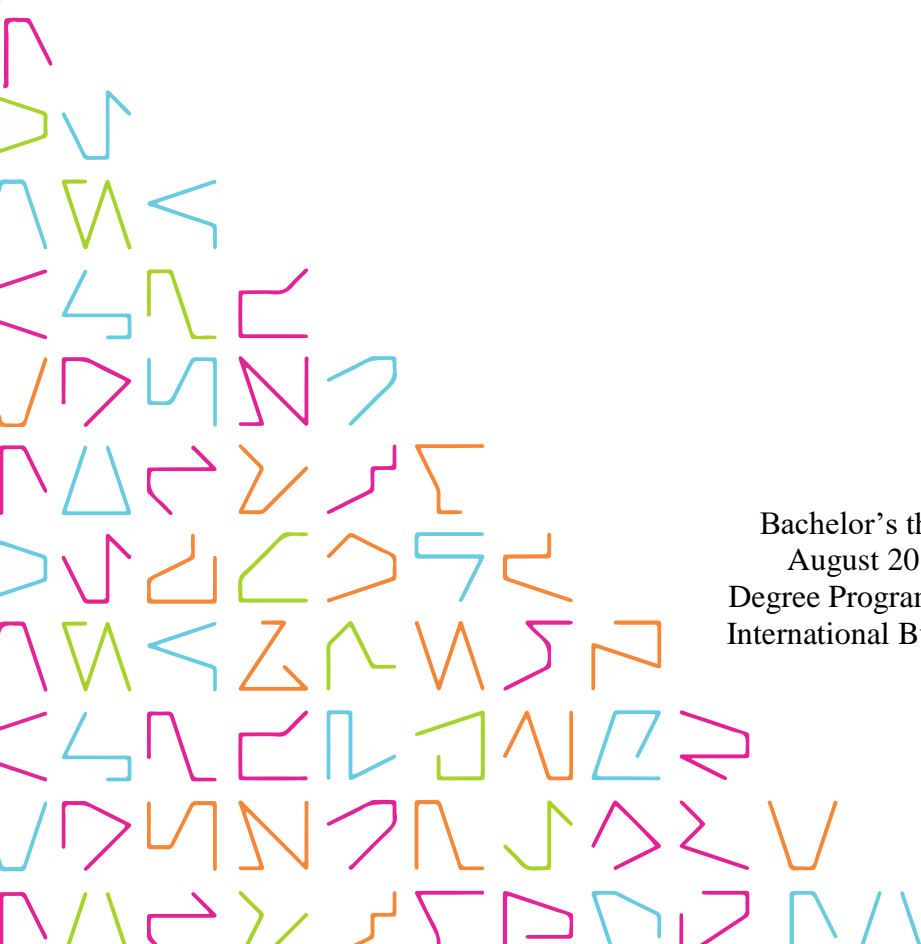TAMK
TAMPERE UNIVERSITY
OF APPLIED SCIENCES

NEUROSCIENCE AND LEADERSHIP

Awareness, Relevance and Applications of
Neuroscience Principles within Leadership
Development in Germany

Klaus Dürrbeck

ABSTRACT

Tampereen ammattikorkeakoulu
Tampere University of Applied Sciences
Degree Programme in International Business

KLAUS DÜRRBECK:
Neuroscience and leadership
Awareness, Relevance and Applications of Neuroscience Principles within Leadership Development in Germany

Bachelor's thesis 86 pages, appendix 3 pages
August 2016

This bachelor's thesis aimed to elaborate the current importance-level of neuroscience within leadership development as well as its future potential. Thereby awareness of leaders and human resource executives, general relevance for organisational success, and current applications of neuroscience principles within development programmes were identified. Additionally, existent and emergent triggers and forces that impede leadership or organisational success were investigated, in order to examine their potential for the valuable application of neuroscience principles.

The research relied on the analysis of secondary data and the generation of primary data through semi-structured expert interviews. Literature, institutional papers, and trend studies were analysed to sharpen the scope of research and inform primary data generation. Subsequently, experts were interviewed to create new insights and answer the research questions.

It was found that human resource executives are well aware about the matter of neuroscience with business applicability, while leaders' awareness was identified as rather low. However, relevance for corporate success and hence application within leadership development programmes were shown to be low or non-existent. With a perspective towards future applications the VUCA world constitutes the main trigger for adaptive measures of organisations. Here neuroscience principles were shown to bear valuable potential in order to tackle future challenges of leaders and organisations. Therefore, the prospects for increasing application of neuroscience contents within leadership development are promising.

The findings should provide a reference point for organisations which are prepared to incorporate contemporary, scientifically grounded, and promising concepts of neuroscience into their leadership development programmes. Furthermore, they may serve external training and development providers as a review of the status quo for neuroscience contents within development formats, as well as offering a future prediction for suitable fields of application.

Key words: neuroscience, neuroleadership, leadership development

CONTENTS

1 INTRODUCTION

1.1 Neuroscience in leadership development

The leadership development industry, once solely driven by psychology and behavioural science, is undergoing a shift within the current decade. With more advanced computer-aided imaging methods the neurosciences continue to unveil the underlying principles between observable behaviours and their mostly hidden causes and triggers. (Waldman, Balthazard & Peterson 2011, 60.) A whole new field, called neuroeconomics has been developing since, bridging the gap between neurosciences, psychology, and economics. A part of neuroeconomics is charged with management-related research questions. This sub-discipline is termed neuroleadership, which illustrates the combination of the afore-mentioned fields. (Peters & Ghadiri 2011, 12–14.) Advances in this discipline enable leadership research to not only make educated guesses, based on psychological theories and paradigms, but to take a real look into the people's brain and identify the previously hidden processes. Currently, neuroscience is mostly utilized to scientifically validate training and development concepts that origin from behavioural science or practical ex-perience. Even though this seems a reasonable first step, neuroscience holds much more potential for training and development than to measure the impact of already proven methods. (Chartered Institute of Personnel and Development – CIPD 2014b, 6–7.) Hence we might see a more proactive application of neuroscience concepts in the future, trying to address the big challenges in leadership development directly.

Through ongoing research efforts by a growing international community of neuroscien-tists, the theories and models with implications on leadership and leadership development are steadily increasing (Rock 2013, 85). As stated in various Human Resource (HR) trend analyses, more than 80 percent of companies worldwide rank leadership as a critical fac-tor to corporate success (Deloitte University Press 2016, 27–28). Especially in the United States, neuroscience principles applicable to business contexts are viewed as promising solutions for a diverse range of current management and leadership challenges (Rock & Cox, 2012). More and more companies develop interest in brain-based leadership con-cepts, which results in the necessity for leadership and management training providers to adapt to this trend (Boyatzis 2014, 300–302). However, respective training programmes are still hard to find among the leadership development sector which is partly attributable

to the rather novel status of the topic. The level of awareness about relevant new findings and concepts in neuroscience among HR executives seems limited, yet kept increasing since 2012 (CIPD 2014a, 22–24). Currently, bringing relevant neuroscience concepts into leadership development practice still fails in most cases (CIPD 2014b, 7–8). This stresses the topicality of the matter and might also indicate a yet unexploited potential for future training programmes.

As neuroleadership experts David Rock and Jeffrey Schwartz suggest, the application of neuroscientific leadership concepts could help to transform our current leadership theories who cease to function properly in an ever dynamic and fast changing environment (Rock & Schwartz 2006, 3). Understanding the underlying principles of the brain that guide the behaviours of leaders as well as followers could lay the foundation for more effective leadership, more sustainable cooperation, and higher openness to continuous change.

1.2   Brief description of commissioning company and motivation for research

The commissioning company for the current case is Munich Leadership Group (MLG), a Munich-based management consultancy. The roots of the privately owned firm date back to 1994. Following the motto "empowering leadership", the product portfolio ranges from training to consulting and coaching of leaders and executives of all managerial levels. With offices in Germany, the United States of America as well as China the company serves a diverse clientele around the globe. Also cooperations with universities and scientific institutions in Germany, the UK, and the USA are maintained to participate in the development of new concepts in the area of leadership.

With approximately 85,000 participating leaders and executives being developed or coached in some 7,500 trainings and workshops so far, the company relies on proven as well as contemporary concepts for these formats. Among others, the rather new concepts of neuroleadership are utilized in trainings and workshops. Following this context, the current research was inspired by these exciting developments and aims to gain further insights about potential markets for such applications.

1.3 Research questions and objectives

This paper aims to identify the awareness and possible applications of neuroscience principles among HR departments and leadership personnel in their respective leadership development efforts. The underlying purpose is to initially evaluate the general awareness and importance level of the topic. Additionally, the identification of promising fields for application is part of the study. Through expert interviews with HR representatives and leaders of major corporations in Germany as well as neuroleadership experts the author tries to create an impression about the current status of and need for neuroscience principles in leadership development.

The research questions that are to be answered are:

1. How important are neuroscientific principles in the leadership development efforts of corporations in Germany?
2. What are currently existing or emerging applications for neuroscience principles in leadership development?
3. How might neuroscientific insights be valuable for leadership development in the future?

The first question should clarify the awareness-level of HR representatives and leaders on neuroscience principles and their applicability to business contexts. This will reflect the awareness and application-readiness of the individual corporation, creating a general picture about the standing of neuroscience, when comparing the answers of all experts. The second question is meant to elaborate already successfully utilized applications for neuroleadership and neuroscience principles (best practises), or emergent applications thereof. The purpose behind this approach is to gain a clearer picture about the corporations' need for leadership development programmes with neuroscience contents. The third question aims to gain insights into possible future developments through the expert's opinions. This is deemed to unveil new, yet unutilized market potential for respective programmes. Even though a prediction of the future is not possible, this could help to understand which challenges the experts expect to be facing in the future and how they plan to tackle these. Such an approach is meant to help to create leadership development solutions that will meet the future needs of clients.

1.4 Structure of the Thesis

In order to answer the aforementioned research questions and attain the objective of the thesis, a line of action (figure 1) is issued which is supposed to aid to understand the structure of the process. The work is divided into two parts, namely the theoretical framework and the empirical investigation.
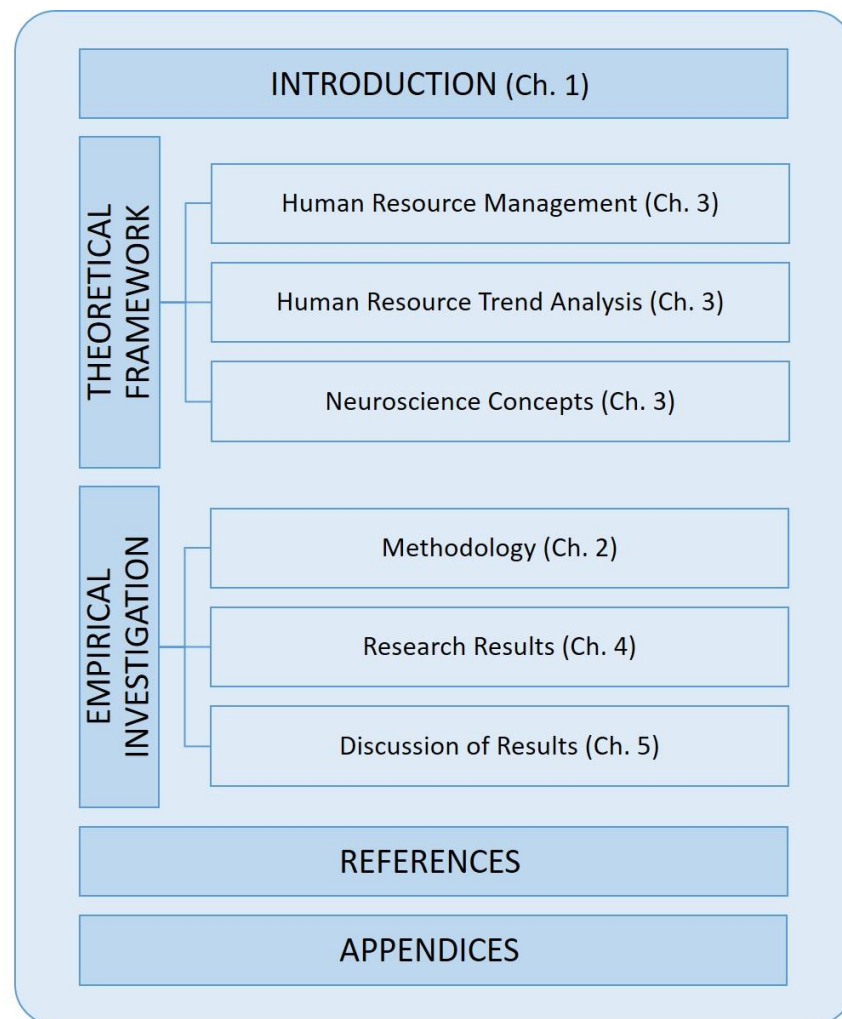
FIGURE 1. Line of action.

To lay a foundation as well as approach the thesis' aim and purpose, the theoretical framework (figure 1) sheds light onto the linked and applicable theories and models. Chapter 3.1 illustrates the leadership development which is part of the common HR strategy among organizations. Current HR trends are analysed in chapter 3.2, in order to approach the scientific problem from a theoretical perspective. This part can also be considered to introduce the research process. Chapter 2.3 describes neuroscience and related fields as

they are viewed in this work and introduces some popular and applicable principles for this case. This part can be viewed as the core component in the initial framework as it approaches the focus topic of the study. It aids in introducing the topic as well as linking principles to unveiled needs within the research part.

The part of empirical investigation (figure 1) states the research design and methodology in chapter two. The chosen techniques for data acquisition are illustrated and methods for data analysis are described. Chapter four states the actual execution of primary research and outlines the results of the expert interviews. The final chapter draws conclusions from the theoretical framework and its connection to the results. The results are interpreted, and unveiled needs with regard to leadership development are linked to applicable neuroscience concepts. Also, further suggestions and limitations for research are stated, where the research approach and its results are critically reflected upon.

2   METHODOLOGY OF RESEARCH

2.1   Underlying methodology

When initially assessing the market of leadership development industry in Germany there is no substantial information about size, trends and other facts publicly available. Especially information about neuroscientific principles that are incorporated in training and development efforts are scarce, even in blogs and low-quality sources. Hence the setup of research is selected to be explorative in order to create first-hand data within a limited scope. The chosen approach of research methodology mainly depends on the inductive model. (Saunders, Lewis & Thornhill 2009, 323.)

