts with the current situation regarding the demographic development in Europe. Further, the impact of skill shortages on companies and possible mitigation strategies will be discussed. Additionally, the impact of psychological implications on employees because of the demographic change will be described.

### *Demographic change: skills shortages and the changes for society*

Because of social mechanisms, Europe is facing major challenges. Due to the demographic developments, not only the population picture, but also the associated dynamics of the development of all participants of the social system changed.

The reason for the upcoming skills shortage is the decline in population. In average a woman in the 19th century gave birth to five children as a result of the high natal birth rate. Over the following decades, fertility rates of women declined massively (Ehmer, 2004). Based on several special effects like the baby boom during the 50s and 60s and a further decline in the birth rate due to the contraceptive pill between 1968 and 1978, birth rate settled around an average of 1.4 children born per woman in Germany (Fuchs, 2013). In France the index is at around 2.03 and in the UK 1.98 (Worldbank, 2011).

Due to mathematics with consistent determining factors a skills shortage is inescapable reality. Because of the increasing life expectation society and economy (Dombrowski et al., 2009) are facing huge challenges like increasing pension costs. In 2008 life expectation for born men was 77.2 years and for women 82.4 years. While in 1960 the demographic distribution has a healthy shape<sup>1</sup>, the population distribution in Germany will change as follows by 2050 (Federal Statistical Office Germany, 2009):

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<sup>1</sup> Assumption:

1. Fertilityrate is constant with 1,4 births per woman
2. Life expectancy of newly born child's in the year of 2060: 85,0 years for boys, 89,2 years for girls
3. Yearly balance of migration + 100 000 persons

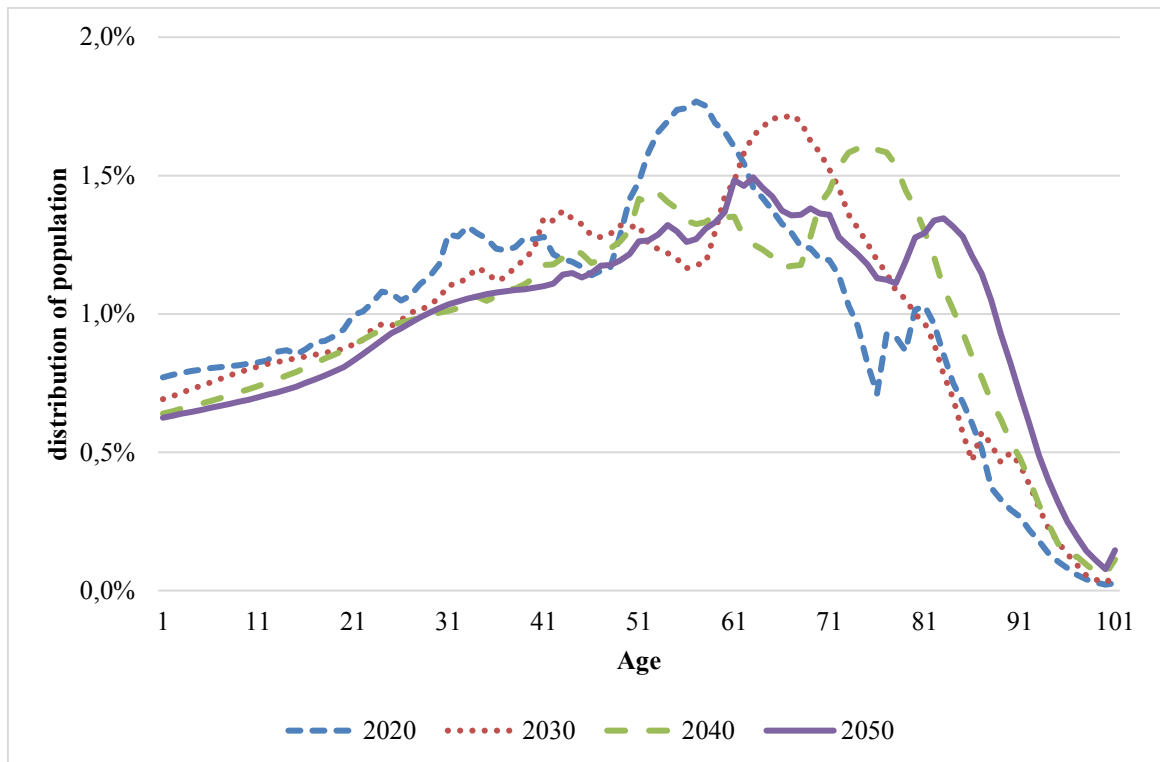


Figure 1: Distribution of population by age in Germany

The federal ministry of vocational training in Germany describes in a model calculation that between 2010 and 2030, 19 million people will quit work while only 15.5 million will start employment (Helmrich et al., 2012). It is a matter of time, when economic indexes and growth of companies will be affected. In society, as a whole there is the question for the right allocation of resources. Due to the described and proven decline of employees and an increase of academic degrees, it is evident that the described shortage is also found within middle qualified degrees (Helmrich et al., 2012).

The same statistics can be found for the most member states of the EU (aggregated). In Spain, the actual and upcoming distribution of the population shows a slightly different picture, but the same outcome of an aging society.

The high demand for ICT practitioners in Spain is not met by the current skills supply due to non-adequate training or specialisation, leading to a lack of ICT practitioners in the country. Most IT firms in Spain are based in Madrid and Barcelona, providing 63% and respectively 15% of the ITC job offers. Results from a survey indicate that 33% of the interviewed IT candidates (out of 10.000) are not willing to change their residence due to a job position (Empirica, 2014).

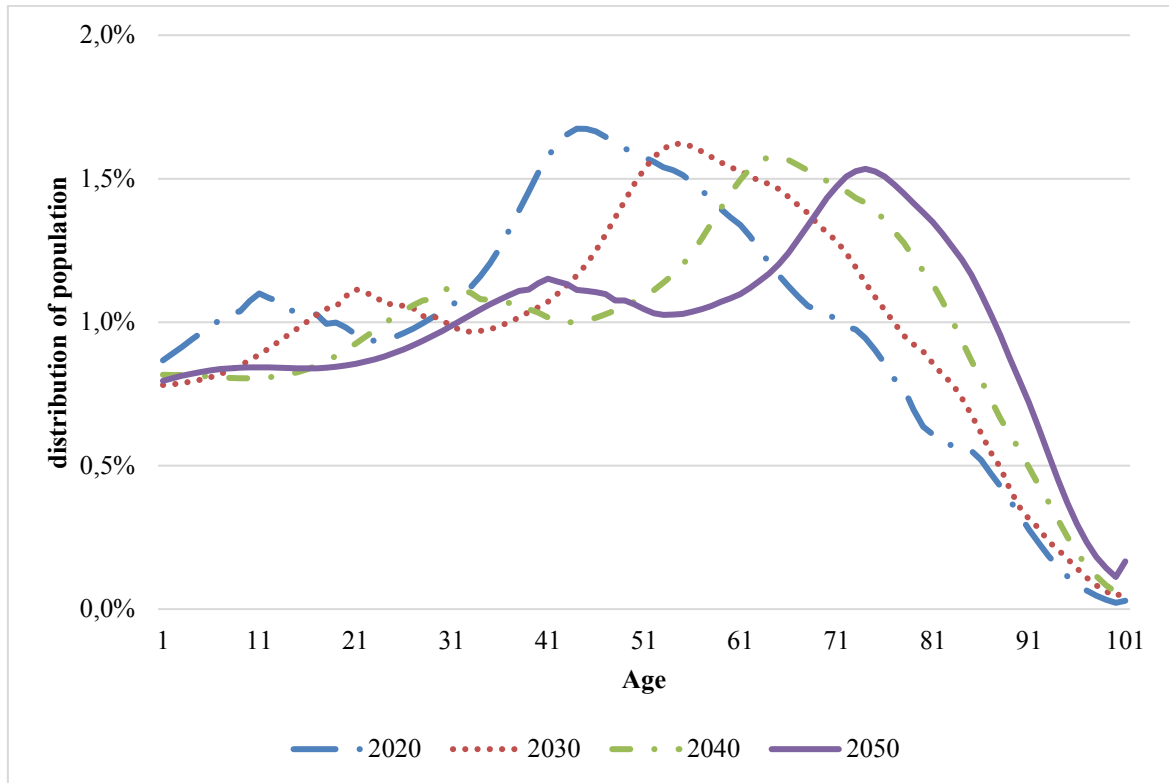


Figure 2: Distribution of population by age in Spain

The development in Spain can be observed on the whole continent. Economic growth rates are set to decline with the ageing of the population, mainly due to the reduction in the working-age population. The projections show that if current trends and policies remain unaltered, the average annual growth rate in GDP for the EU will fall systematically from 2.4% over the period 2004-2010 to only 1.2% between 2030 and 2050 (Eurostat, 2014b). Over time, Europe will have to rely increasingly on its productivity gains as a major source of economic growth. Older workers will constitute an increasing proportion of global labour and economic production resources. However, many countries still employ a relatively small number of older workers due to excessive recourse to early retirement, insufficient financial incentives to work offered by tax and social security systems and poor management of age-related issues in the workplace. This is in particular reflected by insufficient access to training, or even discrimination against older workers (European Commission, 2006).

The segment 80 years or above in the EU-28's population is growing faster than any other age segment of the EU's population. The share of those aged 80 years or above is projected to more than double between 2014 and 2050. During the period from 2014 to 2050 the share of the population of working age (15 to 64 years old) is expected to decline steadily, while the segment 65 to 79 is expected to increase by about 33.1 % (Eurostat, 2015b).

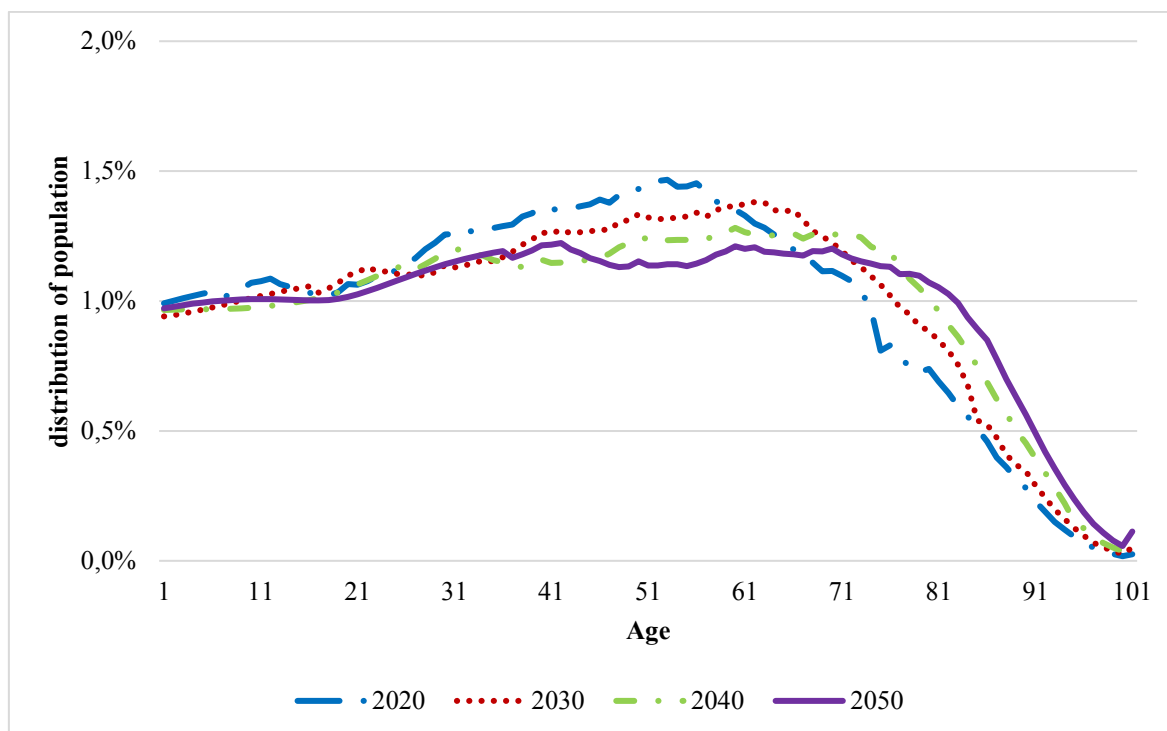


Figure 3: Distribution of population by age in the EU-28

Taking the numbers into consideration, it is surprising that several countries in Europe reveal a high youth-unemployment rate. Spain is the country with the most unemployed people between 15 and 24 years, namely 53.7% followed by Greece (50.7%), Italy (42.9%) and Croatia (41.8%) (Statista, 2016)<sup>2</sup>. In order to overcome the situation, companies, especially ones in previously mentioned countries, step in with own measures to recruit young people and therefore not wait for political solutions to that problem.

A possibility to solve this problem with political intervention is a reduction of the working hours per employee. On the first of July in 2014, the Swedish city of Gothenburg started investigating the question whether a six-hour work day is more effective and efficient than an eight-hour one (A. Taylor, 2014). In an experiment, the city asked one group of nurses to work six hours a day, while another continued working the eight-hour days they were used to. The results of the experiment will be used to decide whether more of the city should switch to a six-hour work day. After two years, the results showed, that the employees were much more healthy, sick days overall could be reduced and the patient care improved. The downside was, that the city had to employ an extra 17 staff, costing 12m kroner (1,6m Euro).

<sup>2</sup> The youth unemployment rate expresses the number of unemployed aged 15-24 as a percentage of the labor force of the same age group. Consequently, the youth unemployment rate doesn't show the percentage of unemployed persons aged 15-24 years with reference to the total population of a country (Statista, 2016).

As of right now, it is unclear if the possible costs will lead to an ending of this experiment (Ben Chapmann, 2017)

Education is critical in the upcoming decades for every country in Europe, but especially for those, who must rely on their workforce and scientists. For example, the Bologna reform was a huge change in Europe which implemented Bachelor and Master Degrees and replaced the common diploma. The goal was a common European degree system, with six or eight semesters as a new regular Bachelor degree and an optional postgraduate Master for some of the students. Several years after the reform got in force, employers and students still don't fully accept these changes. More than half the student body feels inadequately prepared for working life with a bachelor's degree. The majority of the students expressed strong doubts about the acceptability of a Bachelor's degree by the employer ("Bachelor and Master," 2014; Institute for opinion survey Allensbach, 2014). 61 percent of respondents said they wanted to receive a master's degree after the bachelor. Almost three quarters of respondents expect to develop a deeper knowledge, and increase career possibilities with a master's degree.

However, there are no quick solutions, although there are a lot of initiatives from European institutions like the Grand Coalition of Digital Jobs (European Commission, 2013). The fundament for the demographic changes was set decades ago and the problem of the demographic change needs to be solved by the companies themselves (Klingholz, 2009).

### ***Skills shortage in IT-departments and the impact on companies***

*"Information Technology (IT) permeates today almost all areas of private and public life. Especially in companies and organizations, existential dependencies have developed that companies are not aware of. Studies show regularly that enormous damage can be caused within a few hours of downtime and that could threaten the survival of organizations."* (Federal Office for Security in Information Technology (BSI), 2013, p. 5)

A skills shortage first of all is evident in sectors where a high degree of specialized knowledge is required. Politics and industry associations use the IT sector as an example for upcoming skills shortage (Holmes, 2007, pp. 99–100). IT skills shortage is not only a European, but a global problem (van der Merwe & Barry, 2010). Nevertheless, an educated workforce, especially in the IT-department is critical for the ability of a company to innovate and compete

in the market. Surprisingly, there is little research on how education contributes to the profitability of IT firms and how employees contribute to research and development activities (Banker, Wattal, Liu, & Ou, 2009; Radant, 2014a; Radant, Colomo-Palacios, & Stantchev, 2014).

The demand for ICT practitioners in Europe, with growth of around 4% a year, is outstripping the supply, resulting in a shortage of 509,000 jobs in 2015 compared to 274,000 in 2013. This figure is likely to increase to almost one million by 2020. This shortage is caused by a lack of relevant e-skills (Sherry, Carcary, McLaughlin, & O'Brien, 2013). The largest bottlenecks are in the UK, Germany, and Italy, which together would account 60% of all vacancies in Europe. Many of these potential vacancies are likely to remain unfilled unless more initiatives are developed to attract young people into ICT education, and to retrain unemployed people (Empirica, 2013).

Often, effects of demographic change and skills shortage are not measurable for companies (Dombrowski et al., 2009). This leads to increased insecurity for the development of company- and human resources strategies. Recruiting and preservation of employees in IT-departments is a relevant factor for the growth and the success of a company (Menez, Munder, & Töpsch, 2001). According to BITKOM, the Information Technology Union in Germany, there are 43.000 job vacancies for IT experts in Germany (Andreas Streim, 2015). Almost three-quarters (71%) of ICT companies are looking for software developers, especially with skills on cloud computing (53%) and big data (44%), followed by knowledge in social media (34%), programming of classical web properties (28%) and mobile websites or apps (26%). Since the further technological development will proceed with an ever-increasing pace, the importance of IT staff will continue to grow.

Due to the hardly-calculable impact of skills shortages on organizations, risk minimization is necessary. For some industries, it may mean a withdrawal of their business foundation because of an inadequately staffed IT team. A good example is the banking sector. Due to periodic reporting to governmental officials, complex messages and reports need to be created by people who have both, the functional expertise and the technical view on the systems. Often head monopolies (Corbin, Dunbar, & Zhu, 2007) are generated due to this high degree of specialization. If these employees leave the bank or insurance company, there is a possibility for a lawsuit according to regulations of Basel III or the KWG §25a, which could end with the loss of the banking license which is equivalent with the loss of the whole business (German Ministry of Finance, 2015).

One possibility for risk minimization is the outsourcing of work packages of IT-departments in different places in the world. An example is the software development, which is often accomplished by intercultural teams working at various locations around the globe (Colomo-Palacios, Soto-Acosta, García-Peñalvo, & García-Crespo, 2012). Thus, there is the possibility of attracting employees from other countries to utilize and compensate the deficits in the own country. Besides the benefits of the possibilities of a relocation of activities abroad, it also presents challenges for the company, which are located in different geographical, temporal and socio-cultural areas (Colomo-Palacios, Casado-Lumbreras, Soto-Acosta, García-Peñalvo, & Tovar, 2014; Colomo-Palacios, Casado-Lumbreras, Soto-Acosta, Misra, & García-Peñalvo, 2012; García-Crespo, Colomo-Palacios, Soto-Acosta, & Ruano-Mayoral, 2010; Hernández-López, Colomo-Palacios, García-Crespo, & Soto-Acosta, 2012; Luftman & Zadeh, 2011). However, many companies don't have the possibility to outsource work, because they are too small or don't have the right service provider for their specific needs (Braithwaite & Woodman, 2011). These companies need to be convincing from the inside to be attractive for employees. Often, IT is regarded as a pure support department and not as a relevant factor to productivity (Cappelli, 2000). The reputation, acceptance and position of IT-departments must therefore be changed and improved within the organization to gain acceptance for potential future employees (Zardini, Ricciardi, & Rossignoli, 2015).

An orientation for the competences of IT employees is the e-competence framework of the European Commission can be one option (European Commission, 2007). The European e-Competence Framework provides a common language to describe current competence requirements for ICT professionals and executives, career profiles and organizations. If a company conducts this analysis, they will be able to allocate and promote employees in the best possible way. Often the actual employment doesn't equal the actual competence and skill of the employees (Colomo-Palacios, Casado-Lumbreras, Soto-Acosta, García-Peñalvo, & Tovar-Caro, 2013). Besides, it is necessary to encourage cultural changes to make IT-departments more attractive to women. However, there are high hurdles, as expectations diverge greatly from those of men (Kumar, 2017; Traymbak, Kumar, & Jha, 2017) and interpersonal skills are a much more important factor (Cappelli, 2000).

Female students and employees attach above average importance to a profession that can be arranged well with family and private life, in which they can help other people and which promises them a good working environment (Ekanem, 2015). Also, it is important to have a job that matches their own skills and interests and leave enough room for an independent



work environment. Also, the social commitment of the employer's is more important to women than to their male counterparts. Conversely, for men it is important that the job guarantees a high income, good future and opportunities. In addition, men value the encouragement by their supervisors but also a profession with a moderate stress level (Institute for opinion survey Allensbach, 2014).

As many observers have noted, programmers can easily become obsolete when the programming languages that they know are not up to date anymore (Cappelli, 2000). Thus, a constant development of the knowledge of the employees is fundamental. Due to an evolving IT, a necessary specialization of employees is mandatory and ways to maintain productivity must be found. At constant productivity, the available resources will not be enough to generate the same output as in the present time and companies cannot fulfil the demand of the market.

Nevertheless, companies should consider measures to improve the organizational part of the IT-department. The following examples are measures which lead to organizational strength and a gain of productivity for the IT-department.

### ***Implementation of Lean Management philosophy in IT-departments***

The concept of lean management is an extension of the developed concept of Lean Production by the Massachusetts Institute of Technology (MIT) (Werner, 2010). Foundations of these concepts have been developed in the 60s of the last century in Japan, although the term was not used there in this form (Jonsson, Larsson, & Punnekkat, 2013). The term Lean cannot be translated with slim, thin or narrow, but with fit in the sense of healthy and flexible (D. Hahn & Laßmann, 1999). A pragmatic definition is given by Pfeiffer and Weiss. They define lean management as "... a set of principles and measures for more effective and efficient planning design and control of the entire value chain of industrial goods." (Pfeiffer & Weiss, 1994) The central factor in Lean Management is the waste (O. Hahn, 1997). The impact of waste was made evident and measurable through the integration of the concept of the seven Muda, as waste are all expenses considered, for which the customer is not willing to pay. This includes the following circumstances (D. Hahn & Laßmann, 1999):

- Transport – Moving people, products & information,
- Inventory – Storing parts, pieces, documentation ahead of requirements,
- Motion – Bending, turning, reaching, lifting,
- Waiting – For parts, information, instructions, equipment,
- Over production – Making more than is immediately required,

- Over processing – Tighter tolerances or higher grade materials than are necessary,
- Defects – Rework, scrap, incorrect documentation,
- Skills – Underutilizing capabilities, delegating tasks with inadequate training.

Avoiding this kind of waste is equivalent to cost savings. Looking at the elements of Lean Management, similarities with the Tayloristic and Fordistic principles are discernible. Thus, the standardization on the process and system level continues to apply. The production of goods is however replaced by a standardized individualization. This individualization refers to the definition and construction of unified modules and products. The advantage is that they can be adapted to different contexts and thus allows a high flexibility for the organizations (Pfeiffer & Weiss, 1994). For IT-departments, especially media breaks were applied to identify “waste” and avoid them (Nord, Ozkaya, & Sangwan, 2012).

### ***Lowering the complexity with a Software as a service model***

Another factor for efficient structures is an optimized manufacturing depth. In a large number of IT companies, it is a usual sighting, that they produce a variety of their products completely alone. This has negative effects that significantly impact on the cost structure (Ray, Wu, & Konana, 2009). The aim of optimizing the production depth is, that the ratio between company and subcontractors among customer, risk and cost points are in a particularly favourable ratio to each other (P. Carvalho & Marques, 2014). One way to achieve this goal is the concept of Software as a service (SaaS).

In a pure SaaS model, the provider delivers software based on a single set of common code and data definitions that are consumed in a one-to-many model by all contracted customers anytime, on a pay-for-use basis, or as a subscription based on usage metrics (DeZube, 2009) and is based on the concept of cloud computing (Abbas & Samant, 2011). Essentially Software as a Service (SaaS) is a software delivery model whereby a provider hosts all the required software to run an application for example a Content Management System (CMS) on their server and clients pay a subscription fee to use the system. Instead of the client having to install and maintain all the software on their own servers, they can access all the services over the internet, and not have to allocate resources towards software and hardware management (Buxmann, Hess, & Lehmann, 2008). In this model the provider is responsible for managing the hardware and software related to the use of the software including access to the application, security, availability, and performance. Every delivery model has its benefits and drawbacks and SaaS is no exception. At a glance using a SaaS delivery model allows

the client to save time, cost and effort on the setup of hardware and software. It saves resources as the provider is required to maintain the infrastructure and roll out application updates. It is scalable and depending on the nature of the account can be cost effective.

At the same time the nature of having a product that is only accessible through the internet rather than being in-house can present its own risks. If there are issues connecting to the internet, access to the application and its content is lost. Security and Data management is controlled by the provider and may not be as customisable as required. The monthly price depends on criteria that differ depending on the provider. This has the potential to grow the initial monthly subscription as the required criteria changes costing the client more than predicted.

Software as a service has the following benefits (Buxmann et al., 2008; DeZube, 2009; Katzan & Dowling, 2010):

- No client/server software installation or maintenance
- Shorter overall project time
- Enhanced availability/ flexibility
- Automatic updates to the CMS
- Hosting architecture and disaster recovery
- Security

Although SaaS has many advantages, several drawbacks need to be considered too (Buxmann et al., 2008; DeZube, 2009; Katzan & Dowling, 2010):

- Monthly subscription cost
- Security
- Data management
- Connection outage

For SaaS providers, the same risks exist as for any software vendor. Thus, a key feature of digital goods is that the creation of the first unit usually leads to high costs but the possibility of lowering variable costs with reproduction is very high (Buxmann et al., 2008).

### ***Implementation of a functioning IT-governance***

IT-governance is a subset discipline of corporate governance focused on information technology systems with regards to their performance and risk management (Dzombeta, Stantchev, Colomo-Palacios, Brandis, & Haufe, 2014). Fundamentally, it is not much different

from many other corporate governance processes such as managing a company's marketing strategy or purchasing function (although, in practise there are of course some differences). Simply put, if an organisation asks itself "how do we make sure to utilise our information technology properly and in unison with our other goals?" – IT-governance can help the organization to answer this question (Goeken & Alter, 2009). Further, an effective IT-governance addresses several questions (Dahlberg & Kivijarvi, 2006; Heier, Borgman, & Hofbauer, 2008):

- Leadership: What mechanisms exist for IT related decisions in the organisation?

Effective leadership is an essential prerequisite for effective IT-governance. Because IT Governance is a leadership process, attempting IT-governance without proper leadership is as difficult, if not pointless, as attempting projects without project management (Hogan, 2011; King, 2011). But even with a good relationship to the employees, delegation, vision, motivation and goals in place, information management leadership is always an ongoing process (McKnight, 2008).

- Business direction: How to secure that the decisions are correct?

This aspect of IT-governance ensures that the correct IT decisions are made, given the business direction of the organisation. As in many other aspects of business, it is difficult to establish a one-size-fits-all answer to what a "correct" decision is. The definitions of what a "correct" decision is varies, not only between industries and organisations but also within the same organisation over time (Funahashi, Lee, & Rushworth, 2006).

- Performance measurement: How to measure IT?

It is a common view, that you cannot manage what you cannot measure. Without a proper way of measuring the performance of IT there is a risk of making the wrong IT related decisions, for example blaming an application for low performance when in fact there is a bottleneck in the server running the application. A common way of measuring IT performances is through some sort of service level agreements (SLA) (Anderson, 2008). An IT function, internal or sourced externally, should have a defined customer in the business part of an organisation, SLAs are the guidelines and measuring of this supplier-customer relationship. For example, an IT function responsible for ERP-system maintenance might be required to follow SLA's such as "the system should be operational X % of business hours" or "critical incidents should be responded to within 1h of receiving notification of the incident". Because

the performance measurements put in place will incentivise a certain behaviour in the organisation, it is important to establish the right performance measurements to encourage the right behaviour (Johnson, 2008).

- Resource allocation: How is budget and resources allocated in order to maximise the value that IT can bring?

In order for the IT function of an organisation to properly perform its duties and to comply with the SLA's, it needs to be allocated with the proper resources (Nasrabadi, Dehnokhalaji, Kiani, Korhonen, & Wallenius, 2012). Resources can be, for example: hardware, software, people, skills or the financial resources. The allocation of these resources will become much more important in the upcoming years due to scarcity of talent and goods (Radant, 2014a).

- Organisational roles and responsibilities: What roles and responsibilities must be defined to properly make the right IT related decisions?

Roles and responsibilities must be designed and assigned in a way that there is a clear understanding of ownership and responsibilities. Roles need to be assigned both in the IT function and the business functions, i.e. employees of the organisation who utilise the IT systems to perform their jobs (Dubinsky, Yaeli, & Kofman, 2010). There are many different roles but the two main roles are:

- System owner: Typically, someone in the business department who decides what the system is supposed to do and also owns the system's budget.
- System administrator: Typically, someone in the IT-department who is responsible for the upkeep, configuration and reliable operation of the system.

The dynamics between these two roles vary from setting to setting, but it is important that they work in unison to supply the organisation with the most suitable IT system at the most suitable cost. Roles and responsibilities in an IT-department are now one of the main factors for success within the organization (Vinze, 2011).

### ***Consolidation of IT-systems to reduce complexity of the organization***

IT consolidation can be described as strategy to combine similar operations, assets, facilities or other resources in order to achieve economies of scale by avoiding duplication. Consolidation is also commonly used as a term to describe the termination of unused, discontinued, redundant or non-strategic products, resources or services.

When investigating cost cutting opportunities or ways to improve operational efficiency and thereby provide assurance to business management that IT costs are in line with industry, there are good reasons why consolidation can make IT service delivery more efficient and cost effective (Franke, Holschke, Buschle, Narman, & Rake-Revelant, 2010).

There are many examples of scenarios leading to a situation where IT consolidation is a cost saving opportunity (Mitchell, 2005). These include:

- Post-merger and acquisition situations. These often result in a need to remove unnecessary duplication of business processes, IT-applications and infrastructure.
- Fast-growing businesses, where the IT-department may need to stop “wild” infrastructure growth and gain control of service needs and demands.
- Mature organizations with a limited governance of IT over a long period of time, leading to different parts of the organization developing and maintaining their own business supporting IT-applications and -infrastructure.

Any of the above scenarios, or a combination of them, is likely to result in a fragmented application landscape if an IT strategy and governance model is not in place.

Looking at IT application consolidation from an implementation perspective, the short-term (or most straightforward) opportunities typically include termination of not used legacy systems still running (Fallin, 2012). Surprisingly often, old IT applications are retained when new ones are implemented, primarily for the reason of having access to historic data. Usually there are no major changes in the total cost of ownership for the application when the usage changes to read-only. But the business as well as the IT-organization needs to maintain competence on the tool as well as the technical infrastructure (such as operating system, hardware, integrations and storage) and application license costs often remain the same. The strategy is usually to challenge the actual need for keeping legacy data and to archive only the information that is really required for regulatory or key business reasons. A generic digital data archiving solution is useful to have in place in order to implement efficient legacy application and to shut down activities.

Midterm opportunities for application consolidation typically represent dealing with redundant IT-applications. Many larger organizations have a history of mergers and acquisitions, and/or businesses operating in silos. As a consequence, IT-applications solving similar functional needs may be implemented in several areas within the organization (Franke et al., 2010).

The long-term application consolidation opportunities are typically related to more radical improvements. An example is business process redesign, or simplification of the infrastructure and technical architecture; moving from a diverse application portfolio with various small solutions integrated over time, to one common business system supporting all or most processes. Such initiatives produce long-term cost savings, but tend to require larger investments (Network World, 2011). Concerning consolidation of business applications, such a project must be a business-driven initiative. The IT organization can assist with functional and technical assessment, as well as supporting the development of a consolidation roadmap (Mahato, Jain, & Balasubramanian, 2006). However, it must be a business management decision to phase out one application and a consequent roll-out of another application providing similar functional support. Each application exchange may require changes in working processes and thereby training and communication for the affected users (Hadfield, 2006). Experience related to the amount of work needed to execute IT consolidations as described here, ranges from less than three months for short-term opportunities, while mid-term initiatives may take three to six months and long term initiatives take up one to two years (Hadfield, 2006). Timing also depends on the size and complexity of the organization, as well as the strength of the governance model for IT. Typical expected savings in application consolidation initiatives is between 10-30% (Network World, 2011).

The potential for increased efficiency and cost saving via consolidation of applications can be realized by an organization which has the will to implement them and to design an effective process (Tarallo, 2007). The initiative should be seen as a joint venture between business and IT, where the business drives the change process and IT supports with analysis and execution on the technical side. It is the business side that will feel the greatest impact during the consolidation program and thus the need for strong support of the business leadership (Brandel & Betts, 2010). However after that consolidation, an efficient, consolidated and aligned IT service delivery with lower costs, common processes and data models that facilitate reporting and performance analysis, will be just some of the benefits for the company (Brandel & Betts, 2010; Franke et al., 2010).

### ***Human resources management and psychological implications of the skills shortage for employees***

Human Resource Management has a unique impact on the performance of an organization (B. Becker & Gerhart, 1996; Bileviciene, Bileviciute, & Parazinskaite, 2015). It is obvious

that the personnel of companies, in times of demographic change and skills shortages, is becoming increasingly important for businesses. Nevertheless, employees are often regarded as a cost and not as an asset of the company (Sabir & Sabir, 2010). Due to this fact, companies lose large potentials in development, productivity and organizational performance. That these circumstances are not yet anchored within companies, is shown by the fact that depression is the main mental health challenge for employees and more than 30 million European citizens will suffer from depression at some point in their life (European Depression Association, 2013). A survey polled more than 7,000 people in Europe and found that 20% of respondents had received a diagnosis of depression at some point. The highest rate was in United Kingdom (26%) and the lowest in Italy (12%). Among workers experiencing depression, those in Germany (61%), Denmark (60%), and United Kingdom (58%) were most likely to take time off work, while those in Turkey were the least likely to take time off (25%). The costs of depression were estimated at 92 billion Euro in 2010 in the EU, with lost productivity due to absenteeism (taking time off work) and attendance (being present at work while ill) representing over 50% of all costs related to depression.<sup>1</sup> In the IDEA survey the average number of days taken off work during the last episode of depression was 36 days, with Germany and United Kingdom having the highest (41 days) and Italy (23 days) having the lowest (European Depression Association, 2013).

In Germany the number of mental illnesses such as depression and burnout continues to rise from 4.6 sick days per 1000 a year in 2004 to 74.1 days in 2014 (Statista, 2014). The cost of illness due to depression in Germany has increased on average by about 50 % from 2002 to



2008 as shown in the following table (Federal Statistical Office Germany, 2010).

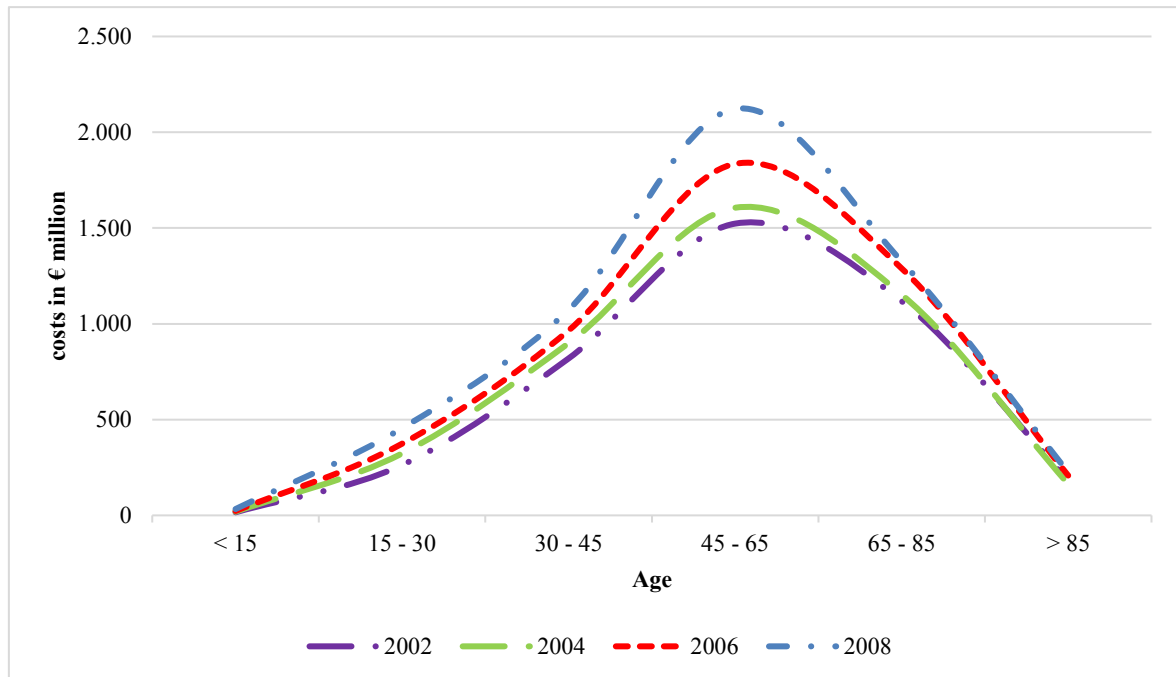


Figure 4: Cost of illness due to depression in Germany

In addition, the number of depressive symptoms, which is indicated as the EURO-D-Scores<sup>3</sup>, increases with age and is higher for women than men. This result is based on the analysis of 28.538 respondents between 50 and 89 years in eleven European countries and Israel. The average EURO-D-Score for men has increased from 1.6 to 3.0 and from 2.5 to 3.8 for women (Buber & Engelhardt, 2011).

Through close examination of the research on these phenomena, more facets like an under challenging work environment due to repetitive activities, the so called bore out (Cürten, 2013), was identified. According to the Stress Report of the Federal Institute for Occupational Safety and Health in Germany the most common mental demands are the supervision of different activities at the same time (58%), severe time pressure and tight deadlines (52%) but also frequent interruptions (44%). 16% of the respondents agree to work at their limit. Nevertheless, this fact is perceived by 74% as psychologically stressful, followed by lack of (73%) or not timely information (65%) (Lohmann-Haislah, 2012). These factors are confirmed by further studies (Gao, 2011; Zeng, Zheng, & Shi, 2010). They show that the HR strategies and the company's relations with its employees need to be adjusted to the circumstances of today. Changes should include previously mentioned factors and additionally the

<sup>3</sup> The EURO-D was originally developed in an effort to harmonize data on late-life depression from population-based studies in 11 European countries as part of the EURODEP collaboration (Castro-Costa et al., 2008).

fact that technologically induced stress is a crucial multiplier, as pointed out by Lee. This is caused by strong technological transformations of an organization (T. S. Lee, Foo, & Cunningham, 1995).

The attitude of the staff on leadership and hierarchy of the company has changed a lot in the last years, enhanced communication and information needs are leading to different expectations. They differ by age and sex (Shatat, El-Baz, & Hariga, 2010b). The integration of psychological contracts (Xiaojing, 2012) and empowerment of the work shall increase the perception and loyalty at the beginning of the employment (Kun, Hai-yan, & Lin-li, 2007). If the employers meet the expectations of the personnel, the corresponding employee expenditures will reduce in a medium and long term range (Shatat et al., 2010b). Gao states in his research following countermeasures to employee stress management (Gao, 2011):

- attention should be paid to the effective measures to train junior managers and enhance psychological health level and the level of production management,
- reform the management style and find out new ideas suitable for the new generation of urban migrant workers,
- focus on the staff and identify who is exposed to excessive stress and
- set up a specialized institution to study the stress of staff.

It is also necessary to develop measures in the company to a corresponding prevention of mental illnesses such as burnout and to meet and implement them in the HR strategies (Bertram, 2013).

There are various models for assessing the value in the different phases of the employment relationship in enterprises and the contribution of human capital to operating profit. Often these models are noted regarded as bureaucracy and unnecessary additional work in the organization (Schneider, Shaw, & Beatty, 1991). If these are not used consistently and kept up to date, they are often considered as irrelevant and the results will not be useful (Perrin, 1998). Prominent examples are the models of Employee Lifetime Value (ELTV) (Mulhern & Moiseyev, 2007) or the People Capability Maturity Model (PCMM) (Curtis, Hefley, & Miller, 2009).

These models cannot be used for the purpose to evaluate the outcome, since they don't evaluate the quality or derive decision for the future, as they only reflect the present or give no evidence for the appropriate allocation of resources. But since they evaluate the result of a

process, they can be an important component to be able to make a comprehensive evaluation of the overall results (Perrin, 1998).

The literature provides several models to determine the performance of employees. In 1964, Vroom developed the theory that performance was a function of ability and motivation (Steele, 1964). This model has been widely criticised because of the non-inclusion of other relevant dimensions of performance (Blumberg & Pringle, 1982). Over the years, research recognised the significance of context of performance. For example Blumberg and Pringle (Blumberg & Pringle, 1982) pointed out that performance is a function of capacity (ability, health, intelligence, education etc.), willingness (motivation, job satisfaction, status etc.) and opportunity to perform (tools, equipment, working conditions, co-worker and leadership behaviour etc.).

Campbell et al (Campbell, McCloy, Oppler, & Sager, 1993) distinguished between the component behaviours that constitute performance, human and technological capabilities required for individuals to achieve the behaviours and antecedents factors which influence differences in each of the required capabilities of performance. In the 2000s systems theory connected Human Resource Management and organizational systems. High-performance work systems (HPWS) are a group of separate but interconnected human resource (HR) practices e.g. selection, training, performance appraisals and compensation, designed to enhance employee effectiveness and individual performance through enhancing employee skill levels and firm specific knowledge and provide lower quit rates and improved motivation (Batt, 2002). The AMO framework, became one of the dominant theoretical approaches towards exploring the HRM-performance link in recent years (Boselie, Dietz, & Boon, 2005). This framework proposes that employee performance (P) is a function of the employee's ability (A), motivation (M) and opportunity (O) to perform (Collings & Mellahi, 2009). Expressed as an equation:

$$P = f(A, M, O)$$

This equation reflects the fact that although the exact relationship between the variables has not been established, all three variables have an impact on employee performance (Boxall & Purcell, 2003). Although the framework offers various explanations about the “complexity” of the variables that determine the performance of the employee, an important set of variables are not mentioned. These models don't address the psychological stress and the latest scientific findings. Furthermore, they neglect the massive change in the expectations

and emancipation of workers. They also exclude the cultural dimension as Hofstede (Hofstede, 1984) describes in detail. However, this is in relation to the internationalization of IT becoming increasingly important. The inclusion of these factors is a fundamental part of today's work environment, since the burden on key personnel is higher and a company usually cannot afford a discontinuation of work. It is therefore essential to derive a combination of disciplines and possibly models combining the performance management, cultural and psychological aspects in the future. To achieve this goal, it is necessary to set up a set of influential factors for employee performance, which will be further assessed in this thesis. This initial set of factors was identified in the first published paper during this PhD-project which was a SLR about the actual state of the art around this research topic (Radant et al., 2014).

| employee ability        | motivation               | opportunity                  | external influences            | internal influences  |
|-------------------------|--------------------------|------------------------------|--------------------------------|----------------------|
| education               | goals                    | business perspective         | private distractions/ problems | Workload             |
| experience              | personal needs (x vs. y) | glass ceiling <sup>4</sup>   | economic distractions          | psychological stress |
| training, qualification | incentives               | permeability of organization | political distractions         | mobbing (bullying)   |
| infrastructure          |                          |                              |                                | job security         |
|                         |                          |                              |                                | company performance  |

Table 1: Variables of employee performance

Regardless of the performance and the associated evaluation of the employee, a rethinking of the management must also take place due the factors mentioned. Hersey and Blanchard set the foundations in their maturity model (Hersey & Blanchard, 1993):

1. The rationale of leadership style is based on the assumption that every employee needs to be led by his maturity to release its potential for the company.
2. The leader should not just lead with his own style, but should be rather in line with the general company management philosophy, taking individual personality and limits into consideration and respecting the needs of the employee.

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<sup>4</sup> The term glass ceiling is a metaphor for the phenomenon that qualified women barely break into the top positions in companies or organizations and no later than "stuck" at the level of middle management (Cotter, Hermsen, Ovadia, & Vanneman, 2001)

3. The degree of maturity (maturity score) of an employee is determined by the combination of motivation (psychological maturity) and ability (working maturity).

Although these mandatory foundations were built in 1993, the culture in companies did not fully adapt them, as the mentioned studies prove. This leads to following research gaps that needs to be solved.

- Development of a methodology to quantify human resource strategies.
- Definition of a holistic model that includes changes regarding employee expectations of different workforce generations.
- Definition of a model that allows companies to identify and derive threats and risks regarding the structure of the organisation and especially employee management with focus on scarcity of talent.

These gaps where also confirmed via an analysis of the state of the art (Radant et al., 2014).

### **3. Problem formulation and research approach**

In this chapter, the author describes the problem to solve in a detailed way. Also, research approach, design and methodologies to solve the research problem will be defined. The third part is the justification of the research methodology and the adopted research method. Finally, a set of limitations on validity are presented and justified.

#### ***Research problem***

As stated in chapter 2, the impact of demographic change on companies will be very dramatic and associated challenges need to be solved and the foundations to solve this problem need to be laid down rather earlier than later. One of these foundations is the creation of transparency about the actual employee needs of the company.

Overall employee performance is depending on a various number of variables that could influence the overall productivity like loyalty, psychological and physiological healthiness and happiness as well (Sawitri, Suswati, & Huda, 2016). To manage these different variables, it is important to quantify and rate them regarding their importance for the company. A conducted SLR in 2014 showed that there is no holistic model that includes these variables and offers metrics for the management nor the controlling (Radant et al., 2014). There are several scientific papers on the subject of skill shortage and their implications for IT-Departments. A large part is an analysis of the causes of the present situation and the associated implications in the future. Another part deals with the organization of companies in the future and explains their advantages and disadvantages. In addition, there are many journals about human resources management and psychological implications for employees. It became apparent during the research, that there are hardly any works that links all variables together, to develop unified strategies and solutions for businesses.

Therefore, companies need a holistic approach to manage scarce resources flexible and target orientated. The novelty of this research lies in the alignment of different measures to gain productivity within the organization and the employees. The goal is to develop a framework that provides companies with a step by step work plan and a holistic approach for the optimization of the employee pool. The main research contributions are focused on filling the gap between organizational and employee development with concurrent measures for the binding of personnel.

**Research approach**

The objective of this thesis is the development of a framework suited to manage personnel in times of scarcity of talent which includes all relevant factors that would influence the productivity of the employees. The focus of this research is the definition of a hierarchical approach that groups the different variables in layers and defines factors and metrics for the continuous measurement of these variables. The factors define what should be measured regarding employee performance and metrics define how a factor should be measured.

To achieve this goal, a proper research method need to be defined. A research methodology is defined as the combination of several methods, assumptions, models, techniques that establishes the procedures for collecting and analysing data, measuring progress and research success in order to solve a defined research problem (Genemo, Miah, & McAndrew, 2016).