Suiting this framework, the required data to be assessed will be of qualitative nature. Research data always constitutes an abstraction of the everyday world, where qualitative research remains closer to it, compared to quantitate methods. When research aims to explore a yet vague phenomenon meaning (qualitative data) should always be assessed before frequency (quantitative data). (Naderer & Balzer 2011, 208–209.) As Saunders et al. (2008) suggest, this will enable the generation and analysis of meaningful data with less restrictions and an increased richness, compared to quantitative approaches. It aims to identify meanings through words rather than numbers, use structuring to categorise acquired data, as well as analyse data through conceptualisation rather than statistical methods. (2009, 280–283.)

As the thesis aims to identify a recent phenomenon within a limited scope and timeframe, the research will follow an applied rather than fundamental approach (Naderer et al. 2011, 199–200). On these grounds the results are intended to inform a various audience of practitioners within leadership development and HR about the findings, but not to claim generalisations that would suit a broader application beyond the frame of the research scope.

2.2   Data acquisition methods

In order to answer the research questions, it was decided to initially assess the current situation through means of secondary research (figure 2). This is deemed to aid the deeper

understanding of driving forces within the HR sector and identify potential links to the application of neuroscience principles. Constructing on these findings, primary research aimed to generate currently lacking data such as current applications as well as future potential for respective concepts.

2.2.1 Secondary data

The corresponding data acquisition method is composed of desk research, primarily through means of online research (Kuss, Wildner & Kreis 2014, 36–37). The process was started by a parallel literature review as well as the assessment of suitable studies and reports, aiming to summarise prevailing or emerging HR trends. This part of research was executed early in the thesis process within the theoretical framework. The field for respective trends was purposefully kept broad in order to gain a holistic picture of HR's challenges and drivers. In a further step, these global trends were translated into terms of leadership development. The identified patterns or phenomena who refer to neuroscience principles were meant to inform primary research.

2.2.2 Primary data

As secondary data was not considered to yield sufficient evidence in order to answer the research questions, it was deemed worthwhile to engage in the generation of original data. This creation of primary data was decided to follow the method of interviewing subject matter experts (figure 2). By using the semi-structured interview as means to gather data, interesting and worthwhile insights can be included while the focus of the research is maintained. With a list of general sample questions and topics to be covered, the data collection remains highly flexible and additional questions to probe new findings can be formulated. For this purpose, an interview guide was created (appendix 1) to maintain focus throughout the interview but allowing adaption to the respective expertise and experience of the respondent. In terms of interaction the interviews were carried out as one-on-one meetings. (Saunders et al. 2009, 318–321.)

In-person meetings, telephone and online communication were chosen as means for conducting the interviews. The scope of potential research participants was narrowed down

to HR executives with responsibilities or general experience in leadership development, subject matter experts in neuroscience, as well as leadership personnel. The sample size depended largely on time constraints and availability of respondents. Hence the sample was chosen to include extreme groups, for instance subject matter experts as 'creators' of leadership development programmes who are deemed to have deep insight and understanding of the matter as well as 'consumers' of these programmes in the form of leadership personnel. (Naderer et al. 2011, 210–211.)

A successful execution of the interviews required substantial examination of relevant literature and background information. The interviewer has to be a quasi-expert in the assessed topic in order to correspond with the interviewee on eye-level. (Rugg & Petre 2007, 135–137.) Hence, the initial literature review on the theoretical framework, the analysis of HR trends as well as existing personal knowledge was incorporated to gain respective competencies. The interviews were chosen to follow a grounded-theory approach by which a short analysis of each meeting's results led to the creation of hypotheses which were tried to be tested during the following interviews (Naderer et al. 2011, 409). Consequently, the schedule was arranged in such a way, to leave space in between meetings in order to allow analysis.

The interviews were realised between 25 May and 30 June 2016. The respective scope was decided to include HR representatives, leadership personnel, as well as subject matter experts in neuroscience and leadership. Contact to prospective participants for the study was established through intermediates, such as facilitators of the commissioning company. In total 12 invitations were sent out, leading to 9 participants which constitutes a response rate of 75 percent. In terms of gender-distribution, four respondents were female while five were male. Appointments were arranged to suit the respondents' tight schedules, but also leaving space in between to evaluate and reflect on the respective statements for key topics and phenomena to guide the questions in the following inquiries. As of geographical distribution the majority of meetings had to be held via means of telecommunication. For this purpose, telephone (land line and mobile) as well as online communication (Skype) was offered. The interviewees were provided anonymity upon request, to increase the likelihood of sharing deeper insights and personal experiences as well as opinions. The language to be used was German, as all recipients were native in this language. This was deemed to avoid misunderstandings and hence increase data quality. Respondents were informed in advance as well as at the introduction of the interview about

the procedure and confidentiality of the material for the sole use of transcription. This was meant to lower potential hesitance from the side of the respondents to openly share experiences (Naderer et al. 2011, 412). Simultaneously notes of important statements or phenomenon were taken during the interview to enable clarification of such or gain a broader impression about the contained phenomenon and possible interlinkages or patterns. The interviews lasted between 34 and 70 minutes with an average duration of 49 minutes each.
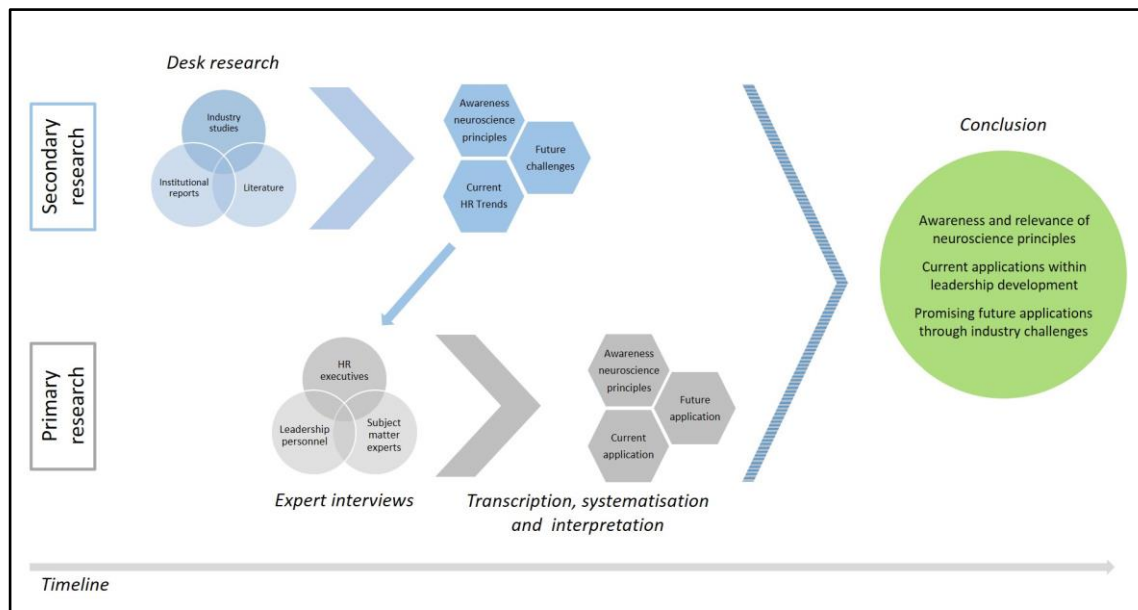
FIGURE 2: Research process model.

2.3 Data analysis

As the quality of research findings depends heavily on their analysis, substantial efforts have to be directed in this direction. Especially the analysis of qualitative data poses a challenge with regard to reliability and validity, which is often a point of critique by advocates of quantitative methods. The application of well-grounded analysis methods is an important decision to be made in this stage of research. Transparency about the analysis process can increase the quality of findings by shedding light onto the circumstances of research and analysis, and enable verifiability. Qualitative data analysis is by nature hypothesis-creating and inductive. Hence it aims to identify characteristic phenomenon and their meaning in the respective field of research. Therefore, the researcher has to remain

open und unbiased towards the research subject and the emerging insights. (Naderer et al. 2011, 407–408.)

2.3.1   Secondary data

The reviewed literature, studies, and HR trend analyses were elaborated by the three research questions. Secondary research results were used to form initial hypotheses in line with the initially formulated research questions. Findings of the desk research were used to inform primary data acquisition by providing indications for patterns or key issues.

2.3.2   Primary data

The research process and data analysis of the expert interviews pursues an interpretative philosophy as over-generalizations and the attempt to reduce the natural complexity in social interactions might prevent substantial insights. Especially in this early stage of research the focus must not be drawn too rigidly. This was backed by the relatively small sample size of nine experts which are available for data generation as well as the limited literature on the research focus. (Saunders et al. 2009, 480–491.) Following the grounded-theory approach, the analysis of the interviews was carried out interactively, throughout the interview process as well as afterwards in more detail. This procedure aided in recognising patterns and relationships to connect HR and leadership necessities with neuroscience concepts (Naderer et al. 2011, 409).

Documentation of data was ensured by electronic audio-recording the interviews through a dictation machine. The audio data was transcribed in succession by utilising the dictation function of google docs. Transcripts were subsequently sent to the respective respondent in order to gain approval for the statements. This was deemed to aid unrestricted use of the data without leading to confidentiality concerns as well as proving data quality in case of misunderstandings. Data's meaning was structured through narrative, as the current case was deemed to necessitate interpretation (cf. Saunders et al. 2009, 480–491).

3 THEORETICAL FRAMEWORK

3.1 Human resource management

With the onset of industrialisation in the early 19th century, organizations started to grow exponentially large. This led to an increasing need for systematic administration of the expanding workforce. In the wake of such developments personnel management became an organisational instrument to balance the legal requirements with a maximisation of the production factor labour. The focus of personnel management was drawn to administrative tasks, utilizing the human capital in the most efficient and effective manner. Hence human capital was considered to be a manageable factor which constitutes a rather mechanistic philosophy of labour. During the 1980s this understanding changed considerably to a more people-centred view where such goals as job satisfaction and efficiency came to the foreground. Employees were no longer seen as a sheer production factor, but as members of an organisation whose needs and qualifications needed to be paid attention to. Also the new term 'human resource management' (HRM) appeared during that time. (Holtbrügge 2015, 1–3.)

Human resource management encompasses all staff-related organisational as well as administrative tasks. It comprises the functional areas of planning personnel requirements, recruitment, placement, compensation and benefits, development, reduction, and controlling. (Lindner-Lohmann, Lohmann & Schirmer 2008, 1–7.) In order to utilize human capital to a maximum, organizations should focus on well-grounded recruitment of talent and the profound and continuous development of their personnel. Human resource management can be distinguished time-wise in strategic and operational measures. Strategic HRM is thus the planned and future-oriented development of human capital, aligned with the corporate strategy and culture. (Rowold 2015, 15–16.)

3.1.1 Human resource development

Human resource development can be considered as part of the strategic HRM. It seeks to systematically develop functional, methodological, social, and personal skills of staff members. Thereby not only a focus onto organisational goals is drawn, but also individual

motives are included. (Bühner 2005, 95.) Content-wise the measures aim to "impart knowledge", relevant to the position or function, "expand practical skills", as well as "develop new attitudes" (Holtbrügge 2015, 137). The overarching maxim of such efforts is to ensure optimum performance (Bühner 2005, 95).

In times of globalization and significantly as well as rapidly changing environments, however, human resource development can also be considered as part of the organisational development. Qualification and advancement of the workforce enable an organisation to adapt its know-how to shifts in the environment and hence gain competitiveness and innovation potential. (Rowold 2015, 173.) In this context, especially the phenomenon of a lifelong learning process gains importance as it is said to be a key success factor in fostering innovation and growth. The future success of companies is dependent on how quickly staff learns and translates new ideas as well as information into suitable action. (Kauffeld 2016, 2.)

Future workforce strategies, industries overall
Share of respondents pursuing strategy, %

Invest in reskilling current employees	65%
Support mobility and job rotation	39%
Collaborate, educational institutions	25%
Target female talent	25%
Attract foreign talent	22%
Offer apprenticeships	22%
Collaborate, other companies across industries	14%
Collaborate, other companies in industry	12%
Target minorities' talent	12%
Hire more short-term workers	11%

Source: Future of Jobs Survey, World Economic Forum.
Note: Names of strategies have been abbreviated to ensure legibility.

FIGURE 3. Future workforce strategies to align HR with fourth industrial revolution. (World Economic Forum 2016).

In a 2016 survey by the World Economic Forum, "Invest in reskilling current employees" was the top priority of Chief Human Resource Managers' strategy to tackle future human capital challenges (figure 3). This evaluation among 371 global corporations can be interpreted as a reference point for future training and development need within the global economy. Organisations increasingly become aware of the potential that lies within their

existing workforce. Efforts to identify, nurture, and utilize these individual talents are more and more increasing. Chapter 3.2 will explore the corresponding needs and implications of current and future HR and leadership efforts to contribute to organizational success.

3.1.2 Leadership development

In order to approach the topic of developing leaders individually and leadership at an organisational level, an initial definition of the term aids in understanding respective models. In everyday language the term leadership development is universally used to describe any means of education, training and development of leaders. Google lists some 19.4m hits for the search term and most literature and sources used in this work utilise the term accordingly. However, in a scientific context several authors distinguish between the terms 'leader development' and 'leadership development' (Day 2001 582–583; Dalakoura 2009, 432–433; Van Velsor, McCauley & Ruderman 2010, 2; McDermott, Kidney & Flood 2010, 358–360). Leader development can be defined by "the expansion of a person's capacity to be effective in leadership roles and processes. Leadership roles and processes are those that facilitate setting direction, creating alignment, and maintaining commitment in groups of people who share common work." (Van Velsor et al. 2010, 2). It is thus focussing on the individual, who needs to be supported in his process to acquire new knowledge, skills or even attitudes. Leadership development covers a broader array of development and can be defined as: "the expansion of the organization's capacity to enact the basic leadership tasks needed for collective work: setting direction, creating alignment, and maintaining commitment." (Van Velsor et al. 2010, 22). It is addressing the organisation as a whole entity, which needs to learn and develop in order to face emerging challenges or utilise business-opportunities. In view of these definitions this thesis handles both, the leader as well as the leadership development. It focusses on the individual development by identifying explicit applications of neuroscience principles in leader development measures. However, it also unveils trends and needs which drive the organisation as a whole and thus direct the broader approach of leadership development. To improve consistency, the term leadership development will consequently be used as a universal description of any means that aim to develop individuals or the whole organisation.

Determining factors for the success of leadership development measures are first and foremost the top management. Through the overall strategy for organisational goal attainment and the predominant corporate culture all development efforts are guided and aligned in correspondence to the corporate vision, mission and strategy. The learning and development department in further consequence acts as transmission to translate the organisational goals into operational measures while meeting the needs of various recipients. This point is crucial in order to merge the overall strategy with current business reality. Furthermore, the direct superiors of training participants can aid in the development process by providing open space for the participation in such measures as well as supporting through practise opportunities for recently acquired skills and knowledge. Finally, however, the participants themselves have to claim responsibility for their professional development. (Rowold 2015, 183.) Especially the last point seems critical in an advancing knowledge-economy where lifelong learning gains momentum.

3.2 Human resource trends

Human Resource Management, as any other business area too, has to follow trends in order to anticipate future developments early on. These trends mostly stem from shifting environmental forces, posing challenges for current HR operations and requiring adaption to such. Respective trends bear indications for leadership development in at least two dimensions:

1. The leaders themselves are directly affected by the triggers that underlie concerned trends.
2. The employees are affected by these triggers, passing on the effects to the leaders which indirectly affects these.

Hence HR trends that are usually formulated in a holistic view almost always apply to narrower target groups such as leaders.

"Talent, not capital, will be the key factor linking innovation, competitiveness and growth in the 21st century" this bold statement by the founder of the World Economic Forum strikingly summarises the currently improving importance of human capital (World Economic Forum 2015, V). For the organisational context this not only means that a mechanistic view of the workforce is no longer maintainable, but human resource or talent is

moving into the focus of successful corporations. Disruptively shifting business models and increasingly complex value chains demand novel skills and knowledge, leading to a widening skills gap of current labour as well as the creation of entirely new occupations. The present skillset of staff will get under pressure by these changes and need constant reinforcement and amplification through training and development. Astonishingly within the next five years the demand for social skills like emotional intelligence and the ability to teach others will gain momentum. In contrast, deeply specialized skills such as programming and the operation of technical equipment will not see respective increases in demand. (World Economic Forum 2016, 3.)

3.2.1 Awareness and relevance of neuroscience principles

In view of the fact that neuroscience is a rather new field of research and its application in a business-context is even more recent, the question about the awareness of HR decision-makers as well as leadership personnel arises. An UK-based initial study from 2012 indicates that only ten percent of HR executives were aware of some key concepts of neuroscience. With rising popularity of the topic in mass media as well as specialised literature, this kept increasing to more than 60 percent in the following years. (CIPD 2014a, 22–23.) Albeit, there seems to be quite a discrepancy between a general interest in the topic and a real awareness on how these concepts can facilitate learning and development or even alter organisational goal attainment. While some HR executives view neuroscience insights as key to understand how people learn and hence develop more effective programmes, this approach does not seem to prevail among the sector (CIPD 2014b, 6–7).

The relevance of neuroscience principles currently seems to be limited to providing scientific evidence for learning and development practices as well as training-contents. It seems to provide a fact-based and measurable explanation of how people behave and how they are affected by used learning and development measures. (CIPD 2014b, 6–7.) The same applies to contents such as leadership skills where neuroscience principles are utilised to create awareness among leaders on how behaviours and actions trigger certain behaviour in staff.

Which of the following factors do you feel most contribute to the success of an L&D/OD professional? (% of L&D/OD professionals)

Factor	Percentage
Business and commercial awareness, including knowledge of the industry and external environment	56
Working collaboratively across an organisation	43
Ability to influence the organisation	40
Experience of training design and delivery	23
Knowledge and use of coaching and mentoring techniques	17
Ability to make recommendations and decisions based on insight	16
Using innovative techniques and offering creative solutions	16
Ability to deliver with limited resources	14
Having a broad internal and external network	14
Having change management expertise	12
Acting as a role model and leading by example	12
Having curiosity for how people learn and develop	11
Knowledge of emerging L&D trends	9
Understanding of new learning technologies (for example e-learning, MOOCs)	8
Understanding and practical application of new learning theories and insights	7
Other	1

Base: 335

FIGURE 4: Factors, most contributing to success of learning and development professionals. (CIPD 2014b)

Learning and development professional's do not view understanding and application of new concepts in learning – such as neuroscience – to considerably contribute to their individual success (figure 4). Efforts to engage beyond a superficial level seem not to be worthwhile. Hence, these concepts do not hold significant relevance for organisational goal attainment either. They are currently applied in a very narrow scope and among a rather small number of organisations (CIPD 2014b, 11–21). It also needs to be mentioned that HR professionals do not see a chance to apply neuroscience principles in isolation. Such concepts are one facet in a holistic approach to learning and development. They rather synergise with the parallel application of concepts from psychology and behavioural science than provide a new approach to HRM. Thus neuroscience is considered a central aspect for future learning and development efforts, but not an individual one. (CIPD 2014b, 6–8.)

3.2.2 Organisational change

The term change in an organisational context is closely connected with adaption to shifts in the environment, staying competitive, and – not least – being successful. Change within business environments is not a new phenomenon. Joseph Schumpeter already stated a 'Theory of Change' in the early 19th century (Schumpeter 1912). By that time companies already were facing ongoing shifts in the economic environment, leading to a need for adaption and thus change. Today's vast amount of corresponding literature and the omnipresence of the matter in any corporate context suggests that there is a necessity for constant change. A 2016 study by Deloitte University Press backs the impression of omnipresent change by stating that more than 90 percent of respondents to their Human Capital Trends consider reshaping the whole organisation as number one priority for future success (2016, 1). The VUCA world (*volatility, uncertainty, complexity, ambiguity*) requires constant adaption to and handling of new challenges within shrinking periods of time.

Currently HR representatives deem more than a third of their leaders incapable of dealing with the VUCA factors (Development Dimensions International 2015, 10–11). Change management competencies rank among the top skills, HR departments seek in their corporation's leaders (Kienbaum 2015a, 39). Change itself appears to have different speeds of adjustment, where corporate capital is much faster adapted to the shifted conditions than the employees (Albach, Meffert, Pinkwart & Reichwald 2015, 4). This lower speed of anticipating change is a critical variable within successful change processes and requires a focus onto the human side of change as well. Leadership personnel occupies a key role within change-initiatives. As they act as catalysts for the redefined corporate vision and goals, they have to act as role models while providing staff with meaning and trust towards the new direction. 'Leading change' is among the core attributes, CEO's seek in effective leaders (Development Dimensions International 2015, 9). Furthermore, a tendency to apply past best-practises towards future challenges remains standard, although these efforts often fail to effectively cope with shifting environments. This gap in required agility within change-processes and the current practise obstructs an early identification of relevant trends and forces. (Kienbaum, 2015b, 6.) Leaders who are able to stand uncertainty, remain receptive for subtle trends and triggers, as well as utilise the diverse knowledge of their teams are key to reach such change-agility.

3.2.3   Leadership

With 87 percent of companies globally stating leadership as an important or very important issue for future success, the matter remains top priority across industries (figure 5). As leaders are transforming the corporate mission and purpose into staff engagement and performance, they are key to business performance (The Boston Consulting Group 2008, 5). Digitisation as a main catalyst for rapid change challenges traditional business models and increases flatter hierarchies which are at the same time increasingly networked. Leaders are more than ever required to act team-centric, collaborate across functions and geographies, think connected, and address a diverse variety of individuals. (Deloitte University Press 2016, 27–29.) Especially the collaboration aspect of leadership gains importance with increasing complexity. Single leaders or small management teams will fail to oversee all connections and causes as well as effects of business issues. They have to interact with internal and external stakeholders, to address challenges holistically and successful. (Karp & Helgø 2008, 32.)

At the same time the workforce becomes both younger and older. Companies are increasingly confronted with a lack of high potentials within their leadership succession systems. Especially through a more networked structure, different leaders with fresh attitudes towards diverse leadership approaches are required who are able to adapt to different leadership levels quickly. (Deloitte University Press 2016, 27–29.) Leadership will not be determined by a fixed set of skills and methods, but rather by a dynamic process of interaction and relationships with others. This will have to rely on recognising and understanding drivers for behaviour in self and others. Leaders will for example have to accept that people do not think and act rational, but are rather guided through emotions. Furthermore, leaders increasingly have to accept not being in control within complex environments. (Karp & Helgø 2008, 32–34.) They will have to inspire team-loyalty through vision, judgemental capability, and comprehensive knowledge, more than through formal position or power. Leading a growing number of diverse team members, superiors will have to rely on more coaching leadership styles in order to attract, inspire and retain talent and exquisite people. (Deloitte University Press 2016, 28–29.)

This also illustrates the deep connection between leadership and talent management. Leadership plays a critical role for identification and development of high potential staff members which in turn are deemed as critical factor for corporate success (Development

Dimensions International 2015, 9). Leadership development is a key-lever for providing a new breed of leaders, able to deliver urgently required skills and capabilities to address latest challenges. Astoundingly, organisations seem to lack engagement in key areas such as young and diverse leaders. Up to 59 percent of companies do invest little to no resources into the development of millennials or diverse talent; 49 percent lack investment into fostering female leaders (Deloitte University Press 2016, 29–30). Already by 2008 a human capital study concluded: "Corporations should invest considerable resources in defining specific leadership models, assessing their leaders, and designing development programs." (The Boston Consulting Group 2008, 5). However, it seems that corporations still lack effective development systems and readiness for a generation of young and diverse leaders. Identifying talent and potential leaders early in their career as well as accelerate their leadership development process by utilising elder leaders as mentors and providing opportunities for experience early on might drive such versatile leadership. Not least, organisations will also have to act on an increasingly structured, science- and data-based, as well as return-driven model of leadership development. Best-practise companies do not only spend more resources on development efforts, but also more effectively as they utilise analytics and a holistic but systematised approach to leadership development. (Deloitte University Press 2016, 30.)

3.2.4   Learning

Throughout the past decades, businesses were relying on the established system of choosing well trained and suitable labour from a wide range of schools and universities. However, with an ever decreasing lifespan of traditional education's contents and the necessity to acquire a broad array of novel skills and knowledge, current public education as well as corporate training and development programs increasingly cease to provide required talent. (World Economic Forum 2015, 28–29.)

A main driver behind shorter lifecycles for skills and knowledge surely is the ongoing digitisation. The exponential growth of knowledge we see nowadays is fuelled not only by a growing world population, but especially by information technology which aids in spreading knowledge worldwide in real time, as well as developing new knowledge through the same channels. (Albach et al. 2015, 4.) Organizations increasingly become aware that a strong learning culture is gaining momentum in utilizing future business

opportunities and maintaining competitiveness (Deloitte University Press 2016, 1). Corporate learning management ranks among the top 5 priorities of HR executives worldwide (figure 5).
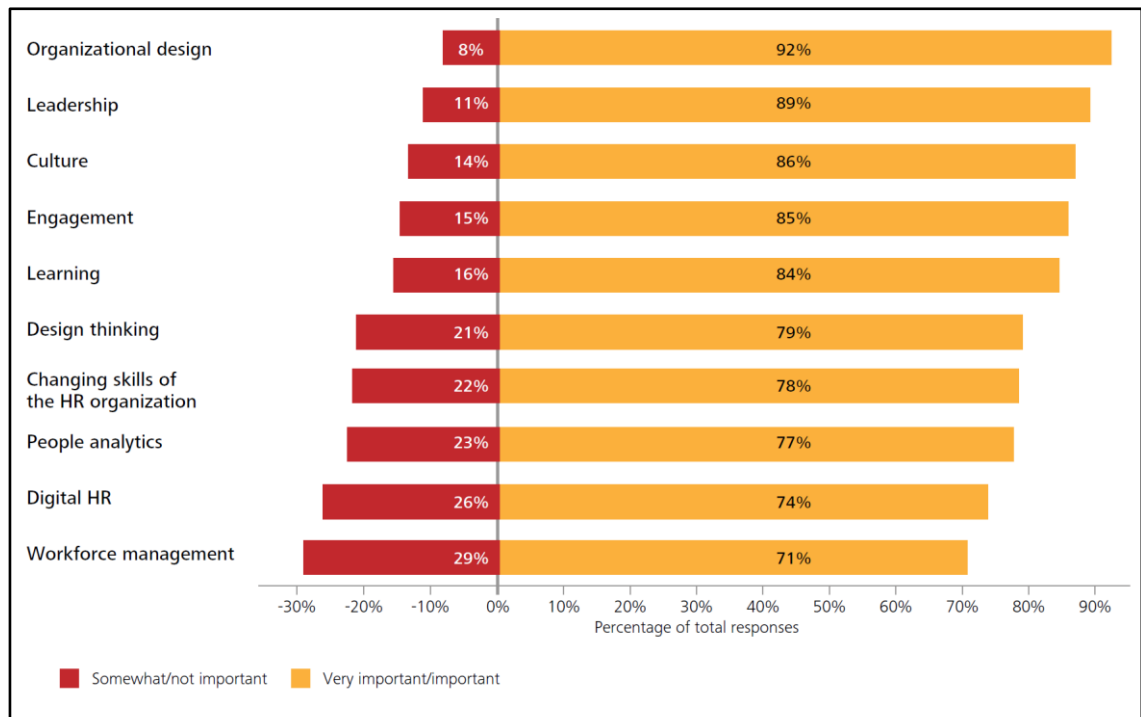
FIGURE 5: Top 10 Human Resource trends in 2016 by importance. (Deloitte University Press 2016)

Lifelong learning in order to constantly adapt the skillset and knowledge to highly agile environments becomes key for organisations as well as their individual leaders and employees. In this context the training and development supply of companies may not suffice the needs of business reality and staff itself anymore. Leaders and employees might see a more active role and have to claim more responsibility in embracing learning opportunities outside of the corporation. Offers such as Udacity, Coursera and the Khan Academy provide a platform for a vast array of learning and education. These new ways of education will however lead to the need for better and probably new approaches to learning and transfer of knowledge. (Deloitte University Press 2016, 57–60.) In the context of leadership development some people even claim that a leader who is not able to apply self-directed learning cannot be expected to effectively lead others. Only if one is able to shape an own process of learning and creating a personal model for leadership she or he will succeed in a leadership role. (Cunningham 2010, 7.)