For this thesis, the research approach follows several phases and each one will build on the results of the previous phase. The overall approach is shown in the following figure and consists of three different phases.

| Phase 1 – Assessment of the state of the art/ background  | Phase 2 – Definition of framework  | Phase 3 – Customization and validation of framework   |
|---|--|---|
| <ol style="list-style-type: none"> <li>1. Evaluation of the current research and state of the art with the method of a SLR.</li> <li>2. Statistical analysis of the development of the population in Germany, Spain and Europe in a whole</li> <li>3. Evaluation of the educational measures in software engineering via a qualitative study</li> </ol> | <ol style="list-style-type: none"> <li>1. Definition of factors that influence employee productivity with the method of a SLR</li> <li>2. Definition of metrics that influence employee productivity with the method of a SLR</li> <li>3. Development and validation of an implementation plan for the framework with the method of a qualitative study</li> </ol> | <ol style="list-style-type: none"> <li>1. Quantitative validation of the framework via an employee survey and quantitative methods</li> <li>2. Qualitative validation of the framework with the method of expert interviews</li> <li>3. Test of the framework in practical conditions in a German company</li> <li>4. Adjustment of framework with the help of the results of the test</li> </ol> |

Figure 5: Research approach

The research approach is separated in three different parts. In the first phase, the state of the art will be examined and the actual development of the population in Europe will be analysed. The third part of this phase is an evaluation of the actual educational measures in information technology via a quantitative study. Since the importance of education of employees will grow in the future (Liliy, Julia, Elena, Oksana, & Anastasia, 2015), this analysis will be the foundation of the further development of the framework.

The second phase is devoted to the definition of the framework and the definition of factors and metrics that influence employee productivity. Also, an implementation plan for companies will be developed. Since the goal of this thesis is to formulate a holistic approach, the definition of the factors and metrics will be carried out with the help of two different structured literature reviews that covers all relevant publications. On the basis of the findings, an implementation plan will be developed. The plan will be tested via a qualitative survey with change management experts.

The third phase consist of different testing activities. The goal is to validate the overall results of phase 2 and identify possible adjustments for the framework if needed. The test will be carried out in three independent steps. The first part is a quantitative study with employees from different backgrounds and hierarchy levels. The second part is the validation of the results with the help of expert interviews and the third part is the actual test of the developed method in a company under real life conditions. The results of this phase will be used to adjust the developed framework if necessary.

### ***Limitations of research***

The purpose of this section is an assessment of the possible limitations of this research regarding its threats to reliability and validity. The reliability of a research refers to the repeatability of findings and validity refers to the credibility or believability of the research (Zohrabi, 2013). Both, reliability and validity of research can be divided in the several subsections and the results, limitations and threats of this thesis will be analysed in regards to this classification.

### ***Threats to reliability***

- **Internal reliability**

Internal reliability is concerned with the consistency of collecting, analysing and interpreting the collected data. Internal reliability is verified when an independent researcher would conclude similar findings as the original researcher (Zohrabi, 2013). Internal reliability in this refers especially to the section 7.1 of this thesis. The analysis of the data consisting of n=391 employees was conducted with in research accepted statistical methods and followed a logically consistent approach. Consequential, no threats on internal reliability can be identified for this thesis.



- External reliability

The concept of external reliability is concerned with the replication of the study so the question is if an independent researcher could reproduce the study and obtain results similar to the original study (Burns, 2003). A possible threat was identified with regards to the qualitative research methods and in specific to the expert interviews applied in chapter 4 and chapter 7. Although the author made sure that the interview partners are all experts in their fields, there is the possibility that a different selection of experts could have led to different results.

### *Threats to validity*

- Internal validity

Internal validity is concerned with the congruence of the results of the research with the reality and about inferences regarding cause-effect or causal relationships (Woodman, 2014). The respondents in the presented analyses are chosen because of their practical background and expertise. With regards to this, the threat comes from the fact that actual personal situations can have a profound effect on the answers concerning e.g. psychological effects or the importance of salary for their life. The approach for the mitigation of this threat in this thesis is the number of the sample size in the presented quantitative study and the use of several different qualitative studies.

- External validity

External validity is concerned about the generalization of the retrieved results beyond this thesis (Konradsen, Kirkevold, & Olson, 2013). The external validity for the statistical analyses can be deemed very high, since the sample size is sufficient enough to apply the results to European employees beyond the sample in the study. A threat to external validity is that the sample size consists only of European employees. Consequently, conclusions for other working cultures e.g. in Japan and China cannot be drawn.

A second threat is, that the framework was only tested in one company. A positive progress of the use and the implementation of the framework is highly dependable on the willingness of the organisation to change and to adopt the framework.

- Content validity

Content validity refers to how accurately an assessment or measurement tool covers the various aspects of the specific construct in question (Burke, 2017). Content validity is

most often measured by relying on the knowledge of people who are familiar with the construct being measured (Rico, Dios, & Ruch, 2012). A possible threat for content validity could be identified for the qualitative validation of the overall framework in chapter 7 since in total three experts validated the *5-layer framework for employee productivity*. This threat on validation was mitigated with the use of a quantitative survey and test under real life circumstances.

- Conclusion validity

Conclusion validity (also named statistical conclusion validity) is the degree to which conclusions we reach about relationships in the data are reasonable and that adequate statistical methods are used whose behaviour is accurate, besides being logically capable of providing an answer to the research question (García-Pérez, 2012). Regarding this research, no threats on conclusion validity could be identified. The conducted tests and used methods are widely used in the research community. Further, for the used statistical tests the coefficient of determination which indicates the proportion of the variance in the dependent variable that is predictable from the independent variable was calculated.

The results of this test supported the statement, that the data was used in a logical way.

The author is aware of the limitations and threats to reliability and validity of the different research methods applied. He has made all possible effort to employ research methods that through their complementarity and structure aim to ensure sufficient research rigor and to not control for cascading effects by specific limitations of one method.

#### **4. Assessment of continuing educational measures in information technologies: A view from the industry**

Skills obsolescence is especially critical in a sector that witnesses fast paced technological, domain, and process changes leading to rapid skills obsolescence, unless these skills are updated often, for example via proper training measures (Bapna, Langer, Mehra, Gopal, & Gupta, 2012). In the specific field of software practitioners, a constant development of the software practitioner's knowledge is fundamental as highlighted by previous works in this field (Agarwal, Pande, & Ahuja, 2014; Khemaja & Mastour, 2014). Main assets in software industry are not servers, buildings or machines. The main asset is knowledge capital (Casado-Lumbreras, Colomo-Palacios, Gomez-Berbis, & Garcia-Crespo, 2009). Due to the fluctuation of labour and the fact that available resources are not increasing along with the increasing needs, knowledge management, training and education in information technology are even more important (Rus & Lindvall, 2002).

##### ***Approach***

The interview study reported here was carried out with some of the most experienced IT-professionals from the consulting company BearingPoint. Six partners and senior managers from BearingPoint participated in the interviews. The sample consisted three Senior Managers and three Partners. Three of them worked as "Software Quality Assurance Engineers and Testers" and three of them as "Information Technology Project Managers". The mean age was 41.83 with a standard deviation (SD) of 6.74. They have work experience in Information Technology on average of 15.33 years with SD of 6.47 and experience in the field of software engineering of 11.17 years with a SD of 5.91 years. The study was structured in two parts. In the first part, the interviewer hosts a round table which five of the six IT-professionals attended. The goal was to identify the most common challenges for IT-companies on continuing education and training. After that, the interviewer created four research questions, based on this event.

Training and training measures (or continuing education and continuing educational measures) are part of the improvement programs in both small (Díaz-Ley, García, & Piattini, 2010) and big companies (Armbrust, Ebell, Hammerschall, Münch, & Thoma, 2008) and knowledge-based enterprises (V. Stantchev & Franke, 2010).

However, to the best of authors' knowledge and although the topic is quite popular in scientific literature, there is not a study devoted to identify these measures in organizational contexts. This chapter is aimed to bridge this gap and builds a fundament for the development of the solution in this thesis. The results will be used in several layers of the *5-layer framework for employee productivity* and especially in the layer *education and employee pool*.

### ***Research plan***

Several research questions were formulated to bridge the formulated research gap and develop a solution for the companies.

- RQ1: Which are the relevant educational measures and their benefits in praxis?
- RQ2: What could be improvements for companies regarding training of employees?
- RQ3: What are the common problems when companies are conducting these measures?
- RQ4: What are controlling instruments for these measures to evaluate the success?

In the second part, the interviews regarding the research questions were conducted and recorded by an interviewer, and later transcribed by him. The study took place as a qualitative interview study in the tradition of the qualitative research interview which allows the researcher to ask questions to different issues in the interviewees' work life and experiences, including practical issues of how to do things and handle cognitive issues such as personal and professional epistemology (Sayrs, 1998). Open-ended questions were used and members of the team had freedom to describe at length their experiences. This data collection approach provides information that could not be obtained through a quantitative approach as it allows opinions, thoughts and feelings (Sayrs, 1998).

Atlas.ti 6 software was used for transcription and coding of the interviews. Subjects were selected from those who answered positively to a personal invitation sent by the authors. The total recorded time of interviews was 5 hours, 30 minutes with an average of 55 minutes and 3 seconds per interview.

### ***Execution of research***

In the following chapter, the mentioned research questions will be answered.

*RQ1: Which are the relevant training measures and their benefits in praxis?*

There are several types of trainings for IT-employees. All of them have their specific elements and benefits. It is important to mention that the choice of which training type should be used, depends on the audience and their skills.

Assessment of continuing educational measures in Information Technology:  
A view from the industry

| Type of training delivery                                | Elements   | Intended audience and benefits   |
|--|--|--|
| Instructor-led training (traditional classroom training) | <ul style="list-style-type: none"> <li>- Classroom setting</li> <li>- For small audiences (up to 20 end users)</li> <li>- Provides walkthroughs</li> <li>- Storyboards and concept slides</li> <li>- Task-level work instructions</li> <li>- Quick reference guides</li> <li>- Hands-on exercises</li> <li>- Facilitator and learner guides</li> <li>- Allows end users to complete scenario-based, hands-on activities</li> <li>- Case studies</li> <li>- Simulations</li> <li>- Online performance support system</li> </ul> | <ul style="list-style-type: none"> <li>- Most appropriate for training groups on changes to concepts, procedures, and detailed functional and technical steps.</li> <li>- Provides participants with access to professional knowledge, allows participants to learn from each other, and emphasizes teamwork.</li> <li>- Excellent for communicating delicate topics.</li> <li>- End-user training is instrumental in decreasing resistance and promoting adoption of new business processes.</li> </ul> |
| Computer-based, web-based, and virtual training          | <ul style="list-style-type: none"> <li>- Self-paced and interactive learning process</li> <li>- Training accomplished by using a CD or via the internet</li> <li>- Online simulations</li> <li>- Exercises</li> <li>- Knowledge checks</li> </ul>  | <ul style="list-style-type: none"> <li>- Self-paced</li> <li>- Online access to course materials</li> <li>- Hands-on practice</li> <li>- Useful for economical training geographically disbursed stakeholders</li> <li>- Facilitates course sessions over the intranet and internet</li> <li>- Useful when classroom training is not available or practical</li> </ul>   |

| Type of training delivery                | Elements   | Intended audience and benefits  |
|--|--|---|
| Hands-on practice environment or sandbox | <ul style="list-style-type: none"> <li>- Production-like environment that end users can use after training to practice specific transactions and processes in the system</li> <li>- Environment uses simulated but realistic data</li> <li>- Self-directed learning</li> </ul> | <ul style="list-style-type: none"> <li>- Most appropriate for individuals who have completed the training course and would like to continue building their confidence using the new system or keep the knowledge and skills recently learned</li> <li>- Self-paced</li> <li>- Hands-on practice</li> <li>- Mirrors the production database</li> <li>- Safe environment in which to practice skills</li> </ul> |
| One-on-one training                      | <ul style="list-style-type: none"> <li>- On-the-job training</li> <li>- Personal coaching</li> <li>- Informal training</li> </ul>  | <ul style="list-style-type: none"> <li>- Better suited for senior-level management</li> <li>- Highly customizable for learning on the job</li> <li>- Provides prompt application of learned knowledge, skills or abilities</li> <li>- Feedback is extensive, contextual, and immediately relevant</li> </ul>  |
| Demonstrations and presentations         | <ul style="list-style-type: none"> <li>- Provides a general introduction to the system and components</li> <li>- Can be conducted in person or on the web</li> <li>- Employed prior to classroom training</li> </ul>   | <ul style="list-style-type: none"> <li>- Ideal for large audiences</li> <li>- Cost-effective</li> </ul>   |

Table 2: Types of Training and their corresponding Elements and Benefits

*RQ2: What could be improvements for companies regarding training of employees?*

All experts stated that - due to the rapid change of requirements - learning and training are more important than ever for ensuring more effective and efficient operations in information technology. This is particularly relevant in the context of societal and demographic changes. Companies need to develop and educate their employees in the best possible way, to retain and achieve the targeted level of production. In what follows, authors summarize the answers given by the participants.

It is important to achieve a certain basis of knowledge in a company on which the measures can build up on each other. So, the first training for new acquired personnel should be a curriculum which teaches the standards and characteristics of the companies' systems, processes and working habits. Afterwards specific trainings for the assigned tasks could be conducted, but it is always necessary to set standards for competence development. Regarding the organization of training, there should be one person who is in charge of the measures. Often, due to miscommunication between departments, trainings overlap not only in schedules but also in the skills taught. This can be prevented if a company uses a knowledge management strategy and a corresponding knowledge management system, which sets the standards, organizes and regulates the educational processes to improve the training time of the employees.

Further training for IT is often not provided with sufficient funding to conduct the necessary trainings nor to equip the labs with the adequate hardware. This is often due to lacking willingness of the leadership of a company to fund investments which have not a short-term business case. Also, the acquired skills and abilities should be used immediately after the training to receive the best possible outcome. Although the gained knowledge will not be lost if it is not applied shortly after the training, the learning process will indeed be far more successful this way.

*RQ3: What are the common problems when companies conducting these measures?*

| <b>Risk</b>                                    | <b>Mitigation</b>   |
|--|---|
| Lack of user commitment to training activities | <ul style="list-style-type: none"><li>- Leadership must communicate that end-user training is mandatory for the required staff.</li><li>- Class attendance will be tracked, and this data will be provided to the appropriate management staff.</li></ul> |

| <b>Risk</b>   | <b>Mitigation</b>   |
|---|---|
|   | <ul style="list-style-type: none"> <li>- The class schedule will be published well in advance of the training delivery date to reduce conflicts, personal commitments, and other scheduling limitations.</li> </ul>   |
| Users don't have pre-requisite knowledge and have skills gaps | <ul style="list-style-type: none"> <li>- Users should have basic PC and Windows knowledge before end-user training. This will be communicated to the appropriate management staff.</li> <li>- Managers should evaluate their user population to determine who needs additional PC and Windows training.</li> </ul>  |
| Technical issues  | <ul style="list-style-type: none"> <li>- Software/database issues - A technical team member will be assigned to serve as a liaison with the Training Lead.</li> <li>- Hardware issues - Create a back-up plan in the event of projector/system issues (for example, a need for additional projector bulbs or an additional projector).</li> <li>- Provide hard copies of slides to end users.</li> </ul>  |
| Training is offered too far in advance of Go-Live             | <ul style="list-style-type: none"> <li>- Instructor-led training (ILT) should ideally be conducted no more than 2 months prior to go-live (ideally 1 month prior to go-live) with other training activities potentially given throughout the project.</li> <li>- Timing of training delivery is important to increase retention of information learned in class and improve the trainees' ability to perform their jobs after go-live.</li> </ul> |

Table 3 Risks and Mitigation Strategies

The overall success of an IT-department depends on the success of the training effort; processes and systems require knowledgeable people to realize planned benefits. While Table 3 summarizes common risks and corresponding mitigation measures, Table 4 presents a list of items which are critical to the success of the training effort, and actions that can be taken to ensure success.

| <b>Critical success factors for training</b>   |   |
|--|---|
| <b>Success factors</b>   | <b>Actions to ensure success</b>  |
| <b>Management commitment</b> – Ensures the required time is committed on the part of | <ul style="list-style-type: none"> <li>- Top Management Commitment</li> <li>- Strong Leadership Communications</li> </ul> |



| <b>Critical success factors for training</b>   |   |
|--|---|
| <b>Success factors</b>   | <b>Actions to ensure success</b>  |
| employees to participate in required activities, training, etc.  | <ul style="list-style-type: none"> <li>- Engage supervisors to ensure priority</li> <li>- Consistency and visibility throughout the organization</li> </ul>   |
| <b>Trainer commitment</b> – Employees selected as trainers will spend significant time and energy learning about the project and how to be effective trainers.                               | <ul style="list-style-type: none"> <li>- Early identification of trainers</li> <li>- Engage immediate supervisors to ensure priority</li> <li>- Train the-trainer program provides training tools content and generates project excitement</li> </ul>   |
| <b>User commitment</b> – Users are ultimately accountable for their own training. Their quality of learning will depend on attitude and commitment.  | <ul style="list-style-type: none"> <li>- Consistent and visible communication</li> <li>- Training requirements communicated early</li> <li>- Engage supervisors to ensure priority</li> </ul>   |
| <b>Knowledge sharing</b> – Rapid development of training will rely on knowledge and information from the company team and subject matter experts (SMEs).                                     | <ul style="list-style-type: none"> <li>- Establishing roles and responsibilities for training developers and core team</li> <li>- Identifying the best people as training developers</li> </ul>   |
| <b>Process and System Design Decisions</b> – Timely process and system design decisions with minor revisions. Significant and last-minute changes will reduce the effectiveness of training. | <ul style="list-style-type: none"> <li>- Understanding the implications for training if or when changes are made</li> <li>- Close coordination with functional teams so changes are communicated quickly</li> <li>- Decision maker awareness of the implication of changes</li> <li>- Communication of the documentation freeze date</li> </ul> |
| <b>Training environments</b> – Access to necessary IT-environments during training development and delivery. Configuration and data must be consistent with the production                   | <ul style="list-style-type: none"> <li>- Properly configured and data populated training environments</li> <li>- Refresh schedules established</li> <li>- Sandbox available to all users</li> </ul>   |

| <b>Critical success factors for training</b>  |  |
|---|--|
| <b>Success factors</b>  | <b>Actions to ensure success</b>   |
| environment. Refresh schedule must be adhered to and practice sandbox with realistic data should be available.  |  |
| <b>Facilities and infrastructure</b> – Training requires dedicated facilities and IT systems. All sites must have adequate network connectivity.          | <ul style="list-style-type: none"> <li>- Close coordination within the department</li> <li>- Early communication of requirements to sites</li> <li>- Adequate equipment in training rooms</li> <li>- On-call IT and training team support</li> </ul> |
| <b>PC workstations</b> – End users must have PC workstations available that are properly configured in a timeframe that coincides with training delivery. | <ul style="list-style-type: none"> <li>- Early identification and communication of requirements to the technical team</li> </ul>   |
| <b>Technical support</b> – Training delivery concentrated in a short period requires minimal rescheduling due to technology and application failures.     | <ul style="list-style-type: none"> <li>- Pre-training checks of infrastructure operation</li> <li>- On-call technical and functional support</li> </ul>  |
| <b>User training materials</b> – Training materials must be user friendly.  | <ul style="list-style-type: none"> <li>- Minimize printed materials;</li> <li>- Documentation needs to be simple and straight forward</li> </ul>   |

Table 4 Critical Success Factors for Training

*RQ4: What are controlling instruments for these measures to evaluate the success of them?*

The experts stated, that the approach for the controlling of educational measures should include four levels of evaluation:

**Training program evaluations** – Course participants evaluate every course taught in the program. The purpose of the evaluation is to gain feedback that can be used to improve subsequent training sessions. The evaluation provides trainees with an opportunity to indicate their level of satisfaction with the following:

- Training materials
- Course content

- Course design
- Facilities

**Classroom performance evaluations** – Trainee evaluations will measure retention via assessments, hands-on exercise completion, and case study understanding. During training, exercises will be structured so that each module builds on the previous module. A user cannot progress through the class unless skills are mastered in each module. Trainers can assess each participant based on his or her progress through the modules.

**Behaviour Evaluation** - This measures how well the participant is applying the new skills on the job (the degree to which training has changed job behaviour) and is collected after the participant has actually used the new skills on the job. Behaviour Evaluation can be linked to the individual's personal development plan.

**Business Results Evaluation** – It measures the impact of the training on the overall business unit performance and is collected after the participant has worked in the new environment for approximately nine to 12 months. A baseline for comparison will be needed for this evaluation to be effective.

| <b>Measures and methods of training evaluation</b> |   |   |
|--|---|---|
| <b>Evaluation</b>                                  | <b>Measures</b>   | <b>Method of evaluation</b>   |
| 1. Program<br>(overall training experience)        | <ul style="list-style-type: none"> <li>- Training administration process (registration, facilities)</li> <li>- Trainer performance</li> <li>- Course material (quality, content and presentation of)</li> </ul>   | <ul style="list-style-type: none"> <li>- Course evaluation</li> <li>- Trainer debrief</li> </ul>    |
| 2. Participant<br>(classroom performance)          | <ul style="list-style-type: none"> <li>- Based on the predefined learning objectives which measure understanding of:                             <ul style="list-style-type: none"> <li>o Facts – such as the new process and procedures</li> <li>o Techniques – such as how a transaction is performed to support my job role</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>- Course evaluation</li> <li>- Trainer evaluation</li> </ul> |

| Measures and methods of training evaluation     |  |  |
|---|--|--|
| Evaluation                                      | Measures   | Method of evaluation   |
| 3. Behaviour (job performance)                  | <ul style="list-style-type: none"> <li>- Behaviour (e.g. willingness to perform job role following processes and procedures)</li> <li>- Performance (e.g., the ability to use the new system effectively with few errors)</li> </ul> | <ul style="list-style-type: none"> <li>- Participant post training survey</li> <li>- Supervisor post training survey</li> <li>- Help desk trouble calls</li> </ul> |
| 4. Business Results (business unit performance) | <ul style="list-style-type: none"> <li>- Improved quality</li> <li>- Reduced costs</li> <li>- Increased productivity</li> </ul>  | <ul style="list-style-type: none"> <li>- Supervisor post training survey</li> <li>- Budget/reports</li> </ul>  |

Table 5 Measures and Methods of Training Evaluation

Methodology for the implementation and execution of training measures in information technology

Also, the expert panel suggested a rigid development methodology for the implementation and execution of continuing educational measures which follows a five steps approach.



Figure 6 Approach for the implementation and execution of continuing educational measures

**Conduct training analysis:** The development and delivery of training must integrate a number of key elements. Before the training solutions are developed or delivered, a thorough requirements assessment and audience analysis will be conducted using skills assessments, job impact assessment, process redesign, and fit/gap analysis. Prerequisite role definitions, types of training, and new course development (for example, as is, from scratch, or off the shelf) are some of the issues that will be identified at this time.

**Design training:** The objectives of developing a training plan are to produce trainings which fit the strategic development and the needed skills of the company. To achieve the desired goals, the implementation of a flexible, blended training delivery solution that considers various training delivery mechanisms was also recommended.

**Develop training:** During this phase the required business, technical, and end-user training materials are build. This may include developing classroom training and train the trainer presentation materials, graphics, interactive elements and post-training job aids. When appropriate these materials will be business scenario based and product centric.

As part of the complete training plan for information technology, detailed specifications for a training environment should be included, but not be limited to the following:

- Hardware architecture,
- Software architecture,
- Training configuration.

An effective training environment is crucial to an effective training. A simulated production-like environment or sandbox will contain the same functionality, views and reporting structure planned for the production client. Thus, it will mirror the real-life situations the trainees might encounter with new projects. This practice training environment will also enable users to practice running transactions and process scenarios during and after classroom training.

**Deliver training:** The experience of the expert panel has shown that a blend of training modes, such as instructor-led training (ILT) and computer-based training (CBT), enhances workforce learning and performance improvement. Instructor-led classes will include just-in-time training and frequent hands-on learning. Self-paced, technology-based training modules offer hands-on practice in the form of simulations, exercises, and knowledge checks. Although, different training strategies for different audiences are appropriate, in addition, a variety of performance support resources for reinforcement, such as quick reference guides, desktop user guides, and online access to course materials should be offered.

It is highly recommended, to provide a “dry run” of each class, manual and material, instructions and lesson plans to evaluate the success or implement necessary adjustments. Training aids, appropriate system manuals, quick reference guides or templates and other training materials should be provided for each participant in the training. Also, a train the trainer approach that uses an organization’s own in-house resources to conduct end-user training and support has been instrumental not only in decreasing resistance and promoting adoption of the proposed solution and business processes, but also in enhancing knowledge transfer and self-sufficiency.

**Conduct evaluation and maintenance:** Critical to the ongoing training program success is confirming that employees in various roles have the necessary knowledge, skills, and abilities to perform their new role functions. In post-implementation, users will require ongoing support and additional training as they work to sustain changes and challenges. New employees will need to learn and understand the systems and processes. Proficiency requires more than attending a one-time learning event held prior to go-live. Research indicates that learning occurs not only through the acquisition of knowledge, but also through the successful application of that knowledge on the job (Mosheiov & Sidney, 2003). Ongoing operational support is just as critical to effective performance as the learning event itself. During this phase, the development of a method to assess the effectiveness of the initial training, which identifies strengths and the need for improvement of the plan to sustain training on an ongoing basis, should be conducted.

The overall goal for training is effectiveness which can be measured in the following seven areas:

- Targeting - End users will understand the courses and be able to schedule appropriate courses.
- Effectiveness - End users who complete required training will be able to successfully perform their duties.
- User accountability - End users who complete training will be able to continue practicing and learning in their own environments and will know how to get additional help and support.
- Participation - Training participation will be recorded and users will be randomly tested prior to go-live to ensure successful knowledge transfer.
- Availability - Training will be delivered on schedule. Facilities, equipment, and systems will be available when needed.
- Customer satisfaction - Training efforts will focus on the needs of the end users being served and they will have a positive perception of their training experience.
- Cost effectiveness - Training will be delivered on time and in budget

The following Table 6 outlines and summarizes the key training activities and deliverables associated with each phase.

Assessment of continuing educational measures in Information Technology:  
A view from the industry

| Phases                | Activities  | Deliverables  |
|-----------------------|---|---|
| Analysis/<br>Strategy | <ul style="list-style-type: none"> <li>– Develop a concise strategy that involves the following key activities:</li> <li>– Identify and tailor approaches to be used in developing and delivering required training such as e-learning, self-study, and classroom options</li> <li>– Perform high-level affected population analysis</li> <li>– Identify facilities and infrastructure requirements by location</li> <li>– Evaluate and recommend training delivery approaches</li> </ul>   | Training plan   |
| Design                | <ul style="list-style-type: none"> <li>– Develop a tactical plan that describes the development and delivery of training (how, what, when, where, and by whom). Develop training content outlines which help the workforce learn new skills, technologies, and processes needed to bridge required competency gaps. Key activities associated with this deliverable are as follows:               <ul style="list-style-type: none"> <li>○ Incorporate appropriate processes and procedures into each course</li> <li>○ Incorporate course mapping to job role grouping</li> <li>○ Develop room, trainer and class schedules</li> <li>○ Develop course material templates and prototypes</li> <li>○ Identify course evaluation tools</li> </ul> </li> </ul> | Training plan   |
| Development/<br>Build | <ul style="list-style-type: none"> <li>– Create courseware and develop training courses. Select trainers for instructor-led classroom delivery (train the trainer). Key activities associated with this deliverable are as follows:</li> <li>– Create training materials and exercises</li> </ul>   | Training plan project team training materials (project development team training) |

| Phases                                    | Activities  | Deliverables   |
|---|---|--|
|   | <ul style="list-style-type: none"> <li>- For each master course, develop an instructor guide, participant guide, quick reference guide, and competency testing criteria</li> <li>- Assist in the design of the training technical environment</li> </ul>  |  |
| Deliver/<br>Deploy                        | <ul style="list-style-type: none"> <li>- Begin knowledge transfer of new related content to the workforce to bridge the gap between the present level and the desired level of skills and behaviours. Key activities associated with this deliverable are as follows:                             <ul style="list-style-type: none"> <li>o Conduct train the trainer sessions for each course</li> <li>o Develop training schedule and instructor assignments</li> <li>o Register training participants</li> <li>o Support training delivery through go-live</li> <li>o Deliver training</li> <li>o Evaluate and document training results</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>- User Training</li> <li>- Training classes, class feedback reports, training report for end users</li> </ul> |
| Evaluation and<br>Maintenance/<br>Operate | <ul style="list-style-type: none"> <li>- Present summary of the learning metrics activities associated with this deliverable are as follows:                             <ul style="list-style-type: none"> <li>o Collect and analyse learner evaluation data</li> <li>o Use instructor feedback</li> <li>o Review training program</li> </ul> </li> </ul>  | <ul style="list-style-type: none"> <li>- Final report on training effectiveness</li> </ul>   |

Table 6 Phases, Activities and Deliverables of Training Development

After training needs are identified and solutions are designed and developed, the training team will work with their staff to support the just-in-time delivery of required training. The training will be delivered based on the pre-defined roles, thus enabling standardization across the organization. This standardization of roles, processes and training will help:

- Drive the initiative across multiple departments or stakeholder groups
- Reduce or eliminate stovepipe processes
- Reshape the workforce to leverage the new procedures, processes, and technologies



### *Analysis of results*

The results of the study should be considered from two different points of view. At first, this study investigates some of the most common challenges for IT-companies regarding the training and continuing education of their employees. The identified and currently relevant training methods in the area of IT are mostly consistent with the identified measures in the literature. Although a purely technical or functional training is considered insufficient especially in the international context of global software development, where learning by doing approaches are more promising and thus trainings are nearly irrelevant (Aurum, Daneshgar, & Ward, 2008), the interviews showed, that formal trainings are a very important source of knowledge for employees, because they set the foundation to gain knowledge on an everyday basis. The authors would rather agree with the findings in the interview. Formal trainings are indeed relevant and set the basis for a further acquisition of knowledge. Additionally continuing educational measures should include a soft skills curriculum (Conn, 2002; Holtkamp, Jokinen, & Pawlowski, 2015).

Also, the authors suggest a standard process, which should help companies to gain a better understanding how trainings are executed from the design until the controlling of the success of the trainings. Similar approaches were published before for several specific requirements (Green, 2005; Kuhrmann, Mendez Fernandez, & Munch, 2013; Vladimir Stantchev & Tamm, 2011).

Due to a wide range of specific needs in Information Technology, the authors propose a more general methodology for the implementation and execution of training measures in information technology. Companies can adopt this methodology and alter it to their actual requirements and situations. In connection with the other findings like risks, risk mitigation strategies and success factors, authors are confident that companies can benefit from this methodology.

### *Revisiting research questions*

In the following chapter, the earlier stated research questions will be revisited and answered.

▪ *RQ1: Which are the relevant educational measures and their benefits in praxis?*

In total, five different educational measures are proposed in by the experts. These methods are:

- instructor-led training (traditional classroom training),
- computer-based, web-based, and virtual training,

- hands-on practice environment or sandbox,
- one-on-one training and
- demonstrations and presentations.

The method is highly dependable on the actual circumstances of the company and the goal that they are want to achieve.

- *RQ2: What could be improvements for companies regarding training of employees?*

The experts stated in their interviews two major improvements. The first one is not dedicated to a specific training measure. More important is, that companies need to make sure that the overall level of knowledge is on a high level for every employee.

The second improvement is concerned about the general funding of trainings measures in the IT-department. This funding needs to be aligned to the actual development of the market and the challenges the company is facing. Therefore it is important, that the overall IT-strategy is aligned to the strategy and the governance model of the company (Wolmarans, Kruger, & Croft, 2016).

- *RQ3: What are the common problems when companies are conducting these measures?*

The experts identified several risks and critical success factors for training measures. These findings can be used to mitigate several problems when companies conduct educational measures. Two main problems were identified.

One challenge can be the target orientated allocation of trainings for the employees that need these trainings the most. Therefore it is important to achieve a certain transparency about the actual skills of the employees in the IT-department (Hidalgo Pérez, O’Kean Alonso, & Rodríguez López, 2016).

A second problem is the sharing of the acquired knowledge in these training measures towards the organisation. Especially in a cost-based environment, it is important, that the knowledge is passed on to other employees that could not participate in these trainings. This allows companies to develop and raise productivity (Hortovanyi & Ferincz, 2015). These problems and the mitigation of them is equally important for soft- and technical skills of the employees (Chillas, Marks, & Galloway, 2015).

- *RQ4: What are controlling instruments for these measures to evaluate the success?*

Training instruction and content will be measured through an evaluation process. The primary use of training evaluation will be to support continuous improvement of training

materials and instructional approaches. A strategy for evaluating the effectiveness of the training should be developed early in the design phase. The baseline for a meaningful controlling of trainings is the clear formulation of goals and expectations. This can be supported by the definition of KPIs that allow companies to quantify the results and the effectiveness of their trainings (Price, 2015). A possible methodology to identify target orientated KPIs is the classification of educational measures to the degree of process-related coverage and to the degree of educational accessibility (Zendler, 2016).

This importance of the evaluation of the training measures is also included in the developed methodology for the implementation and execution of training measures in information technology and further in the proposed framework in this thesis.

### *Discussion of results*

The study answered several research questions regarding the topic of educational measures in Information Technology. The actual state of the art in educational measures for IT-employees was presented as well as possible risks and critical factors. Further, an approach for the development of educational measures was presented.

The proposed framework in this thesis will present several other issues around this topic that need to be considered. For example, the generational differences in the IT-workforce and the management of the different knowledge basis. Especially in IT, lifelong learning is a critical issue for the companies to achieve and retain productivity and for the employee itself to be employed over the span of his work-life (Kruchten, 2015). A second point is the organisational learning besides actual training measures. It is important to give employees the possibility to reflect on past practice or projects to enable a continuous learning in information technology (Dybå, Maiden, & Glass, 2014). Because of the rise in overall knowledge, the standard of training measures in these companies will be higher than in companies that don't enable and promote organisational learning.

A future research area around this topic should be the influence of new developed technologies on educational measures in this area. Especially in the context of digitalised organisations and the use of social media and mobile computing since these developments are changing the actual situation vastly (Laplante, Demartini, Lamberti, & Neill, 2016).

The main limitation of this study is the sample size. Although it is an introductory investigation, it uses a small sample size and, thus, conclusions and implications may not be broadly

generalized. Future studies could include a more representative sample of the total population of the target group or the whole industry. Another limitation comes from the fact that all participants are experts from Germany, which may exhibit regional or national bias, and that regional conditions are not completely considered.

This study was published in the International Journal of Engineering Education, ISI indexed journal, back in 2016 (Radant, Colomo-Palacios, & Stantchev, 2016a).

## **5. Development of 5-layer framework of employee productivity**

An educated workforce, especially in the IT-department is crucial for the ability of a company to innovate and compete in the market (Moreno, Sánchez-Segura, Medina-Dominguez, & Cuevas, 2014). Thus, education and the development of employees need to be one of the top priorities of a company's strategy. Because of the increasing importance of knowledge, measures for learning and education should be implemented in a holistic framework which considers every aspect of employee performance. Due to demographic change companies, especially in SE need to search for untapped potential in their organizations. Older workers will constitute an increasing proportion of global labour and economic production resources.

However, many companies still employ a relatively small number of older workers due to excessive recourse to early retirement, insufficient financial incentives to work offered by tax and social security systems and poor management of age-related issues in the workplace (Humpert & Pfeifer, 2012). This is in particular reflected by insufficient access to training or even discrimination against older workers (European Commission, 2006).

As stated in chapter 1.2., human resource management is changing vastly and several new challenges occur. Therefore, companies need a holistic and transparent view on their employee strategies which allows them to identify threats, derive measures and evaluate the success of them. The framework is combining the complexity to a general method that organisations can follow.

The overall aim of our framework is to provide companies with a tool to better understand possible long-term needs of the staff and how they can align them with organization optimization and the strategies of the company.

The following development of the framework is structured in the following parts. The development of the framework was conducted in two parts. In the first part, the factors that influence the productivity of employees were identified with the method of a structured literature review. The same approach was chosen for the identification of metrics that allow a certain measurement of the factors. The results of these SLR's are described and discussed in the third section of this chapter.

## ***Derivation of factors for a framework to manage employees in times of scarcity of talent***

### ***Research Methodology***

The literature presents a variety of studies about scarce resources and the associated challenges of companies and specifically their IT-departments (Allen, Armstrong, Reid, & Riemenschneider, 2009a; Asgarkhani & Shankararaman, 2014; Cappelli, 2000; Litecky, Prabhakar, & Arnett, 2006; Ross & Thomas, 2008). However, exploring previous research shows that a comprehensive systematic review doesn't exist on this topic. Therefore, this study will facilitate the understanding of the current status of research in different areas and address further investigation.

### ***Research Method***

One way to construct an overview of the state of the art is by using a method which is called Systematic Literature Review (SLR). A systematic literature review is a method of identifying, evaluating and interpreting all available research relevant to a particular research question, topic area, or phenomenon of interest (Kitchenham, 2004). A systematic review is a process of assessment and interpretation of all available research related to a research question or subject of interest. Kitchenham also describes several reasons of undertaking a systematic review, the most common are to synthesize the available research concerning a treatment or technology, identification of topics for further investigation and formulation of a background in positioning new research activities (Afzal, Torkar, & Feldt, 2009; Kitchenham & Charters, 2007). Systematic reviews must be undertaken in accordance with a predefined search strategy. The search strategy must allow the completeness of the search to be assessed. In particular, researchers performing a systematic review must make every effort to identify and report research that doesn't support their preferred research hypothesis as well as identifying and reporting research that supports it (Kitchenham & Charters, 2007). There are several reasons to perform a SLR:

- To summarise the existing evidence concerning a treatment or technology, e.g., to summarise the empirical evidence of the benefits and limitations of a specific agile method.
- To identify any gaps in current research in order to suggest areas for further investigation.
- To provide a framework/background in order to appropriately position new research activities (Kitchenham, 2004).

One advantage is, that it provides information about the effects of some phenomenon across a wide range of settings and empirical methods. If studies give consistent results, systematic reviews provide evidence that the phenomenon is robust and transferable (Milner, 2015). If the studies give inconsistent results, sources of variation can be studied. A second advantage, in the case of quantitative studies, is that it is possible to combine data using meta-analytic techniques. This increases the likelihood of detecting real effects that individual smaller studies are unable to detect. However, increased power can also be a disadvantage, since it is possible to not only detect true effects, but also small biases. The main advantage is the structured approach with a SLR. It differs from a conventional literature review in the following ways:

- Systematic reviews start by defining a review protocol that specifies the research question being addressed and the methods that will be used to perform the review.
- Systematic reviews are based on a defined search strategy that aims to detect as much of the relevant literature as possible.
- Systematic reviews document their search strategy so that readers can access its rigor and completeness.
- Systematic reviews require explicit inclusion and exclusion criteria to assess each potential primary study.
- Systematic reviews specify the information to be obtained from each primary study including quality criteria by which to evaluate each primary study.

### ***Research questions***

The goal of this SLR is to identify which preliminary papers and other scientific materials are published about this topic up to June 2015. For this reason, it is mandatory to develop a set of research questions to search, identify and extract the significant publications. The questions this work proposes are the following:

RQ1: What are factors for baseline wages for high skilled employees in IT-departments?

RQ2: What are factors for measures to optimize and educate the employee pool with reference to untapped potential within an organization?

RQ3: What are factors for measures to support the psychological healthiness of the employees?

RQ4: What are factors and metrics for measures to optimize the work environment of the employees?

RQ5: What are factors for measures to support the work-life balance of the employees?

Factors describe what is being measured while metrics specify how it is being measured.

### **Search strategy**

The research strategy follows the model of the structured literature review. It includes search terms, literature resources and search process, which are detailed one by one as follows:

#### ***Search Terms***

The search string has to be defined based on the population under study, and the keywords and their synonyms. Therefore, the study population includes the relevant keywords from all five layers of the proposed framework.

With this population, the list of keywords and their synonyms, used to generate the search string was:

- employee wages: employee salary,
- education of employees: education of personnel, untapped potential in organizations,
- psychological development of employees: psychological changes of employees,
- workplace environment: workplace optimization, workplace development,
- Work-life-balance.

To generate the search string a Boolean language with AND and OR, and quotation marks for exact text were used. The string format is recognized by all sources of information used, as well as many others. So finally, the search string used is as follows: ("employee wages" OR "employee salary") AND ("education of employees" OR "education of personnel" OR "untapped potential in organizations") AND ("psychological development of employees" OR "psychological changes of employees ") AND ("workplace environment " OR "workplace optimization" OR "workplace development") AND ("work life balance").



### ***Literature resources***

Given the variety of sources to be consulted electronically via the web, five electronic databases of established literature resources were used for the present SLR. This systematic review considers the following list of sources:

- IEEE Digital Library (<http://ieeexplore.ieee.org>),
- ACM Digital Library (<http://portal.acm.org>),
- SpringerLink (<http://link.springer.com>),
- IDEAS Digital Library (<http://ideas.repec.org/>) and
- ScienceDirect (<http://www.sciencedirect.com/>)

These sources were selected because of their reputation and the wide range of research areas and publications. ACM and IEEE gather almost all IT related research while the others cover fields like organizational development, management theories and psychological issues.

### ***Search process***

The SLR was conducted in the following way, as shown in Figure 7 Search process factors: at first, the named digital libraries were searched according to the defined search items for relevant publications. Second, the publications found were reviewed by title and abstract in order to estimate their relevance for the topic. After that, a full text review was conducted which leads to a set of primary studies. Fourth, the primary studies were reviewed whether there are references to other publications with other relevant papers to this topic.

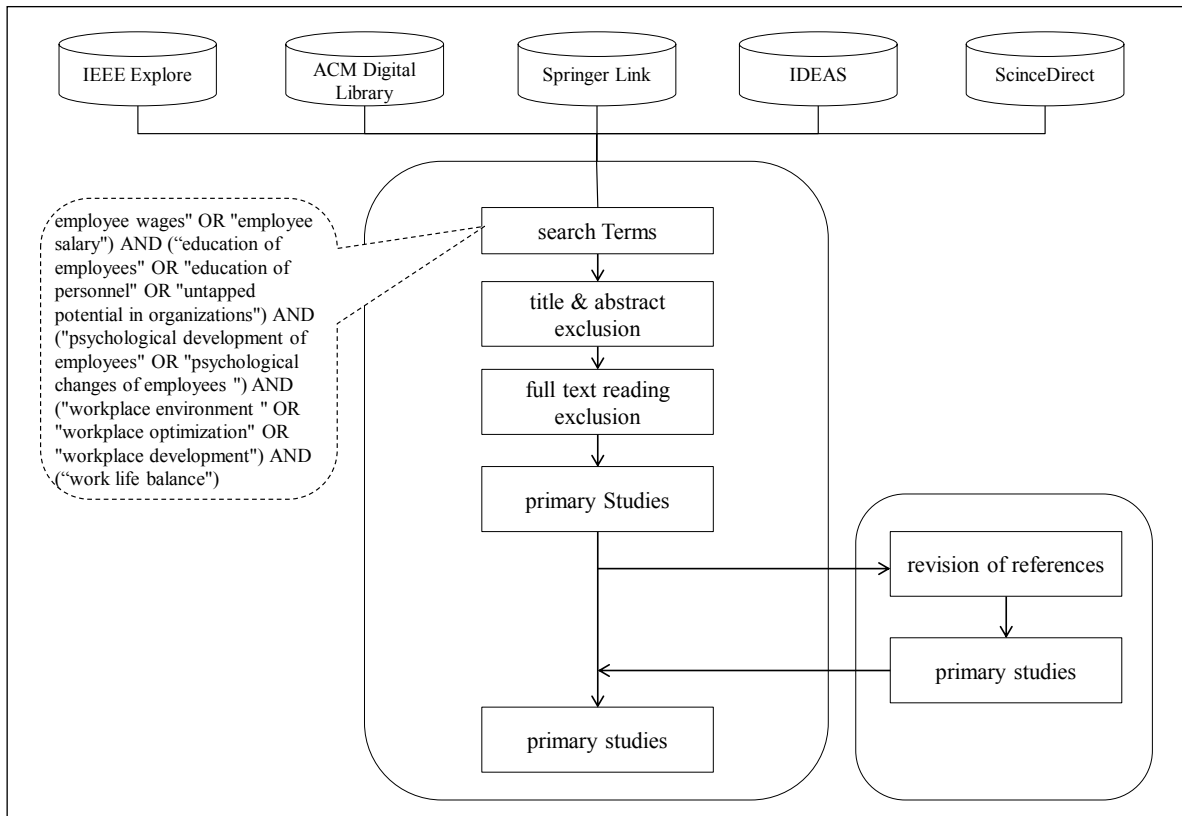


Figure 7 Search process factors

**Data extraction**

The data extracted from each paper was documented and kept in a reference manager Zotero. After identification of the papers, the following data was extracted:

- source (journal or conference),
- title,
- authors,
- publication year,
- classification,
- summary of the research, including which questions were solved.

Based on the criteria for classifying papers, all the papers were reviewed, and the corresponding data was extracted. With the information collected in that form, it was possible to obtain qualitative and quantitative information to answer the planned research questions. In particular, the following information was collected:

- factors for baseline wages for high skilled employees in IT-departments,
- factors for measures to optimize and educate the employee pool,
- factors for measures to support the psychological healthiness,
- factors for measures to optimize the work environment,
- factors for measures to support the work-life balance.

### ***Systematic Review Execution***

For a better understanding and organization of the researched publications, a classification was conducted. For this purpose, the publications were divided into five areas. These areas are defined according to the search terms.

### ***Study selection***

Included and excluded studies are presented in stages following the search process described above. Because of the length of some of the lists of references, they have been hosted online and can be downloaded at any time.

Once initial search results were retrieved, an exclusion/inclusion review procedure was applied with the following inclusion and exclusion criteria:

Inclusion criteria:

- publications that match one of the search items,
- publications that have an empirical content or refer to practical examples in Europe,
- publications, that are related to an allocation of resources in scarce resource situations,
- publications, that are related to Information Technology departments,
- publications, that are related to more than five EU-Countries,
- publications, that are related to a highly-qualified workforce,
- publications, that are related to the research questions.

Exclusion criteria:

- publications that don't match one of the search items,
- publications that don't have empirical content or refer to practical examples,
- publications that are published before or by 31.12.2004.

***Primary studies obtained in the first phase***

The first search was conducted in June 2015, returning 191 papers in total. Irrelevant and duplicate papers were removed and a set of 178 unique papers remained. The result is shown in Table 1.

|                             |     |
|-----------------------------|-----|
| IEEEExplore                 | 48  |
| ACM Digital Library         | 27  |
| ScienceDirect               | 39  |
| SpringerLink                | 38  |
| IDEAS                       | 39  |
| Total                       | 191 |
| Total (without duplication) | 178 |

Table 7: SLR factors first phase results without filtering

Of the 191 searched papers, 13 were duplicated. Table 2 shows the distribution of the searched papers and its source with reference to the search items. The distribution of papers between the different repositories and the good amount of papers for every search objective demonstrate that the selection of the search terms and repositories was prudent and suitable.

|  | IEEE | ACM | ScienceDirect | SpringerLink | IDEAS | Sum        |
|--|------|-----|---------------|--------------|-------|------------|
| Employee wages                         | 10   | 3   | 13            | 6            | 6     | 38         |
| Education of employees                 | 21   | 7   | 3             | 3            | 6     | 40         |
| Psychological development of employees | 3    | 5   | 8             | 16           | 6     | 38         |
| Workplace environment                  | 4    | 7   | 6             | 3            | 5     | 25         |
| Work life balance                      | 7    | 4   | 5             | 6            | 15    | 37         |
| <b>Sum</b>                             | 45   | 26  | 35            | 34           | 38    | <b>178</b> |

Table 8: SLR factors first phase results – distribution without duplication

Of these remaining 178 results, 10 were discarded for being incomplete or not related to the research questions. Of the 168 remaining, 136 were excluded after reading the title and abstract, so 159 results were excluded in the first filter, which left 42 results to be filtered by full-text reading using the inclusion and exclusion criteria. If there was doubt about the relevance of a publication, it was included in the relevant group, leaving the possibility of discarding the paper during the next phase when the full texts of the papers were studied.

|                 |           |
|-----------------|-----------|
| Excluded        | 149       |
| <b>Included</b> | <b>42</b> |
| Total           | 191       |

Table 9: SLR factors first phase results

***Primary studies obtained from the second phase***

The reference lists from the primary studies obtained from the first phase were retrieved and the same filters previously used were applied to them. A total of 32 references were obtained by reading the title and abstract. From these references, 11 were finally selected using the criteria of inclusion and exclusion.

|                        |           |
|------------------------|-----------|
| Excluded               | 10        |
| <b><i>Included</i></b> | <b>32</b> |
| Total                  | 42        |

Table 10: SLR factors second phase results

**Results and Findings**

In this section, the final papers will be matched to the research questions. Furthermore, the research questions are answered with the help of these papers.