Additionally, horizontal learning to deepen and specialise skills and knowledge alone will not meet tomorrows prerequisites anymore. Learning will also have to evolve vertically by connecting different fields of expertise and acquiring competencies in abstract and analytical thinking. Not specialists, but generalists are required for the new world of business, in order to 'connect the dots'. This will aid to create a higher meaning and more holistic picture of ever more complex business challenges. (Petrie 2014, 11.) Businesses will also have to find new ways of cooperation with education and academia in order to adapt learning to current and future economic necessities. Substantial investment in life-long learning, as well as re- and up-skilling will be necessary to keep the corporate human capital at highly effective levels. (World Economic Forum 2015, 28–29.)

3.2.5   Summary of HR-trends

Even though awareness about neuroscience concepts with relevance for business has grown in the past years, the matter is still not considerably viewed as relevant for organisational success. Therefore, respective concepts are mainly used to provide scientific evidence for reasoning existing models and approaches of leadership development. Also neuroscience is not applicable as a singular concept, but rather has to be combined with current psychological and behavioural approaches.

The VUCA world urges constant adaption with diminishing reaction times. Thus the majority of organisations views organisational change initiatives as top priority to ensure future success. The prevalent bottleneck seems to be leaders and people who lack change-readiness. Also the application of past best practises obstructs a necessary trend-responsiveness that would enable early adaption.

Leaders are the key to utilise the full potential of human capital. Thereby collaboration and connected thinking gain priority as they drive corporate success in times of uncertainty and change. Increasingly coaching leadership styles as well as the constant adaption to different levels of leadership are necessary for leadership personnel in order to respond to the current challenges. Concurrently the management of future talent and leaders is key to sustain success. However, organisations appear to hesitate to invest in diverse and young leaders.

As lifecycles for knowledge and skills diminish through digitisation, traditional education cannot keep pace with the elevated requirements of businesses. Lifelong learning is a prerequisite for organisational success, but leaders and staff see a more active role with increasing self-responsibility for learning and development. Learning becomes more interconnected and generalist in order to approach increasing complexity. Also organisations will have to establish cooperations with academia to suffice the new challenges.

3.3 Neuroscientifically grounded concepts for leadership

Constituting the core of the current research project, the present research aims to identify the most suitable and important neuroscientific concepts which are applicable to the field of leadership. In order to give an overview over currently trending concepts, the following six chapters seek to introduce some core-concepts.

Neuroscience is a scientific discipline which combines medical, biological, and psychological approaches to gain a deeper understanding of the structure and functions of neural and neuronal networks. A discipline with a particular focus on economic behaviours is represented by neuroeconomics, which tries to identify cognitive and affective processes in economic settings with methodological support of neuroscience. As a sub-discipline of neuroeconomics, neuroleadership is concerned with managerial and leadership issues, however, it draws from a variety of neuroscientific disciplines. (Peters et al. 2011, 11–15.) Here especially social neuroscience can provide insights and research results with implications on our social behaviour. This is relevant to corporate environments also, as growing interconnectedness in more dynamic environments are dominating work life. (Rock 2008, 1–3.) All such concepts and insights that bear implications for the leadership personnel or organisations as a whole are consistently termed as neuroscience principles throughout the thesis.

The brain in general is a network of different entities that are deeply intertwined and function mostly according to hierarchical structures. From an evolutionary perspective the different parts of the brain can be distinguished into three parts, differentiated in terms of age. The oldest part of the brain, often referred to as *reptile brain*, operates the most basic functions, for instance heartbeat and breathing. It functions mostly automatic, without the need for conscious control. The second stage is the *mammalian brain* which is

related to functions like social behaviour, emotions, and instincts such as reproduction and survival. Its functions also largely work subconscious. The youngest part of the brain is the *cortex*. Especially the *prefrontal cortex* is subject to scientific research as it constitutes the centre of rational decision-making and conscious acting and thinking. (Medina 2014, 11–12.)

3.3.1 SCARF© model

The human social behaviour is largely influenced by a guiding principle of the brain, which strives to minimise threat and maximise reward (Gordon 2000). Following this organising pattern of the brain, humans tend to label any stimuli initially with the adjective 'threatening' or 'rewarding'. This leads to an avoiding (negative) reaction in the former case and to an approaching (positive) reaction in the latter one. As a result, motivation related to social behaviour will only occur through positively associated stimuli. (Rock 2008, 1–3.) This particular model has implications on any relationship between people, but in the context of this work especially for the leadership process and approach. It shows a direct connection between the applied leadership (stimulus) and the respective reaction towards it. Rock suggests a model that reflects key brain functions which are responsible for situations where collaboration and leadership are involved (Rock 2008, 8). It helps to deal with the inherent drive of people to maximise their reward and thus increase motivation. The five-dimensional framework distinguishes individual drivers that affect the threat and reward response within a work setting. These comprise: Status, Certainty, Autonomy, Relatedness, and Fairness.

Status
The first dimension refers to the relative position or importance of an individual, compared to another person or group. Whenever one perceives own superiority comparative to others, the reward response of the brain is triggered. However, when status is lowered for example by expelling someone from a project group, similar parts of the brain are activated as the ones for physical pain. This illustrates the severity of a threat response. Additionally, individual threat responses are very diverse and one might react to a colleague's advice positive while another person reacts defensive. On these grounds current corporate efforts such as performance reviews might pose a threat to the individual status, as they manifest a hierarchy among the peer group (figure 6). Individual's status increases

through own development when a personal growth or learning can be observed as long as attention is paid to such efforts. In this case the reward circuit is activated even though the relative status compared to others has not increased, but one's own status was raised compared to a state before the development process. Positive feedback also affects a rewards response strongly. Rock suggests respective measures instead of financial praises as they seem far more sustainable.

Certainty

The human brain is superbly equipped to learn from current experience and to forecast future events. This constitutes a resource-efficient modus, as the brain seeks certainty by identifying familiar patterns and drawing automatic conclusions. Thereby the brain does not have to engage the highly energy-intense prefrontal cortex in order to process information. However, when the brain identifies only a minor deviation from the standard operating procedure, an error is detected, shifting attention towards this unpredicted event. The prefrontal cortex steps into action, trying to identify the nature of the uncertainty-causing incident and resolve it. Depending on the level of uncertainty this leads to a more or less intense threat-response and a loss of focus and attention; that is why people inherently avoid uncertainty. The origin of uncertainty may range from getting to grips with a new organisational software program to not knowing if one's job is safe. Rock suggests that even small certainty-increasing measures bear huge benefits for motivation and productivity. Stating clear expectations or setting clear and reasonable schedules for tasks might help employees to feel more certain and thus comfortable with challenging new projects (figure 6). In an environment of significant change, people can gain certainty by structuring and planning the organisation's future, even though most plans might not stand reality in the long run. Breaking down large and complex processes into small, manageable actions also helps to increase certainty.

Autonomy

People inherently try to control and thus determine events and outcomes in their near environment. The degree of whether or not one feels to be able to influence the environment or having the choice between options manifests her or his degree of autonomy. Micro-management can significantly reduce the perceived individual autonomy and thus lead to a threat-response. On the contrary, providing people with only a minor choice can increase autonomy and thus trigger a reward-response. Leaders can – within a reasonable

policy-framework – leave decisions about the design of the individual workplace, work-flows or even working hours up to the discretion of their staff. Also within decision-making leaders can increase their employee's autonomy. Delegating tasks and leaving certain levels of decisions up to the recipient's responsibility can not only lower work-loads for leaders but also increase people's autonomy and hence motivation (figure 6). As autonomy can also be linked to the psychological concept of agency, it seems that it correlates with intrinsic motivation. Increasing levels of autonomy can thus be equated with enhanced intrinsic motivation. The latter in turn is said to create more significant and longer lasting motivation, compared to extrinsic motivational factors such as financial incentives.
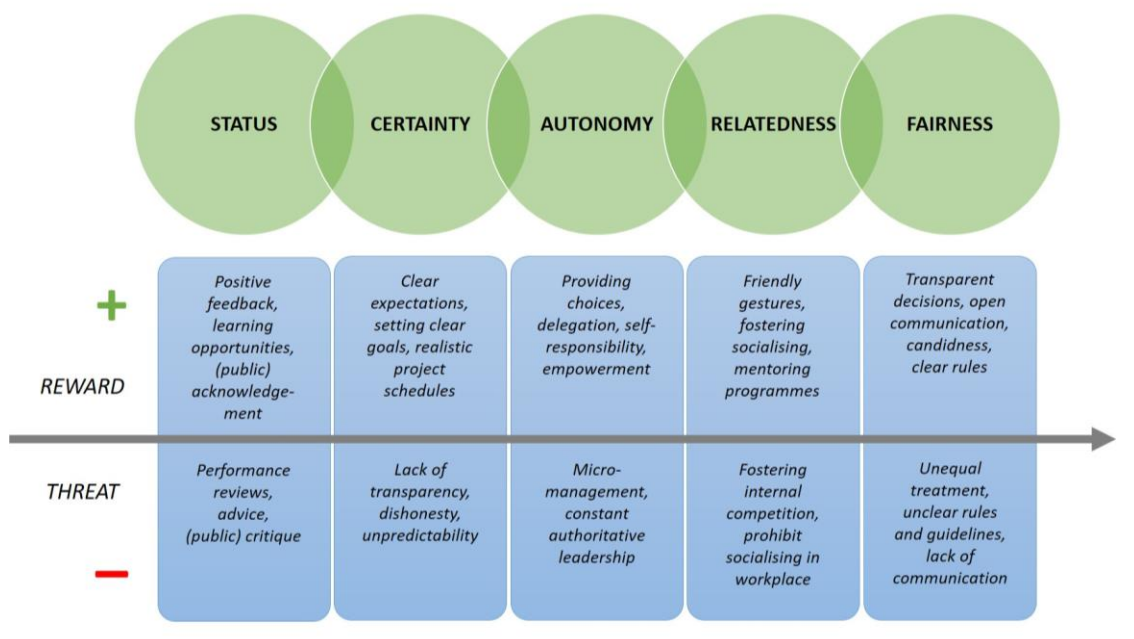
	STATUS	CERTAINTY	AUTONOMY	RELATEDNESS	FAIRNESS
+ REWARD	Positive feedback, learning opportunities, (public) acknowledge-ment	Clear expectations, setting clear goals, realistic project schedules	Providing choices, delegation, self-responsibility, empowerment	Friendly gestures, fostering socialising, mentoring programmes	Transparent decisions, open communication, candidness, clear rules
THREAT **–**	Performance reviews, advice, (public) critique	Lack of transparency, dishonesty, unpredictability	Micro-management, constant authoritative leadership	Fostering internal competition, prohibit socialising in workplace	Unequal treatment, unclear rules and guidelines, lack of communication

FIGURE 6: The SCARF$^{©}$ dimensions with respective leadership behaviours that trigger threat- or reward-responses. (Based on: Rock 2008)

Relatedness

When it comes to trust and relationships with others, the human brain decides within the blink of an eye, if someone is friend or foe. This categorisation of our counterparts usually happens automatically and subconscious. Rock refers to the nature of this relationship and bond of trust by the term relatedness. It is an indicator, to which extent someone feels to be belonging to a social group and experience trustful relationships. It is not surprising that people tend to form smaller groups of like-minded persons within larger groups. This behaviour is probably a result from ancient times when human beings had to form tribes

in order to survive. Strangers usually meant problems and hence induced a threat-response. We continue to act accordingly these days and try to find similarities in others, which in turn will trigger a reward-response; we like the other and trust her or him. On the contrary, we will have problems to empathise with others when we don't see them as 'friend' or even see them as a competitor. This initial labelling will cause a threat-response, leading to dropping collaboration and trust. In order to foster good relationships, small gestures like an open and friendly exchange of names and a simple conversation to find similarities might increase the odds that trust is established and one is felt to be part of the group (figure 6). Such interventions can cause the release of the neuropeptide oxytocin which is related to as a 'bonding hormone', increasing chances to establish positive relationships and a generally more affiliative behaviour. (Rock 2008, 48–49.) What is more is that social relationships seem to constitute a primary need of human beings. Whenever people do not experience safe social contact, they encounter a threat-response (Carcioppo & Patrick 2008, 8–10.) Especially in today's reality of virtual teams the bonding process through means of telecommunication must be kept in mind. Sharing personal information within the framework of informal web-meetings can help create trust and positive social relationships between team colleagues and in turn increase collaboration and the forwarding and sharing of information. (Rock 2008, 48–49.)

Fairness

The final dimension in the SCARF model is fairness – the perceived fairness of any given transaction or further situations. People seem to judge events whether they are fair or unfair for themselves or even for others. What makes this judgement subject to bias is that it is mostly not based on rational decision-making, but on emotions. Hence a threat-response is easily triggered. On the contrary, people who feel treated fairly or who are able to make fair offers to others might realise a strong reward-response. This illustrates the necessity for transparency and open communication about organisational-related issues towards the employees (figure 6). Leaders who are open and candid with such matters will be able to prevent their employees from labelling events as unfair when they are not. Also clear rules and more transparency in salaries and how they are substantiated can alter unfair perceptions. (Rock 2008, 49–50.) Finally, research suggests that an increased feeling of fairness in the workplace can significantly contribute to workplace-satisfaction and physical as well as mental health of staff members (Rock 2012, 8).

3.3.2   Stress and the brain

The vast amount of stress-related literature illustrates the omnipresence of the term in nowadays life. Entering the search term 'stress' to *www.google.com* currently leads to 563 million hits while *www.amazon.com* lists more than 76,000 books related to the search term. In May 2013 a representative study among the EU member countries estimated the total costs for depression, a major result of chronical stress, to €617bn annually (Matrix 2013, 31). In the context of leadership, middle management positions are most likely to experience high levels of stress as they will receive pressure from both sides, their superiors, as well as their employees (Heimann 2007). However, when viewing stress from a scientific perspective it can be divided in different forms, where not every form holds only negative impacts (see also chapter 3.3.3 *peak performance*). In fact, individual persons will show different reactions to the same kind of stress when compared to each other. Stress in general is an aroused physiological state. This aroused state can be triggered by either anxiety or pleasure. A clear definition is thus hard to achieve. However, one approach is a three-part definition: A measurable physiological response, a desire to avoid the situation, and a loss of control. If all three preconditions are met simultaneously, a person experiences stress. (Kim & Diamond 2002, 454.)

The foundation for human's reaction to stress lies in the fight-or-flight response, an inherent neuronal system which responds to threat (Gray 1990). It is meant to ensure survival when threatening events arise as for instance the attack of a predator. Technically, if the body experiences a stress-situation its amygdala responds by triggering the hypothalamus to release adrenaline. This reaction generates an immediate burst of energy and attention to counter or evade the respective threat. Simultaneously cortisol will be released, leading to a suppression of certain body functions such as the immune response. Built only for a short-term response the system will alleviate itself after some time. However, in today's environment, stressful situations often persist for prolonged periods of time, leading to chronical stress symptoms with destructive effects on the body. (Medina 2014, 61–64.) Continued over-arousal increases the allostatic load of the brain (figure 7). This is when stress hormones such as adrenaline or cortisol are chronically being released, leading to an even more sensitive stress-response and hence to ongoing perception of threat. (Rock 2011, 151.) Decreased immune functions increase the likelihood to contract

infections like the common cold. Also the constantly elevated blood-pressure increases risk for strokes and heart attacks dramatically. (Medina 2014, 61–64.)

Besides harmful effects of chronic stress for physiological health, its effects on the cognitive functions are just as adverse. While moderate and limited stress levels can be beneficial for decision-making and learning (chapter 3.3.3), prolonged or intense levels actually hinder rational thinking and memorisation (Medina 2014, 65). The responsible neuronal system which determines such adverse responses, avoiding rational thinking, is the limbic system. This network, linking several parts of the brain guides our thinking and perceiving of environmental stimuli through emotions which leads to decisions. These processes often work subconscious and automatic through the application of values and past experiences. The decisions our limbic system makes are subject to an overarching principle to minimise threat and maximise reward (chapter 3.3.1). However, through evolutionary processes the limbic system is aroused more quickly and with elevated intensity to threatening triggers than towards rewarding situations (figure 7). With exaggerated arousal the limbic system inhibits brain functions dramatically. It reduces resources for the prefrontal cortex – the centre of logical thinking – leading to substantially decreased processing and memorisation of new information. Subsequently the brain is prone to use other brain-regions that process information automatically but are heavily subject to bias (figure 7). Hence decision quality decreases drastically. Also people will tend to seek safety within decisions, avoid taking even small risks, as well as view situations increasingly prejudiced and negative. (Rock 2011, 142–151.)

In terms of memorisation, an increased allostatic load can hinder the building of new neuronal connections which determine long-term memorisation. Thereby stress hormones such as dopamine inhibit the formation of new neuronal cells within the hippocampus – an essential part of the brain for long-term memorisation. As memories are deeply intertwined networks of neuronal cells, the building of new connections is interrupted; the brain cannot memorise new data anymore. Increased amounts of stress hormones also weaken the neuronal cells in the hippocampus, leading to elevated levels of sensitivity to even lighter stress. Even more adverse however, chronic stress can cause neuronal cells to mortify. This means that neuronal networks which are already existent can disappear and hence stored memories are lost forever. (Medina 2014, 66–67.)
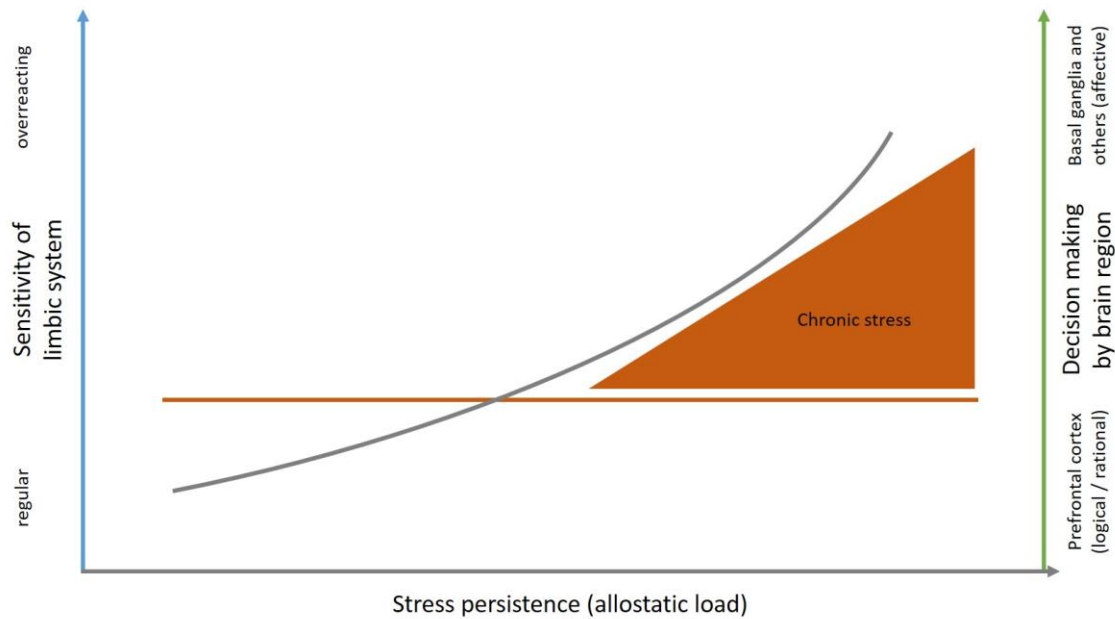
FIGURE 7: Stress responses of brain by terms of limbic system sensitivity and shifting use of different brain regions.

While strategies to fight stress are manifold, one of the most natural is to use the energy resources, the biochemical processes following a stress response have triggered in the body. As the exact reason for the released energy is to engage in fighting or running away from the threat, physical exercise ideally consumes this surplus energy in the body. This leads to an alleviation of stress hormones and thus cuts the acceleration of chronic stress. At the same time physical exercise increases resilience of neuronal cells over time. Whenever bodily movement is performed, the brain is deeply engaged by coordinating the respective muscular contraction and relaxation. This constitutes a subtle stress for neuronal cells which is moderate enough to cause them to increase the resilience of their structure. Subsequently, cells will be reinforced and able to handle increasing levels of stress without taking damage. This can not only leverage individual health and performance, but also positively impact organisational productivity as a whole. (Rathey & Hagerman 2013, 60–79, 83–84.) Other strategies to alleviate negative impacts of stress will be discussed in the following chapters.

3.3.3   Attention, focus and peak performance

In a world of constant information overload there is little chance not to get distracted from a task every once in a while. As some studies found, the average span of attention in work life lasts only eleven minutes until one gets distracted. Given the fact that it requires some 25 minutes to fully concentrate and re-engage on a single task, the cost of distraction becomes quite obvious. Assuming that full attention towards a task leads to more elaborate results in shorter periods of time, there seems to lie substantial productivity and quality potential within conscious use of attention and focus. (Rock 2011, 74.)

The reason why humans can consciously guide their attention, other than most animals, is the prefrontal cortex. This part of the brain is often referred to as *rational brain* or *executive brain*. Among others it is responsible for planning, decision-making and the guidance of attention. (Medina 2014, 10–11.) Attention in neuronal context is based on three networks which work fully integrated in order to process stimuli and draw the attention to a specific one. The initial system called *Intrinsic Alertness* constantly scans the environment through sensory perception. In case of unusual or unexpected events the system triggers an alert response through the *Phasic Alertness*. This activates the *Orienting Network* which draws specific attention towards the respective stimulus and directs sensory perception onto this activity, aiming to elaborate the nature and possible impact on oneself. Such direction of attention might be influenced by past experiences as well as specific interest in certain environmental information. Subsequently the *Executive Network* as final stage processes the acquired information, leading to specific decisions or responses (Medina 2014, 107–111.) As this system works mostly automatically, it can be hard not to get distracted by certain triggers.

According to a study of executives, 80% reported to face time management problems within their role. Distraction is one of the key triggers, followed by general prioritisation and organisation issues (Meager & McLachlan 2014, 7). As the human brain can only process one information at a time, shifting attention through distraction leads to a constant switch of attention between stimuli. This energy-consuming behaviour of disengaging and reengaging focus leads to increasing fatigue of the brains energy resources. According to a study about the *dual-task interference*, even the brain performance of a Harvard graduate can drop to levels of an eight-year-old, when confronted with solving two tasks

at a time. (Rock 2011, 57–59.) In the same context, a study suggests, the ability for reengagement onto the initial task deteriorates substantially with age (Clap, Rubens, Sabharwal & Gazzaley 2011, 7215–7216).

Accordingly, avoiding the once highly praised multi-tasking has become a platitude in the meantime. Prioritisation of tasks and the direction of focus and attention seem a challenge almost everybody experiences in the workplace as well as at home. An initial strategy to counter distraction is to avoid them. This can be achieved by shutting down email-accounts and telephone for determined periods of time in order to stay on sharp focus. Another option is to stop switching between different tasks in short intervals. Dedicating fixed time units for individual tasks can also help to avoid multi-tasking. Lastly, the brain is limited to process information consciously in a serial process. However, when tasks like driving a car are habitualised, they are executed by other brain regions - the basal ganglia - that work very energy efficient and hence do not block the rational decision-making. Thus, if time-consuming routine tasks as for instance telephone calls, certain email replies, and else are formed as habits, more brain capacity is available for rationally demanding thinking. (Rock 2011, 58–66.)

The brain is a limited resource and treating it as such can increase productivity substantially. Physical rest can as well positively alter awareness and thus the ability for full focus. The NASA found that with 26 minutes of sleep during the day, attention advanced by more than a third and reaction times increased by 16 percent in comparison to a control group without respective rest. Another study, examining a nap of 45 minutes was able to demonstrate improved cognitive function, lasting more than six hours. (Medina 2014, 46–47.)

As already explained in the preceding chapter, moderate levels of stress are actually beneficial for physical and cognitive performance. According to a study by Yerkes and Dodson, certain amounts of stress are necessary to perform at optimum levels (1908). Within low arousal levels the brain utilises mostly habitual functions without activation of the prefrontal cortex. Consequently, performance levels, especially in the context of alertness and logical thinking are impaired, the person feels bored (figure 8). In order to activate the brain, increase arousal and engage in a task, a moderate stress response can consciously be triggered. By imagining the negative consequences if the task is not being accomplished on time or according to quality criteria, adrenaline levels are increased,

leading to rising arousal. Another method is to trigger interest towards the task, which releases dopamine. This can be achieved either through a change of working conditions and environment or by a shift in mindset in terms of creating a more positive attitude towards the task and focussing on the 'fun' in it. (Rock 2011, 96–98.)
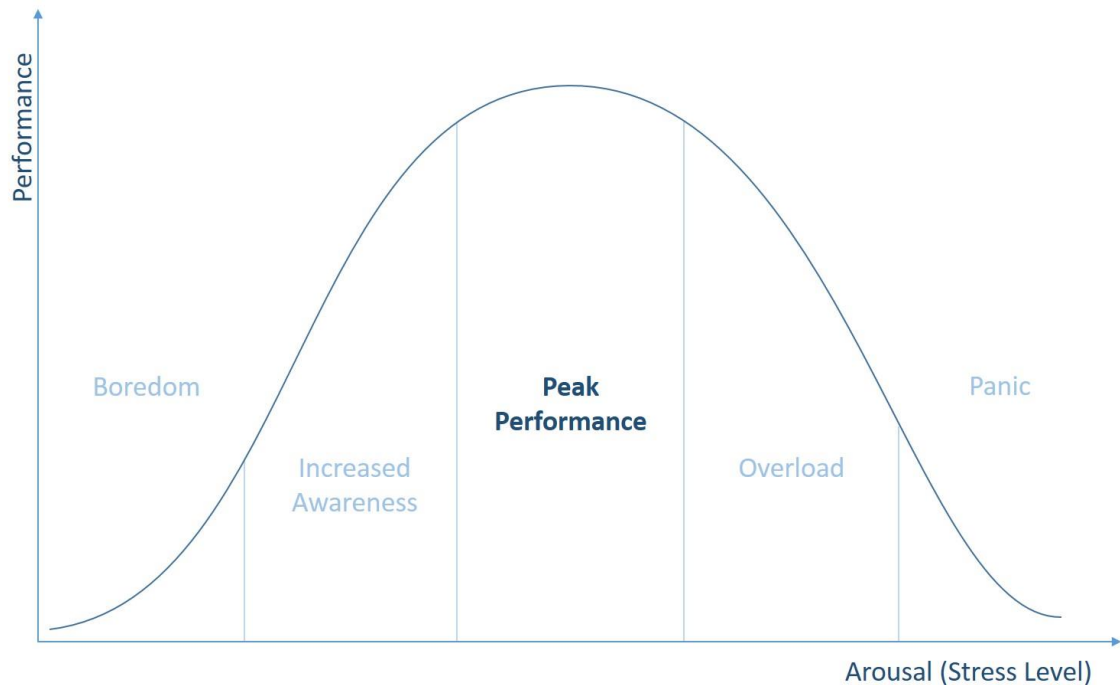

FIGURE 8. Inverted U–curve with respective arousal states. (Based on: Yerkes & Dodson 1908).

As the stress level and hence arousal mounts, awareness increases accordingly, eventually levelling off at a zone of highest performance – the so called *peak performance*. Due to the limited energy resources of the brain, this level cannot be maintained for extended periods of time. In consequence of continuing or even increasing stress, performance starts to drop. At this stage one begins to feel overwhelmed by the extent or intensity of a task which eventually can lead to a trough where panic is the dominating emotion. In order to reverse these developments, the arousal level has to be decreased again. This can be achieved by distracting the conscious mind with sensory stimuli as music. This will disengage the prefrontal cortex and activate larger regions of the brain which process sensory perception. Through this process the brain's energy resources can be saved and probably even recharged, reversing the process of over-arousal.

It should be mentioned that stress thresholds are very individual. While one task might be routine for a person, the same task could be extremely stressful for another. Thus an

examination of one's individual zone of peak performance is the key to consciously trigger high performance. (Rock 2011, 98–101.)