The following tables will show how the retrieved papers fit into a categorization regarding the research questions.

| research question   | publication   |
|---|---|
| RQ1: What are factors for fundamental wages for high skilled employees in IT-departments? | (Grund & Westergaard-Nielsen, 2005), (Peng & Eunni, 2011), (Anger, 2007), (Zhao, 2011), |

|   |  |
|---|--|
|   | (Dao, 2013; Gouveia & Correia, 2013), (Bes-sette, 2014)  |
| RQ2: What are factors for measures to optimize and educate the employee pool with reference to untapped potential within an organization? | (Schmidt & Kunzmann, 2006), (Mehairi & Binning, 2014), (LeRouge, Wiley, & Maertz, 2013), (Crow & Liggett, 2014), (Bykov & Shyshkina, 2014), (Asgrakhani & Shankararaman, 2014), (Asgarkhani & Shankararaman, 2014), (Grice, Peer, & Morris, 2011)  |
| RQ3: What are factors for measures to support the psychological healthiness of the employees?   | (Mehairi & Binning, 2014), (Koppi et al., 2009), (Beard, Schwieger, & Surendran, 2008), (Ross & Thomas, 2008), (Grice et al., 2011), (Zeng et al., 2010), (Kabak, Şen, Göçer, Küçüksöylemez, & Tuncer, 2014), (Aykan, 2014), [23], (Altinoz, Cakiroglu, & Cop, 2012), (Vries, Bakker-Pieper, & Oostenveld, 2010) |
| RQ4: What are factors and metrics for measures to optimize the work environment of the employees?   | (Sykes, 2011), (Allen et al., 2009a), (Rehman, Nasar, & Mugheri, 2010), (Finna & Forgacs, 2010), (Gratton, 2011)   |
| RQ5: What are factors for measures to support the work-life balance of the employees?   | (Nissen & Termer, 2014), (Lazar, Osoian, & Ratiu, 2010), (Humpert, 2014), (Ford & Collinson, 2011)   |

Table 11: SLR factors - research questions and corresponding papers

The findings of the SLR are shown in the following chapter in which the five research questions are answered.

***RQ1: What are factors for fundamental wages for high skilled employees in IT-departments?***

It is a common mistake that most employees use the term compensation synonymously with the money that they receive on their pay check. Total compensation, however, extends beyond salary. Total compensation may be defined as the package of quantifiable rewards that an employee receives for his or her work (Abernethy, Yu Flora Kuang, & Bo Qin, 2015). It is the resources that employers offer to attract, motivate and retain employees. An employee's total compensation includes base compensation, pay incentives and benefits or indirect compensation. In the following we will discuss these three components and identify how they are used in an organization's human resources strategy (Bessette, 2014).

a. Labour costs

Labour costs are defined as the monetary value that the company has to pay to employ an employee. These are therefore pre-tax expenditures, base compensation or fixed income (Bessette, 2014), which includes costs for social security and insurance contributions. Also, further financial incentives (Grund & Westergaard-Nielsen, 2005) like bonuses and pay incentives like car rental programs, overtime payment etc. are included (Anger, 2007; Zhao, 2011).

b. Geographic payment differences

These are differences between purchasing power of two up to n countries, in this research the countries of the European Union (Dao, 2013; Gouveia & Correia, 2013).

c. Wage inequality

Wage inequality is the dispersion of wages for employees within an organization. This spread could be a result of the age, gender, skills, the experience or the performance of an employee (Grund & Westergaard-Nielsen, 2005; Peng & Eunni, 2011; Zhao, 2011).

***RQ2: What are factors for measures to optimize and educate the employee pool with reference to untapped potential within an organization?***

Availability of highly skilled engineering staff and workers is essential for the productive forces of society, and a significant source of innovative development and competitiveness of the national economy. Training highly skilled personnel for high-tech industries is particularly important and difficult, but is also one of the most effective ways to ensure qualitative improvement of the employment structure and to increase the technological level of production and competitiveness in markets for goods and services (Asgrakhani & Shankararaman, 2014). With the rapid expansion of the use of information technology throughout our global society, there is a need to recruit capable new employees to the information technology workforce. As a result, employers need to be aware of the employment issues and concerns of the entire labour pool, and what it takes to satisfy these workers. While a majority of information technology workers are men, women and underrepresented minorities also bring valuable talents to this field (Ross & Thomas, 2008).

a. Employee performance

Employee performance is the productivity per person in a given environment or working field in a company (Anitha, 2014). The performance of employees is influenced by several internal and external factors (Crow & Liggett, 2014), such as:

- data and information;
- resources, tools, and environmental support;
- consequences, incentives, and rewards;
- skills and knowledge, i.e., internal to the individual; when skills and knowledge are missing, this leads to poor performance by the individual;
- individual capacity, which has to do with talents or capability to perform; different jobs require different talents;
- motives, which are deeply embedded characteristics that are possessed by people; motives include the reasons why people do what they do, how they view themselves, their needs, desires, and internal personality traits.

b. Process costs and process duration



Process costs are the total unit cost of the output of a continuous production run in which a product passes through several processes. These costs involve also expenditures for personnel. Process duration or cycle time, is the period required to complete one cycle of an operation or to complete a function, job, or task from start to finish. Cycle time is used in differentiating total duration of a process from its run time.

c. Return of investment in employee education

Investment in employee education conjoins the amount of financial or non-financial resources which are invested in training measures of employees in a certain timeframe (Bykov & Shyshkina, 2014). The impact of highly skilled employees on firm performance is not clear since employee skills increase both the benefits and the costs to an organization. It is therefore essential to measure the effect of education on the performance of a company (Asgrakhani & Shankararaman, 2014).

d. Staff potential within an organization

The staff potential represents the amount of highly skilled employees in an organization which are not successfully integrated in the best interest of the company (LeRouge et al., 2013). Regarding Information Technology departments, this includes especially women, elderly employees and other minorities in ICT departments (Quesenberry, Trauth, & Morgan, 2006; Ross & Thomas, 2008).

e. Identification of vacancies within an organization

This factor illustrates the profiles a company needs to achieve a certain strategic goal. The identification is compiled via a transparency analysis of processes or departments (Asgarkhani & Shankararaman, 2014).

f. Employee fluctuation

Fluctuation is generally defined as the change or variation in a quantity over time. Employee fluctuation is the rate of change of the workforce of a company or department in a given timeframe (Grice et al., 2011).

g. Strategy for corporate education and employee development

This strategy represents a companywide competence management system on an organizational perspective and delivers a management approach by providing pro-

cesses and a methodological framework for developing the competencies of an organization by aligning human resource development activities with business goals (Schmidt & Kunzmann, 2006).

h. Knowledge management

Knowledge management is defined by a system or framework of a company to acquire or distribute ideas, work experiences, information and competent skills (Mehairi & Binning, 2014) at the needed time and with the required coverage of a topic.

***RQ3: What are factors for measures to support the psychological healthiness of the employees?***

Considering previous research exploring the negative effect of job-demands on psychological healthiness of the employees it became obvious that only focusing on the negative effect of job-demands is not suitable (Zeng et al., 2010). Job-demands are a sword with two sides: on one hand, it is a stressor and higher job-demands would result in emotional exhaustion of IT employees; on the other hand, it can stimulate the employees, and properly high job-demands could be helpful for stimulating working motivation of the employees and increasing the employees' professional efficacy (Yan, 2014). In general, the ability to work plays a critical role in mental and physical wellbeing. Work is a primary determinant of socioeconomic position and plays a key role in social life participation, the development of identity and self-esteem. However, there is strong evidence that a poor psychosocial work environment can increase the risk of mental health problems (Reavley, Ross, Martin, LaMontagne, & Jorm, 2014).

a. Company culture

The culture of a company defines how it deals or handles employees and their expectations and needs. The culture of a company could have diverse characteristics e.g. an employee-oriented culture which focuses on the employee and his needs and abilities or a work-oriented culture which concentrates fully on the work packages regardless of welfare or abilities of the employees (Mehairi & Binning, 2014). Also, the style of leadership and the hierarchical structure of a company can influence the psychological health of an employee (Vries et al., 2010).

b. Employee-/ job-satisfaction

This factor applies to the overall satisfaction of employees. It conjoins all possible influences from private life, the relationship to colleagues or superiors till the satisfaction with the assigned work packages (Altinoz et al., 2012). Job satisfaction is mainly regarded as a phenomenon that occurs when the properties of a job fit together with the demands of employees (Kabak et al., 2014).

c. Psychological pressure

This factor conjoins influencing issues on the psychological healthiness of employees. It comprises the job security of employees, missing appreciation, workload, job

complexity, workplace bullying, ongoing change in technology or the behaviour of superiors etc. (Koppi et al., 2009; Pienaar & Willemse, 2008).

d. Psychological induced illness/stress

This factor conjoins the number of psychological induced illnesses in a company in a given timeframe. This factor is not limited to burnout, which is defined as a kind of chronic stress reaction to emotional and interpersonal stressors during work, including emotional exhaustion, cynicism and low professional efficacy (Zeng et al., 2010), but includes any disease related to psychological illness caused by job demands. It has to be considered, that these are multi-dimensional phenomena that include emotional, physical and cognitive illnesses (Pienaar & Willemse, 2008).

e. Workforce generation gaps

IT-companies and departments have to consider, more than other departments (Allen et al., 2009a), the diverse expectations of different generations of employees. The influence on the work environment of the “Millennials”, Generation X and Y is getting more complex. Each generation possesses different characteristics, expectations, and approaches to work. They also have different technological backgrounds (Grice et al., 2011). This has to be considered in organizational structures, team assignments, training activities or career development.

f. Turnover Intention

The definition of turnover intention is the destructive and active actions of employees in case of dissatisfaction from the working conditions. Turnover intention is perceived as a negative factor over the efficiency and productivity of the organization since it results in several negative outcomes for the organization such as loss of an employee, interruption of organizational activities, training and orientation of a new employee replacing the previous one and consequent additional costs and expenses (Aykan, 2014).

g. Loneliness

Loneliness expresses a permanent emotional affective disorder in case of alienation, misunderstanding and rejection feelings of an individual or in case of absence of social partners required in activities creating opportunities for social integration and

affections. There are two types of loneliness, emotional and social. Social loneliness covers the social relations of an individual and usually occurs together with depression and distress because of lack of social network. Emotional loneliness usually originates from lack of close link to another person and covers the feelings of anxiety and emptiness. Individuals thinking that the promises made to them by the organization were broken, may feel themselves worthless, lonely and excluded within the organization and may cut off the communications with the organization and colleagues (Aykan, 2014).

***RQ4: What are factors for measures to optimize the work environment of the employees?***

Workers' performance is tightly linked to their working environment (Del Rio Vilas, Longo, & Monteil, 2013). Work environment consists of different areas, such as the actual physical environment (including temperature, lighting, noise, equipment in the office, the employee's personal space and ergonomically right posture), the psychological and social environment (such as labour demand, personal connections, work relationships, the physical and psychological characteristics of the employee) and it also includes the effects of how work is organized and what tasks are delegated (Finna & Forgacs, 2010).

a. Physiological healthiness and workplace design

Besides the psychological healthiness, the physiological healthiness of employees plays an important role for companies due to the highly negative effect on the job performance (Rehman et al., 2010). One factor is a workplace ergonomics that aims at creating a work place that suits the employee's needs. A well-developed office doesn't only increase work efficiency but it can also significantly reduce costs (Finna & Forgacs, 2010).

b. Job organization

The use of different types of job organization can have important influences on the performance and risk mitigation of an organization. The concept of job rotation for example allows a company to spread important knowledge over the organization. Also, it avoids monotony work environments which raises the overall satisfaction of employees (Allen et al., 2009a). Further, the change in technology and emerging societal trends like the fact that employees, whatever their age, gender or nationality is, will increasingly value greater flexibility in terms of where and when work takes place. How they work will influence the organization of a company significantly (Gratton, 2011).

c. Interruptions in the workplace

There are different types of interruptions (both on- and off-task) that occur during typical office computer-based activities (Sykes, 2011). These disruptions from the assigned tasks reduce productivity of the employees and can also lead to psychological stress. Therefore, it is essential for a company to minimize them to a minimum.

Typical interruptions could be the telephone, instant Messenger, and updating notifications (e.g., Windows update, Adobe, Java, etc.), email notifications, colleague initiated discussion in the participant's office, and distractions (e.g., surrounding office noises, such as, fans, doors, people walking by, nearby conversations, nearby washroom, etc.).

***RQ5: What are factors for measures to support the work-life balance of the employees?***

Work life balance is the compatibility of working life and private life (Nissen & Termer, 2014). But how does the “unbalance” in work and life, such as this “insufficient time and non-achievement in work” and “increased time for private life,” affect employees in IT? This question is relevant to how we view work-life balance. While multiple definitions exist for work-life balance, it generally refers to an individual’s state in which both work and private life are satisfying and fulfilling (Pasamar & Valle, 2011). Although studies investigating the interface between work and private life have been accumulating in organizational psychology, the mainstream so far has been the studies exploring the conflicts between work and personal life. However, in the past decade, the idea is growing among researchers that work and private life are not only in conflictive relationships, but are also in mutually enhancing relationships to enrich each other, and positive experiences in the two domains bring synergy that works together (Fujimoto, Shinohara, Tanaka, & Nakata, 2013).

a. Compatibility of job and private life

At the beginning of a career, family/children is deemed less important, especially for young IT employees. But after some years of working life, the desire for family and children becomes stronger. This aspect then loses its importance when their children have become more independent and leave their parents’ homes. After this, areas such as hobbies, culture and travelling gain increasing interest (Nissen & Termer, 2014). Thus, there are different definitions of a work-life-balance depending on the age, gender or cultural background (Ford & Collinson, 2011).

b. Working time models

Organizations can implement various initiatives and working time models that may assist employees to better balance their work and family responsibilities, gain improvements in well-being and provide organizational benefits (Lazar et al., 2010). These could be: flexible working hours, job sharing, part-time work, compressed work weeks, parental leave, home office arrangements, compressed work weeks and on-site child care facility.

c. Workload of employees



In general overtime is found to be dissatisfying as it affects leisure time, lowers employee satisfaction and has therefore a negative influence on companies performance (Humpert, 2014).

## ***Derivation of metrics for a framework to manage employees in times of scarcity of talent***

### **Search strategy**

The research strategy follows the model of the structured literature review. It includes search terms, literature resources and search process, which are detailed one by one as follows:

The search string has to be defined based on the population under study, and the keywords and their synonyms. Therefore, the study population includes the relevant keywords from all five layers of the proposed framework.

With this population the list of keywords and their synonyms, used to generate the search string was:

- employee wages: employee salary
- education of employees: education of personnel, untapped potential in organizations
- psychological development of employees: psychological changes of employees
- workplace environment: workplace optimization, workplace development
- Work life balance

To generate the search string a Boolean language with AND and OR, and quotation marks for exact text were used. The string format is recognized by all sources of information used, as well as many others. So finally, the search string used is as follows: ("employee wages" OR "employee salary") AND ("education of employees" OR "education of personnel" OR "untapped potential in organizations") AND ("psychological development of employees" OR "psychological changes of employees ") AND ("workplace environment " OR "workplace optimization" OR "workplace development") AND ("work life balance"). Given the variety of sources to be consulted electronically via the web, five electronic databases of established literature resources were used for the present SLR. This systematic review considers the following list of sources:

- IEEE Digital Library (<http://ieeexplore.ieee.org>),
- ACM Digital Library (<http://portal.acm.org>),
- SpringerLink (<http://link.springer.com>),

- IDEAS Digital Library (<http://ideas.repec.org/>) and
- ScienceDirect (<http://www.sciencedirect.com/>)

These sources were selected because of their reputation and the wide range of research areas and publications. ACM and IEEE gather almost all IT related research while the others cover fields like organizational development, management theories and psychological issues.

The SLR was conducted in the following way: at first, the named digital libraries were searched according to the defined search items for relevant publications. Second, the publications found were reviewed by title and abstract in order to estimate their relevance for the topic. After that, a full text review was conducted which leads to a set of primary studies. Fourth, the primary studies were reviewed whether there are references to other publications with other relevant papers to this topic.

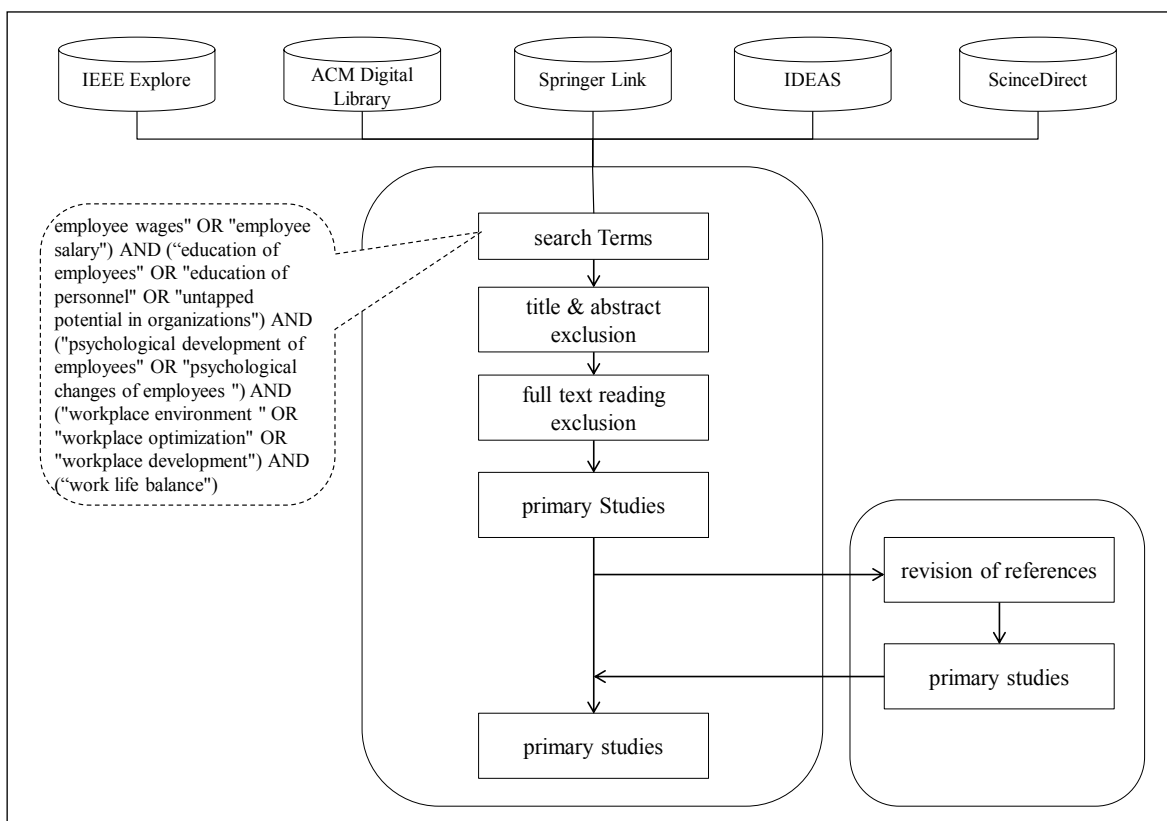


Figure 8: Search process metrics

The data extracted from each paper was documented and kept in the reference manager Zotero. After identification of the papers, the following data was extracted:

- source (journal or conference),

- title,
- authors,
- publication year,
- classification,
- summary of the research, including which questions were solved.

Based on the criteria for classifying papers, all the papers were reviewed, and the corresponding data was extracted. With the information collected in that form, it was possible to obtain qualitative and quantitative information to answer the planned research questions. In particular, the following information was collected:

- factors for fundamental wages for high skilled employees in IT-departments,
- factors for measures to optimize and educate the employee pool,
- factors for measures to support the psychological healthiness,
- factors for measures to optimize the work environment,
- factors for measures to support the work-life balance.

For a better understanding and organization of the researched publications, a grouping was conducted. For this purpose, the publications were divided into five areas. These areas are defined according to the search terms.

The goal of the first SLR was to identify the relevant factors to build a framework. Building on this, the goal of the second SLR is to identify which preliminary papers and other scientific materials are published about corresponding metrics up to this date (August 2015). For this reason, it is mandatory to develop a set of research questions to search, identify and extract the significant publications. The questions this work proposes are the following:

RQ1: What are metrics for the identified factors for fundamental wages for high skilled employees in IT-departments?

RQ2: What are metrics for the identified factors for measures to optimize and educate the employee pool with reference to untapped potential within an organization?

RQ3: What are metrics for the identified factors for measures to support the psychological healthiness of the employees?

RQ4: What are metrics for the identified factors for measures to optimize the work environment of the employees?

RQ5: What are metrics for the identified factors for measures to support the work-life balance of the employees?

The search strategy, search terms, literature resources and search process will be the same as before. The specific approach can be read in the previous chapter.

The data extracted from each paper was documented and kept in a reference manager. After identification of the papers, the following data was extracted:

- source (journal or conference),
- title,
- authors,
- publication year,
- classification,
- summary of the research, including which questions were solved.

Based on the criteria for classifying papers, all the papers were reviewed, and the corresponding data was extracted. With the information collected in that form, it was possible to obtain qualitative and quantitative information to answer the planned research questions. In particular, the following information was collected:

- metrics for fundamental wages for high skilled employees in IT-departments,
- metrics for measures to optimize and educate the employee pool,
- metrics for measures to support the psychological healthiness,
- metrics for measures to optimize the work environment,
- metrics for measures to support the work-life balance.

For a better understanding and organization of the researched publications, a classification was conducted. For this purpose, the publications were divided into five areas. These areas are defined according to the search terms.

Included and excluded studies are presented in stages following the search process described above. Because of the length of some of the list of references, they have been hosted online and can be downloaded at any time.

Once initial search results were retrieved, an exclusion/inclusion review procedure was applied with the following inclusion and exclusion criteria<sup>e</sup>:

Inclusion criteria:

- publications that match one of the search items,
- publications, that are related to an allocation of resources in scarce resource situations,
- publications, that are related to Information Technology departments,
- publications, that are related to more than five EU-Countries,
- publications, that are related to a highly-qualified workforce,
- publications, that are related to the research questions.

Exclusion criteria:

- publications that don't match one of the search items,
- publications that are published before or on the 31.12.2004.

#### Primary studies obtained in the first phase

The first search was conducted in August 2015, returning 300 papers in total. Irrelevant and duplicate papers were removed and a set of 296 unique papers remained. The distribution of papers between the different sources and the good amount of papers for every search objective demonstrate that the selection of the search terms and repositories was prudent and suitable. The result is shown in the following table.

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<sup>e</sup> Inclusion and exclusion criterias where changed in this SLR in comparison to the SLR for the factors of the framework. For example, case studies and examples from countries outside the EU where included as well.

|                                    |            |
|------------------------------------|------------|
| IEEEExplore                        | 43         |
| ACM Digital Library                | 51         |
| ScienceDirect                      | 81         |
| SpringerLink                       | 55         |
| IDEAS                              | 69         |
| Total                              | 300        |
| <b>Total (without duplication)</b> | <b>296</b> |

Table 12: SLR metrics - first phase results without filtering

Of the 191 searched papers, 4 were duplicated. Table 2 shows the distribution of the searched papers and its source with reference to the search items.

|  | IEEE      | ACM       | ScienceDirect | SpringerLink | IDEAS     | Sum        |
|--|-----------|-----------|---------------|--------------|-----------|------------|
| Employee wages   | 9         | 4         | 22            | 10           | 13        | 58         |
| Education of employees and untapped potential in organizations | 14        | 23        | 10            | 8            | 12        | 67         |
| Psychological development of employees                         | 5         | 5         | 20            | 22           | 16        | 68         |
| Workplace environment  | 5         | 9         | 9             | 5            | 9         | 37         |
| Work life balance  | 8         | 10        | 20            | 9            | 19        | 66         |
| <b>Sum</b>   | <b>41</b> | <b>51</b> | <b>81</b>     | <b>54</b>    | <b>69</b> | <b>296</b> |

Table 13: SLR metrics - first phase results – distribution without duplication

Of these remaining 296 results, 43 were discarded for being incomplete or not related to the research questions. Of the 253 remaining, 124 were excluded after reading the title and abstract, which left 129 results to be filtered by full-text reading using the inclusion and exclusion criteria. If there was doubt about the relevance of a publication, it was included in the relevant group, leaving the possibility of discarding the paper during the next phase when the full texts of the papers were studied.

|                 |            |
|-----------------|------------|
| Excluded        | 124        |
| <b>Included</b> | <b>129</b> |
| Total           | 253        |

Table 14: SLR metrics - first phase results

*Primary studies obtained from the second phase*

The reference lists from the primary studies obtained from the first phase were retrieved and the same filters previously used were applied to them. A total of 129 references were obtained by reading the title and abstract. From these references, 71 were finally selected using the criteria of inclusion and exclusion.

|                 |           |
|-----------------|-----------|
| Excluded        | 58        |
| <b>Included</b> | <b>71</b> |
| Total           | 129       |

Table 15: SLR metrics - second phase results

**Results and Findings**

In this section, the final papers will be matched to the research questions. Furthermore, the research questions are tried to answer with the help of these papers.

*Results*

The following tables will show how the retrieved papers fit into a categorization regarding the research questions.

| research question                                    | factor       | publication  |
|--|--------------|--|
| RQ1: What are metrics for fundamental wages for high | Labour costs | (Shen & Ge, 2005); (Allen, Armstrong, Reid, & Riemenschneider, 2009b); (Zwick, 2011); (Oyer, 2005); (Nastasie, 2012); (Smite & |



| research question   | factor   | publication  |
|---|--|--|
| skilled employees in IT-departments?  |  | Solingen, 2015); (Ozimec & Lisanin, 2011); (Feldstein, 2008); (Lazear, 2006)   |
|   | Geographic payment differences                     | (Papapetrou, 2007); (Rusinova, Lipatov, & Heinz, 2015); (Lazear, 2006); (Smite & Solingen, 2015); (Rusinova et al., 2015)  |
|   | Wage inequality                                    | (Shen & Ge, 2005); (Medeiros, 2005); (Daly, Kawaguchi, Meng, & Mumford, 2006); (Stringer, Diddham, & Theivananthampillai, 2011); (Bowles & McGinn, 2007); (Martinsson, 2009); (Ozimec & Lisanin, 2011); (Furnham & Wilson, 2011); (Böheim, Himpele, Mahringer, & Zulehner, 2012) |
| RQ2: What are metrics for measures to optimize and educate the employee pool with reference to untapped potential within an organization? | Employee performance                               | (Kantola, Piirto, Toivonen, & Vanharanta, 2009); (Zülch, Stock, & Leupold, 2011); (Lazear, 2006); (Lorenz, 2015)   |
|   | Process costs and -duration                        | (Zülch et al., 2011); (Lorenz, 2015)   |
|   | Investment in employee education                   | (Banker et al., 2009)  |
|   | Identification of vacancies within an organization | (Mollona & Hales, 2006)  |

| research question   | factor   | publication  |
|---|--|--|
|   | Staff potential within an organization           | (Shen & Ge, 2005); (Litecky et al., 2006); (Trauth, Quesenberry, & Huang, 2006); (Gheordunescu & Panoiu, 2014); (Mollona & Hales, 2006); (Humpert & Pfeifer, 2012); (Hek & Vuuren, 2011) |
|   | Employee fluctuation                             | (Allen et al., 2009b); (Riemenschneider, Armstrong, Allen, & Reid, 2006); (Meland, Waage, & Sein, 2005)  |
|   | Strategy for corporate education and development | (Wasem, 2008); (Exter & Turnage, 2012); (Meland et al., 2005); (Nissen & Termer, 2014); (Cainarca & Sgobbi, 2012); (Hek & Vuuren, 2011)  |
|   | Knowledge management                             | (Afzan Ahmad Zubairy, Mozie, & Ghazali, 2014); (Usman & Musa, 2012)  |
| RQ3: What are metrics for measures to support the psychological healthiness of the employees? | Company culture                                  | (Gheordunescu & Panoiu, 2014); (Barbu, 2014); (Eriksson, 2012); (Ye, Cardon, & Rivera, 2012); (Claybourn, 2010)  |
|   | Employee satisfaction                            | (Hall, Baddoo, Beecham, Robinson, & Sharp, 2009); (Meland et al., 2005); (K. Page & Vella-Brodrick, 2013); (DeTienne, Agle, Phillips, & Ingerson, 2012); (Čančer & Žižek, 2014)          |

| research question   | factor   | publication   |
|---|--|---|
|   | Psychological induced illness                  | (Lohela Karlsson, Björklund, & Jensen, 2012); (Gheordunesco & Panoiu, 2014); (Bektas & Peresadko, 2013); (K. M. Page & Vella-Brodrick, 2008)  |
|   | Psychological pressure                         | (Chilton, Hardgrave, & Armstrong, 2010); (Allen et al., 2009b); (Mgaya, Uzoka, Kitindi, & Shemi, 2009); (Riemenschneider et al., 2006); (Outlay, 2007); (Zülch et al., 2011); (Barbu, 2014); (Khanna & Maini, 2013); (Ye et al., 2012); (Gorenak & Popovic, 2014); (Siponen, Adam Mahmood, & Pahnla, 2014); (Bryson, 2012); (D. Evans et al., 2012); (Claybourn, 2010); (Ek, Sirviö, Koironen, & Taanila, 2014) |
|   | Turnover Intention                             | (Joseph & Koh, 2012); (DeTienne et al., 2012); (Khanna & Maini, 2013)   |
|   | Loneliness                                     | (Elwér, Johansson, & Hammarström, 2014); (Claybourn, 2010); (Sirgy & Lee, 2015)   |
| RQ4: What are metrics for measures to optimize the work environment of the employees? | Physiological healthiness and workplace design | (Gupta & Kristensen, 2008); (Finna & Forgacs, 2010); (Charbotel et al., 2008)   |
|   | Job organization                               | (Zülch & Börkircher, 2012);   |
|   | Interruptions in the workplace                 | (Mark, Iqbal, Czerwinski, & Johns, 2014); (Takemae, Chaki, Ohno,  |

| research question   | factor                                    | publication   |
|---|---|---|
|   |   | Yoda, & Ozawa, 2007); (Finna & Forgacs, 2010)   |
| RQ5: What are metrics for measures to support the work-life balance of the employees? | Compatibility of job and private life     | (Takemae et al., 2007); (Nissen & Termer, 2014); (Lazar et al., 2010); (McCarthy, Darcy, & Grady, 2010); (Drobnič, Beham, & Präg, 2010) |
|   | Work organization and working time models | (Zülch et al., 2011); (Nissen & Termer, 2014); (Dick, 2010); (Moore, 2006)  |
|   | Workload of employees                     | (Allen et al., 2009b); (Chilton et al., 2010); (Riemenschneider et al., 2006); (Holly & Mohnen, 2012); (Drobnič et al., 2010)           |

Table 16: Research questions, factors and corresponding papers

Findings

The findings of the SLR are shown in the following chapter in which the five research questions are answered.

RQ1: What are metrics for fundamental wages for high skilled employees in IT-departments?

The results and corresponding references are organized in the following tables.

| <b>RQ1: What are factors and metrics for fundamental wages for high skilled employees in IT-departments?</b> |   |  |
|--|---|--|
| <u>Factor</u>  | <u>Metric</u>   | <u>References</u>  |
| Labour costs   | Earnings per employee/timeframe after tax                     | (Allen et al., 2009b); (Zwick, 2011); (Oyer, 2005); (Nastasia, 2012)   |
| Labour costs   | Earnings per employee /timeframe after tax/incl. incentives   | (Zwick, 2011); (Oyer, 2005); (Stringer et al., 2011); (Ozimec & Lisanin, 2011)                                 |
| Labour costs   | Labour costs per unit or price/unit labour cost ratio pre-tax | (Smite & Solingen, 2015); (Feldstein, 2008); (Lazear, 2006)  |
| Labour costs   | Future growth of labour costs pre-tax                         | (Zwick, 2011); (Lazear, 2006)  |
| Geographic payment differences   | Comparison of indirect labour costs in EU                     | (Papapetrou, 2007); (Rusinova et al., 2015); (Lazear, 2006); (Smite & Solingen, 2015); (Rusinova et al., 2015) |
| Wage inequality  | Gender pay gap  | (Shen & Ge, 2005); (Medeiros, 2005); (Daly et al., 2006); (Bowles &  |

| <b>RQ1: What are factors and metrics for fundamental wages for high skilled employees in IT-departments?</b> |  |   |
|--|--|---|
| <u>Factor</u>  | <u>Metric</u>  | <u>References</u>   |
|  |  | McGinn, 2007); (Furnham & Wilson, 2011); (Böheim et al., 2012)        |
| Wage inequality  | Earnings per IT-employee in average to other departments after tax     | (Stringer et al., 2011); (Ozimec & Lisanin, 2011)                     |
| Wage inequality  | Earnings per IT-employee in average to other (IT-) companies after tax | (Stringer et al., 2011); (Martinsson, 2009); (Ozimec & Lisanin, 2011) |

Table 17: Factors and metrics for fundamental wages for high skilled employees in IT-departments

The term wages can be defined in various ways as described in the previous chapter. To find the right balance between over- and undercompensation, several variables need to be taken into account. These variables refer to geographical differences as well as comparisons to other companies in that particular market area. Further, governmental rules, like minimum wages, need to be considered as well.

a. Earnings per employee/timeframe after tax

This metric represents the earnings of an employee after payment of taxes, social insurance and other indirect labour costs (Eurostat, 2013; Statista, 2008). Labour Costs are the total expenditure spend by employers for the purpose of employing staff. The following table contains data on average hourly labour costs which are defined as total labour costs divided by the corresponding number of hours worked by the yearly average number of employees, expressed in full-time units. Labour costs cover wages and salaries and non-wage costs, employers social contributions plus taxes less subsidies (Eurostat, 2014a).

|                            | 2004 | 2008 | 2012 | 2013 | 2014 | Change 2014/2013, % |
|----------------------------|------|------|------|------|------|---------------------|
| <b>EA-18</b>               | 23,3 | 25,5 | 28,5 | 28,9 | 29,2 | 1,1%                |
| <b>EA-19</b>               | 23,0 | 25,3 | 28,3 | 28,7 | 29,0 | 1,1%                |
| <b>EU-28</b>               | 19,8 | 21,5 | 23,9 | 24,2 | 24,6 | 1,4%                |
| <b>Belgium</b>             | 29,2 | 32,9 | 38,0 | 38,8 | 39,1 | 0,8%                |
| <b>Bulgaria</b>            | 1,6  | 2,6  | 3,4  | 3,7  | 3,8  | 2,7%                |
| <b>Czech Republic</b>      | 5,8  | 9,2  | 10,0 | 9,8  | 9,4  | -3,8%               |
| <b>Denmark<sup>f</sup></b> | 29,6 | 34,6 | 39,4 | 39,9 | 40,3 | 0,9%                |
| <b>Germany</b>             | 26,8 | 27,9 | 30,5 | 31,0 | 31,4 | 1,5%                |
| <b>Estonia</b>             | 4,3  | 7,9  | 8,6  | 9,2  | 9,8  | 6,6%                |
| <b>Ireland</b>             | 25,5 | 28,9 | 29,8 | 29,8 | 29,8 | -0,2%               |
| <b>Greece</b>              | 15,3 | 16,8 | 15,7 | 14,6 | 14,6 | 0,3%                |
| <b>Spain<sup>e</sup></b>   | 16,5 | 19,4 | 21,1 | 21,2 | 21,3 | 0,4%                |
| <b>France<sup>g</sup></b>  | 28,2 | 31,2 | 34,3 | 34,3 | 34,6 | 0,7%                |
| <b>Croatia</b>             | 6,9  | 9,2  | 9,5  | 9,6  | 9,4  | -1,6%               |
| <b>Italy</b>               | 22,4 | 25,2 | 27,7 | 28,1 | 28,3 | 0,7%                |
| <b>Cyprus</b>              | 12,6 | 16,7 | 16,8 | 16,3 | 15,8 | -2,8%               |
| <b>Latvia</b>              | 2,9  | 6,0  | 5,9  | 6,2  | 6,6  | 6,0%                |
| <b>Lithuania</b>           | 3,2  | 5,9  | 5,9  | 6,3  | 6,5  | 3,5%                |
| <b>Luxembourg</b>          | 30,3 | 31,0 | 33,9 | 35,0 | 35,9 | 2,5%                |
| <b>Hungary</b>             | 5,9  | 7,8  | 7,4  | 7,4  | 7,3  | -0,5%               |
| <b>Malta</b>               | 9,6  | 11,4 | 11,8 | 12,1 | 12,3 | 1,9%                |
| <b>Netherlands</b>         | 27,3 | 29,8 | 32,5 | 33,5 | 34,0 | 1,6%                |
| <b>Austria</b>             | 25,2 | 26,4 | 29,7 | 30,5 | 31,5 | 3,2%                |
| <b>Poland</b>              | 4,8  | 7,6  | 7,9  | 8,1  | 8,4  | 3,8%                |
| <b>Portugal</b>            | 11,3 | 12,2 | 13,3 | 13,2 | 13,1 | -0,8%               |
| <b>Romania</b>             | 1,9  | 4,2  | 4,1  | 4,4  | 4,6  | 5,5%                |

<sup>f</sup> For Denmark and Spain, the year 2013 is taken from national sources.

<sup>g</sup> For France, the aggregate shown for the whole economy for 2008 also excludes education.

|                       | 2004 | 2008 | 2012 | 2013 | 2014 | Change 2014/2013, % |
|-----------------------|------|------|------|------|------|---------------------|
| <b>EA-18</b>          | 23,3 | 25,5 | 28,5 | 28,9 | 29,2 | 1,1%                |
| <b>EA-19</b>          | 23,0 | 25,3 | 28,3 | 28,7 | 29,0 | 1,1%                |
| <b>EU-28</b>          | 19,8 | 21,5 | 23,9 | 24,2 | 24,6 | 1,4%                |
| <b>Slovenia</b>       | 11,2 | 13,9 | 15,6 | 15,3 | 15,6 | 1,8%                |
| <b>Slovakia</b>       | 4,1  | 7,3  | 8,9  | 9,2  | 9,7  | 5,2%                |
| <b>Finland</b>        | 24,4 | 27,1 | 31,3 | 31,9 | 32,3 | 1,3%                |
| <b>Sweden</b>         | 29,0 | 31,6 | 37,3 | 38,2 | 37,4 | -2,2%               |
| <b>United Kingdom</b> | 21,5 | 20,9 | 21,7 | 20,9 | 22,3 | 6,7%                |

Table 18: Labour costs per hour in euro, whole economy (excluding agriculture and public administration)

*Recommended assessment method: Labour costs in Euro per timeframe.*

*Scale: cardinal and interval scale with a monetary value theoretically from  $0-\infty$*

b. Earnings per employee/timeframe after tax/incl. incentives

This metric represents the earnings of an employee after payment of taxes, social insurance and other indirect labour costs inclusive possible incentives like bonus or car services (Weiguo & Yanchun, 2010). These are the hourly earnings for Europe (Eurostat, 2014a):

|              | Median gross hourly earnings (EUR) |      |       | Proportion of low-wage earners (%) |      |       |
|--------------|------------------------------------|------|-------|------------------------------------|------|-------|
|              | Total                              | Men  | Women | Total                              | Men  | Women |
| <b>EU-27</b> | 11,9                               | 12,8 | 11,0  | 17,0                               | 13,3 | 21,2  |
| <b>EA-17</b> | 13,2                               | 14,1 | 12,3  | 14,8                               | 11,0 | 19,2  |
| <b>BE</b>    | 16,4                               | 16,8 | 15,7  | 6,4                                | 3,3  | 10,3  |
| <b>BG</b>    | 1,5                                | 1,6  | 1,5   | 22,0                               | 22,5 | 21,6  |
| <b>CZ</b>    | 4,4                                | 4,8  | 4,0   | 18,2                               | 12,9 | 24,5  |



|              | Median gross hourly earnings (EUR) |      |       | Proportion of low-wage earners (%) |      |       |
|--------------|------------------------------------|------|-------|------------------------------------|------|-------|
|              | Total                              | Men  | Women | Total                              | Men  | Women |
| <b>EU-27</b> | 11,9                               | 12,8 | 11,0  | 17,0                               | 13,3 | 21,2  |
| <b>EA-17</b> | 13,2                               | 14,1 | 12,3  | 14,8                               | 11,0 | 19,2  |
| <b>DK</b>    | 25,0                               | 26,7 | 23,8  | 7,7                                | 5,4  | 9,8   |
| <b>DE</b>    | 15,4                               | 16,9 | 13,8  | 22,2                               | 17,0 | 28,7  |
| <b>EE</b>    | 4,1                                | 4,8  | 3,6   | 23,8                               | 15,5 | 30,1  |
| <b>IE</b>    | 18,3                               | 19,3 | 17,3  | 20,7                               | 17,6 | 23,6  |
| <b>ES</b>    | 9,4                                | 10,3 | 8,4   | 14,7                               | 9,2  | 21,0  |
| <b>FR</b>    | 13,7                               | 14,5 | 13,0  | 6,1                                | 4,5  | 7,9   |
| <b>IT</b>    | 11,9                               | 12,1 | 11,5  | 12,4                               | 10,3 | 15,1  |
| <b>CY</b>    | 9,4                                | 10,6 | 8,0   | 22,7                               | 14,9 | 31,4  |
| <b>LV</b>    | 2,9                                | 3,1  | 2,7   | 27,8                               | 26,7 | 28,7  |
| <b>LT</b>    | 2,7                                | 2,8  | 2,6   | 27,2                               | 24,5 | 29,4  |
| <b>LU</b>    | 17,8                               | 17,8 | 18,0  | 13,1                               | 9,3  | 20,2  |
| <b>HU</b>    | 3,4                                | 3,6  | 3,3   | 19,8                               | 18,1 | 21,5  |
| <b>MT</b>    | 7,5                                | 7,6  | 7,4   | 18,3                               | 15,6 | 22,4  |
| <b>NL</b>    | 15,3                               | 16,4 | 14,3  | 18,1                               | 15,3 | 21,2  |
| <b>AT</b>    | 13,0                               | 14,2 | 11,1  | 15,0                               | 8,2  | 24,8  |
| <b>PL</b>    | 4,0                                | 4,1  | 3,8   | 24,2                               | 21,8 | 26,8  |
| <b>PT</b>    | 5,1                                | 5,5  | 4,6   | 16,1                               | 10,2 | 22,1  |
| <b>RO</b>    | 2,0                                | 2,0  | 1,9   | 25,6                               | 25,5 | 25,8  |
| <b>SI</b>    | 7,2                                | 7,1  | 7,3   | 17,1                               | 15,3 | 19,3  |
| <b>SK</b>    | 3,9                                | 4,2  | 3,6   | 19,0                               | 14,6 | 23,7  |
| <b>FI</b>    | 16,0                               | 18,0 | 14,6  | 5,9                                | 3,3  | 8,0   |
| <b>SE</b>    | 14,9                               | 15,8 | 14,1  | 2,5                                | 1,9  | 3,1   |
| <b>UK</b>    | 12,6                               | 14,1 | 11,2  | 22,1                               | 16,7 | 27,6  |

Table 19: Median gross hourly earnings (EUR) and proportion of low-wage earners (%), by sex, 2010

*Recommended assessment method: Earnings per employee per timeframe*

*Scale: cardinal and interval scale with a monetary value theoretically from  $0-\infty$*

c. Labour costs per unit or price/unit labour cost ratio pre-tax

Given that software development is highly intensive in human capital, the key factor for this industry is personnel (Devarakonda, Gupta, & Tang, 2013). Therefore it is important to compare the costs of a produced unit or the provision of a service with the needed labour costs to achieve the result (Diao, Keller, Parekh, & Marinov, 2007; Gabrisch, 2008).

Recommended assessment method:  $\text{Labour costs per unit} = \frac{\text{labour costs}}{\text{price per unit}}$

*Scale: cardinal and interval scale with a monetary value theoretically from  $0-\infty$*

d. Future growth of labour costs pre-tax

Since labour costs are one of the most important factors for the competitiveness of an IT-Company it is therefore essential to project the future growth of labour costs. This can be achieved through a consideration of different variables, for example the raise of employee compensation in average (including wages, salaries in cash and in kind, employers' social security contributions), vocational training costs, other expenditure such as recruitment costs, spending on working clothes and employment taxes regarded as labour costs minus any subsidies received (Eurostat, 2014a).

Recommended assessment method: *Projection via statistical extrapolation*

*Scale: cardinal and interval scale with value in percent theoretically from  $0-\infty$*

e. Comparison of indirect labour costs in European Union

This metric evaluates the differences of indirect labour costs in different countries and in this case for the EU, but it can easily be extended to other counties or continents. The actual differences in the European Union are shown in tableTable 19: Median gross hourly earnings (EUR) and proportion of low-wage earners (%), by sex, 2010.

*Recommended assessment method:* For similar currencies, like in the Euro Area, the statistics of the EU can be used. For countries with different currencies the calculation is the following.

$$\text{Comparison of labour costs in non € countries: } \frac{\text{labour costs country A}}{\text{labour costs country B}}$$

Country A represents the basis value and country B the reference value of the calculation. Via this calculation, an index is created which allows a company to calculate the value of every spend Euro of labour costs in comparison to other countries.