3.3.4 Brain-friendly learning

A key determinant to the success-story of humankind is the ability to learn and constantly adapt to - sometimes adverse - environmental triggers and conditions. People today are smarter and have access to more information than ever before in history. (Christian 2011) In fact, the limiting variable for the acquisition of new information, concepts, and mindsets are the brains' process of learning and the act of handling this vast amount of available data. Neuroscience provides fresh insights into how the brain processes information and how memorisation takes place in the neuronal networks within the brain.

Rather than storing all information sequentially, the brain filters relevant from irrelevant information at an initial stage. Subsequently these newly acquired information is interlinked with and connected to existing knowledge. This network is strengthened, reinforced, and made more efficient every time it is used. (Medina 2014, 86–87, 138.) This is why repetition or application of new knowledge or skills is key to build long-term memory. However, memorisation and especially long-term memorisation takes time. Spacing out repetitions proved to enhance recall accuracy noticeably. (Medina 2014, 148–150.) What is more is that this repetition partially seems to happen as an automatic procedure during sleep. This is why sufficient and good sleep plays an important role in learning. (Medina 2014, 50–52.)

Another limiting factor to building new neuronal networks are emotions. The overarching principle of threat and reward (see 2.2.1) also guides the effectiveness of learning. A treat-response, triggered e.g. by subconscious pressure due to an upcoming deadline, consumes a vast amount of neural capacity which lacks then in the learning process. Also negative emotions are linked to the newly acquired information which can inhibit memorisation. On the contrary, if learning contents are deemed to be relevant, interesting, and even fun the acquisition is supported by a reward-response which increases creativity and the odds for long-term memorisation. Also the release of the neuro-transmitter dopamine is likely to occur which leads to positive emotions and an even increased ability to memorise and remember in the long term. (Kauffeld 2016, 68.) In fact, emotionally charged stimuli in

general aid long-term memory. When being asked about specific memories of the place and other environmental factors, even nowadays most people will remember several details when they first heard about the 9/11 terror attacks in New York in 2001. Thus in conscious learning the considerate use of emotionally charged information can aid the memorisation process. (Medina 2014, 112, 122.)

The use of multiple sensory channels enhances learning-perceptivity. While processing language in written or spoken form is rather effortful for the brain, providing information in visual form increases processing speeds substantially (Rock 2011, 33–34). Especially the dominance of the visual sense which requires approximately half of the brain's processing capacity should be focussed in brain-friendly learning. It turned out that remembering information which was presented by a picture was over six times more likely to be recalled after three days than the same information in just oral form. (Medina 2014, 190–193.) Research also suggests that the combination of two senses at a time can increase the performance of each one substantially. In studies where this multimodal reinforcement was applied to presentations, participants were significantly better in recalling the information. (Medina 2014, 170–171.) Also shifting lecturing or learning methods from time to time can help improve learning by increasing attention through novel stimuli (Kauffeld 2016, 69).

Finally, science and public long believed that learning is essentially limited to childhood and youth. Synaptic networks were considered to be hardwired when reaching adulthood and hence new neurons would not grow anymore. However, new brain imagining technology was able to invalidate this dogma. Researchers found that even during adulthood neurons are reproduced, a process called *neurogenesis*. (Rathey et al. 2013, 48–49.) What is more is that the brain is not only able to grow new cells but also to rewire and reinforce existent or build new ones. This *neuroplasticity* termed process enables a constant adaption of neuronal processes to improve efficiency. (Merzenich 2004.) One popular example to illustrate this phenomenon is a study on London taxi drivers compared to bus drivers of the same city. Researchers identified increases in hippocampal gray matter of the taxi drivers' brains while the reference group of bus drivers did not show such development. As stress level and other factors were similar among the groups, the researchers identified the constant spatial challenges for the taxi drivers as trigger for changed neuronal networks. As they constantly faced to find new routes throughout the dense and unstructured road network of London, their brains adapted through this stimulus. The bus

drivers always followed a standard route and thus had no such stimulus to alter the brain. (Maguire, Woollett & Spiers 2006, 1097–1099.) This means that learning constitutes a form of exercise for the neuronal networks and hence even adults can build new networks by engaging in learning and constantly keeping stimulation high by reaching for ever increasing challenges. Hence lifelong learning is absolutely possible.

A publication by Rock and Schwartz draws attention to the power of focus when engaging in learning. The *Quantum Zeno Effect*, originating from quantum physics, states that whenever an atom-sized entity is observed it will change position and behaviour. Transferred to neuroscience this means that a conscious focus on acquiring specific knowledge or skills strengthens and reinforces the respective networks. (2006, 6–7.)

3.3.5 Emotional regulation

As for the brains' structure, thinking and acting are almost always guided by emotions rather than rationality (chapter 3.3.2). However, today's environment requires us to keep ahead of primitive reactions and act in calm as well as logical ways. In fact, the limbic system (reaction) in this context is once again impairing the prefrontal cortex (thinking) through the threat and reward circuit (chapter 3.3.1). It means that increased stress levels, where the amygdala perceives a real or imagined threat for life, will cause a fight or flight response and hence shut down rational thinking and decision-making. (Rock 2011, 143–145.) Emotional outbursts seem to be a major issue in the workplace. As a study suggests, more than 70 percent of executive respondents have people-problems within their role. The most stated were arrogance, laziness, and bullying. At least the first and the third can be easily connected to emotions and an inability to control these.

It seems as if most leadership development programmes handle respective matters too simplistic and do not consider or even integrate the individual's psychology. Leaders mostly get simple hints and tips such as "Mediate between two employees, having a conflict." without providing fundamentally new and tested strategies to tackle suchlike challenges. (Meager et al. 2014, .7) This is where emotional regulation can be utilised to alter destructive behaviour and increase both the quality of decisions and of collaboration. Emotional regulation as defined by Mayer and Salovey is "the ability to connect or disconnect from emotions depending on the usefulness of emotion in a given situation"

(1997). Whenever forced into the fight or flight response, these techniques can immediately alleviate overreactions and a blockage of the prefrontal cortex. With particular regard to the following chapter on change, leaders often need to be able to address the anxieties of employees while managing, regulating and probably using their own emotions in the respectively most suitable way (McDermott, Kidney & Flood 2011, 362).

Methods to approach emotional regulation are manifold and range from subtle hints such as getting sufficient sleep and suitable food to exercising self-discipline and willpower (Pychyl 2009). Gross provides a process model of different interventions that can be applied at distinct points within the emotion generation process (figure 9), helping to prevent or alleviate certain emotional responses (2014, 7). By selecting a specific situation, the emergence of undesirable emotional conditions can be averted in advance. A modification of an existing situation can, for example, be achieved by choosing a more suitable environment in order to avoid concerned emotional impacts. The conscious deployment of attention can be utilised e.g. by distracting oneself from a trigger which causes an unwanted emotional response. This can be achieved for example by shifting attention from a criticising negotiation partner to his more open partner. During the phase of appraising a situation, the cognitive change can help to consciously shift perspectives to gain a more desirable emotional state. Thereby the meaning of the situation for oneself can be altered e.g. by not viewing a challenging project as a threat but an opportunity to grow and expand experience. An often used technique in this context is the reappraisal. The last family of response strategies allows to modulate the already emerging or present response to an emotional situation. Thereby any form from breathing and meditation interventions to physical exercise and intoxicants can be utilised in order to decrease the negative experience of emotional responses. (Gross 2014, 9–10.)
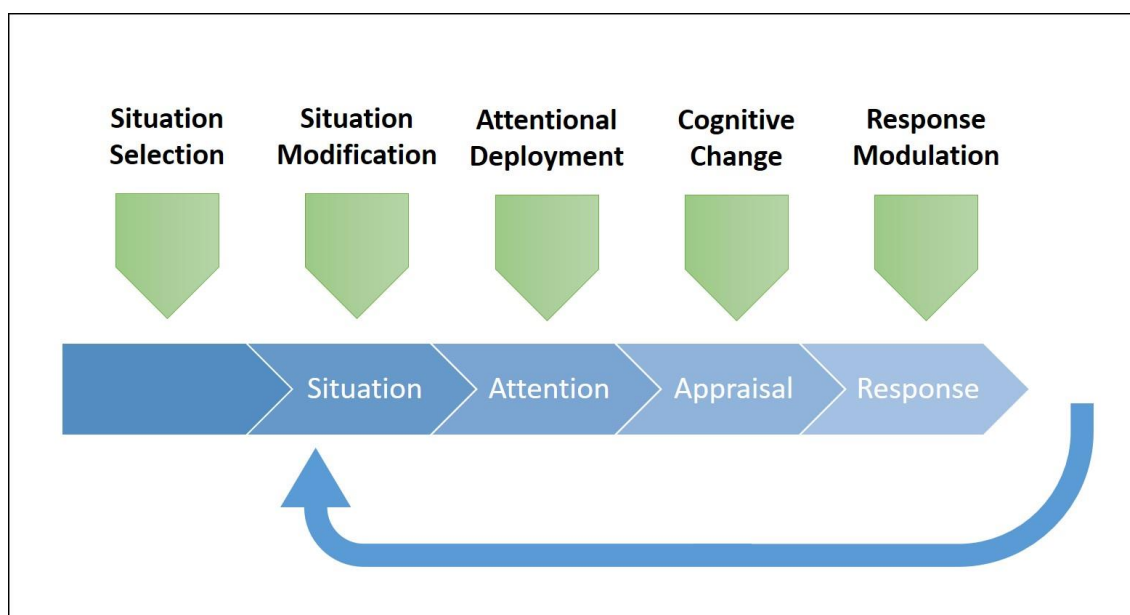
FIGURE 9: The emotion regulation process. (Based on: Gross 2014)

Several studies have shown that the cognitive change proved to be the most effective strategy in order to regulate emotions. Here the labelling as well as the reappraisal can be utilised. (Rock 2011, 152.) Through symbolic labelling, threat-responses of the amygdala towards emotional cues are substantially altered. This means a less active limbic system and hence more resources available for rational decision-making within the prefrontal cortex. By describing an uncomfortable or even threatening emotional stimuli with a few words or even through a symbolic language as by using metaphors, its impact on the limbic system and thus the reaction towards it can be decreased. (Rock 2011, 154–155.) Another strategy that alters emotional responses even more effective is the reappraisal. Thereby negative appraisals of a situation are shifted within a new, more positive and rewarding frame. Here a once threatening situation can be interpreted differently by consciously deciding to perceive it as no threat. Furthermore, an uncomfortable or threatening situation can be consciously altered so as to perceive it as normal. When starting within a new job-role tasks can be overwhelming in the beginning. By just viewing this fact as 'normal' in the beginning, emotional responses can be alleviated. A further technique includes to rearrange own values and priorities. Thereby existing neurologic networks are expanded or rewired by questioning old behaviours and value systems and adapting these towards new challenges. Hence a negative appraisal of e.g. less decisional freedom in the new role can be altered towards increased collaboration and democratic structures within a new team. Decisional freedom is thereby given less priority in the new value system while collaboration is given more weight.

A last method is to shift complete perspectives and positions. By changing context or the own point of view, new insights can be derived. This can for example be achieved by trying to see a situation through the eyes of another involved person. This can also aid in building up a less threatening view on certain circumstances. (Rock 2011, 172–175.) Under any circumstances, emotional regulation is a consciously directed process of own beliefs and perceptions. On the basis of these facts it is highly energy consuming and will work best early in the day, when the brain's energy resources are fresh (Pychyl 2009).

3.3.6   Resistance to change and habit change

Continuous change is the business reality within every economy on the globe. In order to adapt to rapidly changing environmental as well as internal forces, organisations are more than ever prone to a lasting cycle of transformation. Becoming aware of threats or opportunities, identifying and developing respective measures and finally comparing results against intentions and altering the measures is key to business success. According to Rock and Schwartz the ability of corporations to quickly change and adapt to a changing environment lies at the heart of corporate success.

On the people-side of change, however, perceived threats play an important role in determining change readiness and individual motivation (chapter 3.3.1). Continuous adaption of individual beliefs, behaviours, and habits is vital to such company-wide alterations. (Rock et al. 2006, 3–5.) While a reasonable amount of novelty excites the brain and can foster cognition (chapter 3.3.4), too much stimuli force the brain into a fight or flight response. The individual threshold determines how much newness within a change process is actually enhancing the readiness for change, or leading to resistance. (Rock 2011, 78.) These very individual responses, much like the level of arousal (chapter 3.3.4), should be observed when trying to get commitment and win-over staff for change processes.

Change processes from a brain-perspective are huge causes for threat-responses. Anxieties about job safety, future status as well as challenges to adapt to new skillsets and knowledge are just some examples that bear huge potential for avoidance-reactions of staff. Traditional approaches to motivate employees usually constitute of behaviouristic

models as for instance the classical conditioning. Thereby monetary rewards or the threat of penalties is utilised to drive peoples' willingness to change. However, as research proved this 'carrot-and-stick' policy falls short on adults, leading to increased avoidance-reactions or even aggression. (Rock 2011, 285–286.) A deeper understanding about factors that cause respective behaviour can be facilitated by neuroscientific knowledge. As mentioned in chapter 3.3.1 the brain likes to follow routine and stick to habits as this is an efficient and hence preferred modus in terms of energy consumption. Following this, every change of routine is afflicted with a brain's shift of attention towards the non-routine stimulus, followed by a more or less intense threat-response. Thus, one of the main challenges in change processes is to lastingly change routines and habits of employees. (CIPD 2014b, 14–17.)

David Rock proposes a threefold model to evoke habit changes in individuals and groups. Initially, a safe environment has to be created. Following the SCARF© model (chapter 3.3.1) proves valuable again in this context, as consideration of all five dimensions helps to minimise threat and maximise a reward-response. A second step is to intentionally guide own and others' attention towards the desired matter. Intentional focus causes neurons to fire in synergised patterns. This activates the wiring of different neuronal networks and hence creates new brain patterns. By acting according to Hebb's learning theory, the more often such created patterns are activated, the more they are attuned to each other. Following this, the creation of new neuronal networks by consciously and repetitively focussing on a new behaviour increases the likelihood that this behaviour consists. Studies show that a conscious shift of focus can revise networks within weeks. (Rock 2011, 286–289.) This bases on the neuroplasticity-principle (chapter 3.3.2) which states that the brain's state is steadily fluent. The final step is to entrench the newly formed behaviour. Following the brain-friendly approach to learning, repetition is key. Hence, focus has to be drawn onto the behaviour consistently and for prolonged periods of time. In a team setting this can be increased by discussing the change topic repeatedly. Embedding a social component into a habit change process increases odds that the behaviour persists. Also claiming commitment from concerned people to exercise such new behaviour can increase the sustainability. Finally, setting clear goals can aid in this process, as long as the five dimensions of the SCARF© model are observed. (Rock 2011, 298–302.)