Scale: cardinal and interval scale with a dimensionless value theoretically from 0-∞

f. Gender pay gap

The gender pay gap, which represents the imbalances in wages between men and women. It is defined as the difference between the average gross hourly earnings of men and women expressed as a percentage of the average gross hourly earnings of men (Eurostat, 2015a). The following table represents the unadjusted gender pay gap in enterprises employing 10 or more employees which compares the hourly earnings of men and women in general (Perruzzi, 2015).

|                               |      |
|-------------------------------|------|
| <b>EU-28<sup>h</sup></b>      | 16,4 |
| <b>EA-17<sup>3</sup></b>      | 16,6 |
| <b>Slovenia</b>               | 3,2  |
| <b>Malta</b>                  | 5,1  |
| <b>Poland<sup>3</sup></b>     | 6,4  |
| <b>Italy</b>                  | 7,3  |
| <b>Croatia<sup>3</sup></b>    | 7,4  |
| <b>Luxembourg<sup>3</sup></b> | 8,6  |
| <b>Romania<sup>i</sup></b>    | 9,1  |
| <b>Belgium</b>                | 9,8  |
| <b>Portugal</b>               | 13,0 |

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<sup>h</sup> provisional data of Eurostat February 2015

<sup>i</sup> estimated data of Eurostat February 2015

|                            |      |
|----------------------------|------|
| <b>EU-28<sup>h</sup></b>   | 16,4 |
| <b>EA-17<sup>3</sup></b>   | 16,6 |
| <b>Lithuania</b>           | 13,3 |
| <b>Bulgaria</b>            | 13,5 |
| <b>Ireland<sup>3</sup></b> | 14,4 |
| <b>Latvia</b>              | 14,4 |
| <b>France<sup>3</sup></b>  | 15,2 |
| <b>Sweden</b>              | 15,2 |
| <b>Cyprus</b>              | 15,8 |
| <b>Netherlands</b>         | 16,0 |
| <b>Denmark</b>             | 16,4 |
| <b>Hungary</b>             | 18,4 |
| <b>Finland<sup>3</sup></b> | 18,7 |
| <b>Spain<sup>3</sup></b>   | 19,3 |
| <b>United Kingdom</b>      | 19,7 |
| <b>Slovakia</b>            | 19,8 |
| <b>Germany<sup>3</sup></b> | 21,6 |
| <b>Czech Republic</b>      | 22,1 |
| <b>Austria</b>             | 23,0 |
| <b>Estonia</b>             | 29,9 |
| <b>Norway</b>              | 16,0 |
| <b>Switzerland</b>         | 19,3 |
| <b>Iceland</b>             | 20,5 |

Table 20: The unadjusted gender pay gap, 2013

Due to the high number of variables, the gender pay gap needs to be adjusted. The general aim of adjusting the gender pay gap is to include a range of personal characteristics which may differ between men and women and which may therefore explain some of the difference in average pay. Reasons for the difference can be the chosen profession, the level of experience, negotiating skills etc. For example, the adjusted gender pay gap in Germany in the year 2010 was 7% (Destatis, 2014).

*Recommended assessment method: Comparison of the average salary of men to the average salary of women, if necessary per department.*

*Scale: cardinal and interval scale with value in percent theoretically from 0-∞*

- g. Earnings per IT-employee in average to other departments after tax and earnings per IT-employee in average to other (IT) companies after tax

Salaries are not the only reason for employees to stay in a company, but they are one of the most important reasons. Therefore, it is necessary for a firm to pay satisfying wages (Institute for opinion survey Allensbach, 2014). Since every employee defines the term “satisfying” on their own, a company should orientate their wage policy on the average payments of the market.

*Recommended assessment method: Comparison of the average salary of department one to the average salary of department two.*

*Scale: cardinal and interval scale with value in percent theoretically from 0-∞*

*RQ2: What are metrics for measures to optimize and educate the employee pool with reference to untapped potential within an organization?*

| <b>RQ2: What are factors and metrics for measures to optimize and educate the employee pool with reference to untapped potential within an organization?</b> |  |   |
|--|--|---|
| <u>Factor</u>  | <u>Metric</u>  | <u>References</u>                                     |
| Employee performance   | Real output (gross value added) divided by the total number of persons employed  | (Lazear, 2006); (Lorenz, 2015)                        |
| Process costs and duration   | Evaluation of throughput time and lead time                                      | (Zülch et al., 2011); (Lorenz, 2015)                  |
| Investment in employee education   | Expenditure for education of company or department                               | (Banker et al., 2009)                                 |
| Investment in employee education   | Number of employees in training per year   | (Banker et al., 2009)                                 |
| Identification of vacancies within an organization   | Employee requirements analysis   | (Mollona & Hales, 2006)                               |
| Staff potential within an organization   | Employee potential analysis  | (Mollona & Hales, 2006)                               |
| Staff potential within an organization   | Employee performance management system (goal-setting, monitoring and evaluation) | (Kantola et al., 2009); (Gheordunesco & Panoiu, 2014) |
| Staff potential within an organization   | IT vacancies in company  | (Litecky et al., 2006);                               |
| Staff potential within an organization   | Age distribution analysis  | (Humpert & Pfeifer, 2012); (Hek & Vuuren, 2011)       |

| <b>RQ2: What are factors and metrics for measures to optimize and educate the employee pool with reference to untapped potential within an organization?</b> |   |   |
|--|---|---|
| Staff potential within an organization   | Existence of female integration and leadership programs   | (Shen & Ge, 2005); (Trauth et al., 2006); (Nissen & Termer, 2014)                       |
| Employee fluctuation   | Retention rate  | (Allen et al., 2009b); (Riemenschneider et al., 2006); (Meland et al., 2005);           |
| Strategy for corporate education and development   | Existence, development and yearly evaluation of educational strategy and lifelong learning programs | (Wasem, 2008); (Exter & Turnage, 2012); (Cainarca & Sgobbi, 2012); (Hek & Vuuren, 2011) |
| Strategy for corporate education and development   | Gap analysis between existing and targeted skills of employees                                      | (Wasem, 2008); (Meland et al., 2005)  |
| Knowledge management   | Existence of knowledge management/transfer initiative/system  | (Afzan Ahmad Zubairy et al., 2014); (Usman & Musa, 2012)                                |

Table 21: Measures to optimize and educate the employee pool with reference to untapped potential within an organization - indicators view

a. Real output (gross value added) divided by the total number of persons employed

The essential aim of a company is to produce goods and sell them on the market to make profit. The performance of employees is a substantial factor to achieve this goal. Gross value added (GVA) measures the contribution to an economy of an individual producer, industry, sector or region (Financial Times Lexicon, 2013). It provides a financial value for the amount of goods and services that have been produced, less the cost of all inputs and raw materials that are directly attributable to that production.

This metric can serve as an orientation and major benchmark for the success of implemented measures in a company.

Recommended assessment method:  $\frac{\text{Real output in € per timeframe}}{\text{Number of employees}}$

*Scale: cardinal and interval scale with a dimensionless value theoretically from 0-∞*

b. Evaluation of throughput time and lead time

For any company, productivity is one of the major indicators. The evaluation of throughput time and lead time offers a deeper insight in this complex issue. Throughput time is the period required for a material, part, or subassembly to pass through the manufacturing process, and lead time is the number of minutes, hours, or days that must be allowed for the completion of an operation or process, or must elapse before a desired action takes place (van den Bos, Kemper, & de Waal, 2014). Every company can measure its productivity with these indexes, not only companies in the manufacturing industry.

Recommended assessment method: *throughput time and lead time in timeframe.*

*Scale: cardinal and interval scale with a dimensionless value theoretically from 0-∞*

c. Expenditure for education of a company or department

It is assumed, that higher economic value added transmits to higher human capital correlated with higher level of education and thus higher expenditure of education (Verner, 2011). This metric analyses the investments in training of employees and is calculated by dividing the total costs of training and the number of employees of the whole company or a specific department. Costs and especially costs for education are always an important topic for companies. A possibility to lower costs are massive open online courses (MOOCs). With this method, a large number of employees could be educated in one or more topics. Since these courses are often done alone, controlling measures have to be implemented to secure the success of these courses (Milligan & Littlejohn, 2014).

Recommended assessment method: *Sum per timeframe per company or department.*

*Scale: cardinal and interval scale with a monetary value theoretically from 0-∞*



d. Number of employees in training per year

This metric simply states the amount of employees in training measures per year. It can easily be extended to gain further information by dividing the *number of employees in training per year* and the *total number of employees in a company* and putting these figures in a relation.

Recommended assessment method:  $\frac{\text{Number of employees in training}}{\text{Total number of employees}} \times 100$

*Scale: cardinal and interval scale with value in percent theoretically from 0-∞*

e. Employee requirements analysis

A company has to be aware of the development of their employees and the needed profiles to gain a growth in productivity and revenues in future (Dainty, Raidén, & Neale, 2009). Therefore, an analysis to answer the following questions is needed:

- Which profiles does the company need to fulfil its strategic goals?
- How many employees does the company need to achieve its strategic goals?
- How many new hires does the company have to recruit per year?

This analysis should be a recurrent process every year. Also, the underlying assumptions and goals need to be audited to determine necessary changes. A possible qualitative method to gain the needed information could be a survey conducted with the different heads of departments. To conduct a quantitative measurement, basic elements for an employee requirements analysis are needed:

- the current employee capacity,
- estimations for the workload in a timeframe per employee or workstation,
- an evaluation of the proposed changes with a consideration of the impact on the required staffing and
- a plausibility check against references.

After the collection of the data, possible seasonal peaks need to be added to estimate the utilization of the employees over a timeframe of a year.

*Recommended assessment method: Statistics of current utilization of employees in comparison to needed utilization to fulfil requirements of the market.*

*Scale: cardinal and interval scale with value in percent theoretically from 0-∞*

f. Employee potential analysis

The identification and development of high potential employees (commonly referred to as talent management) has been pinpointed by both management scholars and practitioners as one of the major challenges faced by the twenty-first century human resource function (Dries, 2012).

So as important as the information which profiles are needed in the future, is the information what kind of potential and potentials does the company already have in its organization. This is especially relevant during times of scarcity of talent in Information Technology (Radant, 2014a). With tools like an employee survey in connection with employee work appraisals it is possible to identify employees which for example want to work in other departments, want to develop themselves in a certain way or are feasible candidates for executive careers.

Further, the identification of those “hidden gems” in an organization is crucial (Pollitt, 2005). Many high-potential employees will leave a company because they are not identified and or they think they were not valued enough (Schumacher, 2012).

At first, a company needs to define the term high potential or essential/indispensable profile. High potential employees, are employees who produce excellent work performance consistently (Juhdi, Pa’wan, & Hansaram, 2012) and could be a future executive, department head or somebody with a skillset that sets a company apart from the competition. An essential/indispensable profile is needed for the regular, but not less important tasks in an organization. Second, there are a lot of personality assessments and intelligence tests that can be used to help, for example track records. The best predictor of future performance is past performance (Schumacher, 2012).

*Recommended assessment method: Execution of a survey with middle management executives to filter possible candidates.*

*Scale: nominal scale with a dimensionless value 0 or 1*

g. Age distribution analysis

The complex of the best age distribution of a company, in contrast to the size distribution, is rarely discussed in the literature (Cirillo, 2010; Coad, 2010). For the conduction of an age distribution analysis, only few data is needed:

- date of birth
- date of entering the company
- department
- organizational status
- contract status (temporary employment, permanent contract)

Even though the date of birth is the key data for an age distribution analysis, the additional information can be beneficial. They can show executives or HR departments a more holistic view about upcoming problems or needed changes that have to be made. For instance, a company has the goal to allocate the age of their employees normally distributed and the analysis of the date of birth has shown that the company achieved this goal. But false conclusions can be made due to none consideration of information of the employee. For example, these statements can only be derived with additional data:

- The age in the company is distributed normally, but in department A and B it is 25 years in average, whereas in department C and D it is 55.
- The age in the company is distributed normally, but the contract status of the most employees is temporary. Without these employees, the curve would be right or left skewed.
- The age in the company is distributed normally, but the majority of the personnel are located on the upper levels of the organization.

These are only three examples for results that can be derived via an age distribution analysis, but they are showing what kind of important information about the structure of the organization a company can acquire with this evaluation.

*Recommended assessment method: Analysis via age statistics of departments and hierarchical structure of a company.*

*Scale: regarding the execution nominal scale with a dimensionless value 0 or 1 and for the results cardinal and interval scale with a dimensionless value theoretically from  $0-\infty$*

h. Employee performance management system (goal-setting, monitoring and evaluation)

The employee performance management system is an organized assessment process for employees in a company or department of a company. It is used to ensure that employee's activities and outcomes are aligned with the organisation's objectives and strategy (K. Becker, Antuar, & Everett, 2011). Employees that achieve the organisational goals are rewarded with favourable reviews and bonuses, in line with their performance and contribution to the organisation. Tools of an employee performance management system are e.g. goal-setting (planning), monitoring (feedback) and evaluation (appraising) (Decramer, Smolders, & Vanderstraeten, 2013).

*Recommended assessment method: Existence of employee performance management system and corresponding policies to foster a satisfying usage.*

*Scale: nominal scale with a dimensionless value 0 or 1*

i. IT vacancies in company

This metric represents the vacant positions of an IT-department. According to BITKOM, the information technology union in Germany, there were 41000 job vacancies for IT experts in Germany in 2013 (Pfisterer, 2013). Almost three-quarters (71%) of ICT companies are looking for software developers, especially with skills on cloud computing (53%) and big data (44%), followed by knowledge in social media (34%), programming of classical web properties (28%) and mobile websites or apps (26%). Similar numbers can be found in nearly all countries in Europe (Empirica, 2013, 2014).

*Recommended assessment method: Investigation of current utilization and possible utilization if all market requirements are met.*

*Scale: cardinal and interval scale with value in percent and or number of needed employees theoretically from 0-∞*

j. Female integration and leadership programs

It is necessary to encourage cultural changes to make IT-departments more attractive to women. However, there are high hurdles, as expectations diverge greatly from those of men (Ahuja, 2002) and interpersonal skills are a much more important factor (Cappelli, 2000). Female students and employees attach above average importance to a profession that can be arranged well with family and private life, in which they can help other people and which promises them a good working environment (Institute for opinion survey Allensbach, 2014).

*Recommended assessment method: Existence of diversity programs and corresponding policies to foster a satisfying usage. Yearly evaluation of the success of these programs via survey and statistical analysis. The programs should be aligned to actual needs of women, which should be compiled via survey.*

*Scale: nominal scale with a dimensionless value 0 or 1*

k. Retention rate

The retention rate is a figure which represents a comparison of the number of employees which are employed at the beginning and by the end of a year or timeframe. This number is an important indicator for a company, because it displays the number of employees which needed to be recruited only to compensate the losses of workforce during the year, therefore the headcount remains on the same level (Allen et al., 2009b). Effective retention management requires ongoing diagnosis of the nature and causes of turnover, a strategic approach to determine in which human capital markets retention has the largest impact on organizational success, and the development of an appropriately targeted and organized bundle of retention initiatives (James & Mathew, 2012). The retention of employees can be influenced

by a lot of variables but the main reason is a work-life conflict (DeTienne et al., 2012; Joseph & Koh, 2012); (DeTienne et al., 2012); (Khanna & Maini, 2013).

*Recommended assessment method:*  $retention\ rate = \frac{number\ of\ employees\ t_1}{number\ of\ employees\ t_2}$

*Scale:* cardinal and interval scale with value in percent theoretically from 0-∞

l. Gap analysis between existing and targeted skills of employees

The company's strategy sets the target for the development of the organization and its employees. It defines the necessary skills that are needed to fulfil the goals of the strategy. A gap analysis between existing and targeted skills of employees reveals missing skills and capabilities of the workforce, in comparison to the strategy of the company. If a company conducts this analysis, it will be able to allocate and promote the employees in the best possible way. Often the actual employment is not equal to the actual skills of the employees (Colomo-Palacios et al., 2013).

*Recommended assessment method:* Survey with middle management executives and derivation of an action plan to close identified gaps.

*Scale:* nominal scale with a dimensionless value 0 or 1

m. Educational strategy and lifelong learning programs

Due to a highly changing IT-environment, lifelong learning is a must for every employee and company to stay competitive. Companies that support a culture of lifelong learning will have a competitive edge on the market. These programs are an essential part of the educational strategy of a company and should be audited at least every year to include necessary changes and review the success of the learning measures. As many observers have noted, programmers can easily become obsolete when the programming languages that they know fall out of favour (Cappelli, 2000). A constant development of the knowledge of the employees is thus fundamentally.

*Recommended assessment method: Existence, development and yearly evaluation of educational strategies and corresponding policies.*

*Scale: nominal scale with a dimensionless value 0 or 1*

n. Knowledge management/transfer initiative/system

KM is fundamentally the management of the corporate knowledge and intelligent assets that can improve a range of organizational performance characteristics and add value by enabling an enterprise to act more intelligently (Bose, 2004). In a globalized world, it has become crucial for global organisations to have the ability to convert all precious data to useful knowledge (Hasan & Zhou, 2015). The challenge for companies is the motivation of the employees to share their knowledge with other people, which will be even more important with a scarcity of resources and a reduction of available employees with needed knowledge. Especially for IT-departments it is necessary to implement knowledge management initiatives, because often head monopolies are generated due to a needed high degree of specialization (Corbin et al., 2007).

*Recommended assessment method: Existence of a knowledge management system and corresponding policies to foster the usage and data quality.*

*Scale: nominal scale with a dimensionless value 0 or 1*

*RQ3: What are metrics for measures to support the psychological healthiness of the employees?*

| <b>RQ3: What are factors and metrics for measures to support the psychological healthiness of the employees?</b> |  |  |
|--|--|--|
| <u>Factor</u>  | <u>Metric</u>  | <u>References</u>  |
| Company Culture  | Company culture compiled via employee survey   | (Gheordunesco & Panoiu, 2014); (Barbu, 2014)   |
| Company Culture  | Hierarchical structure and organizational permeability                                   | (Eriksson, 2012); (Ye et al., 2012); (Claybourn, 2010)   |
| Employee satisfaction  | Employee expectations compiled via employee survey                                       | (Meland et al., 2005); (DeTienne et al., 2012)   |
| Employee satisfaction  | Existence of employee wellbeing programs   | (K. Page & Vella-Brodrick, 2013); (Čančer & Žižek, 2014)   |
| Psychological induced illness  | Psychologically induced sick days of employees/ timeframe                                | (Lohela Karlsson et al., 2012); (Gheordunesco & Panoiu, 2014); (Bektas & Peresadko, 2013); (K. M. Page & Vella-Brodrick, 2008)     |
| Psychological pressure   | Rate of change in used technology/timeframe and time of adoption                         | (Chilton et al., 2010); (DeTienne et al., 2012); (D. Evans et al., 2012)   |
| Psychological pressure   | Job complexity (e.g. variety of working fields per employee and number of waiting tasks) | (Riemenschneider et al., 2006); (Zülch et al., 2011); (DeTienne et al., 2012); (Barbu, 2014); (Khanna & Maini, 2013); (D. Evans et |



| <b>RQ3: What are factors and metrics for measures to support the psychological health-<br/>iness of the employees?</b> |  |  |
|--|--|--|
| <u>Factor</u>  | <u>Metric</u>  | <u>References</u>  |
|  |  | al., 2012); (Mark et al., 2014); (Takemae et al., 2007); (Finna & Forgacs, 2010)   |
| Psychological pressure   | IT misuse and security policy breaches in the workplace  | (Siponen et al., 2014)   |
| Psychological pressure   | Reported incidents of Workplace violence, mobbing and bullying                                       | (Gorenak & Popovic, 2014); (D. Evans et al., 2012); (Claybourn, 2010)  |
| Psychological pressure   | Job (in)security: status of used employment contracts in an organization                             | (Allen et al., 2009b); (Mgaya et al., 2009); (Outlay, 2007); (Barbu, 2014); (Ye et al., 2012); (Bryson, 2012); (Ek et al., 2014) |
| Turnover Intention   | <i>Included in RQ 2, metric retention rate.</i>  | (Joseph & Koh, 2012); (DeTienne et al., 2012); (Khanna & Maini, 2013)  |
| Workforce generation gaps  | <i>Included in RQ 3, metric Employee expectations compiled via employee survey</i>                   | (Allen et al., 2009b); (Grice et al., 2011)  |
| Loneliness   | Work environment and office design which supports employee networking determined via employee survey | (Elwér et al., 2014); (Claybourn, 2010); (Sirgy & Lee, 2015)   |

Table 22: Measures to support the psychological healthiness of the employees - indicators view

The research on employee well-being as a positive, psychological phenomenon is still in its early stages. While research on mental health in the workplace is relatively common, it has generally taken a stress-and-strain approach to the development of well-being, “fixing what is wrong” rather than “developing what is right” (Shimazu, Umanodan, & Schaufeli, 2006).

Stress has major consequences at individual, organizational, community and economical level. There are financial losses because of the decrease of production, the increase of the expenses for medical insurances of the employees, motivated by diseases and retirements (Radant et al., 2014).

a. Company culture

The company culture defines the acting, work ethic and behaviour of employees on nearly every level of a company. According to Ken Favaro, Senior Manager of the consulting company Strategy&, the culture often tops the strategy of a company (Favaro, 2014): “Strategy is on paper whereas culture determines how things get done. Anyone can come up with a fancy strategy, but it’s much harder to build a winning culture. Moreover, a brilliant strategy without a great culture is ‘all hat and no cattle,’ while a company with a winning culture can succeed even if its strategy is mediocre. Plus, it’s much easier to change strategy than culture.” Strategy and culture need to foster themselves and mature together to achieve the desired results. Therefore a company needs to take measures and develop methods to align them (Dickmann, 2006).

*Recommended assessment method: Figure determined via employee survey aligned with the company’s vision, values, norms.*

*Scale: the existence is measured with a nominal scale with a dimensionless value 0 or 1. Although the results of the employee surveys should be quantifiable in a cardinal scale.*

b. Hierarchical structure and organizational permeability

The structure of a company and its permeability is one of the important factors for young graduates (Institute for opinion survey Allensbach, 2014). This generation of possible employees is unlike other generations, a segment of employees which is considered to be in need of focused attention and with unique and challenging expectations like participation in

companies decision making (Shatat et al., 2010a). Therefore, a company needs to foster and promote employee participation especially through the middle management of the company. Also, a fair amount of decent career opportunities is necessary, to provide a sufficient permeability of the organization which meets the expectations of younger employees.

*Recommended assessment method: Degrees of freedom of management level in given timeframe and existence of employee participation programs.*

*Scale: cardinal and interval scale with the number of promotions theoretically from 0-∞*

c. Employee expectations

Organizations need to make sure that not only the performance and the learning agility of their employees is high, but also their commitment. In order to achieve high commitment, organizations need to establish an employment relationship which is based on mutual benefit (Dries, 2013). Demands and expectations of employees are based on the job they perform, the possibilities of progress, the ways of controlling their work, as well as compensation. Also, the expectations of highly educated workforce, and their satisfaction with the workplace and the assignments they fulfil, is a very important factor of the success of the organisation. Correspondingly it is expected that the success of the organization develops along with the employee satisfaction (Jaksic & Jaksic, 2013). Hence, it is important to gather needed information to answer questions about the expectations of the employees. This rather easy question cannot be answered lightly, because it requires sufficient knowledge about age, gender and social status of the workforce.

*Recommended assessment method: Expectations gathered with employee survey.*

*Scale: regarding the execution nominal scale with a dimensionless value 0 or 1 and for the results cardinal and interval scale with a dimensionless value theoretically from 0-∞*

d. Existence of employee wellbeing programs

Employee wellbeing programs are not initiatives to pamper employees, they are helping an organization to reduce illness and therefore a loss of workforce (Dunning, 2015). Organizations' health and wellness offerings have expanded beyond traditional programs, which formerly focused on physical health, integrated well-being programs are now including mental and emotional health, financial health, work life effectiveness, and workplace environment and stress (Spears, 2012).

*Recommended assessment method: Existence of policies and programs developed with employee representatives or work councils.*

*Scale: nominal scale with a dimensionless value 0 or 1*

e. Psychologically induced Sick days of employees

IT employees are facing high job demands (Zeng et al., 2010). The stress factor with the highest influence on the working people is emotional exhaustion. In consideration of this, it doesn't surprise that the impact of the demographic change on IT personnel is relatively high compared to other departments. (Zeng et al., 2010). The outcome of this situation is a high rate of mental or physiological illnesses, like boreout and burnout (Christensen & Knardahl, 2012) and a lower level of quality and productiveness of the department and the employees.

That these circumstances are not yet anchored within companies is shown by the fact, that the number of mental illnesses such as depression and burnout continue to rise from 4.6 sick days per 1000 employees per year in 2004, to 74.1 days in 2014 (Statista, 2014). Through close examination of the research on these phenomena, more facets as underuse by repetitive activities, the so-called boreout (Cürten, 2013) are identified. According to the Stress Report of the Federal Institute for Occupational Safety and Health in Germany, the most common mental demands are the supervision of different work at the same time (58%), severe time pressure and tight deadlines (52%) but also frequent interruptions (44%). The work on the power limit is rated by respondents with 16% approval. Nevertheless this requirement is perceived by 74% as psychologically stressful, lack of (73%) or not timely information (65%) follows (Lohmann-Haislah, 2012).

These factors are confirmed by further studies (Gao, 2011; Zeng et al., 2010). They show that the HR strategies and the company's relations with its employees need to be adjusted to the circumstances of today. Moreover, these strategies don't address the psychological stress and the latest scientific findings. Furthermore, they neglect the massive change in the expectations and emancipation of workers and also exclude the cultural dimension as (Hofstede, 1984) described in detail. However, this is in relation to the internationalization of IT becoming increasingly important. The inclusion of these factors is a fundamental part of today's work environment, since the burdens on knowledge carriers are higher and a company usually cannot afford a stoppage of work.

*Recommended assessment method: Psychologically induced sick days of employees in a given timeframe:  $\frac{\text{psychological induced sick day of company or department in timeframe}}{\text{number of workdays in timeframe}}$*

*Scale: cardinal and interval scale with value in percent theoretically from 0-∞*

f. Rate of change in used technology/ timeframe and time of adoption

In addition to the factors mentioned above, Lee et al. point out that technologically induced stress is a crucial multiplier. This is caused by strong technological transformation of an organization (T. S. Lee et al., 1995).

Although it can be useful for companies to change the used technology in fast cycles, the setup time will increase with the rate of complexity of the new tool or system because of higher learning curves. With help of the technology acceptance model companies can gain valuable insights into how and why employees make a decision about the adoption and use of information technologies in the workplace and can achieve greater acceptance and a more effective utilization (Venkatesh & Bala, 2008).

*Recommended assessment method: The assessment method depends on the type of the organization. The measurements could be releases per year, major patches and updates or the number of new applications or programs which are launched in a given timeframe.*

*Scale: cardinal and interval scale with a value theoretically from 0-∞*

g. Job complexity

The complexity of a working field is still one of the main reasons for psychological diseases like depression or burnout. Complexity is a term which will define every employee for himself. However, the stress report of the German governmental organization BAUA conducted a survey which researched the main stressors for a complex work environment. These stressors are e.g. different tasks at the same time, pressure from deadlines or interruptions in the workplace (Kliner, Rennert, & Richter, 2015).

*Recommended assessment method: Variety of working fields per employee and number of waiting tasks. Distractions, interruptions and necessary task-switching in the workplace identified via process analysis or employee survey*

*Scale: cardinal and interval scale with a value theoretically from  $0-\infty$*

h. IT misuse and security policy breaches in the workplace

Information technology has changed the way people work, behave and communicate. Workers are more productive than ever before and IT boosts the economic status of mostly every country and company. According to the consulting company Booz&Co digitalization provided a US\$193 billion increase of the world economic output and created 6 million jobs globally in 2011 (Bilbao-Osorio, Dutta, & Lanvin, 2013). But with the commonly known positive effects, several downsides came along with this development. Several studies explored the implications of IT-induced technology stress, technology addiction and IT misuse in the workplace. The advantages of information technology, like higher productivity, faster throughput time, user-friendliness and fast processing can also have several disadvantages like an undermining employee productivity, less innovation and well-being (Monideepa Tarafdar, John D'Arcy, Ofir Turel, & Ashish Gupta, 2014). These disadvantages can have large and significant impacts on counterproductive work behaviour which could result in employee misuse of IT or prohibited behaviour like intentional violations of security policies, which result in high investments in compliance and governance regulations and its enforcement (Boddy, 2014).

Recommended assessment method: *Number of reported incidents.*

*Scale: cardinal and interval scale with a value theoretically from 0-∞*

i. Reported incidents of workplace violence, mobbing and bullying

The definition of workplace violence, mobbing and bullying refers to situations where a person repeatedly and over a period of time is exposed to negative acts (i.e. constant abuse, offensive remarks or teasing, ridicule or social exclusion) on the part of co-workers, supervisors, or subordinates (Branch, Ramsay, & Barker, 2013; Einarsen, 1999). These issues have obviously large consequences for individuals, including higher body-mass, chronic diseases and illnesses, certified and uncertified absence which results in unproductive employee behaviour (Devonish, 2013). Since employees are the fundament of the productivity of a company, workplace violence, mobbing and bullying is a critical subject for maintaining organizational efficiency and effectiveness (Boddy, 2014).

Recommended assessment method: *Number of reported incidents.*

*Scale: cardinal and interval scale with a value theoretically from 0-∞*

j. Job (in)security: status of employment contracts used in an organization

The definition of job insecurity is regarded as an overall concern about the continuous existence of the workplace in the future (Chambel & Fontinha, 2009). Besides the economic development of a company, research has proven that the contract status of employees has both, positive and negative influence on the well-being of an employee (Bernhard-Oettel, Sverke, & De Witte, 2005). Employee contracts can have several forms like full-time-, part-time- or seasonal. In general, precarious employment has mostly negative effects on employees, like depression or other psychological diseases (Martin Olsthoorn, 2014).

Recommended assessment method:  $\frac{\text{number of part time contracts}}{\text{number of all employee contracts}}$

*Scale: cardinal and interval scale with a dimensionless value theoretically from 0-1*

- k. Work environment and office design which supports employee networking determined via employee survey

Human beings need interaction and company in their personal and professional life for their wellbeing in order to perform on a high level and be productive. From a psychological standpoint, an office should have several characteristics to support this issue like social density, view quality and type or light quality (Aries, Veitch, & Newsham, 2010).

*Recommended assessment method: Existence of an office plan which includes latest scientific research and has not only the best utilization of workstations as its goal.*

*Scale: nominal scale with a dimensionless value 0 or 1*



*RQ4: What are metrics for measures to optimize the work environment of the employees?*

| <b>RQ4: What are metrics for measures to optimize the work environment of the employees?</b> |  |  |
|--|--|--|
| <u>Factor</u>  | <u>Metric</u>  | <u>References</u>  |
| Physiological healthiness and workplace design   | Implementation of proper security policies like EU directive 89/391, DIN 4543-1 or existence of workplace design plan which supports psychological healthiness | (Gupta & Kristensen, 2008);(Finna & Forgacs, 2010); (Charbotel et al., 2008) |
| Job organization   | High level of flexibility in the work organization and allocation of employees via job rotation, job enlargement, job enrichment                               | (Zülch & Börkircher, 2012)   |
| Interruptions in the workplace   | <i>Included in RQ 3, metric job complexity</i>   | (Kliner et al., 2015)  |

Table 23: Measures to optimize the work environment of the employees - indicators view

Besides the psychological health, the physiological health of the employees is also an important challenge for companies. Especially companies which depend vastly on the specific knowledge of their employees like in IT-departments (Corbin et al., 2007).

a. Implementation of proper security policies like EU directive 89/391, DIN 4543

The objective of Directives like 89/391/EEC or DIN 4543 is to foster and improve the protection of workers through measures regarding the prevention of work-related risks, the protection of safety and health, the elimination of risk and accident factors and also the informing, consultation, balanced participation and physiological training of workers (Niskanen, Naumanen, & Hirvonen, 2012). These directives implemented responsibilities and obligations of employers in form of risk assessments, creation of protection, prevention services and the duties of workers (carrying out instructions, correct use of equipment, PCs or laptops) (Martínez Aires, Rubio Gámez, & Gibb, 2010).

*Recommended assessment method: Existence of workplace design plans and implemented policies which support psychological healthiness.*

*Scale: nominal scale with a dimensionless value 0 or 1*

- b. High level of flexibility in the work organization and allocation of employees via job rotation, job enlargement, job enrichment

A flexible organization supports various positive developments for a company and its employees. Besides the mentioned benefits for the knowledge transfer within the organization, learning, development and a higher satisfaction of the employees (Bennett, 2003), different environments and movements improve psychological health and reduce ergonomic risks (Otto & Scholl, 2012).

*Recommended assessment method: Existence of policies that support a high level of flexibility in the organization.*

*Scale: nominal scale with a dimensionless value 0 or 1*

*RQ5: What are metrics for measures to support the work-life balance of the employees?*

| <b>RQ5: What are factors and metrics for measures to support the work-life balance of the employees?</b> |   |   |
|--|---|---|
| <u>Factor</u>  | <u>Metric</u>   | <u>References</u>   |
| Compatibility of job and family  | Work-life/family policies   | (Nissen & Termer, 2014); (Lazar et al., 2010); (McCarthy et al., 2010); (Drobnič et al., 2010)                          |
| Compatibility of job and family  | Financial costs/benefits of company in the context of W-L Balance | (Lazar et al., 2010)  |
| Work organization and working time models  | Innovative working (time) models                                  | (Zülch et al., 2011); (Nissen & Termer, 2014); (Takemae et al., 2007); (Dick, 2010); (Moore, 2006)                      |
| Workload of employees  | Availability of employees   | (Allen et al., 2009b); (Chilton et al., 2010); (Makinson, Hundley, Feldhaus, & Fernandez, 2012); (Drobnič et al., 2010) |
| Workload of employees  | Working time per timeframe  | (Allen et al., 2009b); (Riemenschneider et al., 2006); (Holly & Mohnen, 2012); (Drobnič et al., 2010)                   |

Table 24: Measures to support the work-life balance of the employees - indicators view

Work–life balance is the general term used to describe organizational initiatives aimed at enhancing employee experience of work and non-work domains. Work–life balance arrangements and practices refer to initiatives voluntarily introduced by firms which facilitate the

reconciliation of employees' work and personal lives (Darcy, McCarthy, Hill, & Grady, 2012). Initiatives need to consider differences between male and female expectations (Asadullah & Fernández, 2008) and differences in career status of the employees (Darcy et al., 2012).

a. Work-life/family policies

The goal of work-life or family policies in companies is to generate greater productivity of employees due to a higher satisfaction. These policies assist employees to simultaneously fulfil their responsibilities both at work and at home (McDonald, Guthrie, Bradley, & Shakespeare-Finch, 2005). These policies cannot just include regulations and rules for part-time employment or paid leave. They also have to support career opportunities especially for women, because despite the fact that women and mothers increased involvement in paid work, little change has taken place in the organization and provision of unpaid domestic and care work (Baxter & Chesters, 2011).

*Recommended assessment method: Existence of Work-life/family policies, which are constantly reviewed via employee and management surveys to provide the best balance between the actual work in the company and the family life*

*Scale: nominal scale with a dimensionless value 0 or 1*

b. Financial costs/benefits of companies in the context of work-life balance

Work-life initiatives are often a reason for discussion within the management of companies because they don't provide instant improvement of productivity or an increase of revenue (Todd & Binns, 2013). Of course, the installed initiatives need to be controlled and questioned if they provide the anticipated results. A controlling of the implemented policies requires an inclusion of different variables and an evaluation via a business case. Obvious variables are the productivity of the individual, the number of sick days due to child illness, annual spending in work-life initiatives or the number of employees which use these opportunities. Also, further variables like turnover intention or retention rate have to be taken into

consideration as well. This case should be a long-term examination of the retrieved figures and statistics.

*Recommended assessment method: Calculation of a business case which considers the relevant productivity measures of the company or department and the employee. This Business Case should be controlled in certain timeframes.*

*Scale: cardinal and interval scale with a monetary value theoretically from 0-∞*

c. Innovative working (time) models

There are several different working models which can be offered to employees. The most common models will be shortly described in the following table:

| Working model                         | Description   |
|---------------------------------------|---|
| Trust-based working time              | This model changes the management style from controlling the hours at work to a results orientated approach. The employee is responsible for the fulfilment of tasks and is measured by the outcomes of his or her work (Singe & Croucher, 2003). Overtime hours are normally not recorded.   |
| flexible work schedule                | A flexible work schedule is an alternative to the traditional 9 to 5, 40-hour work week. It allows employees to vary their arrival and/or departure times. Under some policies, employees must work a prescribed number of hours per pay period and be present during a daily core time. In difference to trust-based working time, overtime hours are recorded (Coenen & Kok, 2014). |
| Annualised and variable working hours | The concept of annualised working hours distinguished itself from other concepts in a way, that the personnel is employed for a specific amount of hours per year (Corominas & Pastor, 2010). It allows the company to react to a certain demand on the one hand and retain huge flexibility on the other hand. However, use of annualised hours often                                |

| Working model         | Description   |
|-----------------------|---|
|                       | entails decreasing working conditions. The timeframe of the employment of the worker can also have an amount of weeks or month, which is advantageous for the retail industry as one example.   |
| Job-sharing           | The concept of job-sharing comprised at least two part-time employed workers which share a full-time position. The employees coordinate their working and leisure time solely responsible on their own (Crampton & Mishra, 2005). This is a possibility not only for white-collar workers but also for the management and executive staff (Brennan, 2015; Scherrer, 2013).  |
| Part-time employment  | Part-time employment is a large factor in today's economy. It is designed for employees who don't want or can't work on full-time bases so they reach an agreement with their superiors about a defined number of hours to work. This working model is mostly used by women with dependent children to reconcile paid work and family responsibilities (J. Rose, Hewitt, & Baxter, 2013).   |
| Home office           | Home office is a working model which allows the employee to work at their residences without having the obligation to appear at the facilities or offices of the companies (Răvaş, 2013).   |
| Telework              | Telework is in most parts similar to home office arrangements with the difference that the work can be done wherever the employee wants. It is an alternative work arrangement in which employees perform their duties not in a primary or central workplace with the usage of electronic media to interact with others inside or outside of the company (Coenen & Kok, 2014).  |
| Working-time accounts | Working-time accounts are not a working model in a classical way but it should be considered in this list as well. It is a model in which the difference between an employee's hours defined by contract and the actually worked hours is documented. Time worked above or below a reference value is either credited or charged to an account. The calculated balance can either reflect a credit or debit of time. Certain points |

| Working model | Description   |
|---------------|---|
|               | when the balance between contractual hours and hours worked must be zero are not usually established (Lusa & Pastor, 2011). This model provides a company with a powerful tool to gain more flexibility within their workforce (Herzog-Stein & Zapf, 2014). |

Table 25: Innovative working (time) models

When weighing a request from an employee for a changed work arrangement, the responsible executive can perform a quick cost/benefit analysis with the answering of the following questions (Kossek, Lee, & Hall, 2007):

- Does this individual have a track record of above average performance? Can one be confident that a reduced workload would not lessen his drive and commitment?
- What would be the long-term impact on his motivation, productivity, and tenure if this request was denied?
- If the employee left, what key projects or critical client relationships would be compromised?
- What would it cost to recruit and train a replacement?

*Recommended assessment method:* Calculation of a business case which considers the relevant productivity measures of the company or department and the employee. The variables of this business case should be controlled in certain timeframes.

*Scale:* cardinal and interval scale with a monetary value theoretically from  $0-\infty$

#### d. Availability of employees

The common business day for employees has a nine to five schedule and is limited to workdays. In reality, these agreements are shifting to overtime duties and a permanent availability via e-mail or other communication channels (McMenamin, 2007). As described in earlier chapters, permanent availability has negative effects on employees and could result in a decline of productivity. Several companies like BMW, Volkswagen and Mercedes block the devices of their employees after certain working hours to limit communication and allow the employees to recover from the workday (Kaufmann, 2014).

*Recommended assessment method: Communication (traffic) after working hours of employees.*

*Scale: cardinal and interval scale with a value theoretically from  $0-\infty$*

e. Working time per week per timeframe

The working time per employee in a given timeframe has important effects on employees. It defines in the most part its productivity, rates of error or the well-being of the individual in general. For a society and also a company in whole, it provides advantages regarding social equity through redistribution of working hours and raises voluntary social engagement (Buhl & Acosta, 2015).

An orientation for the maximum amount of work per employee is the working time directive 2003/88/EC of the EU. It provides workers with a minimum number of holidays a year and pauses between working days. The working hours per week are also capped to a maximum of 48 hours. It was implemented as an update on earlier versions from 22 June 2000 and 23 November 1993.

*Recommended assessment method: Evaluation of the working hours of employee or department per timeframe.*

*Scale: cardinal and interval scale with value in hours theoretically from  $0-\infty$*



### ***Composition of the 5-layer framework for employee productivity***

In the last two sections, the main components of the framework were identified. The derived factors define what should be measured regarding employee performance and the derived metrics define how a factor should be measured. Every factor has at least one metric that allows a measurement and consequently a controlling of defined measures.

The overall composition of the framework was conducted in the following way. The results of a research on the state of the art on this topic were used to define five layers to structure aspects of employee performance (Radant et al., 2014). The layers of the framework are structured in the following picture:

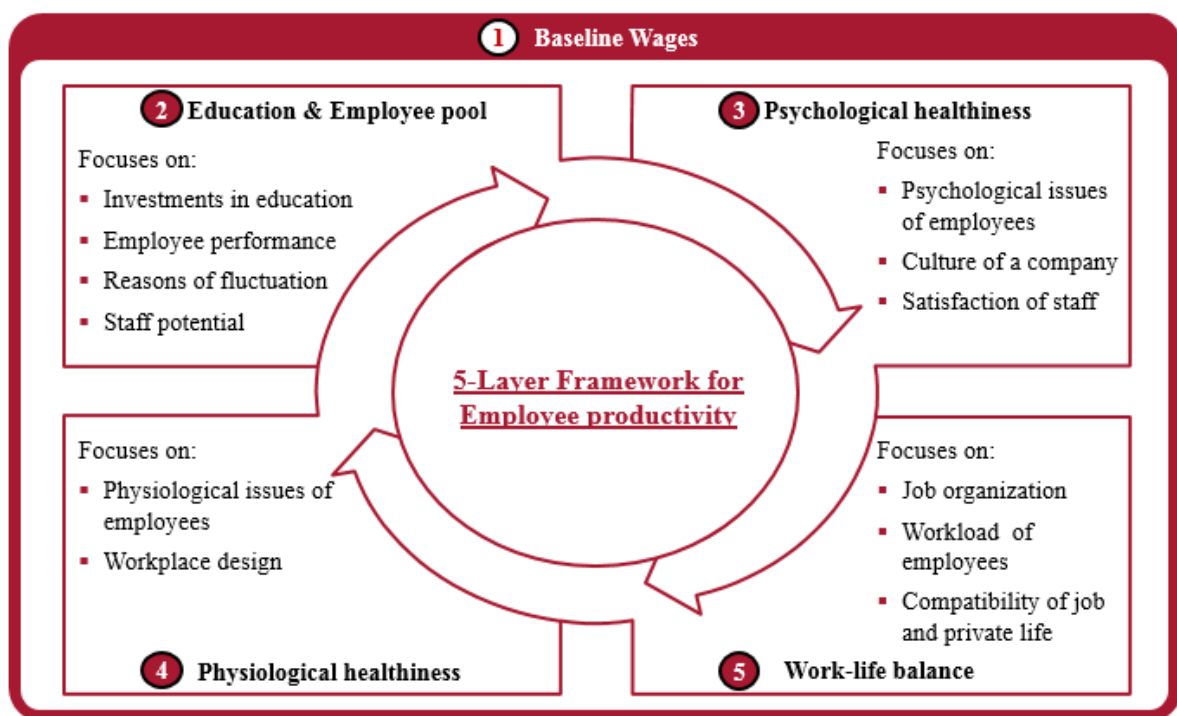


Figure 9: Visualization of the framework to manage resources in times of scarcity of talent

The illustration is selected for a reason, since only an implementation of all blocks will take the full range of the needs of the employees into account while increasing productivity. The first step is a fair and adequate compensation of talents in the IT-department. However, this must take into account the average of merit within the company on the one hand, and the purchasing power within a country and region on the other hand. As mentioned earlier, IT-departments are no longer support divisions, but rather an important factor for the company's profit. The second layer indicates measures to optimize the organization of the company. These could be process improvements like lean management, six sigma or software industrialization. Throughout these measures, companies can gain a much better understanding of

their actual employees and their skills. This is necessary to achieve further optimizations, which are described on the third and fourth layer in this picture. The third layer represents the psychological healthiness and the fourth layer the optimization of the work environment for the personnel. The fifth layer represents measures to develop a good work life balance for the employees.

To lower the complexity of the *5-layer framework for employee productivity*, the framework follows a hierarchical approach. Therefore, the identified factors of the first SLR, described in chapter 5.1 were grouped in the presented layers. In total 22 factors were identified in the first phase of the development of the framework (Radant et al., 2016b). After that grouping, a second SLR was conducted to identify corresponding metrics to quantify the factors and the different aspects that influence employee performance. With this method, 40 metrics could be identified. After that, these metrics had to be connected to the different factors to finalise the overall model.

The usage of the framework follows the hierarchical approach as well. If a company identifies a problem or would like to assess their actual status, they choose a certain layer. After that, they can define their approach on a more detailed level with the choosing of a factor that specifies the actual problem or challenge of the company. With the help of the factors, it is possible to derive certain measures to improve the actual situation. After the agreement on factors, the connected metrics offer a possibility to control the effects of the derived measure since they can be used for a controlling mechanism like a DMAIC-cycle. The following picture illustrates this method for the layer *baseline wages*.

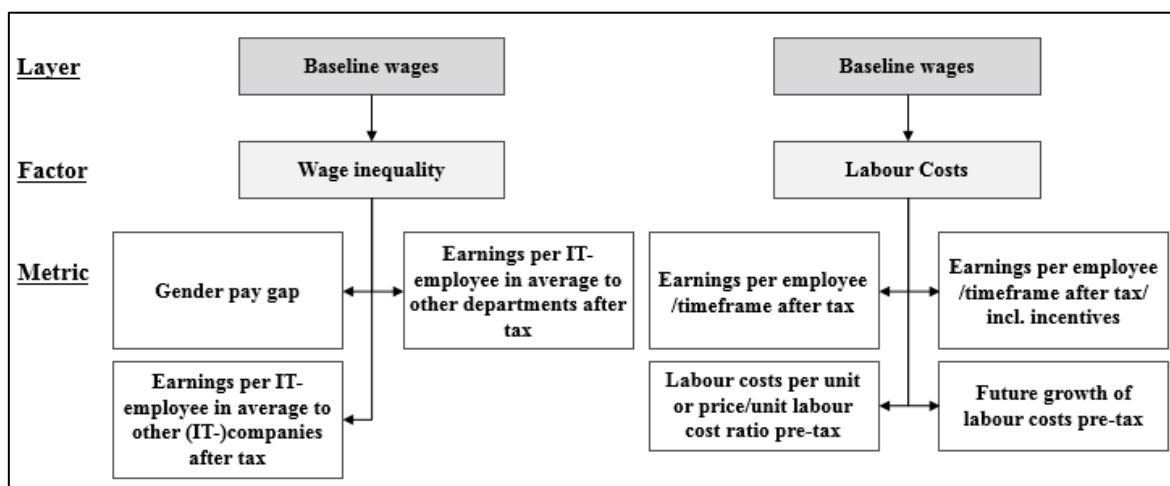


Figure 10: Example I for the use of the framework

In this example, the situation very well could be, that a company has an above average retention rate within its employee pool. Executives have identified that, particularly, two topics need to be improved. The first one regards to the salary and the second one is concerning about the unstructured and uncoordinated employee allocation and promotion of employees. Because of the complexity of these topics, it is hard to derive any target orientated measures against this issues based just on dissatisfaction. Therefore, it is important to analyse the problems on a deeper level.

The framework offers a methodology for these analyses. A dissatisfaction regarding the salary can have several different reasons. This reasons can be the following:

- gender pay gap,
- earnings per IT-employee in average to other departments after tax and
- earnings per IT-employee in average to other (IT-) companies after tax.

Therefore, executives have to analyse the reason for the dissatisfaction within these three areas. Frustration regarding salary is often the result of the comparison of a group of employees to their peer group (H.-W. Lee & Lin, 2014). If the result of this analysis is that the staff in the IT-department earns significant less money than in other departments, this issue can be solved and the risk of dissatisfaction is mitigated.

Of course, companies need to have a very transparent view on their salaries. The factor labour costs offers several opportunities for a transparent calculation of all aspects regarding the wages of employees. These metrics are the following four:

- earnings per employee /timeframe after tax,
- earnings per employee /timeframe after tax/ incl. incentives,
- labour costs per unit or price/unit labour cost ratio pre-tax and
- future growth of labour costs pre-taxes.

With the connection of these two aspects, companies not only have the opportunity to identify possible threats regarding their employee salaries, they can also calculate if possible changes would have a negative effect on their overall financial status.

As mentioned, the second example concerns about the allocation and promotion of employees. The identification and promotion of talent and is one of the key-issues for every company (Craig, 2015). The framework offers several possible analyses for that topic as well, as shown in the following figure.

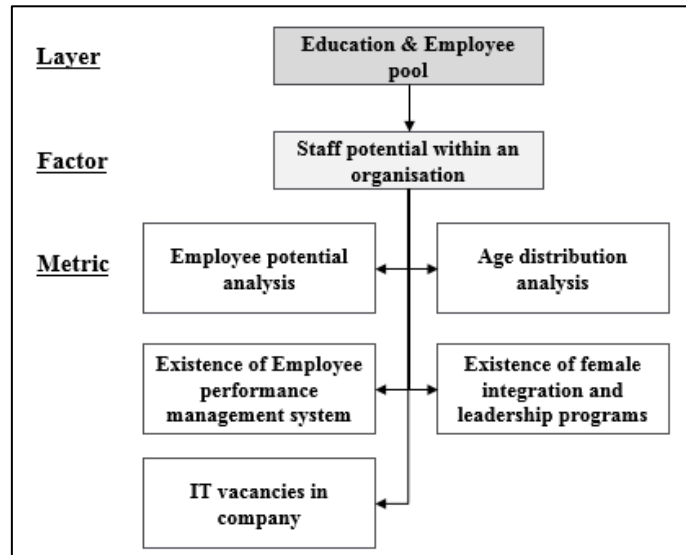


Figure 11: Example II for the use of the framework

Companies can use the factor staff potential within an organisation to analyse the actual problem and derive solutions. The metrics for the analyses are the following:

- employee potential analysis,
- employee performance management system (goal-setting, monitoring and evaluation)
- IT-vacancies in company,
- age distribution analysis and
- existence of female integration and leadership programs.

The results of these analyses will offer important insights about the actual challenges that a company is facing. Also, results of metrics of an age distribution analysis can be used periodically to measure the success of counter measures.

All identified factors and metrics are described in the previous chapters of this thesis including a scientific justification. Also, recommendations for an assessment method and scale for quantification are given. With this framework, companies have the possibility to divide their problems in different pieces to gain a better understanding of their actual situation and derive measures to counteract these challenges.

### ***Results and discussion of findings***

This section discusses the development and results of the designed framework and outlines the theoretical contributions. Furthermore, the findings are discussed from a practical and operative perspective, seeking to provide guidance on how to cope with scarce resources under effectiveness considerations. Finally, the limitations associated with this study are discussed and suggestions for future research are provided.

### Practical and operative implications

Productivity is efficiency in production, answered with the question how much output is obtained from a certain set of inputs. Thus, it is normally expressed as an output-input ratio. On the highest level, there are two possibilities to alter the productivity of an organization. The first one is to buy or build new hard- or software and the second one is an improvement of the actual situation of employees (Syverson, 2011). Under the hypothesis that financial means are not an issue, the level of used hard- and software can be raised indefinitely. Of course, this has its practical endings due to the fact that employees have to maintain and use these kinds of infrastructure. Consequentially the limiting aspect in this equation is the employee and its productivity.

The proposed framework addresses this issue. On the first level, it defines five layers that influences the productivity of employees. These layers are:

- baseline wages for highly skilled employees in IT-departments,
- optimization and education of the employee pool with reference to untapped potential within an organization,
- psychological healthiness of employees,
- physiological healthiness of employees and
- work-life balance of employees.

On the second level the different layers contain factors which determine, what kind of issues should be considered regarding employee productivity. On the third level, every factor has at least one metric and a corresponding measurement method to conduct a quantified assessment of a factor. In summary, five layers contain 22 factors and 40 corresponding metrics to measure the actual status, recognize potential threats and derive measures to retain productivity in the upcoming years. The factors and metrics are distributed in the following way:

|                   | Wages for high skilled employees in IT-departments | Optimize and educate the employee pool with reference to untapped potential within an organization | Psychological healthiness of employees | Physiological healthiness of employees | Work-life balance of employees |
|-------------------|--|--|--|--|--------------------------------|
| Number of factors | 3  | 8  | 6                                      | 2                                      | 3                              |

|                   | Wages for high skilled employees in IT-departments | Optimize and educate the employee pool with reference to untapped potential within an organization | Psychological healthiness of employees | Physiological healthiness of employees | Work-life balance of employees |
|-------------------|--|--|--|--|--------------------------------|
| Number of metrics | 8  | 14   | 11                                     | 2                                      | 5                              |

Table 26: Distribution of factors and metrics

This framework combines the latest research and developments regarding employee productivity and employee expectations (Radant, 2014a). As discussed, the expectations of employees of the Generation Y or of the millennials differ vastly from earlier generations, so that companies need to adopt their strategies to that circumstance.

Moreover, the framework shows, that the measurement of productivity doesn't need to be complex, lengthy or resource consuming regarding the implementation and the day-to-day use. After a conducted problem identification phase, the company can pick the most benefiting layer and can derive measures through the usage of the factors and metrics of this layer. After a first analysis, companies have always the opportunity to compare the newly retrieved data with the initial data set. This presents a possibility to control the success of the implemented measures and to adjust them if necessary.

### **Contribution to the literature**

The results of the study show, that expectations and needs of employees are not one dimensional, nor can they be neglected by companies. Executives have to consider several different issues to secure the retention and motivation of the employees and thus the productivity of the company.

Earlier developed frameworks and methods are concentrated only on one part of the employees or are rather complex (Hall et al., 2009; Wademan, Spuches, & Doughty, 2007). The difference to other frameworks, like the People Capability Maturity Model is that this framework is not a maturity model and doesn't require the implementation of certain parts to achieve the next level or to implement parts of another layer. Literature presented several elements that influence the productivity and motivation of employees (Radant, 2014a). The presented framework is connecting the dots of the earlier findings and results of studies and proposed a combination of this knowledge to create a consolidated approach.

In sum, this research contributes to the literature by developing a comprehensive and holistic theoretical model which combines the research areas of strategy, human resource management, psychology and IT-management and identifies important linkages between a firm's strategy, its human resources, and the productivity or outcomes. This framework provides companies with a tool for the better understanding of possible long-term needs of the staff and how they can align them with organization optimization and strategies.

To date and to the best of author's knowledge, this is the first research that combines factors and metrics of different layers to improve and retain employee productivity in times of scarcity of talent.

The following chapter will introduce an implementation plan for the *5-layer framework of employee productivity* based on the PMI-method.

## 6. Implementation plan for the 5-layer framework of employee productivity

The following chapter defines a possible approach, how companies can implement the *5-layer framework for employee productivity*. Besides the description of the implementation itself, the proposed plan will be validated via a qualitative study with change management experts.

The implementation of the framework follows the Project Management Institute (PMI) project management method. It is easy to adopt because it has no necessity for applications or any other information technologies. Other possible options are Prince2 or IPMA, but PMI was chosen because it is well known and it has set project management standards all over the world and is used by most companies (Fanning, 2014). Project Management is generally seen as a collection of methods that encompasses the tools, techniques, and knowledge-based practices applied to projects, to achieve organizational goals and deliver products or services (Jugdev, Perkins, Fortune, White, & Walker, 2013).

The PMBOK® includes 10 knowledge areas that are representative of most projects: project integration, scope, time, cost, quality, human resources, communication, risk, procurement, and stakeholder management. Each of the PM knowledge areas includes the processes that need to be completed to successfully manage projects (Oun, Blackburn, Olson, & Blessner, 2016). The author used these knowledge areas and process groups and expanded them with activities that a project needs to implement the *5-layer framework for employee productivity*. After the development, the adjusted overall implementation plan was validated via a qualitative study with eight change management experts from the consulting company Beating Point.

The PMI-framework consists of different process groups that are used along the project lifecycle. The following table shows the different knowledge areas that should be used in different phases (Harrington & Nelson, 2013).

| PMBOK® Project management process groups |                                   |                                     |                                    |  |                            |
|--|-----------------------------------|-------------------------------------|------------------------------------|--|----------------------------|
| Knowledge areas                          | Project management process groups |                                     |                                    |  |                            |
|  | Initiating Process Group          | Planning Process Group              | Executing Process Group            | Monitoring & Controlling Process Group | Closing Process Group      |
| 4. Project Integration Management        | 4.1 Develop Project Charter       | 4.2 Develop Project Management Plan | 4.3 Direct and Manage Project Work | 4.4 Monitor and Control Project Work   | 4.6 Close Project or Phase |



| <b>PMBOK® Project management process groups</b> |  |   |                               |  |                       |
|---|--|---|-------------------------------|--|-----------------------|
| <b>Knowledge areas</b>                          | <b>Project management process groups</b> |   |                               |  |                       |
|   | Initiating Process Group                 | Planning Process Group                  | Executing Process Group       | Monitoring & Controlling Process Group | Closing Process Group |
|   |  |   |                               | 4.5 Perform Integrated Change Control  |                       |
| 5. Project Scope Management                     |  | 5.1 Plan Scope Management               |                               | 5.5 Validate Scope                     |                       |
|   |  | 5.2 Collect Requirements                |                               | 5.6 Control Scope                      |                       |
|   |  | 5.3 Define Scope                        |                               |  |                       |
|   |  | 5.4 Create WBS                          |                               |  |                       |
| 6. Project Time Management                      |  | 6.1 Plan Schedule Management            |                               | 6.7 Control Schedule                   |                       |
|   |  | 6.2 Define Activities                   |                               |  |                       |
|   |  | 6.3 Sequence Activities                 |                               |  |                       |
|   |  | 6.4 Estimate Activity Resources         |                               |  |                       |
|   |  | 6.5 Estimate Activity Durations         |                               |  |                       |
|   |  | 6.6 Develop Schedule                    |                               |  |                       |
| 7. Project Cost Management                      |  | 7.1 Plan Cost Management                |                               | 7.4 Control Costs                      |                       |
|   |  | 7.2 Estimate Costs                      |                               |  |                       |
|   |  | 7.3 Determine Budget                    |                               |  |                       |
| 8. Project Quality Management                   |  | 8.1 Plan Quality Management             | 8.2 Perform Quality Assurance | 8.3 Control Quality                    |                       |
| 9. Project Human Resource Management            |  | 9.1 Plan Human Resource Management      | 9.2 Acquire Project Team      |  |                       |
|   |  |   | 9.3 Develop Project Team      |  |                       |
|   |  |   | 9.4 Manage Project Team       |  |                       |
| 10. Project Communications Management           |  | 10.1 Plan Communications Management     | 10.2 Manage Communications    | 10.3 Control Communications            |                       |
| 11. Project Risk Management                     |  | 11.1 Plan Risk Management               |                               | 11.6 Control Risks                     |                       |
|   |  | 11.2 Identify Risks                     |                               |  |                       |
|   |  | 11.3 Perform Qualitative Risk Analysis  |                               |  |                       |
|   |  | 11.4 Perform Quantitative Risk Analysis |                               |  |                       |
|   |  | 11.5 Plan Risk Responses                |                               |  |                       |

| PMBOK® Project management process groups |                                   |                                  |                                    |  |                         |
|--|-----------------------------------|----------------------------------|------------------------------------|--|-------------------------|
| Knowledge areas                          | Project management process groups |                                  |                                    |  |                         |
|  | Initiating Process Group          | Planning Process Group           | Executing Process Group            | Monitoring & Controlling Process Group | Closing Process Group   |
| 12. Project Procurement Management       |                                   | 12.1 Plan Procurement Management | 12.2 Conduct Procurements          | 12.3 Control Procurements              | 12.4 Close Procurements |
| 13. Project Stakeholder Management       | 13.1 Identify Stakeholders        | 13.2 Plan Stakeholder Management | 13.3 Manage Stakeholder Engagement | 13.3 Control Stakeholder Engagement    |                         |

Table 27: PMBOK® Project management process groups

The implementation plan will be structured in the following six phases.

1. Initiating
2. Planning
3. Execution
4. Monitoring and controlling
5. Risk management
6. Communication and project marketing

These phases will be described in the following chapters of this thesis.

### ***Initiating***

This chapter describes the process before an actual project. Especially with a view on analyses that a company has to undertake to understand the challenges they are facing. The first step is to bring the leader(s) of an organization to the realization that significant change is required (Pater, 2015). The activities conducted at this early stage centre around the chief executive officer or another senior leader. The main output from this phase is the case for change, which outlines the necessity for a change of the actual HR and organizational policies by confronting the senior executive with examples of the actual problems and emerging threats the company is currently facing. These examples could be, for instance, a high retention rate or a high average age of the employees. It is important that the chief executive (and management team) acknowledges that the organization needs to change, recognizes potential and significant benefits and has engaged specific employees or external consultants to conduct further analysis. Possible documents are age analyses or demographic outlooks for the company and the market, possible references from other companies currently facing similar problems.

Initial meetings serve to validate the expectations regarding the timing and scope of the framework. These discussions serve to initiate and structure the project plan. The resulting mobilization plan outlines in broad terms the anticipated approach, timeframe and deliverables for all phases, while detailing the activities to be undertaken during the early phases of the project. The mobilization plan will focus on project events as well as on the activities required to appropriately mobilize the organization for the project ahead.

Via a quick check or a quick assessment, the scope and problem analysis can be defined much more accurate. With the help of a provided quick-check assessment, the project manager can analyse very quickly the different layers (e.g. implementation of employee performance systems, workplace of the future, analysis of staff potential, identification of employee shortage) to measure the actual status, recognize potential threats and derive measures to retain productivity in the upcoming years.

During that phase, the company should have a first initial impression which layer of the framework addresses what kind of symptoms and problems of the organization. To reach a better understanding of the actual state of the company, a simple check-up via a simple yes/no questionnaire of the metrics can be done.

Building a common understanding of the organization's current situation, both its internal operations and its position within the market, is essential to set the proper context for the project and to gather and accurately interpret pertinent information received. The complete portrait of the organization's situation is defined through the combined development of the internal organizational overview, business position, holistic business model and strategic outlook.

The first part is to develop a portrait of how the organization will conduct business in the future. This allows the project team to choose the right layers and factors for the analysis. Usually a company has a business strategy and accordingly defined goals to achieve this strategy. It is therefore important to review this strategy and deviate implications for the employees.

The internal organizational overview provides an initial snapshot of the current environment in which the company operates. Available documentation is reviewed to gather internal data such as company history, employee statistics, spending in education, recent financial trends and current position in the market. This is important to calculate the metrics in the later parts of the project.

Articulating the actual state provides first basic information, and highlights key elements of its business environment, such as strengths, weaknesses and opportunities versus those of competitors. Finally, the holistic business model takes a “value chain” perspective of the entire organization, offering management a non-traditional look at the internal and external relationships that form the foundation of how the company operates for employees on a daily basis. This phase ends when multiple levels of the organization understand where the organization wants to be and can consistently and uniformly articulate this. At this point, both the relevant executives and personnel share a common understanding of the organization’s structure and operations. At this stage, the project is publicly announced throughout the organization, a project office is established and a core team of the organization is chartered to explore the (as yet unquantified) opportunities of the “future state” and the organizational vision. The company needs to identify the urgent and important issues which can be solved by the several layers of the framework.

It is necessary that information such as the confirmed business vision, critical success factors, shared values and guiding principles be clearly articulated across the company through the development and execution of a communication plan. This plan identifies evident sponsorship activities, the main audiences to be targeted, messages to be communicated, the sponsors who will do the communicating, the frequency of communication, and the media to be used. It serves as a formal company document listing the activities that are to be executed daily by members of the organization to initiate and drive the change campaign.

Organizational vision statements are ineffective if they are not supported by tangible actions that are required to realize that vision. The articulation of critical success factors calls for the identification of stakeholders, their expectations concerning what constitutes “quality” service, as well as the ways that the organization must excel to meet these expectations. Key performance indicators provide the quantified parameters required for project success.

The realization of a positive project outcome is founded on the notion that all existing elements of an organization, people, process, technology, policies, etc., must be opened to challenge. Therefore, the assessment of processes, technology and human resource issues establishes a comprehensive performance baseline that can pinpoint to opportunities as well. The project charter includes a description of a business case, as well as an overview of technology and human resource changes that the eventual implementation of the recommended processes will require.

A business case is a mathematical method to calculate the investments and revenues over a certain time span to calculate the length of time to the amortization of the investment (Hockerts, 2015; Molthan-Hill, 2015). The calculation of a business case for the implementation of the framework depends on the layers that the company would like to implement and on the tools and methods that are already in place. Also, it has to be mentioned, that the derived measures from the framework will not pay-off in a short-term period.

Once the project team has sufficiently formed its proposed portrait of the “future state”, the team’s proposals are presented as “work-in-progress” to a broader audience of affected employees to gather meaningful feedback. This validation exercise is important to obtain employee buy-in and can take many forms. The feedback will be reviewed, considered and partially integrated in the final project charter. If the framework is piloted in e.g. one department, it can also be helpful to show the employees the chosen layers for the analysis. This will help to minimize rumours or the thought that the goal of the project is cost cutting via a reduction of the headcount.

### *Planning*

This chapter is devoted to the actual planning of the project. The main deliverables of this phase are the following:

- a project charter which is accepted from all relevant stakeholders,
- a work breakdown structure that includes all steps that are defined in this chapter and,
- a project infrastructure that defines the rules and responsibilities for the project.

The project charter is the document, which when approved, allows the project manager to set up the project and develop the project management plan together with the newly appointed project team. This plan consists of several parts like the project budget plan, project plan and risk register and a communication plan, which should include the type and frequency of key management reviews and information distribution. The communication plan relies on having identified the project stakeholders. Once the project team has agreed upon the content of the first version of the project management plan, then it should be presented to the steering committee for approval. When approved, it forms the baseline for the monitoring and control of the project. At this point, the company has to define which layers of the framework should be used in the upcoming project.

The next step is the definition of the work breakdown structure (WBS), schedules and activities. The formulation of the WBS follows a top down approach, as shown in the following picture:

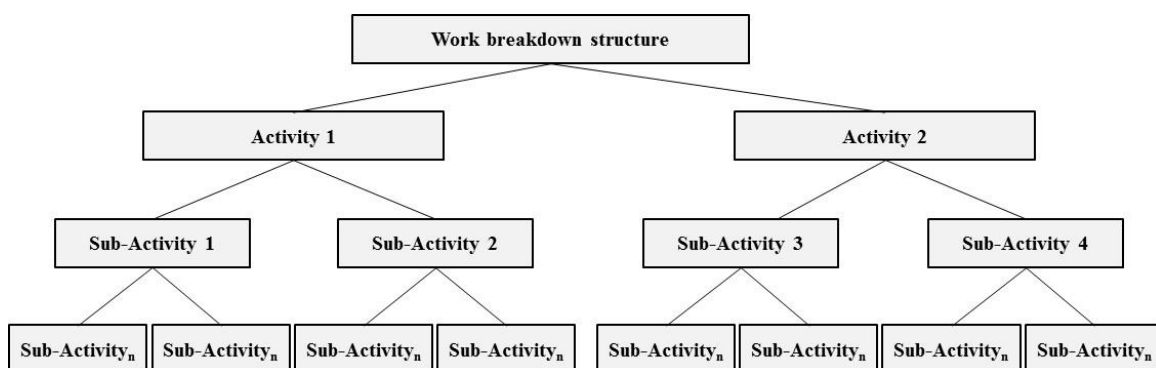


Figure 12: Model of a work breakdown structure

The activities need to be separated into a set of items into subsets that are mutually exclusive and collectively exhaustive. It defines itself as the optimum arrangement of activities that are exhaustive and doesn't double count at any level of the hierarchy. That allows the project

teams to work independently from one another on different issues of the project at the same time. If the activities have a certain timeframe or expenditures, they should not be managed like activities but as projects to raise the probability of a successful execution.

After the finalization of the WBS, the activities will be supplemented with the needed number of workdays to complete an activity. The accumulation of the estimated workdays follows the bottom up approach. These numbers enable the project manager to plan specific resources for the activities, to develop a schedule, estimate the project costs and determine the project budget. During this stage, the company should have decided which layers, factors and metrics will be used in this project. The hierarchical approach of the *framework for the management of scarce resources* is an important help for the development of the WBS. The layers, factors and metrics can be used as an orientation as shown in the following picture.

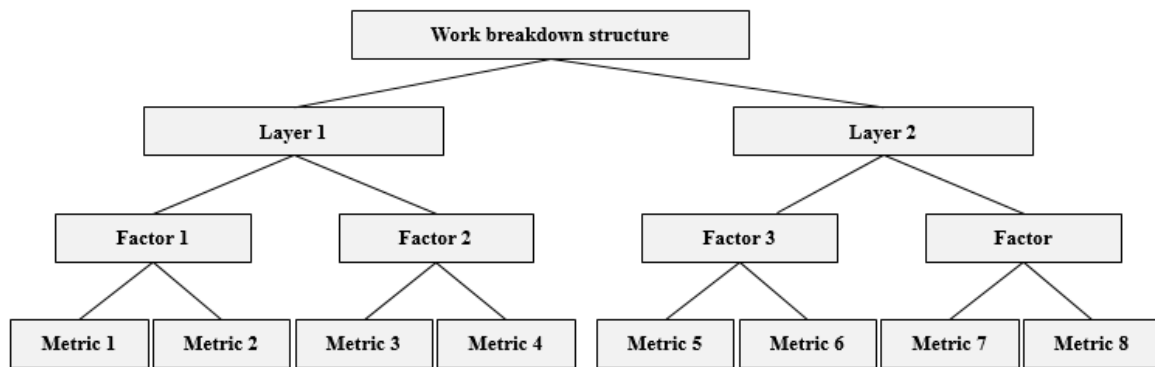


Figure 13: The framework for the management of scarce resources as a WBS

The implementation and execution of a proper risk and stakeholder management will be discussed in the following chapters.

Besides that, the project infrastructure and dates for meetings should be agreed on. The analysis of the actual state of a company with the help of the framework requires involvement from various parts of the organisation and several meetings and workshops and these should be planned as early as possible.

### *Executing*

In this project phase, the actual implementation of the framework and its factors and metrics is conducted and the different steps towards the implementation will be discussed. Besides that, deliverables apart from the framework itself are presented.

Each subproject has its own discrete requirements, specifications, costs and results. These subprojects will probably and sometimes inevitably have dependencies on each other and on other elements of the project. These elements will suggest several possible scenarios for implementation of the framework. Management has to make decisions regarding which implementation plan should be followed. This is highly dependable on the layers of the framework that will be implemented. Scenario and migration planning need to be considered from two perspectives: financial outcomes and probability of success. The implementation plan together with the business case will enable these decisions. Both deliverables confirm the expected sequence, timing, costs and benefits of the earlier plans.

The first step in the executing phase is the acquirement of the needed resources and the allocation and assignment of these project members to the different activities. If needed resources are not available, this circumstance constitutes a high project risk that needs to be addressed to the steering committee. After receiving or calculating the relevant information needed for the framework, the best way to derive measures and corresponding timetables is to conduct workshop sessions with the relevant stakeholders of a department or the organisation. These workshops should involve executives as well as employees. In these sessions, the layers, factors and metrics need to be discussed one by one, the actual numbers need to be compared to the industry benchmark and possible measures will be derived. Due to the involvement of several departments and employees, the project should plan this workshop series with enough contingency days to absorb possible delays.

Independently of the scope of the overall project and consequently of the layers that will be implemented, the following deliverables need to be provided by the project team.

1. Competency needs assessment: It identifies the shortfall between current employee skills and the competencies required to function effectively in the “To-Be” state. While this assessment can vary significantly in size, a comprehensive assessment will map out a personalized (re)training path for each employee, based on their individual needs (Harvard Business Review Analytic Service, 2014). It will also point to



ways that the organization can optimize its investment in training by employing a combination of different delivery modes (e.g. computer-based training/support, on-the-job mentoring/partnering, classroom courseware, etc.). The process redesign exercise will have identified a series of policy changes required to enable the adoption of the new process. In this context, “policies” refer to either external regulations or internal “house rules” that guide day-to-day employee decisions and behaviours in the workplace.

Policy/regulation changes are catalogued (including the benefits and risks associated with each) as input for management approval. New/revised policies outline the new rules for staff, and explain “why” the policy is being rewritten, as well as how their daily work routine will change thus. Position/competency profiles outline key job responsibilities, and allocated time percentages are drafted in accordance with company practices. Job description formats are often stipulated within provisions of collective agreements.

2. Competence matrix: The selection of the preferred parts of the framework that should be implemented requires a full delineation of roles and responsibilities for key positions (executives who are responsible for the implementation and the enforcement of the new HR-strategies), to explain the full extent of the proposed changes. This exercise sets clear boundaries on the duties of each position, thereby reducing the potential for confusion and duplicated effort during and post implementation. It also facilitates the calculation of the workforce numbers and costs, indicating the number (and position/level) of employees involved in the new processes.
3. Human resource strategy: This document outlines a comprehensive plan for addressing anticipated obstacles to change prior to and after project roll-out. This strategy builds upon change management information accumulated since the inception of the project. It contains, for example, tactics for dealing with resistance to change, fostering frequent sponsorship activities and ensuring compliance with new policies. This strategy is also input into the migration plan. A lot of the suggestions that can be derived with the framework centres about flexibility of work and expenditures for employees, which could promote resistance within the executive staff of the organisation.

4. Business case: The anticipated financial implications, risks and timing of the proposed solutions are presented to senior management in the form of a business case. In some organizations, senior management opts to spend months conducting detailed financial analyses before proceeding past this point. Other management teams are comfortable offering an “approval-in-principle” based on a rough assessment. Ideally, the level of detail provided should enable senior management to select a preferred scenario, allowing for a final “go/no-go” decision, by sub-project, at the end of the phase (i.e. once all impacts have been identified and considered). Key conclusions from all deliverables in this phase are synthesized into committed project results and budgets, a deliverable that entails a refinement of the financial estimates that were presented to management in the business case.
5. Analysis of the effects of the framework on the organization: The further part of this phase is to design the details and understand the consequences to the organization of implementing the preferred solution. The project becomes a composite of multiple, discrete sub-projects for which parallel teams explore the interrelated impacts of conducting simultaneous changes to processes, human resources, technology, policies, and physical infrastructure. This planning facilitates the identification of real costs, benefits and migration activities that will maximize the probability of a successful implementation and demonstrable results for the company. Detailed process descriptions are developed to explore precisely how the new work processes will function. In most cases, this activity involves a systematic analysis to identify the detailed information requirements of process flows. Once detailed process descriptions have been defined, an organizational structure is described that outlines how the company’s workforce can best be organized to perform these new processes. Internal constraints, such as clauses in collective agreements, shortages of required skills, “turf” battles for control of territory, etc. often dictate several different scenarios to be explored. Senior management must then choose a preferred model based on the strengths and weaknesses of each option.
6. Measurement system: This system is needed to set in place mechanisms that feed information to both staff and management pertaining to actual versus planned performance. The system that is developed must transcend simple process measurements and provide a true indication of the overall success of the initiative (e.g. compliance with new policies, success of training programs, etc.). For the framework, the

author suggests the method of a DMAIC-cycle because it presents an iterative approach for the controlling of the derived measures. All of this is to help individuals and teams achieve agreed-upon business outcomes, and to provide appropriate recognition of their success.

7. Documentation: This will invariably be required to provide the necessary support to employees upon full implementation of the Framework. Front-line employees refer to the process/user's manual for guidance on how to perform their new duties in re-designed processes, as well as how to perform day-to-day job tasks with the aid of the new IT-system, if applicable.
8. Training: Support materials are built as part of the learning strategy and materials deliverable and await delivery to employees in accordance with implementation schedules that are prepared later in this phase. New materials and educational software programs are tested with employee focus groups. In larger organizations, "train the trainer" programs are also developed.

By the end of this phase, a complete business solution will have been designed with the help of the framework and a business case and migration plan will have been agreed upon "in-principle" by senior management, and understood by all affected managers and staff. The project office serves as the focal point of all migration planning and business case activities, maintains communication channels and dispatches unresolved issues that have been identified for further analysis in subsequent phases. This effort is strongly dependent on the number and level of detail of migration scenarios contemplated.

By this time, most anticipated impacts of the business solution will have been identified and can be weighed into revised financial and risk estimates. Elements of the framework are now fully designed and planned project-by-project, in accordance with the migration plan. Resources are marshalled, orchestrated and enrolled; the sequence of capital expenditures is known; cash flows are forecasted; profit and loss impacts are understood and benefits are assigned and scheduled. Senior managements "go/no-go" decision at this stage constitutes the "point of no return" for project building and implementation. Key employees will have been assigned active roles to deliver project results on time and on budget. Individuals are considered accountable for the success of the project, and specific rewards and consequences are often implemented to motivate appropriate actions.

The project office monitors progress, risks and the quality of the multiple development sub-projects, coordinates the timing of implementation and organizational impacts, and establishes a mechanism for benefit-tracking.

After the design of the solutions, the next step is to set in motion the full suite of process, technological and social changes that have been designed and built across the company. Implementation begins when the targets of change begin experiencing the impacts and are expected to adopt the new state. There is a wide range of activities being completed by implementation teams in this phase, such as equipment installation, employee training, issue documentation/resolution, and managing compliance to new processes and policies.

Managing the roll-out of the framework throughout the entire organization (often across many geographic regions) is one of the most challenging aspects of the project. Abnormally high levels of support are likely during the initial operation of the business solution that need to be directed and coordinated. New issues to be addressed for the implementation to proceed smoothly will continuously arise. It is therefore suggested to pilot the use of the framework in one region or one department, like the IT-department to minimize risks and enable fast change.

Given that organizations have a natural tendency to gravitate toward traditional behaviours, even well-intentioned employees often slip back into performing the job duties just as they have always done them. This situation can result in performance gains to be lost over time or to not be realized at all. To sustain the new environment, a performance feedback mechanism, connected directly to the critical success factors of the project goals, is put in place to measure desired performance targets, and provide for corrective action and continuous improvement.

During the implementation, it is not only important to measure the resulting improvement in organizational performance, but to also measure the progress of the implementation itself. This measurement is conducted as part of project management using the implementation plans and performance feedback mechanisms. This is especially important when parts of the organisation and the culture of work will be changed by the measures derived with the help of the framework.

Upon completion of this phase, the framework will be operational across the organization and employees will have been fully trained. Staff will be configured under the revamped organizational structure and will respect the revised policies that govern their work duties.

The employees will see and feel the benefits and senior management will declare that the expected results from the framework have indeed been achieved.

The project office is coordinating and controlling all implementation events. Daily progress is monitored against implementation plans. Benefit tracking and performance feedback are in place to measure the learning curve and performance improvements against established timelines of the migration plan for derived measures from the framework.

### ***Monitoring and Controlling***

The goal of this phase is to put mechanisms in place to ensure that performance improvements resulting from the project are sustained over time and ultimately lead to opportunities for additional performance gains. If the framework (or parts of it) is implemented, it provides a well-grounded information basis to determine ongoing strength and weaknesses. The main deliverable of this phase is a defined and implemented controlling system for the identified factors and metrics that allows a regularly assessment of the success of the *5-layer framework for employee productivity*.

By training small teams responsible for identifying and initiating ongoing improvements, the company will commence an effort to make continuous performance improvement an integral part of the organizational culture.

A continuous improvement program is established, which outlines the way future performance enhancements will be supported in the organization. Along with initiating programs such as Total Quality Management (TQM) and Statistical Process Control (SPC), this plan addresses the need to develop and sustain appropriate management leadership of and participation in, performance improvement. In addition, the plan identifies the steps that are needed to allow the employees not only to recognize opportunities for improvement, but also to become empowered to act upon them. Although this phase is ongoing, demonstrable results will occur on several fronts, including the successful completion of continuous improvement projects.

After the finalization of the project a DMAIC-cycle (define, measure, analyse, improve, control) should be implemented for the derived measures. This task should be carried out by the HR-department because they are the recommended point of contact for the use of the framework.

### ***Risk Management***

The purpose of this part is to define and formalize the risk management procedures to be followed during and after the implementation of the framework. Risks can only be managed if they are understood ahead of time and plans have been considered to manage the risks (Marcelino-Sádaba, Pérez-Ezcurdia, Echeverría Lazcano, & Villanueva, 2014). The main deliverables of this phase are:

- a risk catalogue that defines possible risks and mitigation strategies,
- a defined risk management process for the implementation and
- a method that monitors and controls the identified risks for the project.

The purpose of risk management is to minimize the impact of several types of risks on the project, by detecting and addressing potential risks before significant, negative consequences occur. Risk Management provides a disciplined approach and environment to support proactive decision making to:

- assess continuously what could go wrong (risks),
- assess opportunities that the project team should consider in relation to the overall execution of the project,
- determine the priority of identified risks and opportunities,
- implement strategies to respond and manage those risks or to act on opportunities.

There are inherent risks associated with the implementation of the framework. These risks are mostly associated with the change processes that are inherent with the framework. The interviews in chapter 8.2 revealed, that especially long year front-line managers would have problems with these changes because they have to change their style of leadership and allow the employees more flexibility. Also, expenditures could rise due to higher costs in employee development. A lot of the measures that could be derived with the framework lead to less control of the manager and to more control for the employee. Besides that, the change of processes and possible headcounts can lead to less salary and bonuses because they are often tied to these numbers.

### **Risk Definition**

The Project Management Body of Knowledge (PMBOK) defines risk as an event or condition that has either a positive or a negative effect on at least one project objective (Project

Management Institut, 2013). It is important to understand, that the term *risk* is not negative per se. Consequently, the project team will consider events that have positive effect throughout the project lifecycle, but the risk management plan will be primarily used to manage negative events.

There are four alternatives for managing risks:

- **Avoid** the risk by not performing the activities that could materialize the risk.
- **Accept** the risk if the cost to reduce, avoid or transfer the risk is greater than the risk (all risks that are not avoided or transferred are retained by default).
- **Reduce** the risk by performing the activities in another manner thereby mitigating the effects of the risk.
- **Transfer** the risk by moving the activities to another group or spreading the activities over a great number of personnel.

### **Risk Management Process**

The Risk Management process starts at the beginning of the project and continues throughout the project's lifecycle with the help of a risk assessment team (RAT).

Risk planning is the development and identification of the tools, activities, roles and responsibilities associated with the approach. Risk planning culminates in the risk management plan including risk process and risk tracking procedures (de Bakker, Boonstra, & Wortmann, 2011).

Identifying risks involves determining which risks will affect the project and documenting their characteristics (Bowers & Khorakian, 2014). The project team will begin risk identification during the project planning stage. In general, the number of risks can be high through the early phases of a project, such as the initiating phase, but the amount at stake remains low. As a project progresses into the planning phase, the number of risks may decrease but the amount at stake may increase.

The risk identification step may require inputs from the statement of work, contract, project charter and project management plan, project schedule, draft budget, historical data and other initial planning documents.

The originator, a team member who first identifies the risk:



- documents the risk in the risk log with as much information as possible,
- may choose to be the owner or identify a risk owner,
- assesses the risk or notifies the project manager (PM) of the need for assessment.

The project manager will perform and facilitate risk identification regularly throughout the project. As the risk management cycle iterates, the project manager will also ensure the Risk Log is updated.

The identified risks will vary from company to company or even from department to department. The framework offers a lot of possible organisational changes that will effect a company on several levels.

Analysing and assessing a risk involves conducting the impact analysis, determining probability, and categorizing, prioritizing, and ranking the risk. The extent of assessment required depends on the nature and type of risk. Conducting risk assessment for certain risks may be straightforward, but for some others it may be more exhaustive. Six attributes will be associated with each risk; they are: priority, category, timeframe, probability, impact, and rank.

Priority indicates the significance of the risk to the project. It is a way to recognize risks for effective planning, mitigation, and monitoring. A risk may have low impact and low probability, but can still be a high priority. Working with other RAT members, the risk owner will establish the priority based on one of three levels:

- High: The risk is of high significance to the project and impacts the current phase and/or could bring the project to halt.
- Medium: The risk is of moderate significance to the project and impacts the next/subsequent phases and/or could hamper the progress of the project.
- Low: The risk is of low significance to the project and impacts the future phases and/or could affect the quality of the deliverables.

The Probability indicates the likelihood of a risk's occurrence. It will be determined based on a subjective assessment by the Risk Owner, with input from the RAT members, and is one of five levels:

- Almost certain: Greater than 90% probability of occurrence, it is highly likely this risk will occur.
- Likely: Between 70% and 90% probability of occurrence, it is likely this risk will occur.

- Possible: Between 50% and 70% probability of occurrence, it is possible this risk will occur.
- Unlikely: Between 20% and 50% probability of occurrence, it is unlikely this risk will occur.
- Rare: Below 20% probability of occurrence, it is rare that this risk will occur

The probability of a risk may change as the project progresses and more information is discovered. Based on the risk rating, the risk index is calculated as follows:

$$\text{risk index} = \frac{\text{Likelihood} \times \text{Consequences} \times \text{Effectiveness of Mitigation Measures} \times 100}{\text{possible maximum of rating}}$$

The nature of a risk is, that a complete information basis is not available to determine its impacts (Besner & Hobbs, 2012). The risk assessment team will examine individual risks as well as interdependent risks in order to analyse the potential impact. Determining the impact requires:

- analysing the root cause of risk, interdependencies with other risks, consequences of risk occurrence and resulting negative project effects,
- quantifying the effect to the project in terms of cost, schedule, and quality,
- tying the risk to the lowest possible project activity, task, or deliverable level,
- categorizing and documenting the impact as one of five impact levels:
  1. **Catastrophic:** Risk that has the potential to shut down the project based on cost, schedule delay, or an event that cannot be overcome.
  2. **Major:** Risk that has the potential to have a significant impact on project cost, greatly delay schedule, or significantly impair performance.
  3. **Serious:** Risk that has the potential to impact project cost, delay the schedule, or impair performance.
  4. **Important:** Risk that has the potential to have some impact on project cost, slightly delay schedule, or slightly impair performance.
  5. **Minor:** Risk that has relatively little impact on cost, schedule or performance.
- Documenting the detailed outcome of analysis in the Risk Impact Analysis section of the Risk Log.

The extent of which the impact analysis will be undertaken, is dependent on the nature and extent of the risk and how much control the project can exercise in mitigating the risk. Some risks call for subjective analysis while others call for objective analysis. Working with RAT members, the Risk Owner will determine the method of analysis and carry out the impact analysis accordingly.

|                  |                     |                      |                      |                     |                      |                   |
|------------------|---------------------|----------------------|----------------------|---------------------|----------------------|-------------------|
| Probabil-<br>ity | Almost Cer-<br>tain | 2.5<br>Moder-<br>ate | 5.0<br>High          | 7.5<br>Very<br>High | 20.0<br>Extreme      | 25.0<br>Extreme   |
|                  | Likely              | 2.0<br>Moder-<br>ate | 4.0<br>High          | 6.0<br>Very<br>High | 16.0<br>Very<br>High | 20.0<br>Extreme   |
|                  | Possible            | 1.5<br>Low           | 3.0<br>Moder-<br>ate | 4.5<br>High         | 12.0<br>Very<br>High | 15.0<br>Very High |
|                  | Unlikely            | 1.0<br>Low           | 2.0<br>Moder-<br>ate | 3.0<br>Moderate     | 8.0<br>Very<br>High  | 10.0<br>Very High |
|                  | Rare                | 0.5<br>Low           | 1.0<br>Low           | 1.5<br>Low          | 4.0<br>High          | 5.0<br>High       |
|                  |                     | Minor                | Im-<br>portant       | Serious             | Major                | Cata-<br>strophic |
|                  |                     | Impact               |                      |                     |                      |                   |

Table 28: Risk ranking/exposure matrix

The Risk Owner, working in conjunction with the RAT, will develop and document a risk response plan for each identified and analysed risk. Developing a risk response plan includes determining feasible strategies for effectively managing a risk:

1. Avoidance: don't continue with this particular aspect of the project, because the risk is so great that the benefits would not be cost effective.
2. Acceptance: accept the risk, document and communicate it, but don't develop a plan to mitigate the risk. Take a chance that it will not occur or accept the consequences. Risk impact materializes if realized.
3. Mitigation: develop a mitigation plan to reduce and continually monitor the risk. Risk impact materializes if realized.
4. Transfer: transfer the risk and accountability outside the project. Risk impact materializes if realized.

### **Risk monitoring, management and control**

Monitoring and managing risks are critical to a successful project. Each calls for different actions from different team members, the Project Manager, stakeholders and even sponsors. Monitoring involves proactively looking for any signs of triggering events that cause risks to occur and preparing to execute risk response plans. Managing involves reviewing open risks in the current project context, identifying any new risks, and ensuring adequate plans to address risks are developed, and communicating risks to the concerned project members.

Managing risks involves reviewing risks periodically, ensuring adequate response plans are in place, and communicating risks to the project team, stakeholders, and sponsors.

The PM will review risks periodically based on priority and ranking and will report them to project sponsors, stakeholders and the project team according to the following guidelines:

- Risks with high priority ranking will be reviewed in project team meetings and in Senior Management status review meetings.
- Risks with medium ranking will be reviewed in project team meetings and in Senior Management status review meetings.
- Risks with low ranking will be reviewed in project team meetings.

These reviews may result in the discovery of more information about existing risks or the identification of new risks, or even recognition that some risks no longer exist. Risk owners are responsible for keeping their risk specifications updated and the responsible manager has to ensure that the Risk Log is up to date.

It is important to recognize that the risk management process is iterative and risk priorities and rankings may change as the project progresses and more information is discovered.

When risks occur, the Risk owner will notify the PM and the RAT of the occurrence and execute the risk response plan. The PM will work with the RAT and the Risk owner to convert the risk to an issue for tracking under the issue management process.

Upon satisfactory execution of the risk response plan, the risk will be updated and closed if no further occurrences are expected (H. Taylor, 2006). The Risk Management process is iterative and will occur throughout the project lifecycle as risks are identified, monitored, and managed. The open project risks and associated strategies need to be included in all formal status communications.

### *Communication & project marketing*

This chapter is devoted to the communication and project marketing in- and outside of the project. The main deliverables are the following.

- A communication plan, that defines the intensity of communication as well as target groups and communication needs.
- A mobilization plan involves all relevant stakeholders, tools and methods for the communication of project results and implications for the company.

Communication is the key for the acceptance of the changes of the affected employees (Line Ramsing, 2009). Open communication is a leadership tool in order to reduce resistances and misunderstanding as early as possible within the project. When communicating, not only the content is critical, but also who communicates (Naqvi & Aziz, 2011). Within this context, it is key that sponsors and leadership of the project commit themselves to the project and the upcoming changes. Only if the employees are convinced that their leadership is committed to realize the planned changes, the tools of communication can be implemented (de Carvalho, 2014). Especially in employee related topics like the use and implementation of the proposed framework, it is very important, that leadership ensures that this is not a cost-cutting project with the goal to reduce headcounts.

The major goals of a communications strategy, is to build awareness, create interest & confidence, and maintain support:

- Create awareness of the project and sustaining interest throughout all phases of the project.
- Ensure that employees know and understand the vision, background, benefits, importance and priority.
- Create interest in, and energy around, participating in the transition to the project.
- Create confidence that the project will be marked by open communication and knowledge sharing.
- Regularly inform employees and stakeholder about the project progress and decisions.
- Ensure that full user involvement is maintained throughout the project lifecycle and beyond.

- Establish a communications system that enables open and honest two-way communications.
- Involve all members of the organization or the department in which the framework is piloted.

### **Communication plan**

In order to achieve the above-named objective, a communication concept and plan which is specifically aligned to the needs of the project, has to be developed. The communication concepts include the following components:

- set up of communication infrastructure,
- identification of target groups,
- determination of communication needs,
- development of an integrated communication planning (communication channels, frequency and intensity, feedback channels, etc.) aligned to the project phases; this also includes project marketing activities and material,
- identification and formulation of key messages and testing of the messages via selected employees.

A differentiated communication approach according to target groups is of central meaning within the project. The target groups differ not only from their organizational role in the company/project, but also from the impacted departments. Within the communication planning it is important to regularly review the communication objectives as well as the activities and key messages. If needed, the communication plan has to be aligned. The communication activities have to be set up along the project phases and should be included in the project plan. The effort that a company has to put in communication is considerably higher than in other projects with lesser organisational change. All proposed measures need to be conducted over the period of the project and possible after the implementation of the framework as well.

#### *Set up of Communication Infrastructure*

One of the most important critical success factors, is to establish an effective communication & mobilization infrastructure (M. M. de Carvalho, 2014). This ensures that the most appropriate levels within the organization, both internal and external, receive the correct level of

information in a ‘two-way’ approach to communication, applying ‘top down’ and ‘bottom up’ techniques. Apart from the stakeholders of the project, it is very important to ensure that senior management is involved and committed to the project to minimize rumours and promote the organisational ability for change that the framework proposes.

| <b>Group</b>  | <b>Role</b>  |
|---|--|
| <b>Sponsor &amp; Project Steering Committee</b>               | The Sponsor & the Project Steering Committee forms the highest level communications channel for the project. They will sponsor the launch announcement and give continuing support throughout the project in communications with the entire organization world-wide. |
| <b>Project Team Members (Process Owner &amp; Team Leader)</b> | The project team will constantly be in communications at all levels. They must be open to communication from users in the ‘bottom up’ process and give positive and consistent ‘top down’ messages from the project.   |
| <b>Project Team Members</b>                                   | They will be the main communication link between the project team and the end users to ensure ‘bottom up’ communication is effective.  |
| <b>Change Management Network*</b>                             | Communicates into the affected departments and ensures the feedback flow back to Change Management   |

Table 29: Roles within the Communication Infrastructure

#### *Identification of Target Groups*

The Identification of communication target groups will be done in cooperation with the sponsors and project management with the help of the following steps.