4   RESEARCH RESULTS

4.1   Expert-interview setup at a glance

In-depth interviews were conducted to create valuable insights towards the research questions. The general direction of research thereby was informed through preceding secondary research. Experts' experience and knowledge were meant to shed light onto their respective awareness and opinions about neuroscience principles with business relevance. Furthermore, existing applications of such principles were to be elaborated. Finally, the focus on current and future challenges for HR and leadership was meant to provide insights into the current drivers and needs and in turn to enable the identification of valuable fields for application of neuroscience principles. (appendix 1.) This strongly interpretative approach was supported by the two subject matter experts who shared their opinions and subsumption of identified prospective fields for application.

The sample of respondents consisted of the following:

1. Senior Specialist for Global Learning & Development, TÜV SÜD (professional services provider, 20,000 employees worldwide); 25 May 2016, telephone, total duration: 35 minutes.

2. Dr. G. Senoner, Head of Human Resource Development, STRABAG SE (construction services, 73,000 employees worldwide); 25 May 2016, telephone, total duration: 39 minutes.

3. Former Head of Department for Sales and Dealer Organisation Germany, Volkswagen AG (automotive manufacturing, 101,000 employees in Germany); 27 May 2016, telephone, total duration: 57 minutes.

4. S. Zeising, Global HR Business Partner, BAYER AG / BAYER Animal Health (life sciences, 117,000 / 3,000 employees worldwide); 2 June 2016, Skype, total duration: 53 minutes

5. Head of Marketing, major automotive manufacturing corporation, (> 80,000 employees in Germany); 3 June 2016, telephone, total duration: 63 minutes.

6. F. Fabritius, Neuroscientist and Senior Executive, Munich Leadership Group; (management consultancy services, 45 employees worldwide); 8 June 2016, telephone, total duration: 70 minutes.

7. Consultant for Management Diagnostics and Development (international management consultancy, 700 employees worldwide); 22 June 2016, telephone, total duration: 55 minutes.

8. HR representative of global process technology provider (18,000 employees worldwide); 24 June 2016, telephone, total duration: 34 minutes.

9. Dr. Hans Werner Hagemann, Chief Executive Officer, Munich Leadership Group; (management consultancy services, 45 employees worldwide); 30 June 2016, face-to-face, total duration: 39 minutes

The respective respondents' statements are indicated as 'IR' (interview respondent) followed by the abovementioned number, in order to increase clarity and comprehensibility.

4.2   Awareness and relevance

As examined in the previous HR trend analysis, awareness about neuroscience principles currently seems to be widely existent among HR-executives', while it is no such relevant matter in leaders' priorities. Relevance in terms of goal attainment, personal success and other vital fields for the target group was currently not given, however. Newness of the matter as well as time constraints in acquiring new knowledge seemed to avoid the groups to engage deeper into the topic.

4.2.1   Awareness

Asking about the personal awareness level with regard to neuroscience principles, relevant to business, all HR representatives reported to be aware about and have at least a general understanding of the underlying models. IR2, for example, described that he had deeply engaged into neuroscience some years ago during a trainer and coach function. Some even dealt with neuroleadership on a rather regularly basis. As neuroscience principles are part of respective corporate leadership development programmes, all involved stakeholders gained a deeper knowledge about relevant principles (IR1, IR4). Respondents also reported that they saw other representatives of their respective corporate HR

entities of being at least aware if not even dealing with these contents (IR4). Some, however, did only get in touch with the topic through their academic background and did not see an increased awareness about the matter among their colleagues (IR8).

On the contrary, only one of the two interviewed leaders was aware of neuroscientific concepts, however without substantial deeper understanding or knowledge of these. This is backed by reports of the HR representatives, that see rare to non-existent awareness among leadership personnel. Leaders who did not participate in recent development programmes or pursue an own interest in the topic might not be aware of such principles (IR1). IR4 mentioned that due to the fact leadership development programmes were starting to include neuroscience concepts three years ago, most of the elder managers and leaders will not have a considerable amount of awareness for respective topics. Thus he deemed majorly the younger leaders of being in possession of awareness and probably deeper understanding of suchlike principles. With regard to the hierarchical structure of the organisation, leadership personnel within middle-management and above, who are located within the headquarters seemed to gain more insight into respective matters, compared to rather remote positions in the corporate branches (IR3, IR5). This might likely be caused by an easier access to workshops and information formats who are held at the headquarters.

IR6 however mentioned from personal experience that the identified awareness levels will not always hold true. A vast amount of HR representatives in companies she conducted trainings, workshops, and other formats were not aware of such principles before the meeting. Hence she provided initial description of respective neuroscience principles, which built awareness among this limited scope of HR professionals. In turn, after conducting a training or workshop, a proportionally higher number of leadership personnel was aware of the topic and respective principles, compared to HR. IR9 reported from his experience that for HR this was absolutely true two years ago, but has increased substantially to date. He deems the positive impact of neuroscience for leadership development to have arrived in the awareness of HR-representatives of German corporations. However, this awareness constitutes only the initial stage. The next step will be for HR to probe the market for suitable partners that help transfer the neuroscientific knowledge into real-world applications for leaders.

4.2.2 Relevance

In terms of relevance for HR and leadership, there were no signs that neuroscience principles are currently considered to bear direct potential for supporting organisational or individual goal attainment. The HR-community seems to treat these topics rather like an 'orphan' at the moment (IR4). They are simply utilised to support and enrich other topics, but are not at all deemed to change the game (IR1). Depending on personal attitudes of HR executives they might at least value external service providers, who include such topics into their development programmes – but rather as a nice-to-have feature (IR2). However, with a view to the future, some respondents articulated the opinion that relevance of respective principles will increase. Importance of neuroscience insights is growing, in order to understand, why people behave in one way or the other, as well as how the brain affects human behaviour (IR4). Also incorporating neuroscience insights about how the human brain learns best, into the conceptualisation of trainings and other delivery formats is viewed as a chance and necessity for the future (IR8).

IR9 viewed HR departments to increasingly face the challenge of providing leaders with high quality development measures as competitive pressure is rising in every sector. The market of development providers as such is vast and intransparent, often with questionable approaches and models as for instance esoteric tendencies. Neuroscience can bridge the gap between leaders' need for profound, scientifically grounded knowledge, and practicable applications to improve leadership. Content-related, neuroscience offers more substance than previous psychological models, which are mostly grounded in introspection. Thereby the identification of triggers and how they influence behaviour is a key benefit, as leadership is always about the interaction of people. However, at the moment organisations seem to struggle in finding suitable and worthwhile applications for neuroscience principles (IR2). Partially the practical relevance is considered to be lacking yet (IR7). This is particularly caused by the missing transfer from science to business realities as well as a limited number of practical examples and best practises so far (IR8, IR9).

4.2.3 Interpretation of findings

In terms of latest neuroscience insights, HR representatives appear to act like early adopters for the topic due to their role and purpose of providing leadership and staff with

the most effective development contents available. This awareness for the matter currently seems to start trickling down to the level of leaders, however slowly without having reached a critical mass to indicate a turning point. Accordingly, neuroscience's potential for corporate success is not considered to be relevant, even though some HR representatives predict such developments in the future. Therefore, respective principles are currently used to enrich traditional contents, in order to make these seem more modern, but not fundamentally changing present management models and beliefs. Furthermore, neuroscience is partially applied to corporate challenges where traditional approaches cease to function, but still without a systematic approach. The potential of neuroscience has yet to be proven and pragmatic application models to be presented in order to convince organisations about its relevance for corporate success.

4.3 Current fields of application

The already existing or developing applications of neuroscience principles in leadership development are rather scarce. These contents were being utilised intentionally in only a limited amount of recurring training programmes and the total proportion within such is estimated to a maximum of five percent (IR1). Intentionally in this context means that the HR departments purposefully include respective matters in development efforts. Furthermore, corporations utilise single workshops or keynote speeches with neuroscience contents on an occasional basis, to provide inspiration and set impulses during unconventional events such as change processes (IR6). Neuroscience contents are almost exclusively delivered by external training and development providers, while internal training departments seem to hold on to more classic programmes (IR1, IR4).

In general, different aspects of leadership development are deeply intertwined with each other and are thus hard to distinguish. People-leadership [*principles on how to lead personnel*] determines corporate culture, while corporate culture will determine specific mindsets in personnel which influence the readiness for change as well as learning. In turn, different mindsets might determine how leadership is perceived and thus influences motivation and productivity of a single staff member. (IR4.) Hence, identified applications of leadership principles were rather scattered with different maturity levels and varying purposes. Additionally, contents are often simply not termed neuroscientific although they originate thereof (IR4). Thus there might be a variety of principles already

utilised without a conscious awareness of these. Identified fields of current application consist of the following.

4.3.1 Leading people

A significant part of leadership development itself is the act or process of leading others. Leadership as well as management styles and models are imparted to enable current or future leaders for more effective and productive goal attainment. In the context of neuroscience principles, there seemed to be no substantial contents incorporated in development measures that would indicate a changed model of leadership at the moment. However, companies were already enriching proven leadership and management training with some neuroscientific insights and models. Providing leadership and management personnel with explanatory models, how human behaviour is caused through specific triggers, enables these to gain awareness about the potential results of their leadership (IR1).

As the corporate people-leadership is shifting through the entry of new and young personnel, perspectives seemed to slowly shift towards novel approaches and explanatory models including neuroscience principles. At BAYER this is currently limited to theoretical models, however also practical application of some neuroscience insights will be seen in the near future. Especially the influence of emotions within decision-making as well as motivation are deemed an insightful field with growing importance. (IR4.) Other companies on the contrary do not incorporate neuroscience principles at the moment (IR3, IR3, IR5, IR8). IR5 expressed her wish to learn more about the underlying triggers of human behaviour that are revealed through latest neuroscience, in order to direct her leadership effectively. However, currently there seemed to be no such attempts within her corporation.

4.3.2 Change management

To date, organisations align their change initiatives on behavioural and psychological models as for instance the Kuebler-Ross model (1969) about the five stages of grief (IR7). Leaders have been taught respective models for decades within leadership development in order to prepare these for adaptive measures within the organisation. At TÜV SÜD

neuroscience principles were already part of more advanced leadership programmes. They constituted a part of change management contents, where they were used to shed light onto people's potential reactions to change, the triggers for such, as well as strategies to cope with. Also the application of the SCARF$^©$ model (see chapter 3.3.1) falls into this part of training programmes. It aimed to provide the participants with explanations, how people respond to certain triggers that are impeded during change-initiatives, as well as how this influences the motivation and willingness to change. (IR1.) These contents were still at a low proportion, however, and were largely used to scientifically support traditional change management models.

Not grounding their approaches in neuroscience, IR7 reported that his organisation utilises change management models which try to increase the awareness among leaders on how their employees perceive a change process as well as which [*emotional*] phases they are passing through in such situations. This aimed to explain reactions of different employees towards different triggers within an environment of uncertainty and rapid shifting challenges. Other corporations were developing leadership programmes that impart change management and organisational development, including neuroscience principles. However, these efforts were at an early and evolving stage. (IR4.)

IR8 reported that, as her corporation went through a major restructuring, a leadership development programme was currently being conceptualised which will incorporate motivational aspects and triggers of employees during change processes. Some corporations did not see a rising pressure within change management at the moment, as industry-related knowhow was not considered to shift dramatically in the next years. Yet, they were preparing for mega trends as for instance digitisation, leading to increasing efforts in areas like learning and qualification of employees. (IR2.) IR7 also observed similar developments among clients as they face new market entrants and potential disruptors within traditional sectors such as automotive. As business models increasingly are jeopardised through these competitive forces, the need for rapid adaption increases.

4.3.3 Learning

In terms of learning, lifelong learning and learning-agility were frequently used labels for required business skillsets. They were mostly connected to the ability for quick and effective adaption to change [*change-agility*]. Behind this stands the corporate aspiration to innovate and evolve towards competitive advantage – for the sheer necessity to survive. (IR4.) However, most companies seemed to not actively invest resources into this direction yet. Apart from relevant certifications and trainings that are a prerequisite for conducting job-related tasks, the employees and leaders are given self-responsibility to gain additional knowledge and skills (IR1). At other companies, despite having excellent training and development programmes for employees, leadership personnel will only receive training for their core function (IR5). The execution of corporate learning initiatives still seemed to follow traditional models of classroom-learning, that do not hold up to latest neuroscience insights (IR1). Thus the transfer of newly acquired skills and knowledge is not fully utilised.

IR4 reported that HR-initiatives to identify new ways of skill and knowledge transfer were currently discussed, however not yet a matter which was tried and tested in real settings. He pointed out that the mindset of individuals is key to a successful learning process and hence is grounded in suitable leadership and organisational culture. He deemed building participant's awareness as a key variable in this context. Even though not explicitly utilising neuroscience principles, IR7 reported that his company successfully applies learning techniques that appear brain-friendly, for some time now. Learning is seen as repetitive process and hence modules are planned sequentially, leaving time for application in the real environment of the leader as well as a subsequent self-reflection. Contents are consistently repeated throughout the different modules and interconnected to provide a bigger picture. Also participants are enabled to exchange experiences of the applied knowledge in order to avoid recurring mistakes.

4.3.4 Stress-management

While some corporations already included stress-related topics and coping-strategies into their leadership development programmes (IR1, IR4), most companies seemed to detach

the topic from leadership matters. IR2 reported that these issues are handled by a systematised workplace health management for some three years now. However, the connection of such models with leadership in terms of 'healthy leadership' and creating a 'healthy environment' are currently at an initial stage of discussion and slow, incremental evolution. Nevertheless, the relevance of stress-management, burnout-prevention, and the preservation of physical performance seemed to gain centre stage in corporations. HR is increasingly involved in developing respective concepts and interlink these with leadership. In this context also some neuroscience insights and principles seemed to be utilised. (IR4.) IR7 reported that his company includes hands-on techniques for stress management in their training formats which enable leaders to keep calm in exceptional situations and transfer this calmness onto their employees as well. IR5 from a leader's perspective wished for more connected thinking, as she deemed stress-management as an important factor for good leadership. Hence she pleaded in favour of increasingly incorporating stress-management topics into the leadership development programmes.