- Determination of groups that will be affected by the project
- Clustering of these groups according to their tasks, roles, responsibilities and communication needs

#### *Determination of Communication Needs*

Each of the defined target groups has different communication needs. The communication plan must take into account the level of understanding users and sponsors need to have of the project throughout its life. Following a list that describes, what topics have to be addressed to the different target groups.

| Topics   | Target Groups  | Communication Needs   |
|--|--|---|
| <b>Positioning of the Project</b>                          | <ul style="list-style-type: none"> <li>▪ Steering committee</li> <li>▪ Sponsors</li> <li>▪ Process owner</li> <li>▪ Key/end user</li> <li>▪ HR/works council</li> <li>▪ Indirect affected departments</li> </ul> | <ul style="list-style-type: none"> <li>▪ Background of the project (what, why, when)</li> <li>▪ Integration concept for the incorporation of the project in the general project environment</li> <li>▪ Relevance of the project for the organization</li> <li>▪ Objectives of the project</li> <li>▪ Implementation of feedback channels</li> </ul> |
| <b>Project Organization (Roles &amp; Responsibilities)</b> | <ul style="list-style-type: none"> <li>▪ Steering committee</li> <li>▪ Sponsors</li> <li>▪ Process owner</li> <li>▪ Key/ end user</li> <li>▪ Indirect affected departments</li> </ul>                            | <ul style="list-style-type: none"> <li>▪ Composition and structure of the project</li> <li>▪ Roles and responsibilities</li> <li>▪ Set up of management, decision and steering committees</li> </ul>  |
| <b>Project Status</b>                                      | <ul style="list-style-type: none"> <li>▪ Steering committee</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Project status (project success, budget, current topics, risks, change requests, decision papers)</li> </ul>   |
| <b>Project Milestones &amp; Results</b>                    | <ul style="list-style-type: none"> <li>▪ Sponsors</li> <li>▪ Project management/project Team</li> <li>▪ Process owner</li> <li>▪ Key/end user</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Project plan</li> <li>▪ Realized objectives and results</li> </ul>   |
| <b>Decisions</b>   | <ul style="list-style-type: none"> <li>▪ Sponsors</li> <li>▪ Project team</li> <li>▪ Process owner</li> <li>▪ Key/end user</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Management decisions</li> <li>▪ Time table for upcoming changes</li> <li>▪ Overview about decision makers</li> </ul>   |
| <b>Process Changes</b>                                     | <ul style="list-style-type: none"> <li>▪ Process owner</li> <li>▪ Key/end user</li> <li>▪ HR/works council</li> <li>▪ Indirect affected</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Development of new processes/detail information</li> <li>▪ Impact on department and employees</li> <li>▪ Deviation of as-is and to-be</li> </ul>   |



| Topics                                   | Target Groups   | Communication Needs  |
|--|---|--|
|  | departments   | <ul style="list-style-type: none"> <li>▪ Realization plan</li> </ul>   |
| <b>Technical Information and Changes</b> | <ul style="list-style-type: none"> <li>▪ Steering committee</li> <li>▪ Project team</li> <li>▪ Key/end User</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Implantation and changes of processes</li> <li>▪ Changes in the technical environment</li> <li>▪ Implementation plan</li> <li>▪ Time tables for technical changes</li> </ul>  |
| <b>Project news</b>                      | <ul style="list-style-type: none"> <li>▪ Sponsors</li> <li>▪ Process owner</li> <li>▪ Keyend user</li> <li>▪ HR/works council</li> <li>▪ Indirect affected departments</li> </ul> | <ul style="list-style-type: none"> <li>▪ General information (updates, newsletter, etc.)</li> <li>▪ Changes within the teams and responsibilities</li> <li>▪ Planned events</li> </ul>   |
| <b>Training</b>                          | <ul style="list-style-type: none"> <li>▪ Sponsors</li> <li>▪ Project team</li> <li>▪ Key/end user</li> <li>▪ HR/works council</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Goal setting for training</li> <li>▪ Training concept</li> <li>▪ Target groups and course curriculum</li> <li>▪ Training content</li> <li>▪ Training planning</li> <li>▪ Training material and documentation</li> <li>▪ Support/key user lists</li> </ul>   |
| <b>Feedback Tools &amp; Channels</b>     | All   | <ul style="list-style-type: none"> <li>▪ The opinion and feedback of employees is key</li> <li>▪ Feedback channels and contact Points</li> <li>▪ Feedback process, evaluation und integration in the project (impacts)</li> <li>▪ Improvements and changes, caused by feedback and input of employees</li> <li>▪ Communication of feedback results and employee surveys</li> </ul> |
| <b>Statements</b>                        | <ul style="list-style-type: none"> <li>▪ Project team</li> <li>▪ Process owner</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Statements from sponsors, departments, managers, etc.,</li> </ul>   |

| Topics                                 | Target Groups   | Communication Needs  |
|--|---|--|
|  | <ul style="list-style-type: none"> <li>▪ Key/end user</li> <li>▪ HR/works council</li> <li>▪ Indirect affected departments</li> </ul> | <ul style="list-style-type: none"> <li>▪ Integration of reports and experiences</li> <li>▪ Interviews/dialogue</li> </ul>  |
| <b>Interfaces to other Departments</b> | <ul style="list-style-type: none"> <li>▪ Indirect affected departments</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Process interfaces</li> <li>▪ Potential organizational changes</li> </ul>   |
| <b>HR relevant topics</b>              | <ul style="list-style-type: none"> <li>▪ HR/works council</li> </ul>  | <ul style="list-style-type: none"> <li>▪ HR-relevant topics, which result form process and organizational changes, e.g. changes within the roles and responsibilities of the employees</li> <li>▪ Benefits and critical issues of the implementation</li> <li>▪ Reports about the project progress</li> <li>▪ Information about trainings</li> </ul> |
| <b>FAQs, Critical Quotations, Help</b> | <ul style="list-style-type: none"> <li>▪ Project team</li> <li>▪ Key/end user</li> </ul>  | <p>Example FAQs:</p> <ul style="list-style-type: none"> <li>▪ What are the impacts of the project for the roles and task of the employees?</li> </ul>  |

Table 30: Communication Needs

*Development of Communication Plan*

One of the most challenging tasks within communication is to ensure user and sponsor expectations remain in line with project reality. To achieve this, it has to be carefully planned when and how communication takes place. In order to set up a target oriented Communication planning along the project phase, the following steps have to be proceeded:

- Definition of the communication mechanism and channels (integration of the existing mechanism and channels within the organization, e.g. in connection newsletter, website, Management Meeting, etc.)
- Definition of supporting project marketing material (e.g. project flyer, poster, videos, screensaver, etc.)
- Determination of frequency and intensity of communication according to target groups and project phases

- Definition of feedback channels
- Development of communication plan

*Definition of the Communication Mechanism and Channel*

Given the diversity of an organization in terms of culture and possibly to a lesser degree working practices and procedures, it is important to establish communication methods and channels that will enable open and effective dialogue between all entities involved in this project (Fox, 2009).

The following is an overview of recommended communication methods and channels that should be integrated in the communication plan:

| Type of Communication | Communication Channel | Mechanism  | Objective   |
|-----------------------|-----------------------|------------|---|
| <b>Paper based</b>    | Mail box of employees | Newsletter | Disseminate high-level strategic information between the project team and the entire organization. <ul style="list-style-type: none"> <li>▪ Statement of why demographic change is a threat to the company and how can possible changes look like</li> <li>▪ Assure the organisation that the goal is not cost-cutting or reduction of personnel</li> <li>▪ Objectives and strategic objectives relating to the framework</li> <li>▪ A statement of intent from the executive and project sponsor</li> <li>▪ Information relating to the project organization covering structure, roles and responsibilities and</li> <li>▪ Information on major project</li> </ul> |

| Type of Communication | Communication Channel | Mechanism                          | Objective  |
|-----------------------|-----------------------|------------------------------------|--|
|                       |                       |                                    | <p>milestones and timescales</p> <ul style="list-style-type: none"> <li>▪ Specific information about project progress and important decisions, events and next steps</li> </ul> <p>Although this is just an e-mail. This is the best way to reach all employees to reduce rumours and outline the strategic goal that the company wants to achieve with the framework. This method should be used regularly and should be send via the account from the sponsoring executive to show the commitment to change.</p> |
| <b>Electronically</b> | E-Mail                | Briefing Packages                  | Presentation material about the project (e.g. Kick-off presentation)   |
|                       | E-Mail                | Project Sponsor Memo               | Show Leadership commitment to the vision and objectives of the project   |
|                       | E-Mail                | Info mails                         | Inform employees about communication activities (e.g. launch of the intranet website, evaluation results of workshops and events, etc.)  |
|                       | Intranet              | Management Presentation & Articles | Inform organization on regular basis about vision, background and objectives of the framework and derived measures as well as projects progress and decisions  |

| Type of Communication | Communication Channel            | Mechanism  | Objective  |
|-----------------------|----------------------------------|--|--|
|                       | Intranet Project website         | Presentations, Articles, Memos, Minutes, Progress Reports, Contacts Lists, Mailbox | Provide a working platform for project team members with all project relevant information                                    |
|                       | Phone                            | Project Hotline  | Provide a hotline for employees that have questions about the project, the goal and the methodology of the framework         |
| <b>Face to Face</b>   | Kick-off                         | Briefing / welcome package, presentation, Workshops, Video                         | Initial mobilization of project team   |
|                       | Steering Committee               | Progress presentation  | Provide a high-level presentation about key issues around scarcity of resources and associated problems, decisions and risks |
|                       | Project Committee                | Progress presentation  | Provide a presentation about project progress, key issues around scarcity of resources, decisions and risks                  |
|                       | Team Leader Integration Meetings | Presentation with Integration Topic  | Share all integration topics with functional tracks  |
|                       | Project Team Sessions            | Presentation   | Give short update on overall project progress  |

| Type of Communication | Communication Channel | Mechanism                  | Objective  |
|-----------------------|-----------------------|----------------------------|--|
|                       | Management Meeting    | Progress Presentation      | Provide a high-level presentation about the project progress and important decisions |
|                       | Road shows            | Info Stands, Poster, Flyer | Inform the organization about the project  |

Table 31: Communication Mechanism and Channels

*Definition of Communication tools*

Project Marketing is a supportive part of the communication plan for the internal and external marketing of the project. Project marketing material should be incorporated within all documents and activities in the communication plan, aiming to raise the publicity and to ensure the positive image of the project. The aim of the project marketing is a standard and representative marketing of the framework and the derived measures. The following mechanism can be used:

| Instrument  | Integrated in / Applied to:  |
|---|--|
| <b>Project Name, Project Logo</b>                                   | Mails, Newsletter, Minutes, Presentations, Bulletins, Project Website, Progress Reports, Memos |
| <b>Poster</b>   | Offices, Meeting rooms, Workshops, Events  |
| <b>Screensaver</b>  | Mail to employees  |
| <b>Sponsor Videos</b>   | Kick-Off, Workshops, Meetings  |
| <b>Template, Standards and Guidelines</b>                           | Mails, Newsletter, Minutes, Presentations, Bulletins, Project Website, Progress Reports, Memos |
| <b>Marketing through Sponsors, Change Agents and Opinion Leader</b> | Project Events, daily project work, network  |

Table 32: Project Marketing Tools

The selection of the used methods and tools should be orientated on the size of the project and the impact on the organization. The higher the size and impact, the more tools and methods should be used.

*Definition of Communication Intensity and Frequency*

In addition to the selection of the channel and mechanism, the frequency of communication has to be determined. The frequency and intensity also depend on the respective target groups as the following charts illustrates:

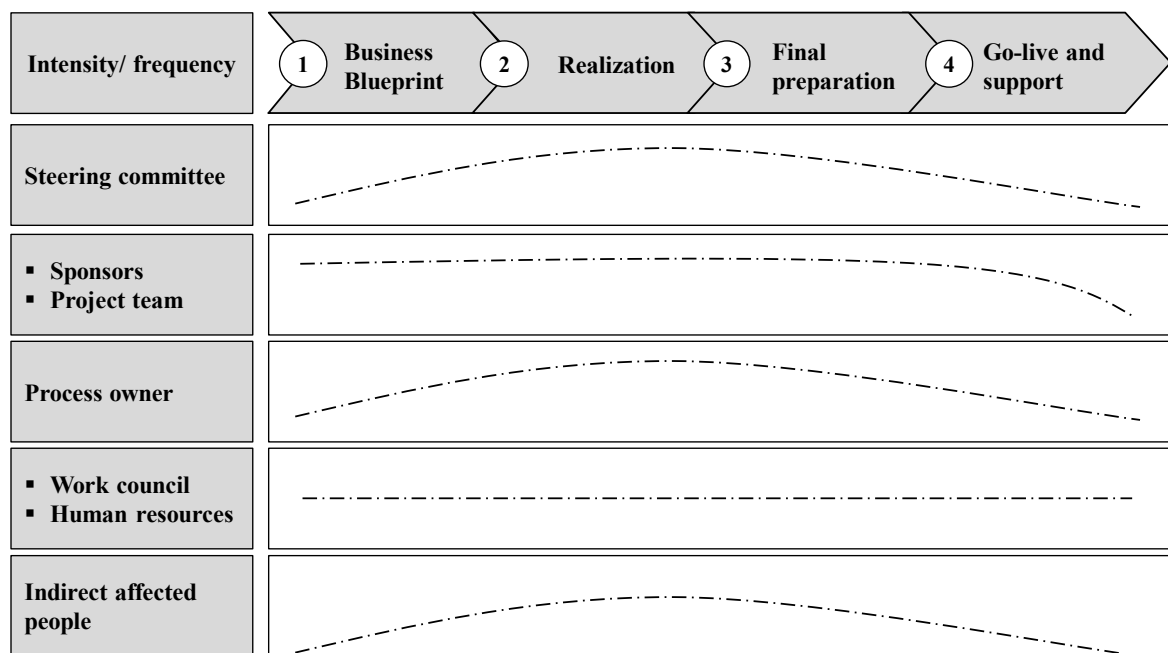


Figure 14: Communication Frequency and Intensity

*Definition of feedback channels*

Communications effectiveness is measured by conducting surveys with people from across the organization. Many of these people will have participated in a specific communications event, such as a Kick-off Meeting. Others may have attended a training or education session. Still others will have been exposed to some element of the “continuous” communications that surround the project. For measurement purposes, event-driven and continuous communications can be put in place:

- Event-driven communications are communications that are completed at a single point in time, a kick off for example.

- Continuous communications are communications that can be accessed over an extended period of time, accessing a website for example. Continuous measures are used to measure and manage the effectiveness of continuous communications.

| Measure                            | Survey Tool   |
|------------------------------------|---|
| <b>Event-driven Communications</b> | <ul style="list-style-type: none"> <li>▪ post-event evaluation surveys</li> <li>▪ training evaluation surveys</li> </ul>  |
| <b>Continuous Communications</b>   | <ul style="list-style-type: none"> <li>▪ random e-mail survey</li> <li>▪ newsletter insert cards</li> <li>▪ communications website</li> <li>▪ random sample telephone survey</li> <li>▪ personal interviews</li> <li>▪ informal feedback</li> </ul> |

Table 33: Style of communication

Given the scope and importance of an implementation, it is highly likely that many people in the implementing organisation will have heard something about the project through informal channels. It is important to identify people who have not participated or partaken in a communications or training event and to gauge this group’s perceptions of the impacts of the project. Especially the continuous communication method is very important to address the employees that are not directly involved in the project or the use of the framework to ensure their commitment to change. Surveys with these employees can offer valuable insights regarding the perception of the project. This information can also be used to identify organisational threats and risks that are associated with the implementation of the framework.

By gauging these perceived impacts, the communications team establishes a baseline that shows the relative effectiveness of the team’s communications and training initiatives.

*Development of Communication Plan*

Based on the defined target groups and the communication needs, the selected channels and mechanism, the marketing tools as well as determined frequency and intensity, an integrated communication plan will be developed.

The communication plan comprehends the following parameter: mechanism, description of mechanism, objective, target group, language, frequency and content, marketing material, channel, phase, responsible sender and the feedback channel.



All communication documents should be tested and have to be validated before they are distributed to the applicable target group. Change management is responsible for the creation of the document with input from the functional teams. Every message or document that will be sent out should be tested, depending on the type of statement. It is also possible to test communication documents with selected employees. The validation has to be effected by the project manager and/or the project sponsor. The responsibility for the distribution of the document also depends on the type of document.

Strong opposition to the project could put it in jeopardy. Given this, considerable effort should be given to ensure the correct information/perceptions are developed and deployed by the most appropriate personnel.

All communications must be timely and it is important to maintain flexibility in the communication plan to account for sudden changes in perception either by staff or the market.

Project benefits must be emphasized throughout communications. The messages should be realistic and achievable, underpinned by a strong long-term strategy that has been built with the aid of staff at all levels.

Further the change management team must measure the organization's comprehension of key messages and the impact of key messages on the organization. Comprehension represents the extent to which people from across the organization have understood key messages and themes. Quantitative and qualitative feedback surveys, tell the change management team, where various stakeholder groups are in this progression. With this knowledge, the communications team can then tailor project communications so that they better reflect each group's communications needs.

In all the communications development activities, the following key guidelines have to be considered:

- Place members of the stakeholder groups in the spotlight whenever possible and have them “share their story” with other stakeholder groups.
- Leverage change representatives to establish a consistent flow of information
- Consistently mine the organization for and communicate success stories.
- Communicate face-to-face when feasible.
- Develop “brand” awareness – create an identity for the project.

- Establish communications standards and ensure consistency.
- Be consistent in the tone and content of all messages.
- Promote the credibility of the project through visible leadership support.
- Create opportunities for engagement; personal interaction serves this purpose better than printed materials.
- Encourage involvement; provide opportunities to participate in the process.
- Communicate personal impacts and address personal concerns.
- Reinforce the personal message; create the learning opportunities that show individuals at a fundamental level what the change may mean to them.
- Maintain momentum; share wins, promote milestones, recognize and reward success.

The goal of mobilization and stakeholder management is to reduce reservations from employees as early as possible regarding the use of the framework and to build employee's awareness, understanding, and involvement with the project. Gain an understanding of the expectations around the future organization and capabilities as well as to gain insight to project criteria and potential challenges. This also respects cultural and language aspects. Leverage key leaders to promote the project and identify informal leaders within the organization regardless of position. To reach these goals, a detailed mobilization plan will be developed: The mobilization plan aims fulfil the following goals.

- Show how and when stakeholder groups will be engaged.
- Drive commitment from affected stakeholders to take actions that support a successful implementation of the framework.
- Lay out tasks, activities, and events to continually engage key stakeholders throughout the implementation of the framework and the derived measures.
- Plan for interactions and events that are sequenced to build commitment.
- Serve as a dynamic tool that is revised regularly to accommodate the direction and speed of change as the project proceeds.
- Include planning for events that promotes stakeholder feedback.
- Leverage leaders at all levels to drive commitment throughout the company.
- Include “project promoters” to spread the project message.

- Involve project team members as project co-owners to help drive the message throughout the company.

### **Mobilization plan**

The mobilization plan will be developed as a complement to the communication plan. It addresses the processes and set of interactive events to promote participation and gain acceptance for the project among leaders and other affected stakeholder groups. The mobilization plan is aligned with phases of the project and is intended to evolve over the course of the project as new information and insight is gained while conducting mobilization events. It is intended for use primarily by the change team, project office and selected executive leaders to help chart and steer activities for organizational acceptance.

Based on the defined communication target groups, which usually also correspond to stakeholder groups, the mobilization events and activities will be planned accordingly to the approach in the communication planning by aligning them to the project phases.

For mobilization, it is important to know who the key stakeholders within the project are, and engage them throughout the project lifecycle to reduce resistances. Therefore, within the mobilization plan, a stakeholder analysis and change interviews will be conducted to gain valuable input into designing an effective solution. This also provides the opportunity to identify risks and issues before it is too late to effectively address them. The results of the stakeholder analysis and the interviews will be considered in planning the mobilization activities in order to address the specific needs and concerns of stakeholders. The mobilization activities will be set up along the project phases complementary to the communication plan as already shown in the previous chapter.

Based on the defined mobilization activities, events and marketing tools, a detailed mobilization plan will be developed and integrated in the communication plan. In this phase, the plan need to be checked permanently against the identified risks. As mentioned before, the framework offers a lot of change for the organisation and there can be several risks associated with that circumstance.

The following are the most common activities during that phase.

| <b>Mobilization Activity/Events</b> | <b>Objective</b>   |
|-------------------------------------|--|
| <b>Kick Off Events</b>              | <p>Initiate project or project phase in order to mobilize all project team members and change agents. To initiate the project or a project phase all project team members and change agents are to be invited to a kick-off event. At the beginning of the project, this event is the official start of the project, aiming to involve and mobilize all concerned parties and to demonstrate sponsor commitment. All participants should understand the following:</p> <ul style="list-style-type: none"> <li>▪ How to classify the project and the framework into the corporate strategy?</li> <li>▪ How the business case was set up and what will be the impact?</li> <li>▪ What meaning and impacts the framework will have on the company?</li> <li>▪ What are the roles and responsibilities within the project?</li> <li>▪ What are the next steps and the timeline of the overall project?</li> </ul>                        |
| <b>Stakeholder Analysis</b>         | <p>Identify key stakeholders in the organization to know their buy to the project. Based on the defined stakeholder groups, an analysis of key stakeholder groups or Individuals need to be conducted. The identification of the individual stakeholder groups should be organized in cooperation with the project management, the project team and the change management network. To finalize the stakeholder analysis, individual interviews will be carried out in order to identify the restraints and levers of the project, based on a standard interview questionnaire.</p> <p>Other areas, such as a description of how the change affects the stakeholder and the stakeholder's readiness to accept change, or specific success metrics, can be addressed, depending on time and the knowledge base of the participants. The Stakeholder Analysis should be monitored, reviewed and adjusted during all project phases.</p> |
| <b>Change inter-views</b>           | <p>Present the framework and engage leadership; Identify buy in, restraints and levers of the stakeholder referring to the project; Soliciting</p>   |

| <b>Mobilization Activity/Events</b> | <b>Objective</b>   |
|-------------------------------------|--|
|                                     | direct Feedback about Change Process; also, use this method to further develop the change management network   |
| <b>Management Presentations</b>     | Present the results, progress and decision of the project on a regular basis to update and engage management   |
| <b>Road shows</b>                   | Promote joint vision, goals, benefits and communicate about project status, progress and next steps  |
| <b>30 Minutes info stands</b>       | Give employees the possibility to get a short and high level information about the project; promote the project within the organization and give a short update on project status/progress |
| <b>Teambuilding</b>                 | Strengthen the team spirit within the project team and within the organization by regular teambuilding exercises and sessions  |
| <b>Go Live Employee Surveys</b>     | Survey if employees are ready for the change   |

Table 34: Mobilization activity/events and objectives

For the selection of the presented methods and tools, it is important not to try to overachieve.

The following criteria should be considered:

- size of the company,
- number of employees,
- duration of the project,
- number of involved departments and
- complexity and hierarchical structure of the organisation.

The presented tools and methods, will not be successful if they are not executed consistently and permanently.

### ***Validation of the implementation plan***

The implementation plan was built with the help of the PMI process groups. These process groups are a standard approach for project management and the goal of this phase was the identification of the most important steps for the implementation of the *5-layer framework for employee productivity*. Also, since the framework offers various possibilities for organisational change, one research question was devoted to the most common challenges when companies conduct projects which involve organizational change.

### **Approach**

The validation of the framework was conducted in June and July 2016. The applied research method was an interview study with some of the most experienced Change Management experts from the consultant company BearingPoint. The sample of eight participants consists of consultants of different age groups and industries. The mean of the age is 40.5 years with a standard deviation of 9.84. The youngest participant was 31 and the oldest 61 years old. The years of experience in average was 12.75 years with a standard deviation of 8.22. The proposed method and qualitative research approach is recommended by several publications around this topic of organisational change (Carù, Cova, & Pace, 2014; Garcia & Gluesing, 2013).

### **Research plan**

The goal of this study was to proof the effectiveness and feasibility of the implementation plan as well as the discovery of potential improvements and further practical insights. To achieve this, the following research questions were developed:

- RQ1: What are the most important parts of an implementation plan for a change management project?
- RQ2: What are the most common challenges when companies conduct projects which involve organizational change?

The study was structured in the following way, the implementation plan of the framework and the framework itself was presented to the attendees. After that, the participants answered three different questions for every research question. The questionnaire was structured in the following way:

RQ1: What are the most important parts of an implementation plan for a change management project?

- Are the PMI process groups a fitting methodology for the implementation of the framework?
- Which phase needs the most effort in personnel?
- Which phase needs the most effort in time?

RQ2: What are the most common challenges when companies conduct projects which involve organizational change?

- What kind of risks are the most common for this kind of projects and what are strategies to counteract these risks?
- How would you prioritize the presented types of communication and would you add further measures (Scale 1-5 with 1 being the most important one)?
- How would you prioritize the presented mobilization activities and events and would you add further measures (Scale 1-5 with 1 being the most important one)?

### **Execution of research**

As mentioned, the interview study took place from June until July 2016. The author conducted eight different interviews with the change management experts. The number of interview partners is deemed as sufficient for the purpose of this topic (Healy & Perry, 2000; Porter, 2007). The main strategies to promote the rigor and quality of the research: ensuring the quality or “authenticity” of the data and the quality or “trustworthiness” of the analysis are fulfilled. These strategies are similar to ensuring validity and reliability in quantitative research (Sargeant, 2012).

The first step was a workshop with all participants to achieve an overall understanding about the topic and the goals that the *5-layer framework of employee productivity* wants to achieve. In this workshop, the author also presented the implementation plan to the audience, followed by a questions and answers session. In the weeks after the workshop, the author conducted the interviews with all eight participants. A second workshop was conducted after the interview phase to discuss the results of the interviews and settle possible open questions regarding the framework.

The results of these interviews will be shown in the following chapters of this thesis.

### Analysis of results

Two of the experts indicated, that the PMI process groups on their own are not enough to execute a change management project of this size. Five process groups are rather an umbrella for the overall programme or project (thus including the technical and functional topics), whereas the change management approaches need to be more detailed. But any change plan or approach needs to be included into the overall programme plan, which could consist of those five process groups.

Overall it can be concluded, that the PMI framework is a fit for the implementation of the proposed framework, if the importance of communication is raised through all process groups and change management tools are included. The results are distributed in the following way.

|   | Yes, the PMI process are a fitting methodology | No, the PMI process are not a fitting methodology |
|---|--|---|
| Are the PMI process groups a fitting methodology for the implementation of the framework? | 5  | 2   |

Table 35: Distribution of responses of participants regarding the fit of the PMI methodology

Change projects have often the goal to change the culture of an organization, thus a certain amount of training measures is needed to alter specific habits of the employees. If a company decides to implement the framework most of the experts stated, that the executing phase needs the most effort in time and resources because a wide range of actions is needed: These actions include frequent communication measures, training and knowledge transfer, bringing people together to discuss important and critical topics during the change. This is an ongoing process during and after the project, where a majority of employees are involved. The results are distributed in the following way.

|   | Initiating | Planning | Executing | Monitoring & controlling | Risk management | Communication & project marketing |
|---|------------|----------|-----------|--------------------------|-----------------|-----------------------------------|
| What phase needs the most effort in personal? | 2          | -        | 6         | 1                        | -               | -                                 |
| What phase needs the most effort in time?     | 1          | -        | 4         | -                        | -               | 3                                 |



Table 36: Distribution of responses regarding the effort in time and personnel for the different phases

During that change process, the transparency of the goals and measures is very important to lower insecurity and raise a mutual understanding for the actions.

*RQ II - What are the most common challenges when companies conduct projects which involve organizational change?*

The challenges and risks of a change project are widely spread. Nevertheless, the experts stated five different main risks and issues that need to be considered in all phases of the project.

- No clear vision/no common understanding. → Mitigation strategy: Develop common understanding and define change vision in workshops/interviews with management (management involvement).
- Lack of management commitment. → Mitigation strategy: Active stakeholder involvement, engage leadership.
- Resistance to change or boycotting change. → Mitigation strategy: Active stakeholder involvement, identify opponents and involve them actively.
- No or bad communication to employees, rumours in the organization, uncertainty, many high performing employees are leaving the company. → Mitigation strategy: clear communication strategy top down from executives to employees (honest and continuous messages).
- Keep the high performer in the company. The risk is to lose them on the market, if the change is not communicated and executed well, thus the employees decide to go the path with the company for mutual benefits. → Mitigation strategy: Include them early in the project, show them career paths and opportunities after the project in the new organizational structure.

To achieve a balanced and transparent communication, different types were presented to the participants of this study (paper based, electronically, face to face). The experts ranked the channels according to their importance in the following way.

| # of participant | Paper based | Electronically | Face to face |
|------------------|-------------|----------------|--------------|
| 1                | 2           | 3              | 1            |
| 2                | 3           | 2              | 1            |
| 3                | 3           | 2              | 1            |
| 4                | -           | -              | -            |
| 5                | 3           | 2              | 1            |

| # of participant | Paper based | Electronically | Face to face |
|------------------|-------------|----------------|--------------|
| 6                | 2           | 2              | 1            |
| 7                | 2           | 3              | 1            |
| 8                | 3           | 2              | 1            |

Table 37: Ranking of communication types

Regarding certain mobilization activities, the experts were also asked to rate the presented activities on a scale from 1-5 (1-most important, 5-least important).

| Mobilization activities  | Participant #1 | Participant #2                   | Participant #3 | Participant #4 | Participant #5 | Participant #6 | Participant #7 | Participant #8 |
|--------------------------|----------------|----------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Kick Off Events          | 2              | Prioritization is not possible - | 1              | 3              | 2              | 2              | 1              | 1              |
| Stakeholder Analysis     | 1              |                                  | 2              | 1              | 1              | 3              | 1              | 1              |
| Change Interviews        | 2              |                                  | 1              | 2              | 1              | 2              | 1              | 1              |
| Management Presentations | 2              |                                  | 2              | 1              | 2              | 1              | 1              | 2              |
| Road shows               | 2              |                                  | 3              | 1              | 1              | 1              | 3              | 3              |
| 30 Minutes Info Stands   | 2              |                                  | 2              | 1              | 2              | 1              | 3              | 2              |
| Team-building            | 3              |                                  | 3              | 1              | 1              | 2              | 3              | 1              |
| Go Live Employee Surveys | 2              |                                  | 4              | 1              | 1              | 2              | 3              | 3              |

Table 38: Ranking of mobilization activities

An early involvement and mobilisation of important stakeholders due to telling a story of why things are the way they are, and what the benefits are per stakeholder group is very important. Employees need to participate through an open and transparent communication. Also, it is important to train the leadership for leading the change and to have a clear concept for communication and training with tailored information relevant for each stakeholder group. This communication should be honest and address critical topics ahead. The managers need to be proactive on discussions on those topics.

The most important and promising communication methods are the personal conversations between the employee(s) and their respective managers. This is due to the possibility to ask direct and personalized questions and receive corresponding answers. During and after the project, managers need to be available for their employees as often as possible. The second

most important method is the electronic communication. Electronic communication is not only the communication via e-mail, but also methods like pull- and push messages or the documentation and the progress of the project in the intranet or Microsoft SharePoint of the company. An example of the connection of personal and electronic communication can be video messages. They are not as effective as an actual personal discussion between a manager and an employee, but the possible reach is much higher. The least important communication methods are paper based methods. In a mostly digitalized world, most information are consumed via e.g. smart phone or tablet. This has to be considered in actual change projects as well. Moreover, paper-based communication channels are much more expensive in comparison to the digital ones. In general, various groups can be targeted in different ways, based on types of topics and content.

### **Revisiting research questions**

In the following section, the earlier stated research questions will be revisited and answered.

RQ1: What are the most important parts of an implementation plan for a change management project?

As mentioned before, the experts had different opinions regarding the usage of the PMI-framework as an implementation plan for the *5-layer framework of employee productivity*. In total five out of seven experts stated that the PMI-method is indeed a solid foundation for the implementation plan. The research question can therefore be answered with “yes”.

RQ2: What are the most common challenges when companies conduct projects which involve organizational change?

Communication is key for every change project (van der Voet, 2014). The proposed framework in this thesis offers several opportunities for change in all parts of an organisation. The ranking of the different methods shows, that all measures are important for the implementation of the framework. The experts rated every measure at least with a 3 on a scale from 1-5. The most important measures are the stakeholder analysis and measures which have a personal aspect to them. This confirms the earlier results, that the personal contact to the employees over exceeds all other measures and that these actions should be preferred.

### **Discussion of results**

The experts overall validated the approach and the implementation plan as a usable method for the framework proposed in this thesis. Although it has to be mentioned, that the experts

had very indifferent opinions about which phase will need the most effort in personal and time. This uncertainty is also confirmed with results from other scientific publications (Wolper, 2016; Worley & Mohrman, 2014).

The pure implementation of the desired project result is often not the issue. Normally, the quality of the outcome is the determinant if a project is called a success or not (Davis, 2014). The implementation of a certain tool, process, strategy or culture can be achieved with different methods and tools. For the implementation of the presented framework, the author suggests the PMI framework and six out of the eight experts followed that recommendation because typically change management activities are aligned with project management activities. It was also stated, that the PMI process groups can be applied, if change management aspects are included (case for change, change vision, stakeholder analysis and involvement, communication, training, leadership involvement, change monitoring).

The test also confirms the actual state of the research, that communication is key for this kind of project (Frank Cervone, 2014). It is very important to track stakeholders and their communications needs over the complete project duration.

Besides the described results of this validation of the implementation plan, it has to be mentioned, that leadership plays the most significant role during that process (Abdullah, 2012). They should lead by example over the whole period of the implementation of the framework and afterwards as well.

## **7. Test and customization of the 5-layer framework of employee productivity**

The test of the framework is structured in several parts. The aim of this test phase is the validation of the identified layers, factors and metrics and of the framework. To achieve this goal, a three-step test approach was conducted. The first step was a quantitative study with n=391 employees. The participants were living in different countries in the EU and had different occupational backgrounds. The second step was a qualitative validation with experts from different fields, both from the scientific and economic world. The third step was the test of the framework under real-life conditions in a bank in Germany over a four-month timespan.

### ***The study – a quantitative survey with IT-professionals***

The following section describes the approach and the results of the quantitative survey with employees from different occupational backgrounds and countries in Europe. One goal of this study was the verification of the findings from the previous phases and the identification of possible gaps in the theoretical work of the SLRs. The second goal was the identification of the importance of factors for productivity as well as gender and age based differences between employees.

### **Approach**

The study took place as a quantitative study and is based completely on primary data. The survey was structured in five parts. The first part collects the personal data for statistical reasons and to obtain a profile of the participants. The parts two three and four are concentrating on different elements of factors that are influencing the productivity of employees as a whole, and in detail the productivity of IT-employees. The last part is focussing on social and organizational variables, regarding the skills shortage of employees and connected pressing issues for companies. The questionnaire contains only closed questions to allow a complete quantitative analysis of the data.

The five parts of the survey were:

- Part 1: personal information,
- Part 2: factors for performance,
- Part 3: IT-employee management,
- Part 4: stress related factors, and

- Part 5: skills shortages and pressing issues for IT-companies.

In total, 391 participants took part in the survey. In average, the respondents had an age of 35.67 years with a standard deviation of 9.7389.

### Research plan

The study aimed at collecting data from different backgrounds regarding educational background, age, actual profession or gender. The goal was to collect a sample which allows comparisons between employees which are working in an IT-profession, and employees that are working in different occupations.

| Age range | Participants (Amount) | Age Average | Participants (%) |
|-----------|-----------------------|-------------|------------------|
| < 30      | 128                   | 26.06       | 33               |
| 31 - 49   | 214                   | 37.26       | 55               |
| > 50      | 49                    | 53.82       | 13               |
| Total     | 391                   | 35.67       | 100              |

Table 39: Age range of participants

The sample also consists of employees from different countries in Europe. Germany has the highest response rate with 224 and Italy, Portugal, France and Sweden the least participants.

|          | Participants (Amount) | Age Average | Participants (%) |
|----------|-----------------------|-------------|------------------|
| Germany  | 224                   | 32.68       | 57               |
| Spain    | 83                    | 38.65       | 21               |
| other    | 42                    | 40.81       | 11               |
| UK       | 26                    | 36.96       | 7                |
| Norway   | 9                     | 47.11       | 2                |
| Italy    | 3                     | 49.33       | 1                |
| Portugal | 2                     | 43.00       | 1                |
| France   | 1                     | 35.00       | 0                |
| Sweden   | 1                     | 50.00       | 0                |
| Total    | 391                   | 35.67       | 100              |

Table 40: Country of origin of participants

The literature suggests that expectations differ vastly between men and women (Nissen & Termer, 2014). Because of that, the analysis focuses not only on productivity of employees in whole, but also in differences because of the gender of the employees. 76% of the participants were male and 24% were female.

| Sex    | Participants (Amount) | Age Average | Participants (%) |
|--------|-----------------------|-------------|------------------|
| Female | 93                    | 32.78       | 24               |

| Sex   | Participants (Amount) | Age Average | Participants (%) |
|-------|-----------------------|-------------|------------------|
| Male  | 298                   | 36.57       | 76               |
| Total | 391                   | 35.67       | 100              |

Table 41: Gender of participants

Since the roles and responsibilities of IT-employees are very different, a differentiation is necessary. The sum of the participants in different IT-roles is 274.

|                       | Participants (Amount) | Age Average | Participants (%) |
|-----------------------|-----------------------|-------------|------------------|
| Non-IT                | 117                   | 31.44       | 30               |
| IT-Consultant         | 90                    | 32.72       | 23               |
| Academics             | 66                    | 43.52       | 17               |
| IT-Project Manager    | 49                    | 37.33       | 13               |
| Programmer            | 28                    | 35.00       | 7                |
| IT-Sales              | 15                    | 39.53       | 4                |
| Head of IT-Department | 13                    | 37.92       | 3                |
| Architect             | 11                    | 44.82       | 3                |
| IT-Support            | 2                     | 31.00       | 1                |
| Total                 | 391                   | 35.67       | 100              |

Table 42: Profession of participants

To assess possible further differences and to receive a holistic picture of the expectations and needs of employees from different backgrounds, the scientific education of the participants was also compiled.

|                        | Participants (Amount) | Age Average | Participants (%) |
|------------------------|-----------------------|-------------|------------------|
| Economics/ Business    | 147                   | 31.91       | 38               |
| Information Technology | 119                   | 38.86       | 30               |
| Engineering            | 60                    | 38.23       | 15               |
| other                  | 46                    | 37.13       | 12               |
| Mathematics            | 11                    | 32.45       | 3                |
| Legal                  | 8                     | 34.00       | 2                |
| Total                  | 391                   | 35.67       | 100              |

Table 43: Scientific background of participants

Research questions

To achieve the formulated goal and to raise transparency for the complex issue of employee motivation, productivity and psychological healthiness, four research questions were formulated.

- RQ1: Is there an actual shortage of skills in the different IT-professions and what will be the development in the next five years?
- RQ2: Which are the most important factors for IT-employee productivity?
- RQ3: What are the most common reasons for job related stress in IT-departments?
- RQ4: What are the most pressing issues for IT-Companies or departments regarding their employees?

In the following parts, the research questions will be answered with the help of the gathered data.

### **Execution of research**

The self-completion on-line survey reported here was carried out from May to August 2016. Self-completion questionnaires are reported to be good for use in management research, as their inherent confidentiality encourages honest and truthful responses among respondents (Buchanan, 2008). The survey and its questions were built on the basis of the previous research of the author (Radant, 2014a; Radant et al., 2014, 2016b). The data was compiled via an online survey through the internet platform typeform.com. The gathered data was evaluated with the tools *power query* and *power BI*. The statistical analyses were carried out with the software IBM SPSS.

### **Analysis of results**

*RQ1: Is there an actual shortage of skills in the different IT-professions and what will be the development in the next five years?*

The first question was focussed around the issue weather there is a skills shortage for IT-employees in Europe or not. To answer the questions, the participants had the possibility to give multiple answers in which IT-professions they see an actual scarcity of resources and or a scarcity of resources in three or five years.

The responses of all respondents show a significant shortage of skills and expect no change in three and five year ranges. Only 23% of the participants are not experiencing an actual shortage of skills, 20% have the opinion that there will be no skills shortage in three years and 21% in five years.

The highest demand for IT-employees are in the professions architect, IT-Manager and programmer. The number of the expected skills shortage in three and five years of all three occupations are around 40%. This indicates, that IT-departments will not have a lack of only one particular job profile, but several different profiles. Consequently, companies need to



engage in several measures for different profiles to retain the needed employees for their businesses.

| Responses of all participants         | Actual shortage skills (%) | Shortage of skills in 3 years (%) | Shortage of skills in 5 years (%) |
|---------------------------------------|----------------------------|-----------------------------------|-----------------------------------|
| Architect                             | 32                         | 40                                | 41                                |
| IT-Manager                            | 38                         | 40                                | 41                                |
| IT-Sales                              | 14                         | 15                                | 17                                |
| IT-Support                            | 16                         | 17                                | 18                                |
| Programmer                            | 37                         | 42                                | 42                                |
| There is no actual shortage of skills | 23                         | -                                 | -                                 |
| There will be no shortage of skills   | -                          | 20                                | 21                                |

Table 44: expected skills shortages in IT-companies - all responses

The extraction of the set of data which includes only answers from participants which work in an IT-company or IT-department shows a similar but slightly more negative picture. 19% of the participants are not experiencing an actual shortage of skills, 17% have the opinion that there will be no skills shortage in three years and 18% in five years. The same slightly negative picture can be found for the different job profiles.

| Responses of IT-employees             | Actual shortage skills (%) | Shortage of skills in 3 years (%) | Shortage of skills in 5 years (%) |
|---------------------------------------|----------------------------|-----------------------------------|-----------------------------------|
| Architect                             | 37                         | 42                                | 44                                |
| IT-Manager                            | 41                         | 44                                | 47                                |
| IT-Sales                              | 12                         | 13                                | 16                                |
| IT-Support                            | 17                         | 16                                | 18                                |
| Programmer                            | 38                         | 44                                | 43                                |
| There is no actual shortage of skills | 19                         | -                                 | -                                 |
| There will be no shortage of skills   | -                          | 17                                | 18                                |

Table 45: expected skills shortages in IT-companies - responses from IT-employees

A comparison of the answers of the participants from Germany and Spain reveals several differences in the IT-employee market of these countries. For example, only 8% of the participants from Spain have the opinion, that there is no actual shortage of skills in their country. The number in Germany is with 25% significantly higher. Nearly the same numbers can be found for the expected skills shortage in three and five years although the participants

expect a slight raise in Spain in five years from 8% to 12%. Also, the numbers for the different profiles are above average in Spain, especially for the IT-Manager with 51% shortage in three and 53% shortage in five years.

| Actual and expected shortages in Germany and Spain | Architect | IT-Manager | IT-Sales | IT-Support | Programmer | There is no actual shortage of skills | There will be no shortage of skills |
|--|-----------|------------|----------|------------|------------|---------------------------------------|-------------------------------------|
| Actual shortage of skills (%)                      |           |            |          |            |            |                                       |                                     |
| Germany  | 33        | 38         | 15       | 17         | 38         | 25                                    | -                                   |
| Spain  | 36        | 47         | 16       | 20         | 37         | 8                                     | -                                   |
| Shortage of skills in 3 Years (%)                  |           |            |          |            |            |                                       |                                     |
| Germany  | 42        | 40         | 17       | 20         | 45         | -                                     | 21                                  |
| Spain  | 41        | 51         | 19       | 12         | 36         | -                                     | 8                                   |
| Shortage of skills in 5 Years (%)                  |           |            |          |            |            |                                       |                                     |
| Germany  | 42        | 39         | 20       | 19         | 46         | -                                     | 21                                  |
| Spain  | 42        | 53         | 17       | 18         | 31         | -                                     | 12                                  |

Table 46: Actual and expected skills shortages in Germany and Spain

*RQ2: Which are the most important factors for IT-employee productivity?*

The productivity of employees is a widely discussed issue around the literature in several publications (Hernandez-Lopez, Colomo-Palacios, & García-Crespo, 2013; Qureshi et al., 2013). The factors discussed in this paper are the results of an extended structured literature review conducted by the author in 2016 (Radant et al., 2016b).

The participants should rate the following factors on a scale from 1 (lowest) to 10 (highest) regarding their importance for their day-to-day business. These ratings can be based on different expectations and experiences in different countries or companies in Europe. For example, the quantitative characteristics of the factor *adequate salary* will be very different when comparing Germany and Bulgaria. Nevertheless, the rating can create insights about the significance of these different factors.

| Factor                   | 10   | 9    | 8    | 7    | 6   | 5   | 4   | 3   | 2   | 1   |
|--------------------------|------|------|------|------|-----|-----|-----|-----|-----|-----|
| Adequate salary (%)      | 13.6 | 14.8 | 37.9 | 22.0 | 6.4 | 3.3 | 1.3 | 0.3 | 0.5 | -   |
| Education (%)            | 21.7 | 22.8 | 25.8 | 13.3 | 7.2 | 6.4 | 1.5 | 0.3 | 0.3 | 0.8 |
| Company culture (%)      | 24.6 | 23.0 | 30.9 | 12.5 | 4.6 | 2.3 | 0.8 | 0.8 | 0.3 | 0.3 |
| Career opportunities (%) | 26.1 | 25.1 | 26.1 | 10.5 | 7.7 | 2.0 | 1.0 | 1.0 | 0.3 | 0.3 |

| Factor                | 10   | 9    | 8    | 7    | 6   | 5   | 4   | 3   | 2   | 1   |
|-----------------------|------|------|------|------|-----|-----|-----|-----|-----|-----|
| Work life balance (%) | 32.5 | 19.2 | 21.0 | 11.8 | 7.7 | 3.6 | 3.1 | 0.8 | 0.3 | 0.3 |

Table 47: Importance of factors of employee productivity

A sum of the ratings from 7-10 which are chosen by the majority of participants provide an interesting view of the importance of the different factors. The most important one is work-life balance with 92.1%, followed by company culture with 91%. Adequate Salary with 88.2%, career opportunities with 87.7% and education with 83.6% are the following important factors. All of the five factors are in the same region and the spread is only 8.5% which allows the conclusion, that they all have basically the same importance for employees. An analysis of the same factors from a gender perspective is showing a similar picture, but interesting details as well. According to the findings from this survey, the differences between male (M) and female (F) professionals are not as significant as mentioned in several other publications.

| Factor                     | 10    | 9     | 8     | 7     | 6    | 5    | 4    | 3    | 2    | 1    |
|----------------------------|-------|-------|-------|-------|------|------|------|------|------|------|
| Adequate salary (%) F      | 15.05 | 9.68  | 41.94 | 20.43 | 5.38 | 5.38 | 1.08 | -    | 1.08 | -    |
| Adequate salary (%) M      | 13.09 | 16.44 | 36.58 | 22.48 | 6.71 | 2.68 | 1.34 | 0.34 | 0.34 | -    |
| Education (%) F            | 26.88 | 20.43 | 32.26 | 10.75 | 2.15 | 6.45 | 1.08 | -    | -    | -    |
| Education (%) M            | 20.13 | 23.49 | 23.83 | 14.09 | 8.72 | 6.38 | 1.68 | 0.34 | 0.34 | 1.01 |
| Company culture (%) F      | 37.63 | 17.20 | 23.66 | 13.98 | 2.15 | 3.23 | 1.08 | -    | -    | 1.08 |
| Company culture (%) M      | 20.47 | 24.83 | 33.22 | 12.08 | 5.37 | 2.01 | 0.67 | 1.01 | 0.34 | -    |
| Career opportunities (%) F | 35.48 | 18.28 | 24.73 | 10.75 | 8.60 | 1.08 | -    | 1.08 | -    | -    |
| Career opportunities (%) M | 23.15 | 27.18 | 26.51 | 10.40 | 7.38 | 2.35 | 1.34 | 1.01 | 0.34 | 0.34 |
| Work life balance (%) F    | 33.33 | 20.43 | 22.58 | 9.68  | 8.60 | 3.23 | 1.08 | 1.08 | -    | -    |
| Work life balance (%) M    | 32.21 | 18.79 | 20.47 | 12.42 | 7.38 | 3.69 | 3.69 | 0.67 | 0.34 | 0.34 |

Table 48: Importance of factors of employee productivity - gender perspective

This conclusion becomes even more evident, if a selection of a dataset of the ratings from 7-10 is provided. The only mentionable difference is the factor education. This factor is for 90.32% of the female participants and for 81.54 of the male participants important. All other factors not differ more than 2.13%.

| Factors                    | 10    | 9     | 8     | 7     | Sum 7-10 |
|----------------------------|-------|-------|-------|-------|----------|
| Adequate salary (%) F      | 15.05 | 9.68  | 41.94 | 20.43 | 87.10    |
| Adequate salary (%) M      | 13.09 | 16.44 | 36.58 | 22.48 | 88.59    |
| Education (%) F            | 26.88 | 20.43 | 32.26 | 10.75 | 90.32    |
| Education (%) M            | 20.13 | 23.49 | 23.83 | 14.09 | 81.54    |
| Company culture (%) F      | 37.63 | 17.20 | 23.66 | 13.98 | 92.47    |
| Company culture (%) M      | 20.47 | 24.83 | 33.22 | 12.08 | 90.60    |
| Career opportunities (%) F | 35.48 | 18.28 | 24.73 | 10.75 | 89.25    |
| Career opportunities (%) M | 23.15 | 27.18 | 26.51 | 10.40 | 87.25    |
| Work life balance (%) F    | 33.33 | 20.43 | 22.58 | 9.68  | 86.02    |
| Work life balance (%) M    | 32.21 | 18.79 | 20.47 | 12.42 | 83.89    |

Table 49: Importance of factors of employee productivity - gender perspective rating 7-10

The same results can be found, when extracting the answers of IT-employees. The one slight difference is the importance of education which is five percent lower than the percentage when all participants are included.

| Factor                   | 10    | 9     | 8     | 7     | Sum   |
|--------------------------|-------|-------|-------|-------|-------|
| Adequate Salary (%)      | 15.38 | 12.50 | 40.38 | 19.23 | 87.49 |
| Education (%)            | 17.31 | 23.56 | 23.08 | 14.42 | 78.37 |
| Company Culture (%)      | 23.08 | 24.52 | 28.37 | 12.98 | 88.95 |
| Career Opportunities (%) | 20.67 | 23.56 | 29.33 | 10.58 | 84.14 |
| Work Life Balance (%)    | 31.73 | 21.63 | 21.15 | 11.06 | 85.58 |

Table 50: Importance of factors of employee productivity - IT-employee's perspective rating 7-10

Wages are always one of the important issues for employees. A certain salary can motivate and promote productivity, but a below average salary can and mostly will promote the opposite (H.-W. Lee & Lin, 2014). But how important is the factor salary for different age groups? To answer this question, the responses of the participants regarding the salary were divided into three separate datasets. Although the differences are not that significant, it is worth mentioning, that the salary is most important for the age group from 30 – 49 years (91.12% answered with a rating from 7-10) following the age groups  $\leq 29$  with 85.94% and  $\geq 50$  with 81.63%.

| Factor                        | 10   | 9     | 8     | 7     | 6    | 5    | 4    | 3 | 2    |
|-------------------------------|------|-------|-------|-------|------|------|------|---|------|
| Adequate Salary (%) $\leq 29$ | 9.38 | 14.06 | 39.84 | 22.66 | 7.03 | 3.91 | 1.56 | - | 1.56 |

| Factor                      | 10    | 9     | 8     | 7     | 6     | 5    | 4    | 3    | 2 |
|-----------------------------|-------|-------|-------|-------|-------|------|------|------|---|
| Adequate Salary (%) 30 - 49 | 16.82 | 15.42 | 38.79 | 20.09 | 4.67  | 2.80 | 0.93 | 0.47 | - |
| Adequate Salary (%) ≥ 50    | 10.20 | 14.29 | 28.57 | 28.57 | 12.24 | 4.08 | 2.04 | -    | - |

Table 51: Importance of factor wages in different age groups

Diversity is very important for companies to fulfil the demand of the market. Therefore, the integration of women and the integration of older employees is critical. The analysis of the data suggests, that the importance of the different productivity factors doesn't vary with the gender of the employees. Besides that, it is important to know if there are age related changes of the importance over the period of an employment. For this reason, two hypotheses were built to answer this question.

H<sub>1</sub>: The importance of the different productivity factors (adequate salary, education, company culture, career opportunities, and work life balance) is age related and will change over the period of employment.

H<sub>0</sub>: The importance of the different productivity factors (adequate salary, education, company culture, career opportunities, and work-life balance) of an employee is not age related and will change over the period of employment.

Correlation analysis was conducted to explore the relationships between the demographic datasets and the factors for productivity. The correlation coefficient was calculated in the following way.

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{(\sum x^2 - (\sum x)^2)(n \sum y^2 - (\sum y)^2)}}$$

The interpretation of values of the correlation using the Pearson correlation coefficient (r) is as follows: <0.1 is a trivial correlation, 0.1 - 0.3 is small correlation, 0.3 - 0.5 medium correlation, >0.5 is high correlation (Sirková, Ali Taha, & Ferencová, 2014). The correlation coefficient, determines the relationship between the variables age and productivity factors (r<sup>2</sup>).

The results are shown in the following table.

| Age | Adequate salary |                | Education |                | Company culture |                | Career opportunities |                | Work life balance |                |
|-----|-----------------|----------------|-----------|----------------|-----------------|----------------|----------------------|----------------|-------------------|----------------|
|     | r               | r <sup>2</sup> | r         | r <sup>2</sup> | r               | r <sup>2</sup> | r                    | r <sup>2</sup> | r                 | r <sup>2</sup> |
|     |                 |                |           |                |                 |                |                      |                |                   |                |

|       |         |        |         |        |        |        |         |        |        |        |
|-------|---------|--------|---------|--------|--------|--------|---------|--------|--------|--------|
| >30   | 0.151   | 0.0228 | -0.0778 | 0.0061 | 0.0594 | 0.0035 | 0.0003  | 0      | 0.0782 | 0.0061 |
| 30-49 | -0.0371 | 0.0014 | 0.0622  | 0.0039 | -0.006 | 0      | -0.1334 | 0.0178 | 0.1322 | 0.0175 |
| 50-63 | -0.3259 | 0.1062 | -0.0898 | 0.0081 | 0.1343 | 0.018  | -0.1324 | 0.0175 | 0.1384 | 0.0192 |

Table 52: Results of analysis of age and importance of productivity factors

The data shows, that with one exception, there is no significant relationship between the variables age and the different productivity factors. The only significant correlation can be found between the age of 50-63 and an adequate salary. Also, the coefficient of determination, which indicates the proportion of the variance in the dependent variable that is predictable from the independent variable, indicates no linear relationship between the variables. The values of the p-tests ( $\alpha = 0.05$ ) support the initial findings.

| Age   | Adequate Salary |          | Education |          | Company Culture |          | Career opportunities |          | Work Life Balance |          |
|-------|-----------------|----------|-----------|----------|-----------------|----------|----------------------|----------|-------------------|----------|
|       | r               | P-Test   | r         | P-Test   | r               | P-Test   | r                    | P-Test   | r                 | P-Test   |
| >30   | 0.151           | 0.088871 | -0.0778   | 0.387647 | 0.0594          | 0.505392 | 0.0003               | 0.997318 | 0.0782            | 0.380271 |
| 30-49 | -0.0371         | 0.589381 | 0.0622    | 0.365224 | -0.006          | 0.930466 | -0.1334              | 0.051324 | 0.1322            | 0.053474 |
| 50-63 | -0.3259         | 0.027087 | -0.0898   | 0.552851 | 0.1343          | 0.373552 | -0.1324              | 0.380412 | 0.1384            | 0.359003 |

Table 53: Results of analysis of age and importance of productivity factors - P-test

The result is, that  $H_1$ : The importance of the different productivity factors (adequate salary, education, company culture, career opportunities, work-life balance) is age related and will change over the period of employment, needs to be rejected with only one exception. Besides the productivity factor adequate salary in the age group of 50-63, there is no statistical evidence to support this statement.

*RQ3: What are the most common reasons for job related stress in IT-departments?*

Cases of psychological diseases like depression, burn out or bore out are continuously rising every year (Statista, 2014). Obviously, this fact has large effects on the overall productivity of employees and subsequently on the performance of the companies as well (Bertram, 2013; Federal Statistical Office Germany, 2010)

| Job profile           | 10   | 9     | 8     | 7     | Sum 7-10 |
|-----------------------|------|-------|-------|-------|----------|
| Architect             | -    | 9.09  | 27.27 | 36.36 | 72.73    |
| Head of IT-Department | 7.69 | 15.38 | 53.85 | -     | 76.92    |
| IT-Consultant         | 3.33 | 6.67  | 21.11 | 32.22 | 63.33    |
| IT-Project Manager    | 6.12 | 16.33 | 24.49 | 30.61 | 77.55    |
| IT-Sales              | -    | 13.33 | 40.00 | 13.33 | 66.67    |
| Programmer            | 3.57 | 7.14  | 14.29 | 14.29 | 39.29    |

Table 54: Level of job stress - IT-employee perspective

Within a dataset from 7-10, IT-Project managers rated their stress level the highest, closely following by the head of the IT-department and the architects. Programmers rated their stress level the lowest in comparison to the other job profiles.

| Level of your Job Stress | 10   | 9     | 8     | 7     | 6     | 5     | 4    | 3    | 2    | 1    |
|--------------------------|------|-------|-------|-------|-------|-------|------|------|------|------|
| Female in %              | 4.30 | 5.38  | 25.81 | 18.28 | 16.13 | 13.98 | 8.60 | 2.15 | 3.23 | 2.15 |
| Male in %                | 3.69 | 12.08 | 22.82 | 23.49 | 15.44 | 12.08 | 4.36 | 4.36 | 1.68 | -    |

Table 55: Level of job stress - gender perspective

The male participants rate their level of job stress higher than the female participants. 62.08% of the male and only 53.77% of the female participants rate their stress level between 7 and 10. The higher stress level with male employees can be explained via a breakdown of the most common stressors for employees as shown in the following table. In average, male personnel is working longer hours and is more often located in managerial positions, than female employees (Humpert, 2014; LeRouge et al., 2013; Riemenschneider et al., 2006).

The highest stressor for employees is the volume of work with 74%, which is defined by the working hours per timeframe or the work that needs to be done in a given timeframe (Gheordunescu & Panoiu, 2014). The second highest stressor for employees is the nature of the job and its responsibilities with 55%. In an IT-environment, activities like technical changes or releases in a given timeframe, the responsibility for IT-projects which can have effects on the whole organization, can be summarized under this stressor. Additionally, department heads and project managers can be susceptible for this stressor because of their job position.

| Stressors for employees                    | Stress Reason (%) | Stress Reason (Count) |
|--|-------------------|-----------------------|
| Volume of work                             | 74%               | 291                   |
| Nature of the job and its responsibilities | 55%               | 215                   |
| Interpersonal relations                    | 30%               | 118                   |
| Precariousness employment                  | 13%               | 49                    |
| Bullying                                   | 12%               | 46                    |
| Physical work environment                  | 11%               | 44                    |
| Personal health issue                      | 10%               | 38                    |
| Other                                      | 4%                | 17                    |

Table 56: Psychological stressors for employees

From a gender perspective, the most results are in the same areas. The highest spread can be found in the stressor interpersonal relationships with a 6% difference. The spreads for the other stressors are between 0%-3%percent. These findings show the same results as research question I. Furthermore, regarding stressors in the job environment, there are no significant differences between men and women. Nevertheless, this means also that the highest stressor

remains the volume of work and a look on this stressor from a gender perspective has no effect on the overall rating and order of all stressors.

| Stressors for employees                    |        | Stress Reason (%) | Stress Reason (Count) |
|--|--------|-------------------|-----------------------|
| Volume of work                             |        | <b>74%</b>        | <b>291</b>            |
|  | Female | 73%               | 68                    |
|  | Male   | 75%               | 223                   |
| Nature of the job and its responsibilities |        | <b>55%</b>        | <b>215</b>            |
|  | Female | 54%               | 50                    |
|  | Male   | 55%               | 165                   |
| Interpersonal relations                    |        | <b>30%</b>        | <b>118</b>            |
|  | Female | 34%               | 32                    |
|  | Male   | 29%               | 86                    |
| Precariousness employment                  |        | <b>13%</b>        | <b>49</b>             |
|  | Female | 10%               | 9                     |
|  | Male   | 13%               | 40                    |
| Bullying                                   |        | <b>12%</b>        | <b>46</b>             |
|  | Female | 14%               | 13                    |
|  | Male   | 11%               | 33                    |
| Physical work environment                  |        | <b>11%</b>        | <b>44</b>             |
|  | Female | 13%               | 12                    |
|  | Male   | 11%               | 32                    |
| Personal health issue                      |        | <b>10%</b>        | <b>38</b>             |
|  | Female | 12%               | 11                    |
|  | Male   | 9%                | 27                    |
| Other                                      |        | <b>4%</b>         | <b>17</b>             |
|  | Female | 4%                | 4                     |
|  | Male   | 4%                | 13                    |

Table 57: Psychological stressors for employees - Gender perspective

The analysis of the dataset of IT-employees and different job profiles generates different results than the overall picture or the gender perspective. Architects are not as exposed to the stressor *volume of work* as the other job profiles. For IT-manager and programmer, the stressor is with 82% and 86% significantly higher than the average value of 74%. The average value for the stressor *nature of the job and its responsibilities* is 55%. This average value doesn't apply to the profile of an IT-sales employee or an architect. The values of these profiles are much above the average. On the opposite, this stressor doesn't apply to programmers. They ranked this stressor with 39% rather low.

| Stressors for IT-employees | Architect | Head of IT-department | IT-consultant | IT-project manager | IT-sales | Programmer |
|----------------------------|-----------|-----------------------|---------------|--------------------|----------|------------|
| Volume of work             | 36%       | 77%                   | 77%           | 82%                | 67%      | 86%        |



| Stressors for IT-employees                 | Architect | Head of IT-department | IT-consultant | IT-project manager | IT-sales | Programmer |
|--|-----------|-----------------------|---------------|--------------------|----------|------------|
| Nature of the job and its responsibilities | 73%       | 62%                   | 52%           | 55%                | 87%      | 39%        |
| Bullying                                   | 36%       | 8%                    | 10%           | 14%                | 27%      | 18%        |
| Interpersonal relations                    | 27%       | 31%                   | 31%           | 24%                | 33%      | 39%        |
| Personal health issue                      | 9%        | 15%                   | 11%           | 8%                 |          | 14%        |
| Physical work environment                  | 9%        | 8%                    | 9%            | 14%                | 13%      | 18%        |
| Precariousness employment                  | 9%        | 15%                   | 16%           | 8%                 | 20%      | 29%        |

Table 58: Psychological stressors for employees - IT-employee perspective

The obvious answer to this research question is, that the *volume of work* and the *nature of the job and its responsibilities* are the stressors that are affecting employees the most. A deeper analysis of the data provides several interesting insights. For example, the difference regarding psychological pressure between men and women, is very low. Furthermore, it is worth mentioning, that the only significant differences can be found, when the various job profiles are analysed.

As mentioned before, the age of the employees is also an important variable for companies. It is important to analyse the effect of age on the stress level of an employee. For this reason, three datasets of different age groups were selected and two hypotheses were build.

H<sub>1</sub>: The age of an employee has no effect on his stress level.

H<sub>0</sub>: The age of an employee has an effect on his stress level.

Pearson correlation analysis was conducted to explore the relationships between the demographic datasets and the stress level of the employees. Also, the method of the p-test as a test for the hypothesis was used. The results are shown in the following table.

| Age   | Number of pairs | Correlation r | Coefficient of determination r <sup>2</sup> | P-Test (significance of 0.05) |
|-------|-----------------|---------------|---|-------------------------------|
| x<30  | 122             | 0.0645        | 0.0042                                      | 0.480296                      |
| 30-49 | 209             | 0.0249        | 0.0006                                      | 0.720439                      |
| 50-63 | 46              | -0.0624       | 0.0039                                      | 0.68036                       |

Table 59: Results of analysis of age and stress level of employees

The outcomes show no significant correlation between the variables age and stress level of the employees. The coefficient of determination, which indicates the proportion of the variance in the dependent variable that is predictable from the independent variable, indicates no linear relationship between the variables. The values of all three p-tests ( $\alpha = 0.05$ ) shows, that the  $H_0$  Hypothesis needs to be rejected and the age of an employee has no effect on his or her stress level.

*RO4: What are the most pressing issues for IT-companies or departments regarding their employees?*

As described, employees have very diverse expectations regarding their work environment, how to behave at work and how they want to be led by their superiors. Also, because of the inevitable, upcoming skills shortages, companies need to know their employees, improve the environment around them, but also find measures outside of the direct management of the staff (Radant et al., 2016b). The participants of this survey had the opportunity to choose more than one answer for the question: “what do you see as the most pressing issues for IT-companies or departments regarding their employees?” The participants ranked the possible answers *recruiting* (51.4%) and *career development* (50.4%) as the highest. The third possible answer *lowering of the retention rate* was only rated as important in 35% of the cases. The least voted answer was *process optimization* with 29.2%.

|                            | Pressing Issues (%) | Pressing Issues (Count) |
|----------------------------|---------------------|-------------------------|
| Recruiting                 | 51.4 %              | 201                     |
| Career development         | 50.4 %              | 197                     |
| Lowering of retention rate | 35.0 %              | 137                     |
| Process optimization       | 29.2 %              | 114                     |

Table 60: Most pressing issues for IT-Companies or departments regarding their employees

The answers are showing a clear focus on the employee and away from an optimization of the organization. That the issues recruiting and career development cover the first two places is not a surprise either, and it fits into the results of the previous research questions. Due to the demographic change and the ever-increasing rate of change in technology, companies are forced to recruit more people on average and need to invest more money in their learning and development programs.

The area of recruiting has changed a lot over the last decades and even the last years. It has evolved from a simple topic to a very complex issue for companies. Just one decade ago, businesses communicated open positions through print publications and normally quality

candidates allied to the vacancies. Today, recruiting is much more professionalised. Recruiting strategies are implemented and SLAs like the cost per hire are introduced. Also, there are multiple technologies, tools, partners and services involved in the recruiting activities, which also raises the complexity of the processes. Social media tools, video, big data, cloud-based products (Vladimir Stantchev, Prieto-González, & Tamm, 2015) and mobile recruiting platforms are creating an interesting combination of resources to improve the recruiter’s capability to more efficiently match applicants with the right opportunities (Sahay, 2015). Several studies show that e-recruiting reduces costs for filling vacancies. Organizations that have adopted e-recruitment, as opposed to traditional recruiting achieved a 95% reduction in recruitment costs compared with traditional methods (e.g. newspaper ads). Applying such a strategy can attract a large number of applicants, which on the opposite will generate a tremendous amount of work in the selection phase (Artene & Medinschi, 2013). Each company’s recruiting process is divided into three major steps: identification, attraction and selection (Choudhury, 2012). These steps are also represented in the factors of the *framework to manage talent in times of scarcity of talent* (Radant et al., 2016b). These factors and corresponding metrics are detailed in the following table:

| <b>Factors for the identification, attraction and selection of employees</b> |   |
|--|---|
| <u>Factor</u>  | <u>Metric</u>   |
| Identification of vacancies within an organization                           | Employee requirements analysis  |
| Staff potential within an organization                                       | Employee potential analysis   |
| Staff potential within an organization                                       | IT vacancies in the company   |
| Staff potential within an organization                                       | Age distribution analysis   |
| Staff potential within an organization                                       | Existence of female integration and leadership programs   |
| Employee fluctuation   | Retention rate  |
| Strategy for corporate education and development                             | Existence, development and yearly evaluation of educational strategy and lifelong learning programs |
| Strategy for corporate education and development                             | Gap analysis between existing and targeted skills of employees                                      |
| Company Culture  | Company culture compiled via employee survey  |
| Employee satisfaction  | Employee expectations compiled via employee survey  |
| Compatibility of job and family  | Work-life/family policies   |
| Work organization and working time models                                    | Innovative working (time) models  |

Table 61: Factors for the identification, attraction and selection of employees

The third most pressing issue is the *lowering of the retention rate* with 35% and the fourth pressing issue is *process optimization* with 29.2%.

### **Revisiting research questions**

In the following chapter, the research questions will be revisited.

- *RQ1: Is there an actual shortage of skills in the different IT-professions and what will be the development in the next five years?*

The results of the survey confirm the current results of the literature, that there is an actual shortage of skills and the demand for IT-employees will rise in the upcoming years (Mendryk & Dylon, 2013; Radant, 2014b; Winkler & Zander, 2007). The analysis confirms also the significance of this thesis and the need for companies to change their employee strategies.

- *RQ2: Which are the most important factors for IT-employee productivity?*

The overall result of the analysis of the data regarding the importance of the productivity factors shows, that it is not possible to determine if one factor is more important than the other. The results show a significant importance of all researched factors. This indicates, that companies need to consider all the mentioned factors in their HR-strategies. It is not sufficient to concentrate on one factor and maybe compensate a lower salary with better career opportunities or a better work-life-balance. The optimal mixture of the factors will improve the productivity of employees and that is the key for the success of a company.

- *RQ3: What are the most common reasons for job related stress in IT-departments?*

From an IT-employee perspective, there are several differences between the various job profiles. For example, the architects that participated in the survey consider the nature of the job and its responsibilities as the highest stressor and rate the volume of work as very low. For the profiles of a programmer it is the opposite. Stressors like personal health issues, a physical work environment or precariousness employment are not rated high for either job profile. From a gender perspective unlike the factors of productivity answered in RQ2, the most results are in the same range.

*RQ4: What are the most pressing issues for IT-Companies or departments regarding their employees?*

Due to the mentioned rapid change in technology, IT-companies and –departments have to work on the development of their employees from day one of their assignment (García-Alvarez, Suárez Álvarez, & Quiroga García, 2014; Van Reusel, Yde, & De Corte, 2007). Career development is not only about learning the necessary technical skills to fulfil the expectations of the employer. Because of the internationalization of IT-project teams, social skills are also necessary (Colomo-Palacios, Casado-Lumbreras, et al., 2012; Radant et al., 2016a). Companies have to have a clear view of the needed skills, both for a middle- and long-term. To achieve that, transparency is the key. The HR-strategies need to be aligned with the business strategy and analysis that unite these strategies and show possible gaps between the actual state and a possible target organization. The identification of these gaps allows the company to take measures to counteract possible developments.

### **Discussion of results**

Because of the increasing complexity of new developed software and a needed specialization of employees, productivity of software development companies became more and more challenging in the last years and it can be expected that the importance of these topics will increase in the future (Corbin et al., 2007).

The results of this survey should be considered from different points of view. This study investigates not only the possibility of a skills shortage in the IT-industry, it also answers questions about productivity of employees, psychological stressors for employees and the most pressing issues for the IT-sector as well.

The answers of the participants confirm the actual state of the research, that there is an actual shortage of skills for IT-employees and that the situation will get worse in the upcoming years, especially for architects, IT-manager and programmer. The results have also shown, that the situation in Spain is much more negative than in Germany. Only 8% of the participants from Spain have the opinion that there will be no skills shortage in three years and 12% have that opinion for a five-year term. Thus, companies need to take measures to counteract this development rather fast to be prepared for this trend. These measures must include the changing expectations of employees and the mitigation of psychological stressors to minimize sick days and the possibility of a decrease of the employee productivity.

The findings also show, that the factors for employee productivity *adequate salary, education, company culture, career opportunities and work-life-balance* are distributed in a 12%

range and all of them are over 80% regarding their importance. The result is, that IT-companies or IT-departments have to weigh all factors very high in their HR-strategies. The survey also has shown, that the differences regarding the importance of these factors between women and men are not very high and for the most parts not significant. These results are contradicting earlier research, which stated the differences between men and women on the subject of their expectations, their needs in the work environment and psychological impacts on their productivity (Arntén, Jansson, & Archer, 2008; Doyle & Hind, 1998; Ekanem, 2015; Rupert & Morgan, 2005) and supports research that indicates none or no significant gender induced differences (Purvanova & Muros, 2010).

Regarding the psychological stress of employees, the answers of men and women are also similar in most cases and large differences cannot be found. The most common reasons for job related stress in IT-departments is the *volume of work* and the *nature of the job and its responsibilities*. Apart from this, male participants rate their level of job stress higher than the female participants. 62.08% of the males and only 53.77% of the female participants rate their stress level in a scale from 1-10 (10= highest) between 7 and 10.

The most significant challenges for IT-companies and departments are career development and recruiting. This indicates, that companies need to focus their attention on the actual and the future employees. Because of the fast-changing environment in the IT-landscape, development of employees becomes crucial for companies to stay competitive and be productive. The third important vital concern is the lowering of the retention rate, which is rated surprisingly low considering the importance and the connection between recruiting and the retention of employees. The least pressing issue for the participants is the process optimization. Nevertheless, in times of ongoing digitalization of work and the constant change of processes, process optimization is a very important tool for companies to raise productivity besides human factors and the productivity of employees. So the process optimization through digitalization is not a question of when, it is a question of how and companies have no choice but to adapt and shape their organization in the best way possible to stay competitive (Gratton, 2011).

The main limitation of this study is the research method itself. Because of the quantitative approach, it was not possible to ask questions to the participants apart from the questions in the survey. Possible misunderstandings cannot be ruled out and follow-up questions to obtain a clearer view on the opinions of the employees, cannot be asked either. Also, because

of this, there is no way to tell how truthful a respondent is being, how much thought a respondent has put in and if the respondent may be forgetful or not thinking within the full context of the situation. Nevertheless, we are confident that these disadvantages can be neglected thanks to the size of the sample.

Despite the mentioned limitations, this study contributes to the literature and to practice in several different ways. Additionally, a variety of questions in different research areas were answered with this survey. As discussed, the productivity of employees is one, if not the most important asset, of a company, especially for a knowledge driven area like information technology.

Since there is an evident shortage of skills in numerous countries in Europe, companies have to adapt the way they treat their employees in accordance to the demanding circumstances of the employee market. The minimization of psychological stress and consequently sick days, is one of the critical components for companies in the upcoming future (Ek et al., 2014; Pandey and Sharma, 2016). The results show, that this stress is influenced by several different stressors and that most of them need to be considered by companies when they allocate work or design workspaces. On the other side, there are several factors that promote employee productivity. Some of them, like work-life balance, company culture or salary are more important and should be a relevant part of every HRM-strategy. This strategy has to also involve proper measures for the recruiting and the development of employees, as they complement each other and should be considered with the same importance.

It is common knowledge, that a loss of productivity can have several reasons besides organizational failures. The author is confident, that the results of this survey can help organizations to gain productivity, reduce costs and allocate their personnel in a more target oriented way. Achieving productivity in an organization and especially in an IT-department will become much harder in the upcoming years. Besides the needed experts, hardware and infrastructure, the development of an organization into a flexible and well organized system, will be much more important to prevail in a highly competitive market, than to develop a certain system or program in a given.

### ***Test of the 5-layer framework for employee productivity – qualitative validation***

The goal of this test phase was the qualitative validation of the framework. To achieve this goal, several experts from different backgrounds were interviewed regarding different aspects of the framework.

#### **Approach**

The qualitative validation of the framework was conducted from December 2016 until January 2017. Three experts from different fields participated in the interviews. The experts were:

1. *G.S.*

Ms. G.S. is an Owner of Executive Advisors since 2007. She served as an Executive Vice President of the Commercial Services business unit at BearingPoint Inc. from July 2002 to February 2007. Prior to joining BearingPoint in July 2002, she served as the Global Managing Partner of Arthur Andersen's business consulting practice, which under her leadership was one of the fastest growing global consultancies. She held various positions within Arthur Andersen LLP and was a Founding Member of Arthur Andersen's business consulting practice from 1984 to June 2002 and Auditor from 1977 to 1984. In her more than 25 years of service with BearingPoint and Arthur Andersen, she advised public company Boards of Directors and management teams on a variety of business issues. She has been an Independent Trustee of Federal Realty Investment Trust since July 11, 2006. She has been a Director at MTS Systems Corporation since September 30, 2009. She is a Certified Public Accountant. Twice recognized as one of Consulting Magazine's Top 25 Consultants, Ms. G.S. is the executive-in-residence and leadership instructor for its leadership programs at the Yale School of Management. She has also lectured on leadership development at West Point and Harvard Business School, and is currently the co-instructor of Leadership in Crisis for Villanova's Executive MBA program.

2. *E.S.*

Dr. E.S. studied politics and history at the Friedrichs Wilhems University in Bonn from 1996-2001. He received his PhD in history in 2005. After his scientific career, he began working as a specialist for IT-project controlling at Postbank, following several positions in the HR-department. Since 2016 he is the leader of executive development and HR-marketing for the Postbank.



### 3. C.C.L.

Ms. C.C.L. is an Adjunct Professor at Universidad Complutense de Madrid, Spain. She received her PhD in Psychology from the Universidad Autónoma of Madrid (2002). She has been working in several research institutions and universities since the 1990s including Universidad Autónoma de Madrid, Universidad Complutense of Madrid and Escuela de Administración de Empresas (EAE). She also served as HR consultant in several companies in the IT sector. Her research interests include human capital development, staffing along with emotions in organizational contexts.

All interview partners are experts in their respective fields with a long year experience.

### **Research plan**

To achieve the goal of a qualitative validation of the framework, one overall research question was used.

*RQ1: Is the Five-layer framework for managing scarce resources a usable approach for companies to raise transparency for the management of their personnel in times of demographic change and scarcity of talent?*

To obtain detailed results, this research question was specified with four underlying questions:

1. Do you think, that a majority of companies is aware of the impact that the demographic change will have on their organizations and on the productivity of employees?
2. The framework suggests that companies organize their HR strategies in five different layers. Do you think, that these areas are representing the necessary parts for employee management in the future?
3. The framework follows a hierarchical approach. Every layer is divided in several factors. Do you think, that these factors cover all the aspects of the respective layer or would you add other factors?
4. To raise transparency and give a company a possibility to control their actions, every factor has a metric to quantify this factor. Do you think, that the metrics are usable to quantify the factors in a way that benefits a company?

The research questions were discussed and answered in three different interviews with the participants.

### **Execution of research**

The interviews were conducted and recorded by an interviewer and later transcribed by him. The study took place as a qualitative interview study in the tradition of the qualitative research interview, which allows the researcher to ask questions around different challenges in the interviewee's work life and experiences, including practical issues of how to do things and handle cognitive issues such as personal and professional epistemology (Sayrs, 1998). Open-ended questions were used and participants had freedom to describe at length their experiences. This data collection approach provides information that could not be obtained through a quantitative approach as it allows opinions, thoughts and feelings (Sayrs, 1998).

This approach allows a holistic assessment of the layers, factors and metrics of the framework with the help of highly qualified experts in their fields. Also, the questions are allowing validation of the results of the survey with IT-professionals.

### **Analysis of results**

In the following part, all the mentioned questions will be answered to ultimately satisfy the overall research question.

1. *Do you think, that a majority of companies is aware of the impact that the demographic change will have on their organizations and on the productivity of employees?*

All expert stated that the companies are aware of the problems, which they are facing or will face in the near future. But often, no actions are following the realisation that the problem is real and the risks for their companies are very high. This is because of conflicting priorities between short-term and long term financial goals. The discussion in these companies is similar to the actual debates in German politics about the security of the pensions of the citizens. Further, according to the experts it is often the case that front-line managers are lying to secure their positions and cover possible mistakes. Overall, new management philosophies need to be implemented to meet the new expectations of the employees on the one hand, and build an environment that keeps them productive on the other hand.

2. *The Framework suggests that companies organize their HR strategies in five different layers. Do you think, that these areas are representing the necessary parts for employee management in the future?*

All experts stated that the layers represent the actual state of the art of the economic world and of the discussions in the scientific world. The layers summarize the important parts of human resource management and formulate a very good umbrella term for the underlying factors and metrics.

3. *The framework follows a hierarchical approach. Every layer is divided in several factors. Do you think, that these factors cover all the aspects of the respective layer or would you add other factors?*

The factors of the framework are describing and refining the layers in a very good way and no further factors should be added. But the importance of several factors was mentioned in the interviews. For example, the staff potential within an organisation and especially the recruiting of employees. In this modern age of scarce resources, it is even more important to recruit the right people at the right time. This is important for all kinds and sizes of companies and departments, but even more important for IT-companies and departments. If the company is small, it heavily relies on the workforce of an individual employee and if the company has a huge workforce, unproductive employees can cover their work or the lack of very good. As a way to improve the selection of future employees, Dr. Ernst Stilla mentioned the use of cognitive tests since cognitive intelligence is associated with job performance (Côté & Miners, 2006).

4. *To raise transparency and give a company a possibility to control their actions, every factor has a metric to quantify this factor. Do you think, that the metrics are usable to quantify the factors in a way that benefits a company?*

The experts answered this question also positively. The metrics are usable to quantify the factors in a beneficial way. Nevertheless, the experts mentioned several additional metrics which should be included in the framework. Especially metrics that include the upcoming changes of the economic world due to the digitalization of work and processes.

It was also mentioned, that it is important to support the loyalty of employees to their respective company or employer. One measure to maintain or raise loyalty is the realisation of corporate social responsibility events. Several studies found out, that employees who perceive that their organization is investing in CSR practices that are morally consistent with the organization and their strategic goals, performed better

at their jobs and revealed more open minded behaviours on behalf of the organization (Gaudêncio, Coelho, & Ribeiro, 2014; Story & Neves, 2015).

The results of this test showed, that the overall framework included all relevant factors and most of the relevant metrics. According to the experts, the following metrics should be added:

- Layer: Education and employee pool; Factor: Employee performance; Metric: Technical infrastructure of the workplace

The performance and productivity of an employee, especially in an IT-environment is highly dependent on a state of the art IT-infrastructure. An old infrastructure leads to wasted time due to long process durations (c.f. *Implementation of Lean Management philosophy in IT-departments*).

*Recommended assessment method: Conduct an assessment of actual developments on the IT-market.*

*Scale: nominal scale with value yes or no.*

- Layer: Education and employee pool; Factor: staff potential within the organisation; Metric: Assessment and calculation of the variance of needed profiles due to the changes of digitalization and newly digitized processes

The digitalization will change companies in ways we cannot even project. But it is also a certainty that several profiles that are needed now, will not be needed at all anymore or need to be changed in the future. Therefore, it is important, that companies conduct analyses that project these changes.

*Recommended assessment method: Conduct an assessment of actual profiles and needed profiles in the future.*

*Scale: nominal scale with value yes or no.*

- Layer: Physiological healthiness; Factor: Physiological healthiness and workplace design; Metric: Physiological induced Sick days of employees/timeframe

Besides the discussed psychological problems of the employees, it is also important to counteract physiological problems, because they also often lead to physiological problems (Kuykendall & Tay, 2015)

*Recommended assessment method: Physiological induced Sick days of employees in a given timeframe:*

*psychological induced sick day of company or department in timeframe*  
*number of workdays in timeframe*

*Scale: cardinal and interval scale with value in percent theoretically from 0-∞*

- *Layer: Work-life balance; Factor: Loyalty of employees; Metric: CSR activities in a timeframe*

As described earlier, the loyalty of employees is constantly decreasing. CSR activities are one method to gain loyalty between employees and their employers. Especially, but not exclusively women tend to gain loyalty through well elaborated CSR-policies.

*Recommended assessment method: Conducted CSR-activities in a timeframe*

*Scale: Cardinal scale with a value from 0- theoretically ∞*

It was also mentioned, that the results of every employee survey should always be analysed from an age perspective. Due to the often very different views of employees of different generations, this analysis can offer very important insights about the actual feelings and opinions of the employees.

### **Revisiting research question**

*RQ1: Is the Five-layer framework for managing scarce resources a usable approach for companies to raise transparency for the management of their personnel in times of demographic change and scarcity of talent?*

With the help of the four underlying research questions, the answer to *RQ1* is according to the experts “yes”. The *Five-layer framework for managing scarce resources* is a usable approach for companies to raise transparency for the management of their personnel in times of demographic change and scarcity of talent. The framework includes all relevant variables of today’s human resource management strategies. The proposed additional metrics expand and enhance the framework especially on the technical side. Since digitalisation will have a massive impact on the strategy and processes of an organisation, it has subsequently also a huge impact on the HR-strategies and the employees themselves.

### **Discussion of results**

In total four metrics in three different layers are suggested from the interview partners to include them into the *5-layer framework of employee productivity*.

This is especially important in the case of the metric *assessment and calculation of the variance of needed profiles due to the changes of digitalization and newly digitized processes* in the layer *education and employee pool*. Since the digitalisation of organisation and processes of companies has a huge impact on their productivity it is an important metric that was added after this test phase. Also, addressing this point is the metric *technical infrastructure of the workplace* in the layer *employee performance*. Because it includes the need for an analysis of the ongoing technical development in the IT-environment.

These additions all support the overall functionality of the framework because they addressing open points and closing existing gaps from the development phase.

### ***Test of the 5-layer framework for employee productivity – a case study***

To validate the theoretical foundations of the framework it was important to test the results under real life conditions. To achieve this goal, the author conducted a case study with a German bank which has a high dependency on its IT-department. The method of a case study was used because of the possible insights that can be gained with this method (Colomo-Palacios, Fernandes, Soto-Acosta, & Sabbagh, 2011; Dzombeta et al., 2014; Lucio-Nieto, Colomo-Palacios, Soto-Acosta, Popa, & Amescua-Seco, 2012). The advantages outweigh possible disadvantages like the influence of variables from the outside and the inside of the company, and management issues during the test phase.

#### **Approach**

The case study was conducted from November 2016 until the end of February 2017. The company was a half public development bank in Germany, Schleswig Holstein. The bank of the Land (state) Schleswig-Holstein, plays a key role in providing financial support to foster regional development and growth in Schleswig-Holstein. It also offers advice on funding and financing. It provides tailor-made solutions for corporate, real estate and public infrastructure financing, as well as for city development, environmental and energy projects.

Furthermore, grants are provided to support labour market development and training measures. Financial assistance is given to public and private investment projects in Schleswig-Holstein. With more than 400 employees, the bank is in charge of approximately 60 programmes and products including special services, such as EU Consulting and digital program solutions (e.g. a navigator through the funding and financing instruments in Schleswig-Holstein). During the time of the testing period, the company has 50 FTEs in the IT-department.

The employees in the IT-department of the company have an average age of 45 years which is much higher than the average in their peer group. This also leads to further problems. For example, the age has a huge effect on the healthiness of the employees.- The higher the age of an employee is, the more likely off days due to health issues are (Ng & Feldman, 2013; Tenhiälä et al., 2013). A separate problem for the bank is, that especially younger employees leave the company for better paid jobs in other cities, especially in the consulting industry.

The bank has already tried different measures to retain their personnel and lower the average age of the employees. The goal of the test phase was to evaluate the results of the actual measures and the HR-strategy with the framework. Also, further measures needed to be

identified to achieve a lowering of the retention rate and ultimately to decrease the average age of the employees. Besides these goals, measures should be identified to improve the working environment that supports the healthiness of the employees to gain productivity.

**Research plan**

The sponsor of the project was the Chief Information Officer (CIO) of the company. Besides the IT-department, experts from the HR-department were also involved. The test of the framework was structured as a project and split in different phases:

1. Phase I: Information gathering with the help of the framework
2. Phase II: Analysis and evaluation of the information with the framework
3. Phase III: Derivation of measures and implementation of controlling mechanisms

The project and the particular phases followed this schedule:

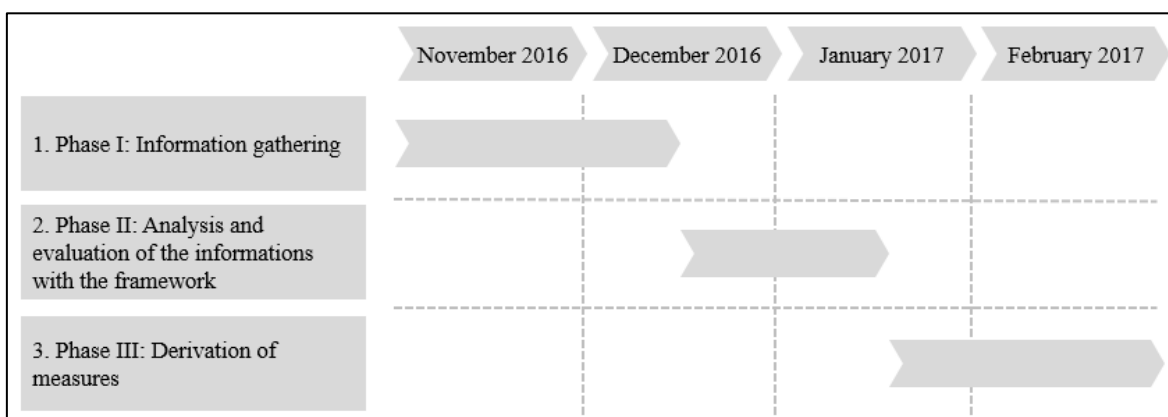


Figure 15: Phases of the test project

The phases, activities and outcomes will be described and discussed in the following sections.

For this research, the same research question as in the previous section was used.

*RQ: Is the Five-layer framework for managing scarce resources a usable approach for companies to raise transparency for the management of their personnel in times of demographic change and scarcity of talent?*

**Execution of research**

An important task of the framework is creating transparency about the current state of the company, their HR-strategies, relevant operating figures and the measures that it has already taken to counteract their problems regarding employee productivity. The first step were several telephone conferences and meetings to present and introduce the framework, its goals and the functionality. After that, several workshops took place. In the first workshop, the



layers and factors were discussed to evaluate which parts of the framework are needed and can be used for deeper analysis. Since the bank is a half public organization, the salary was set and no object for investigation. Since there are also no international business relationships the layer was dismissed. Consequently, the layer's *education and employee pool*, *psychological and physiological healthiness and work life balance* were selected for further analysis. In the next workshop, the factors for the further assessment were selected. The representatives from the HR- and IT-department discussed the suggested factors and corresponding metrics regarding the possible availability of the needed data and information. The participants agreed that it is not necessary to dismiss certain factors in this early stage of the project. If information is not available in the first phase, it will later be discussed if the data should be compiled and collected.

In summary, all factors and metrics, besides the layer *baseline wages* were selected for the information gathering and further analysis. Because of a highly sophisticated HRM-system nearly all the needed data was provided by the bank. A few figures like the retention rate in a certain timeframe or a detailed age distribution analysis needed to be calculated by the HR department. The provision of the data took approximately two weeks. The timespan of the data gathering would become much longer if the company did not have a functioning HRM system and all data needed to be calculated or compiled in the first place.

### **Analysis of results**

For the analysis of the provisioned data, the content of the framework was converted in a Microsoft Excel sheet and the data was inserted. The advantage of this method is, that the sheet created a high level of transparency about the metrics and the inserted data. The metrics in the framework consist of quantitative metrics and “yes or no” questions. The “yes or no” questions are used if a metric includes the implementation of a method and/or a tool. After the insertion of the data, the author gathered reference data from the industry to benchmark the bank with this data. These are the results and findings for the different layers. If no information could be retrieved, it will be mentioned why and if the bank will use that metric in the future.

- Education and employee pool

| <b>Results of the test of the layer education and employee pool</b> |   |   |
|---|---|---|
| <u>Factor</u>   | <u>Metric</u>   | <u>Findings</u>   |
| Employee performance  | Real output (gross value added) divided by the total number of persons employed | As a development bank, the output is calculated with the total number of volume of money which is flown into the economic or private institutions. The amount in 2015 was 2.3 billion (2.1 in 2014) |
| Process costs and -duration   | Evaluation of throughput time and lead time                                     | No analysis conducted so far but a possible implementation will be discussed with the CEO.  |
| Investment in employee education                                    | Expenditure for education of company or department                              | No analysis conducted so far but will be implemented.   |
| Investment in employee education                                    | Number of employees in training per year  | No analysis conducted on the employee level. But there were 1,751 internal and external trainings in 2015. (1,046 in 2014).   |
| Identification of vacancies within an organization                  | Employee requirements analysis  | There is only an age distribution analysis. Suggestion for the extension of the analysis are made.  |
| Staff potential within an organization                              | Employee potential analysis   | No analysis conducted so far, but will be implemented. In 2016 there were three Bachelor students working in the bank.  |

| <b>Results of the test of the layer education and employee pool</b> |  |  |
|---|--|--|
| <u>Factor</u>   | <u>Metric</u>  | <u>Findings</u>  |
| Staff potential within an organization                              | Employee performance management system (goal-setting, monitoring and evaluation)                     | System is in place and is used in all parts and departments of the organisation.   |
| Staff potential within an organization                              | IT vacancies in company  | The company has three vacancies in the IT-department (SAP CML programmer)  |
| Staff potential within an organization                              | Age distribution analysis  | The average age of the employees is 45. The company has approximately 575 employees  |
| Staff potential within an organization                              | Existence of female integration and leadership programs  | There is a female leadership program for the whole bank in place, but no concrete measures for the IT-department are agreed on. The measures will be developed in 2017 |
| Employee fluctuation  | Retention rate   | The retention rate in the IT-department is 2.  |
| Strategy for corporate education and development                    | Existence, development and yearly evaluation of educational strategy and life-long learning programs | A strategy is existing, that covers all relevant aspects of the companies' strategy including support of Bachelor and Master students.                                 |
| Strategy for corporate education and development                    | Gap analysis between existing and targeted skills of employees                                       | No analysis conducted so far but will be implemented.  |

| <b>Results of the test of the layer education and employee pool</b> |  |   |
|---|--|---|
| <u>Factor</u>   | <u>Metric</u>  | <u>Findings</u>   |
| Knowledge management  | Existence of knowledge management/transfer initiative/system | A knowledge management system is in place (MS-SharePoint) |

Table 62: Results of the test of the layer education and employee pool

- Psychological healthiness

| <b>Results of the test of the layer 3 psychological healthiness of the employees</b> |  |  |
|--|--|--|
| <u>Factor</u>  | <u>Metric</u>  | <u>Findings</u>  |
| Company Culture  | Company culture compiled via employee survey           | An employee survey is conducted every year which assess the actual state of the culture.   |
| Company Culture  | Hierarchical structure and organizational permeability | The bank has three hierarchical levels which is adequate for this kind of organisation.  |
| Employee satisfaction  | Employee expectations compiled via employee survey     | An employee survey is conducted every year which assesses the expectations of the employees.   |
| Employee satisfaction  | Existence of employee wellbeing programs               | Programs like this don't exist and will not be implemented as of right now. Other measures will be implemented to improve the current situation. |

| <b>Results of the test of the layer 3 psychological healthiness of the employees</b> |  |   |
|--|--|---|
| <u>Factor</u>  | <u>Metric</u>  | <u>Findings</u>   |
| Psychological induced illness  | Psychologically induced Sick days of employees/ timeframe                                | No analysis conducted so far and will not be implemented due to the protection of privacy data.   |
| Psychological pressure   | Rate of change in used technology/timeframe and time of adoption                         | The bank has one major release every year which is normal for a bank.   |
| Psychological pressure   | Job complexity (e.g. variety of working fields per employee and number of waiting tasks) | No analysis conducted so far but will be implemented.   |
| Psychological pressure   | IT misuse and security policy breaches in the workplace                                  | No analysis conducted so far but will be implemented.   |
| Psychological pressure   | Reported incidents of workplace violence, mobbing and bullying                           | No analysis conducted so far and will not be implemented due to the protection of privacy data. An anonymous analysis is in discussion with the worker's union. |
| Psychological pressure   | Job (in)security: status of employment contracts used in an organization                 | The company is not using temporary contracts for their employees  |
| Loneliness   | Work environment and office design which supports  | There is an actual concept for the workplace design which was implemented 13 years ago. The concept should be updated with the                                  |

| <b>Results of the test of the layer 3 psychological healthiness of the employees</b> |  |  |
|--|--|--|
| <u>Factor</u>  | <u>Metric</u>                                      | <u>Findings</u>                                |
|  | employee networking determined via employee survey | newest findings and developments, if possible. |

Table 63: Results of the test of the layer 3 psychological healthiness of the employees

- Physiological healthiness

| <b>Results of the test of the layer 4 physiological healthiness of the employees</b> |  |   |
|--|--|---|
| <u>Factor</u>  | <u>Metric</u>  | <u>Findings</u>   |
| Physiological healthiness and workplace design                                       | Implementation of proper security policies like EU directive 89/391, DIN 4543-1 or existence of workplace design plan which supports physiological healthiness | Since the bank is a half public company, measures are in place due to governmental regulations.                   |
| Job organization   | High level of flexibility in the work organization and allocation of employees via job rotation, job enlargement, job enrichment                               | There is no actual concept in place for the IT-department. A development of a concept could be conducted in 2018. |

Table 64: Results of the test of the layer 4 physiological healthiness of the employees

- Work life balance

| <b>Results of the test of the layer 5 work life balance</b> |                           |  |
|---|---------------------------|--|
| <u>Factor</u>   | <u>Metric</u>             | <u>Findings</u>  |
| Compatibility of job and family                             | Work-life/family policies | Policies are implemented to help especially young parents to arrange family-and work-life. |

| <b>Results of the test of the layer 5 work life balance</b> |   |   |
|---|---|---|
| <u>Factor</u>   | <u>Metric</u>   | <u>Findings</u>   |
| Compatibility of job and family                             | Financial costs/benefits of company in the context of work-life balance | No analysis conducted so far and will not be implemented due to the complexity of the investigation.            |
| Work organization and working time models                   | Innovative working (time) models  | The company offers part-time employment, home-office and telework. Also, working-time accounts are implemented. |
| Workload of employees                                       | Availability of employees   | No analysis conducted so far and will not be implemented due to the protection of privacy data.                 |
| Workload of employees                                       | Working time per timeframe  | Analysis showed that the working time is at a normal rate of eight hours a day.                                 |

Table 65: Results of the test of the layer 5 work-life-balance

3. *Phase III: Derivation of measures and implementation of controlling mechanisms*

The results of the analysis with the help of the framework created a wide range of points for further discussions with the bank. Overall and in comparison, to their peers, the bank is in good shape regarding their HR-strategies with reference to the upcoming demographic change. Several measures are already in place or will be implemented in the near future, like innovative working models or plenty of possibilities for the education of employees.

Nevertheless, there are some opportunities for the bank to raise the productivity and loyalty of their employees and to gain popularity for possible applicants.

| <b>Identified measures during the test phase</b>   |   |  |
|--|---|--|
| <u>Factor</u>                                      | <u>Metric</u>                               | <u>Measures</u>  |
| Process costs and duration                         | Evaluation of throughput time and lead time | With the use of MS-Share-Point and their fully functioning SAP core banking system, an evaluation of throughput time and lead time is possible and should be implemented to measure actual results and future performances.  |
| Identification of vacancies within an organization | Employee requirements analysis              | The employee requirements for the IT-department in the current state is transparent. For a deeper analysis, the data of the actual state should be connected with the age distribution analysis. This allows the company to gain deeper knowledge about their employees. Especially, to predict future developments and risks. |
| Staff potential within an organization             | Employee potential analysis                 | Although there is an employee-performance-management-system in place, there is no analysis to identify and develop high potentials in the organisation.  |



| <b>Identified measures during the test phase</b> |  |  |
|--|--|--|
| <u>Factor</u>                                    | <u>Metric</u>  | <u>Measures</u>  |
| Staff potential within an organization           | Existence of female integration and leadership programs                                  | The bank should develop a concept for a program to develop and promote women within the IT-department. This includes the promotion of the IT-department and the company in general to recruit more women.                |
| Strategy for corporate education and development | Gap analysis between existing and targeted skills of employees                           | Although there is a strategy for corporate education and development in place, there is no detailed analysis for the future state. This analysis should be implemented at least in for the success critical departments. |
| Company Culture                                  | Company culture compiled via employee survey   | There is already a yearly employee survey in place. Nevertheless, the results should be analysed with regards to age and department to achieve a more detailed view.   |
| Psychological pressure                           | Job complexity (e.g. variety of working fields per employee and number of waiting tasks) | The complexity of the different working fields is not assessed yet. The challenge is the effort in time and money that the company   |

| <b>Identified measures during the test phase</b> |  |  |
|--|--|--|
| <u>Factor</u>                                    | <u>Metric</u>  | <u>Measures</u>  |
|  |  | has to put into the realisation of such kind of analysis.  |
| Psychological pressure                           | IT misuse and security policy breaches in the workplace  | There should be an analysis, conducted by the IT-security officer. Therefore, incidents that fit this category should be identified and counted over a certain period of time. The main challenge for that is, that managers and employees report these incidents. |
| Psychological pressure                           | Reported incidents of Workplace violence, mobbing and bullying   | The analysis that should be conducted is similar to the analysis for the metric <i>IT misuse and security policy breaches in the workplace</i> , but should be located in the HR-department. Again, the challenge here is the reporting of incidents.              |
| Job organization                                 | High level of flexibility in the work organization and allocation of employees via job rotation, job enlargement, job enrichment | There is no actual concept for the flexibility in the organisation of work, but the company should develop one. The advantages are obvious, especially in times of scarcity of talent.   |

| <b>Identified measures during the test phase</b> |                                  |   |
|--|----------------------------------|---|
| <u>Factor</u>                                    | <u>Metric</u>                    | <u>Measures</u>   |
|  |                                  | These concepts allow employees to obtain knowledge in different fields, which allows for flexible assignments in times of capacity peaks.   |
| Work organization and working time models        | Innovative working (time) models | Besides the mentioned working (time) models that are already in place, there are several opportunities to organize the company in a different and possibly better way. As stated before, the bank is rather conservative, especially because of the high average age of the employees. So a cultural shift is necessary to shift to models like trust-based working time and a flexible work schedule which benefits especially younger labour. |
| Workload of employees                            | Availability of employees        | This point is especially important for employees receiving payment over and above standard salary because employees under a collective bargaining agreement have fixed  |

| Identified measures during the test phase |               |  |
|---|---------------|--|
| <u>Factor</u>                             | <u>Metric</u> | <u>Measures</u>  |
|   |               | working hours. There has to be an analysis about the availability of managers in the company (via E-mails etc.). Privacy of data has to be considered. |

Table 66: Identified measures during the test phase

The tests show several possible measures that could be implemented in a short-term or in a long term. In the next months, the company will evaluate the results and suggested measures regarding their feasibility and possible costs for the implementation.

Besides the measures, it is very important to implement controlling measures similar to those that are stated in earlier chapters. Without those, it will be very hard to identify if measures were successful.

### Revisiting research questions

For this test, one overall research question was formulated.

*RQ: Is the Five-layer framework for managing scarce resources a usable approach for companies to raise transparency for the management of their personnel in times of demographic change and scarcity of talent?*

The test has shown, that the answer to this research question is positive. The *Five-layer framework for employee productivity* is a usable approach for companies to raise transparency for the management of their personnel in times of demographic change and scarcity of talent. The test has shown, that the framework works very well and it achieves all the previous stated goals. These goals are to raise transparency about possible problems, risks and achievements of the HR-strategies and policies to ultimately promote the productivity of the employees.

What became apparent during the test phase is, that the five layers are working in the same way as the areas quality, time and costs in the project management triangle. Which means, that if one part is fix and cannot be changed, like the layer *baseline wages* in this case, one or more layers have to compensate for that. Discussions with employees have shown, that

they would accept a lower salary and stay in a company, if the company offered other benefits in education, flexibility of work and work-life balance.

Besides that, the company is in good shape. It has already acknowledged the problem and the need for organisational changes. Several different measures are already in place to promote loyalty of employees. For instance, temporary contracts for their employees are not in use and will not be in the future and job security in general is a top priority for the whole company. Although the company has implemented several measures, at sometimes these measures can contradict the happiness and productivity of the employees. The company has implemented several restrictions regarding the working time. Employees must follow these restrictions independently from their actual work or schedule. This leads to interruptions of meetings or important work packages can't be finished because they have to take a break e.g. of one hour. In the workshops, the participants always questioned the derived measures if they contradict other factors or the overall productivity of the company.

### Discussion of results

In total, twelve measures could be identified. The distribution of these measures for every layer is stated in the following table.

| Layer  | short-term | mid-term | long-term |
|--|------------|----------|-----------|
| Results of the test of the layer 1: baseline wages                             | -          | -        | -         |
| Results of the test of the layer 2: education and employee pool                | 2          | 3        | -         |
| Results of the test of the layer 3: psychological healthiness of the employees | 1          | 3        | -         |
| Results of the test of the layer 4: physiological healthiness of the employees | -          | -        | 2         |
| Results of the test of the layer 5: work life balance                          | -          | 1        | -         |

Table 67: Summary of measures and timescale for implementation

These twelve measures are separated in three categories regarding their development and implementation.

- Short-term: The development and implementation will start as soon as possible and will be finished in the next three months.
- Mid-term: The development and implementation will start in approximately three months and will be finished in the next twelve months.

- Long-term: The development and implementation will start in approximately twelve months and will be finished in the next 24 months or the development and implementation can't be planned yet.

In total, measures for three metrics couldn't be derived because of possible breaches of the privacy of personal data.

|   | Factor                        | Metric  |
|---|-------------------------------|---|
| 1 | Psychological induced illness | Psychologically induced Sick days of employees/<br>timeframe      |
| 2 | Psychological pressure        | Reported incidents of workplace violence, mobbing<br>and bullying |
| 3 | Workload of employees         | Availability of employees   |

Table 68: Metrics that conflicted with privacy of personal data

Since it is not necessary to use personal data for these analyses, negotiations with the worker's council will follow up to this project. According to the involved managers, there is a chance to use this data in the future. As lessons learned for this project, the following issues need to be considered. First of all, the company has to be aware of the problem of demographic change and different expectations of generations of the workforce. Secondly, the ability to change is highly dependent on the willingness of the organisation, its employees and the executives to promote and implement change. That was the case in this test-situation, but if this mind-set is missing and the company is not aware of the situation and the associated risks, a project like this could fail (Wander, 2013). Besides that, it is also necessary that the company emphasizes the value that the IT-department offers to the overall productivity of the company (Zardini et al., 2015).

As described earlier, the way that people work is changing in a rapid way from a separation of work and private life, to a connection and a balance of these elements. Besides several other differences, young generations see work and private life as a flow and not as separate areas (Iorgulescu, 2016). Every company has to take this circumstance into account but especially the tested company. Because of the high age average of the employees (45 years) the cultural differences between the working generations are very high, as stated previously in the literature (Low, Bordia, & Bordia, 2016; Wright, 2016). This can lead to significant challenges when implementing new models of work that contradict the way of work of other

generations. Nevertheless, changes need to be implemented, rather sooner than later. These changes have to be realized when the employees of younger generations outweigh the number of employees of the older generations. This moment can arise, when the generation of baby-boomers will retire in five to seven years (Oladapo, 2014).

This need for change is putting a lot of pressure on all organizations to successfully maintain or increase their competitiveness. That is especially true for the IT-departments in the banking and financial sector (Vrecko, Barilovic, & Bozicev, 2015). This test has shown that the framework worked very well under these real-life conditions. It provided valuable insights to the executives concerning possible threats and risks regarding their employees and overall productivity of the company.

***Customization and finalization of the framework***

After the successful test of the framework, several adjustments and additions to the framework had to be made. For example, several metrics needed to be added after the qualitative validation with the experts. The practical test showed no further need for changes or modifications. Although the effort to calculate some of the metrics is high, but they are needed to gain a full picture of the actual state of the company. The following tables show the final factors and metrics of the framework after the test period.

| <b>Layer 1 baseline wages – final factors and metrics</b> |  |
|---|--|
| <u>Factor</u>   | <u>Metric</u>  |
| Labour costs  | Earnings per employee/timeframe after tax                              |
| Labour costs  | Earnings per employee/timeframe after tax/incl. incentives             |
| Labour costs  | Labour costs per unit or price/unit labour cost ratio pre-tax          |
| Labour costs  | Future growth of labour costs pre-taxes                                |
| Geographic payment differences                            | Comparison of indirect labour costs in EU                              |
| Wage inequality   | Gender pay gap   |
| Wage inequality   | Earnings per IT-employee in average to other departments after tax     |
| Wage inequality   | Earnings per IT-employee in average to other (IT-) companies after tax |

Table 69: Layer 1 baseline wages – final factors and metrics

| <b>Layer 2 education and employee pool – final factors and metrics</b> |   |
|--|---|
| <u>Factor</u>  | <u>Metric</u>   |
| Employee performance   | Real output (gross value added) divided by the total number of persons employed |
| Employee performance   | Technical infrastructure of the workplace                                       |



| <b>Layer 2 education and employee pool – final factors and metrics</b> |  |
|--|--|
| <u>Factor</u>  | <u>Metric</u>  |
| Process costs and duration   | Evaluation of throughput time and lead time  |
| Investment in employee education                                       | Expenditure for education of company or department   |
| Investment in employee education                                       | Number of employees in training per year   |
| Identification of vacancies within an organization                     | Employee requirements analysis   |
| Staff potential within an organization                                 | Employee potential analysis  |
| Staff potential within an organization                                 | Employee performance management system (goal-setting, monitoring and evaluation)   |
| Staff potential within an organization                                 | IT vacancies in company  |
| Staff potential within an organization                                 | Age distribution analysis  |
| Staff potential within an organization                                 | Existence of female integration and leadership programs  |
| Staff potential within an organization                                 | Assessment and calculation of the variance of needed profiles due to the changes of digitalization and newly digitized processes |
| Employee fluctuation   | Retention rate   |
| Strategy for corporate education and development                       | Existence, development and yearly evaluation of educational strategy and lifelong learning programs                              |
| Strategy for corporate education and development                       | Gap analysis between existing and targeted skills of employees   |

| <b>Layer 2 education and employee pool – final factors and metrics</b> |  |
|--|--|
| <u>Factor</u>  | <u>Metric</u>  |
| Knowledge management   | Existence of knowledge management/transfer initiative/system |

Table 70: Layer 2 education and employee pool – final factors and metrics

| <b>Layer 3 physiological healthiness – final factors and metrics</b> |   |
|--|---|
| <u>Factor</u>  | <u>Metric</u>   |
| Company Culture  | Company culture compiled via employee survey  |
| Company Culture  | Hierarchical structure and organizational permeability  |
| Employee satisfaction  | Employee expectations compiled via employee survey  |
| Employee satisfaction  | Existence of employee wellbeing programs  |
| Psychological induced illness  | Psychologically induced Sick days of employees/<br>timeframe  |
| Psychological pressure   | Rate of change in used technology/timeframe and time<br>of adoption                                     |
| Psychological pressure   | Job complexity (e.g. variety of working fields per em-<br>ployee and number of waiting tasks)           |
| Psychological pressure   | IT misuse and security policy breaches in the workplace   |
| Psychological pressure   | Reported incidents of Workplace violence, mobbing and<br>bullying                                       |
| Psychological pressure   | Job (in)security: status of employment contracts used in<br>an organization                             |
| Loneliness   | Work environment and office design which supports<br>employee networking determined via employee survey |

Table 71: Layer 3 physiological healthiness – final factors and metrics

| <b>Layer 4 psychological healthiness – final factors and metrics</b> |  |
|--|--|
| <u>Factor</u>  | <u>Metric</u>  |
| Physiological healthiness and workplace design                       | Implementation of proper security policies like EU directive 89/391, DIN 4543-1 or existence of workplace design plan which supports psychological healthiness |
| Physiological healthiness and workplace design                       | Physiological induced Sick days of employees/ timeframe  |
| Job organization   | High level of flexibility in the work organization and allocation of employees via job rotation, job enlargement, job enrichment                               |

Table 72: Layer 4 psychological healthiness – final factors and metrics

| <b>Layer 5 work-life balance – final factors and metrics</b> |   |
|--|---|
| <u>Factor</u>  | <u>Metric</u>   |
| Compatibility of job and family                              | Work-life/family policies   |
| Compatibility of job and family                              | Financial costs/benefits of company in the context of work-life balance |
| Work organization and working time models                    | Innovative working (time) models  |
| Workload of employees  | Availability of employees   |
| Workload of employees  | Working time per timeframe  |
| Loyalty of employees   | CSR activities in a timeframe   |

Table 73: Layer 5 work-life balance – final factors and metrics

In total, the framework in its final version consists of five layers and several underlying factors and metrics. The total numbers are shown in the following table.

| Layer                            | Number of factors | Number of metrics |
|----------------------------------|-------------------|-------------------|
| Baseline wages                   | 3                 | 8                 |
| Education and untapped potential | 8                 | 16                |

| Layer                     | Number of factors | Number of metrics |
|---------------------------|-------------------|-------------------|
| Psychological healthiness | 5                 | 11                |
| Physiological healthiness | 2                 | 3                 |
| Work-life balance         | 4                 | 6                 |
| <b>Sum</b>                | <b>22</b>         | <b>44</b>         |

Table 74: Number of factors and metrics of the final version of the framework

During the test phase in total four metrics were added to the initial version of the framework. Two metrics were added to the layer education and employee pool, one metric in the layer physiological healthiness and one metric in the layer work-life-balance. These are the metrics that were added after the test phase.

- Layer: Education and employee pool; factor: Employee performance; metric: Technical infrastructure of the workplace
- Layer: Education and employee pool; factor: staff potential within the organisation; metric: Assessment and calculation of the variance of needed profiles due to the changes of digitalization and newly digitized processes
- Layer: Physiological healthiness; factor: Physiological healthiness and workplace design; metric: Physiological induced Sick days of employees/timeframe
- Layer: Work-life balance; factor: Loyalty of employees; metric: CSR activities in a timeframe

In total the number of metrics changed from 40 to 44 which is a raise of 10%. The number of factors has not changed after the test. All three tests confirmed, that the number of factors is sufficient.

## **8. The use of the 5-layer framework for employee productivity – a view from different roles in an organisation**

One of the most important parts of Human Resource management is continuity (Ghinea & Moroianu, 2016). Measures and activities regarding the recruiting and development of employees are ongoing activities, which in best case are implemented in the business as usual processes of an organization. Continuity allows companies also to secure the results and improvements which are gained and achieved with the help of the Five-layer framework of employee productivity (Bruns, 2014). These results need to be also transferred into the existing business as usual processes of the organization (K. H. Rose & Gladden, 2015).

In the following chapter, the use of the framework is described from the viewpoint of different stakeholders and from the perspective of employees which are mostly influenced by the framework as identified in chapter six and seven. These groups of persons or employees are:

- CEO and/or CIO,
- IT-front line manager,
- IT-employees and
- HR-department.

### ***The role of the CEO and or CIO***

The Chief Executive Officer (CEO) is responsible for leading the development and execution of the company's long term strategy with a focus on creating shareholder value. The CEO's leadership role also involves being ultimately accountable for all day-to-day management decisions and for implementing the company's long and short-term goals. The CEO acts as a direct link between the board and management of the company, and communicates to the board on behalf of the management. The CEO also communicates on behalf of the company to shareholders, employees, government authorities, other stakeholders and the public.

As information technology became more and more important to industries and companies, CIOs are seen as key contributors to expressing strategic goals and implement measures to achieve them. A significant component of the CIO role is to educate executive management and employees on the business value and risks, IT systems hold for an organization (Shao, Wang, & Feng, 2016).

To gain and generate business value, CIOs must understand and quickly respond to a number of market forces, including innovations in technology, disruptive technology and a client base that expects to do business across all channels (Paz, 2017). The increasingly rapid pace of technology change, about extensive customer adoption of digital technologies, such as social media, mobile devices and cloud computing, have forced CIOs and their enterprises to rethink the role IT plays in nearly every aspect of the business - from operational efficiency to employee productivity to client service to business goals.

The test has shown, that the proposed framework can be a very powerful tool for a company. But it can only unfold its power if it is implemented in the relevant processes and is aligned to the company's strategy. The strategy alignment focusses on the relationship of the different functions of a company with the goal, that they adapt their strategy together, in a cohesive way. The CIO has the responsibility that the goals of the IT-department are aligned and support the strategy of the whole company (Luftman, 2000). The CEO has to oversee and secure the execution of the strategy by all departments.

The central pillar to achieve business goals are the employees of the company (Hakimian, Farid, Ismail, & Nair, 2016). After the CEO sets the strategic guidelines for the development of the company, one part of the duties of the CIO is to calculate the needed resources to achieve these goals. It is important to note, that in this case the pure number of FTEs (full time equivalents) is not a sufficient number, because several other variables need to be considered. These variables are e.g. development of wages, education of employees in a timeframe, the related increase of productivity or possible retention rates.

Since the operational planning is part of the job description of the front-line managers<sup>10</sup> Members of the top management can use the framework to identify and interpret fundamental indexes regarding the productivity of employees. The following factors and metrics are derived from the earlier stated activities and tasks of an executive of a company and are also supported by the findings of the author during the test phase of the framework in chapter 7.3.

| <b>Factors and metrics of the 5-layer framework for top management</b> |   |
|--|---|
| <u>Factor</u>  | <u>Metric</u>                             |
| Labour costs   | Earnings per employee/timeframe after tax |

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<sup>10</sup> The first or second level managers (line managers, office managers, supervisors) directly responsible for production of goods and services, and supervision of clerical staff and shop floor employees.

The use of the 5-layer framework for employee productivity for employee productivity - a view from different roles in an organization

| <b>Factors and metrics of the 5-layer framework for top management</b> |   |
|--|---|
| Labour costs   | Earnings per employee/timeframe after tax/incl. incentives  |
| Labour costs   | Labour costs per unit or price/unit labour cost ratio pre-tax                                       |
| Labour costs   | Future growth of labour costs pre-taxes   |
| Geographic payment differences   | Comparison of indirect labour costs in EU   |
| Wage inequality  | Gender pay gap  |
| Wage inequality  | Earnings per IT-employee in average to other (IT-) companies after tax                              |
| Process costs and -duration  | Evaluation of throughput time and lead time   |
| Investment in employee education                                       | Expenditure for education of company or department  |
| Investment in employee education                                       | Number of employees in training per year  |
| Staff potential within an organization                                 | Age distribution analysis   |
| Staff potential within an organization                                 | Existence of female integration and leadership programs   |
| Employee fluctuation   | Retention rate  |
| Strategy for corporate education and development                       | Existence, development and yearly evaluation of educational strategy and lifelong learning programs |
| Strategy for corporate education and development                       | Gap analysis between existing and targeted skills of employees                                      |
| Company Culture  | Company culture compiled via employee survey  |
| Psychological induced illness  | Psychologically induced Sick days of employees/timeframe  |
| Psychological pressure   | Job (in)security: status of used employment contracts in an organization                            |
| Workload of employees  | Working time per timeframe  |
| Compatibility of job and family  | Financial costs/benefits of company in the context of work-life Balance                             |

Table 75: Factors and metrics of the 5-layer framework for top management

It is worth mentioning, that these factors and metrics are suggestions. The hierarchical structure differs in every company. Therefore, top management can be more or less interested in the operational activities and consequentially need to have additional and more detailed numbers and calculations.

***The role of the IT-front line manager***

As previously mentioned, front line managers are the first or second level managers (line managers, office managers, supervisors) directly responsible for production of goods and services and the supervision of the employees. These managers are also responsible to transfer the cultural values and ideas of the company and lead them in a way that there is a cordial work atmosphere which empowers the staff to work in the best possible way. Typically, the responsibilities carried out by front-line managers are (Metz, Sökmen, & Biyik, 2016; Roses, Brito, & Filho, 2015):

- day-to-day employee management,
- the management of operational costs,
- measuring operational performance and
- identifying and implementing measures for the optimization of performance,
- providing technical expertise,
- allocating work and tasks,
- monitoring work and assuring the needed quality,
- dealing with customers/clients or other departments,
- recruiting and development of the staff with training measures.

Also, they need to provide numbers and suggestions based on these activities for the top management of a company. The following factors and metrics are derived from the earlier state activities and tasks of a front-line manager of a company and are also supported by the findings of the author during the test phase of the framework in chapter 7.3.

| <b>Factors and metrics of the 5-layer framework for front line managers</b> |   |
|---|---|
| <u>Factor</u>   | <u>Metric</u>   |
| Labour costs  | Earnings per employee/timeframe after tax                     |
| Labour costs  | Labour costs per unit or price/unit labour cost ratio pre-tax |
| Wage inequality   | Gender pay gap  |



The use of the 5-layer framework for employee productivity for employee productivity - a view from different roles in an organization

| <b>Factors and metrics of the 5-layer framework for front line managers</b> |  |
|---|--|
| Wage inequality   | Earnings per IT-employee in average to other (IT-) companies after tax   |
| Employee performance  | Real output (gross value added) divided by the total number of persons employed  |
| Employee performance  | Technical infrastructure of the workplace  |
| Process costs and -duration   | Evaluation of throughput time and lead time  |
| Investment in employee education  | Number of employees in training per year   |
| Identification of vacancies within an organization                          | Employee requirements analysis   |
| Staff potential within an organization                                      | Employee potential analysis  |
| Staff potential within an organization                                      | IT vacancies in company  |
| Staff potential within an organization                                      | Assessment and calculation of the variance of needed profiles due to the changes of digitalization and newly digitized processes |
| Employee satisfaction   | Employee expectations compiled via employee survey   |
| Psychological pressure  | Rate of change in used technology/timeframe and time of adoption   |
| Psychological pressure  | Job complexity (e.g. variety of working fields per employee and number of waiting tasks)   |
| Psychological pressure  | IT misuse and security policy breaches in the workplace  |
| Psychological pressure  | Reported incidents of Workplace violence, mobbing and bullying   |
| Knowledge management  | Existence of knowledge management/ transfer initiative/system  |
| Job organization  | High level of flexibility in the work organization and allocation of employees via job rotation, job enlargement, job enrichment |
| Workload of employees   | Availability of employees  |
| Workload of employees   | Working time per timeframe   |
| Loyalty of employees  | CSR activities in a timeframe  |

Table 76: Factors and metrics of the 5-layer framework for front line managers

### ***The role of the HR-department***

The HR-department plays a significant role in today's businesses. Especially with consideration of the demographic change and the need to retain and recruit more employees than before (Eurostat, 2014b).

Discrimination, harassment, unfair practices - these terms have become all too familiar in today's workplaces. Human Resources can help protect a growing company by developing and enforcing standards that govern how employees interact on the job. These guidelines, supported by company-wide training on appropriate workplace behaviour, can help protect the company from legal liability and help create a more pleasant and productive workplace (Carden & Boyd, 2014; Kuncze & Meyer, 2014).

In a fast-paced business environment, people are more important than job descriptions. Organizations may find an employee's role changing from week to week, if not day to day. The HR department can take on the challenge of providing employees with the new information and skills they will need to thrive as the organization changes. The department can also help the staff to set and achieve individual career development goals, leading to increased job satisfaction as workers see opportunities for personal success.

Besides that, one of the most important tasks of the HR-department is evaluating human resource management methods and measuring their results. All HRM programs are pretty much worthless without a proper controlling of the results, figures and outcomes. For the proposed framework, it is meaningful to use the DMAIC (define, measure, analyse, improve, control) cycle. The purpose of the DMAIC cycle is to assess a problem in a structured way, develop an understanding of the existing processes and what affects the outcomes of the defined measures. The goal is to develop and implement measures and solutions to close the earlier identified gaps.

The process owner of the framework should be the HR-department. It has the responsibility for the performance and the execution of the use of the framework. Also, they should have the authority and ability to make necessary changes and gather suggestions for improvements.

To achieve a proper controlling of the implemented measures, it is reasonable to use a tool like excel or a database which allows a tracking of several periods. The use tool also raises

The use of the 5-layer framework for employee productivity for employee productivity - a view from different roles in an organization

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transparency and needed data, e.g. for board members, can be retrieved fast and secure. The technical ownership lies in the IT-department.

The following factors and metrics are derived from the earlier state activities and tasks of the HR-department of a company and are also supported by the findings of the author during the test phase of the framework in chapter 7.3.

| <b>Factors and metrics of the 5-layer framework for the HR-department</b> |   |
|---|---|
| <u>Factor</u>   | <u>Metric</u>   |
| Labour costs  | Earnings per employee/timeframe after tax   |
| Labour costs  | Earnings per employee/timeframe after tax/incl. incentives  |
| Wage inequality   | Gender pay gap  |
| Wage inequality   | Earnings per IT-employee in average to other departments after tax                                  |
| Wage inequality   | Earnings per IT-employee in average to other (IT-) companies after tax                              |
| Investment in employee education  | Expenditure for education of company or department  |
| Investment in employee education  | Number of employees in training per year  |
| Identification of vacancies within an organization                        | Employee requirements analysis  |
| Staff potential within an organization                                    | Age distribution analysis   |
| Staff potential within an organization                                    | Existence of female integration and leadership programs   |
| Employee fluctuation  | Retention rate  |
| Strategy for corporate education and development                          | Existence, development and yearly evaluation of educational strategy and lifelong learning programs |
| Strategy for corporate education and development                          | Gap analysis between existing and targeted skills of employees                                      |
| Company Culture   | Company culture compiled via employee survey  |
| Company Culture   | Hierarchical structure and organizational permeability  |

| <b>Factors and metrics of the 5-layer framework for the HR-department</b> |  |
|---|--|
| Employee satisfaction   | Existence of employee wellbeing programs   |
| Psychological induced illness   | Psychologically induced Sick days of employees/ timeframe  |
| Psychological pressure  | Reported incidents of Workplace violence, mobbing and bullying   |
| Psychological pressure  | Job (in)security: status of used employment contracts in an organization   |
| Loneliness  | Work environment and office design which supports employee networking determined via employee survey   |
| Physiological healthiness and workplace design                            | Implementation of proper security policies like EU directive 89/391, DIN 4543-1 or existence of workplace design plan which supports psychological healthiness |
| Compatibility of job and family   | Work-life/ family policies   |
| Work organization and working time models                                 | Innovative working (time) models   |
| Workload of employees   | Working time per timeframe   |

Table 77: Factors and metrics of the 5-layer framework for the HR-department

Since every organization is different, these factors and metrics are also just suggestions and might need to be customized.

### ***The role of IT-employees***

The role of the staff is very important for the success of the proposed framework. Since the framework offers a quantified approach to assess the actual state and the strategies of staff related policies, the participation of employees is indispensable.

The participation is especially needed when employee surveys are carried out. Often, the number of participants is very low and the results cannot be used for the deduction of measures to improve the performance or the work environment of the employees (de Waal, 2014). Leadership has also great responsibility, especially after the survey was carried out. If the results imply, that changes are necessary, measures need to be implemented to change

the actual situation. Otherwise employees will not attend later surveys or will not take them and/or the leading personnel seriously (Pritchard, 2014).

Another important part is related to psychological pressure and psychological diseases. Mobbing is a relatively new concept for behavioural scientists, which is shown in the form of unfriendly behaviour of employees at the workplace. The term mobbing is often used as synonym for the term bullying (Qureshi et al., 2013). It is also worth to note, that research shows that there has been no significant difference in the mobbing perceptions of employees in terms of gender, age, educational level, length of service or job group/position. Mobbing perceptions don't vary by any distinctive group with certain demographic characteristics and kind of jobs (Özşahin, Zehir, Yıldırım, & Uysaloglu, 2012).

Beside the framework, it is very important that companies have policies in place that prevent and manage cases of bullying in a proper way, since this behaviour has immediate impact on the performance of an employee and on the culture of a company in whole (Bryant, Buttigieg, & Hanley, 2009).

The following factors and metrics are derived from the findings of the test phase of the framework in chapter 7.3. The objective is, to identify the relevant parts of the framework which require the immediate collaboration of employees.

| <b>Factors and metrics of the 5-layer framework which require the collaboration of employees</b> |   |
|--|---|
| <u>Factor</u>  | <u>Metric</u>   |
| Strategy for corporate education and development   | Existence, development and yearly evaluation of educational strategy and lifelong learning programs |
| Company Culture  | Company culture compiled via employee survey  |
| Employee satisfaction  | Employee expectations compiled via employee survey  |
| Psychological induced illness  | Psychologically induced Sick days of employees/ timeframe   |
| Psychological pressure   | Job complexity (e.g. variety of working fields per employee and number of waiting tasks)            |
| Psychological pressure   | IT misuse and security policy breaches in the workplace   |

| <b>Factors and metrics of the 5-layer framework which require the collaboration of employees</b> |  |
|--|--|
| Psychological pressure   | Reported incidents of Workplace violence, mobbing and bullying                                       |
| Physiological healthiness and workplace design   | Physiological induced Sick days of employees/ timeframe  |
| Loneliness   | Work environment and office design which supports employee networking determined via employee survey |
| Workload of employees  | Availability of employees  |
| Workload of employees  | Working time per timeframe   |

Table 78: Factors and metrics of the 5-layer framework which require the collaboration of employees

Since every organization is different, these factors and metrics are also just suggestions and might need to be customized.

### ***Concluding remarks***

A company will only achieve the best results with the framework, when every part of the organization delivers inputs and results. High quality and usable data is the key for success. This became especially apparent during the test of the framework under real life conditions as described in chapter 7.3. The company already had a very good foundation of HR-relevant data that the project could use. Because of that, the project team had the opportunity to focus solely on the identification of possible threats on productivity and the development of corresponding counter-measures to these threats. Also, the involvement of different parts of the organisation secured a high standard of quality regarding the measures derived from the framework.

As equal important as the involvement of all parts of the organisation is the involvement of the leaders of the company or the leaders of the department. They have to encourage the employees and communicate, that the framework is a tool that can help the organisation and can also help the employees to have a better productivity and a better working environment.

Besides the actual day-to-day work, executives need to have a clear vision of the company in the future. To develop this vision, the framework offers the presented factors to executives. These mentioned factors relate directly to the field of work on an executive (Abernethy

et al., 2015; Bock, Opsahl, George, & Gann, 2012; Connelly, Haynes, Tihanyi, Gamache, & Devers, 2016; O'Reilly, Caldwell, Chatman, & Doerr, 2014).

The involvement of the other parties in the use of the framework is described in the same way. This involvement is also backed by similar research (Clifford, 2016; Ebner, Mueller, Urbach, Riempp, & Krcmar, 2016; Eom, 2015; Mete et al., 2016; Trullen, Stirpe, Bonache, & Valverde, 2016). Together with the results from the test phase, this shows, that all parts of an organisation need to work together to solve the actual and upcoming problems regarding the demographic change, changing expectations of employees and the scarcity of resources. During the application of the framework the principal lessons learned was, that the company needs to have the willingness to change their actual ways of work and encourage the employees to articulate risks and weaknesses to translate them into possible chances and strengths.

## **9. Research objectives revisited, limitations and final remarks**

In the first chapter of this document it was described the goal of this PhD thesis. The goal and novelty was to align different measures to gain productivity within the organization and the employees in times of scarcity of talent. The developed framework should provide companies with a step by step work plan and a holistic approach for an optimization of the organization. The main research contributions are focused on filling the gap between organizational and employee development with concurrent measures for the binding of personnel. In the following parts, these goals will be revisited and evaluated for their success.

### ***Research objectives revisited***

At the beginning of this project, several hypotheses were developed. These hypotheses are as follows:

- H<sub>1</sub>: The skills shortage will affect the productivity of employees in every part of the organisation and in particular in information technologies.
- H<sub>2</sub>: Without a significant change in HR-policies, companies will not have the power to retain talented employees in times of scarcity of talent.
- H<sub>3</sub>: The expectations employees have regarding their work life differ vastly in regards to their age and gender.
- H<sub>4</sub>: The raise in psychological diseases needs to be addressed by the companies with the help of different working models and an adjustment in their leadership philosophy to keep their employees healthy.

To test these hypothesis, several research questions were developed. In the following part, the performed research and its results will be assessed by answering the stated questions and by aligning the results with the main goal of this research.

### ***Research objects***

1. *Identification of the psychological and physiological needs of the different workforce generations.*

During the research, it became obvious, that the different workforce generations don't necessarily have different needs. More interesting than differences between generations are the changes of the actual way of work. Most psychologic diseases developed in the last ten years (cf. chapter Human resources management and psychological implications of the skills shortage for employees). This is because of several issues. First of all, the



growing technologization leads to higher communication and availability of the employees. Further, because of the demographic change, most of the skilled employees in IT-departments are working under immense pressure and often more hours a week than the normal 38-40 hours. Also, the growing rate of change in the IT-environment has an effect too. Employees in an IT-department have to learn and educate themselves continuously on several different subjects. Besides that, the study with n=391 participants has shown, that many companies have not emphasized the role and importance of IT. But appreciation is one of the most important emotions for an employee and a lack of appreciation can lead to depression as well. Also, mobbing in the workplace is not an issue for most companies. These findings are supported by the qualitative and quantitative validation of the framework (cf. Test of the 5-layer framework for employee productivity – qualitative validation; Test of the 5-layer framework for employee productivity – qualitative validation). To counteract these problems, the author proposed measures and a method for IT-companies and IT-departments (cf. Methodology for the implementation and execution of training measures in information technology).

2. *Identification of gaps regarding the perception of different generations in expectations for their companies and management.*

Every generation has different perceptions and opinions how something should be done. The different working generations are the same. The statistics show that the generation of the baby-boomers will retire in the next five to seven years (cf. Demographic change: skills shortages and the changes for society). This means, that companies have exactly this timeframe to incorporate changes in their organisations to meet the changed expectations of the workforce. These new expectations refer mostly to the management of their respective superiors and the way how a workday is organised. A lot of companies still manage their personnel with the time that they are in the office. If an employee works overtime and is available for his managers, it is a good working employee. Research shows, that this method of managing by time is not only wrong, it is also not supporting a productive work environment.

For employees of the generation y and z, flexibility is one of the most important factors. The basis for that is the management with goals and objects. Phrased in a simple term, if a certain work package is done and the quality has the expected level, the employee is free to work on other tasks, his education or can go home. This mind-set allows to chal-

lenge the actual processes and helps to include levels of flexibility in the work environment which will have profound effects on the productivity of the employees. The developments of the industry 4.0 are showing a lot of possible methods and tools which would benefit the employees and the companies as well. Besides that, the quantitative survey showed, that the salary is still an important factor for the workforce. But it is far away from being the most important. Companies have to pay their employees at least the average salary of their peer group. Further, there are several gender based differences that have to be mentioned and that companies need to be aware of, since women are mostly underrepresented in the IT-industry. Regarding a potential employer, women are often looking for other characteristics in a company than men. Women tend to value the social commitment, like CSR activities, of a company much more than men. Also, women are more likely to relinquish salary if the surrounding work environment fits their ideals.

3. *Definition of a framework for companies to raise transparency for the management of their personnel in times of demographic change which also includes psychological issues. The framework has to include all relevant factors that influence the productivity of employees in times of scarcity of talent.*

The goal was to build a framework which includes all relevant factors of employee productivity and allows companies to gain transparency about their actual HR-strategies and -policies. Companies then have the opportunity to identify strengths and weaknesses to derive measures to e.g. lower their retention rate and/or raise their productivity.

For that purpose, a hierarchical approach was used. The framework is subdivided in layers, factors and metrics. The layers are building the first level to structure the different areas of employee productivity. The next level are factors. The factors determine what should be measured regarding a certain layer like baseline wages. The third and lowest level are metrics. Metrics determine how a factor should be measured. Every factor has at least one metric. The following table shows the distribution of the different layers, factors and metrics.

| Layer                            | Number of factors | Number of metrics |
|----------------------------------|-------------------|-------------------|
| Baseline wages                   | 3                 | 8                 |
| Education and untapped potential | 8                 | 16                |
| Psychological healthiness        | 5                 | 11                |

| Layer                     | Number of factors | Number of metrics |
|---------------------------|-------------------|-------------------|
| Physiological healthiness | 2                 | 3                 |
| Work-life balance         | 4                 | 6                 |
| <b>Sum</b>                | <b>22</b>         | <b>44</b>         |

Table 79: Final number of layers, factors and metrics

Metrics can be used to repeatedly and periodically assess the development of individual metrics or factors. This allows companies also to quantify the success of certain measures that had the goal to e.g. improve processes, the knowledge of employees or the allocation of employees.

As mentioned, the framework follows a hierarchical approach. The usage of the framework follows this method as well. The following picture illustrates this approach.

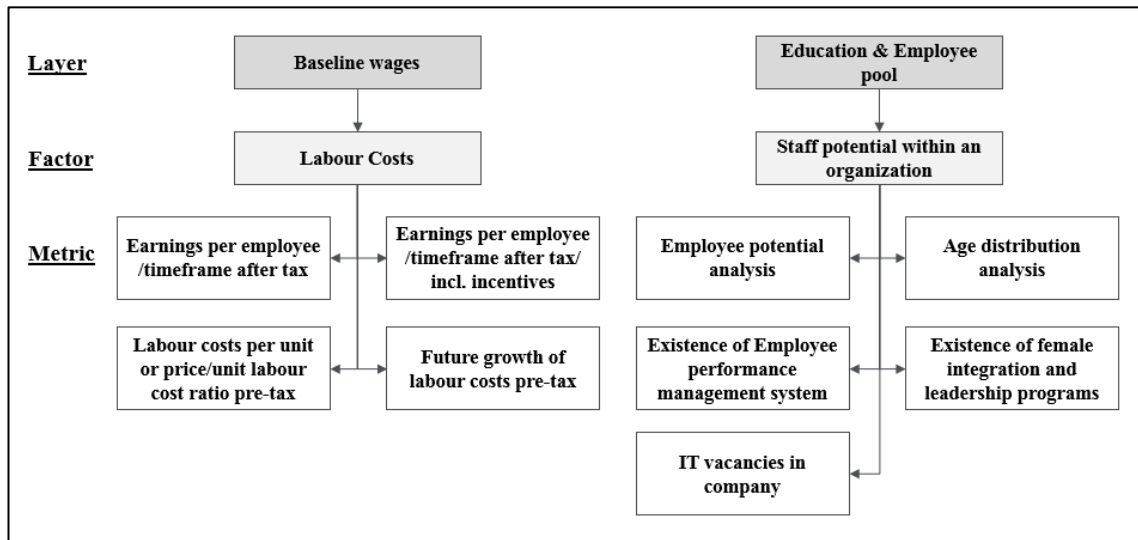


Figure 16: Examples of the use of the framework

If a company identifies a problem or would like to assess their actual status, they choose a certain layer, a factor and metric. With this procedure, it is possible to divide problems in different pieces to gain a better understanding of the situation. The findings are validated by the qualitative validation and the test of the framework (c.f. chapter Test of the 5-layer framework for employee productivity – qualitative validation and chapter Test of the 5-layer framework for employee productivity – a case study).

4. *Development and validation of an implementation plan that allows companies of every size to conquer the effects of demographic change, lower retention rates and retain productivity.*

After the definition and development of the framework, a tailored implementation plan was developed (c.f. Implementation plan for the 5-layer framework of employee productivity).

It covers all relevant aspects of a deployment of the framework in a project environment. The implementation plan consists of six different phases, starting with the project set-up, following the actual deployment and monitoring and controlling measures. Also, the implementation of a framework like this is always a huge change for a company. Because of this fact, several parts of the implementation plan are devoted to risk- and change management.

The validation of the suggested implementation plan was conducted with eight of the most experienced change management experts from the consulting company Bearing-Point. Besides the validation of the presented plan, the focus of the expert interviews was also the ranking of communication types, activities and measures. The conclusion of the experts was, that the implementation plan fits the purpose of a method to implement the framework.

This was also confirmed when using the implementation plan for the test of the framework in a company that is highly dependable on the IT-department and their employees. The plan can be used as a very good structure and blueprint for further projects and implementations.

### ***Final remarks and further research activities***

This thesis is mainly focused on the side of the companies and organizational development. Companies can change their workforce and the way that the employees work. Nevertheless, it is important to point out several circumstances around this topic, especially around the young workforce generation. This group of labour<sup>11</sup> is very tough to manage. The thesis has shown, that this generation is less loyal to a company and has expectations that differ vastly from previous generations. Because of the demographic change, companies need to focus on the needs of that generation.

The challenge is to keep this young generation happy and productive. The actual corporate environments are mostly not helpful to counteract these problems. This is often because of the short-term focus and the figure-driven orientation of the companies, which was mentioned in previous chapters. This leads to the prejudice of this young generation that they are not prepared to cope with this corporate certainty. But it is the lack of leadership in these organisations that are not aware of the actual sociologic situation. Due to the demographic change, it must be the companies' responsibility to educate, develop and support this generation in missing social and technical skills. Consequently, one further research approach would be a detailed analysis of the results and the impact of the derived measures on millennials.

A second possible research topic would be an analysis regarding the impact of digitalisation on IT-organisation with a focus on the employees. Currently, there is uncertainty in companies about possible changes within an organisation because of digitalised processes and the impact on employees regarding effective and efficient allocation as well as a future-proof education of them (Larjovuori, Bordi, Mäkinieniemi, & Heikkilä-Tammi, 2016).

As described, the framework consists of several layers, factors and metrics. The importance of these layers, factors and metrics can vary vastly between different cultures and countries. It should be mentioned, that the results of this thesis and the framework itself are working the best in western cultures or western orientated industries. Employees of other cultures, like the Chinese or Japanese would value other factors more due to a higher connection to their respective employers and the actual work culture (Agnew, Harris, Lewis, & Rovnick, 2017; Yamashita, Bardo, & Liu, 2016).

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<sup>11</sup> Millennials

*The presented framework will build measures to help companies to deal with these challenges. But a change in the mind-set of the managers is also unavoidable to succeed in this times of scarcity of talent, especially in this fast and vastly changing IT-environment.*

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