4.3.5   High performance

The ability to perform at highest levels as well as motivate and guide others to do so is one of the aspirations of many companies. Some companies provided such contents on a systematic basis within their leadership development programmes (IR1, IR4, IR8). Partially they are utilised to provide participants with models and self-management practises in terms of consciously performing at highest levels when needed (*peak performance –* chapter 3.3.3). But mostly these practises were connected with a broader approach, enabling leaders to inspire and enable their teams to perform at highest levels. (IR1, IR4, IR8.) Other organisations treated the subject more loosely by providing leaders and staff with individual workshops or similar measures in order to set an impulse, but without a structured approach to create high performance (IR3).

4.3.6   Other areas for application

Apart from the mentioned cases within leadership development it was also mentioned that neuroscience principles find application within marketing. Neuromarketing and related models or theories were reported to constitute a growing field of interest and subsequent

application in corporate marketing and sales departments within the last two or three years. As the purchase decision of customers depends on neurological processes and largely on emotions, this is an emerging field to incorporate neuroscience principles as well. (IR4)

4.3.7 Interpretation of findings

The examples of current and emerging applications for neuroscience reinforced the initial interpretation that such insights are utilized for the main purpose of reasoning existing models and theories from behavioural science and psychology. Organisations seemed to struggle with the triggers and forces caused by a VUCA world which have adverse implications of a variety of business fields. They seemed to fail approaching these challenges holistically, and responded with rather unsystematised approaches that appear to be reactive instead of proactive. Therefore, development program contents appeared rather isolated without consideration of the manifold interdependencies of different aspects. An interesting phenomenon that unveiled and evolved during the interviews, however, was that neuroscience seemed to particularly help fact- and figure-driven individuals to gain a new perspective on respective approaches as it is measurable and scientifically grounded. That makes it easier for them to understand and accept. (IR1.) The mostly engineerial clientele of technology companies seeks to gain a rather technical view on human behaviour. Thereby elusive phenomenon like emotions and their influence on behaviour become measurable and hence provide a better access to these topics for this audience. (IR2, IR4, IR9.) IR6 supported this predominant view from own experience. As neuroscience often provides scientific reasoning for existing models, it is backing such with a measurable and scientific basis. It should not be underestimated however, that some existing models also have been proven wrong by neuroscience.

4.4 Challenges and trends for HR and leadership

In order to identify promising fields for the application of neuroscience principles it was deemed worthwhile to inquire the main triggers for HR and leadership that prevail and

evolve at the moment. Founded on the HR-trend analysis (chapter 3.2), the initially identified triggers were tested against the real-world experiences of respondents'. Interviewees were asked to name and describe the most urgent or important challenges they face in HR or leadership. As mentioned in the previous chapter (4.1.2) the individual challenges are largely intertwined, influenced by, or dependent on each other. This made the boundaries between individual triggers or phenomena hard to identify, hence the following key issues might show fluent transitions.

4.4.1 Leading people

The act of leading others towards a vision or goal is still a main task of leadership. Although the understanding of leadership is shifting towards more democratic and participatory models and styles, its importance for organisational goal attainment remains unbroken (IR1, IR3, IR4). Leaders will increasingly have to think about what their people want, what motivates them, and what makes them stay in the organisation. As money proves to be nothing more than a hygiene-factor nowadays, leaders have to create environments that are fuelling intrinsic motivation through provision of purpose and joy at work (figure 10). (IR9.) Especially providing staff with purpose is deemed to bear huge potential and is directly linked to corporate culture (IR4, IR9). Leaders should provide a framework, supporting their followers in contributing to corporate success. (IR9.)

IR2 increasingly saw the necessity to create a leadership that addresses younger and elder employees at the same time (figure 10). A key is that respective models include humanistic approaches which consider the individual's behaviour, personality, and stress-patterns. He believed that the new generation of employees and leaders (*generation Y / millennials*) will increase such developments as they will actively demand new ways of leadership and individual development. IR4 even believed that the new generation will induce a revolution of leadership over time due to their shifted demands, when compared to the preceding generation (figure 10). This can cause a whole new approach on how to live leadership as well as organisational culture. At the same time, increasing numbers of subject matter experts with very technically-oriented mindsets are moving on to leadership positions. This bears the challenge to qualify and develop these into good leaders, where they have to cope with people's rather different and partially irrational emotions and behaviours. (IR1.)

- Provide purpose
- Right environment
- Foster participation

- Different generations
- Including emotions
- Shifting demands (Gen Y)

Motivation

Leadership Style

Creativity

Strength-Orientation

- Trust
- Freedom
- Respect and diversity

- From fear to openness
- Drive change proactively

FIGURE 10: Components of future leadership.

Increasing competitiveness in all business areas also will increasingly necessitate innovation and creativity as a game-changing lever. 'Good leadership' is a prerequisite for these developments as it directly and indirectly influences motivation, creativity, and innovativeness in people. When companies master to motivate people through emotional relationships, empowerment, trust, and self-responsibility they can achieve such good leadership (figure 10). (IR4.) Leading with respect and appreciating, as well as utilising the potential of diversity is vital to enhance creativity and innovativeness (figure 10). Leaders are called upon to identify the individual talents of any team member, in order to merge various aspects, opinions, and mindsets towards a greater whole. (IR9.)

Also some companies seemed to focus on the development of individual strengths through a more strength- and less failure-oriented leadership (IR1). It is considered to improve leadership by viewing emotions as a human reality instead of a weakness. Respective approaches can increase risk-taking and more openness in admitting lack of knowledge or competence which will alter a culture of fear (figure 10). All of this has to be filled with life through leadership. (IR4, IR9.) Interestingly, this was exactly what IR5

found a main challenge in performance-driven companies. Rigid leadership directs focus rather on failure and weaknesses, which in turn obstructs a failure-tolerant leadership, that she considered key for upcoming vital change processes.

In general, leadership personnel increasingly have to ponder on how to guide staff towards goals, how to improve levels of creativity and openness, as well as how to reduce fear. In this context neurosciences can provide support by minimizing fear e.g. with the Threat-and-Reward model and the SCARF$^{©}$ model, which bases on this principle. (IR9.)

4.4.2 Required leadership characteristics

With a view to required future skills or traits of leaders, various were named. Leaders will increasingly have to be generalists with superior competencies in social, methodological, and leadership matters (IR2). As of constant change, leaders will be required to possess substantial change-readiness. This encompasses the ability to endure and deal with uncertainty (IR1, IR4). Curiosity, eagerness to experiment, as well as courage will rank high in leaders' most wanted traits. This should enable them to enact change more quickly and generate better results. (IR9.) Also a high learning-agility and -readiness will be expected, as skills, competencies, and knowledge date out more quickly (IR1, IR4, IR7, IR8, IR9). Leaders will have to internalise lifelong learning to the fullest and act as role models for their employees (IR7). Strong self-reflective skills will be needed to constantly monitor personal competence or behavioural gaps. (IR8). Leaders will need to be open and non-judgemental in order to overcome personal bias (IR9). Readiness to alter own behaviour and mindsets will be key for leaders to cope with volatile and dynamic environments. (IR4, IR9.) By the fact that leaders work through people they require certain skills in people-leadership. Empathy in order to not only view matters rationally but also understand, that behaviour is guided through emotions aids in deeper understanding of employees' reactions. (IR7.) Translating vision and purpose to the level of staff can enhance motivation substantially. Also accelerating innovation is a key task for future leaders. Exquisite skills in collaboration, cross-functional as well as cross-divisional, are required as well. (IR4.) Respecting and valuing diversity as well as differences helps leaders to utilise the potential of globalisation (IR4, IR9). Also communication skills together with socialness will help leaders to reach their goals (IR7, IR9).

4.4.3   Corporate culture

The VUCA-world is shaking up previous constants such as corporate structure and strategy that used to provide safety for staff as well as management. The single constant that will be prevalent in the future is the organisational culture. As a driver it will adapt to rapid changes by forming smaller entities and improving flexibility. Organisations have to shift their focus towards corporate cohesion [*spirit*], values, and ethical rules in order to shape a successful culture. Motivation is substantially based on a provision of purpose. This should not rely on marketing-driven values but reflect the corporate reality. Extremely successful corporations consist of a small core of highly-determined individuals with mutual reliability and a sense of 'making the world better'. These individuals will utilise any ethical correct means to achieve their goal and act highly flexible in terms of goal orientation. Neuroscience provides support in identifying the inherent drivers and triggers of people and hence, what motivates them. Through fact-based science it also helps to persuade science-oriented persons why soft skills are of utmost importance. (IR9.)

As IR4 indicated (chapter 4.1.2), he considers people-leadership and the respective corporate culture to go hand in hand. Leadership creates people's mindsets which in turn shapes culture. As a key determinant, culture guides and drives organisational development through change processes which is gaining increasing importance in terms of competitiveness and future success. At the same time, mindset and established culture can be a substantial barrier to corporate change. IR5 reported that in her corporation stress in leadership positions is simply not a matter which is expressed publicly. It is considered a weakness and thus kept secret by the individuals themselves. Hence, even if the corporation inquires stress levels of leaders and managers, the vast amount will neglect respective experiences, based on the corporate culture they live. This culture however spreads into other sectors of the corporation as well. IR5 also expressed, that senior leaders will avoid provided learning and development measures of the company as they fear exposing a weakness. Showing interest in such measures might unveil a deficit in some areas and hence is avoided due to the fear of social exposure. Yet, in terms of looming huge change initiatives, this avoidance to learn and personally develop can substantially impede these efforts.

4.4.4 Continuous change and complexity

Being asked about current challenges for HR and leadership, all respondents admitted to be concerned with the matter of ongoing change. Some heavily referred to the VUCA-environment that forces businesses and their individuals to continuously adapt (IR1, IR4). While triggers for change are manifold, digitisation, demographic shifts, an emerging generation of new employees and leaders [generation Y], as well as disruptive changes for business models were among the most frequently mentioned (IR1, IR2, IR3, IR4, IR7, IR8).

Directing change constitutes one of the main tasks for leaders. Yet, most change initiatives are lacking to take employees along the process. The personal impact of initiatives on staff is mostly underestimated if not even unrecognised. Neurosciences provide a variety of insights in order to consider the human side of change such as habit change or the Threat-and-Reward principle. (IR9.) IR4 stated, that change-agility of organisations depends largely on the predominant organisational culture (figure 11), which origins from individual leadership cultures and the shaped mindsets in people. Hence, the ability to successfully manage continuous change depends significantly on leadership. This involves to address younger and elder employees at the same time in order to direct them towards the desired vision and goals. For leaders, this means that they have to possess substantial skills in coping with ambiguity, providing employees with meaning and empowering them through increased trust and self-responsibility (figure 11). (IR4.)

Individual motivation is deemed an important variable within change management trainings (IR8). Identifying and responding to motivational triggers of employees is key for leaders' efforts towards corporate alignment. Also providing a purpose for change initiatives is vital to counter resistance to change (figure 11). (IR7.) People need to be taken along the way emotionally. Only if a change process is emotionally relevant – by the fact that changing bears personal advantages or that not changing bears huge personal disadvantages – the individual will engage in it and change own behaviours (figure 11). At this point the model of Threat-and-Reward helps to understand individual motivational factors (figure 11). (IR5.)
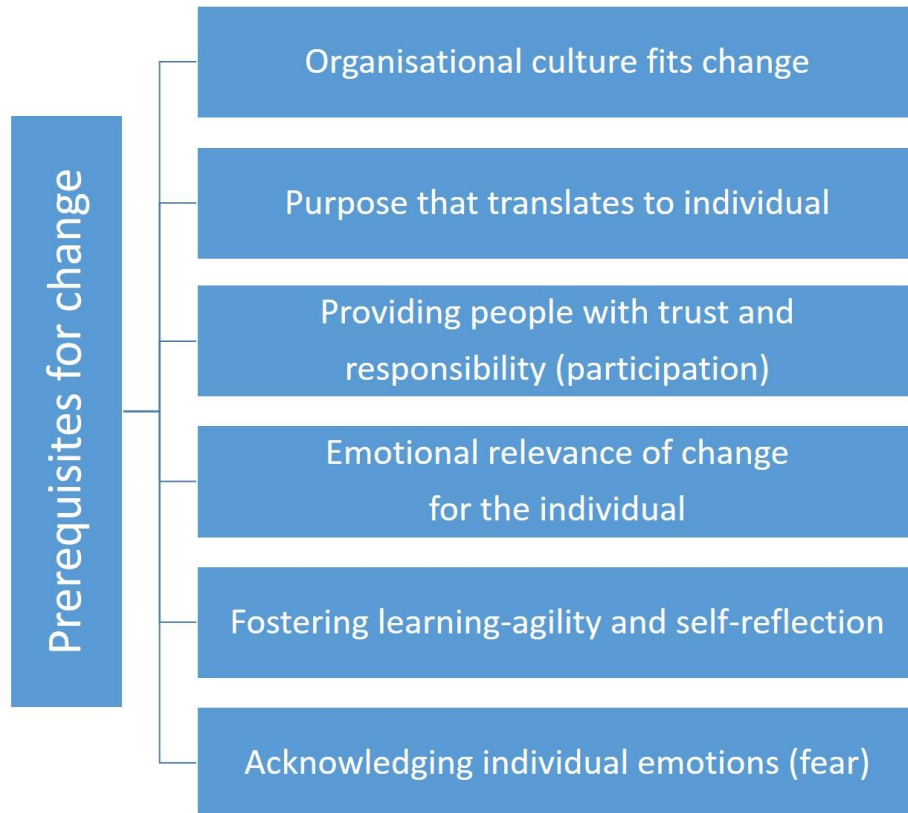
FIGURE 11: Key-prerequisites for sustainable change.

Employees will increasingly have to take over self-responsibility in terms of learning and readiness for change, as the mentioned VUCA-environment causes skills and knowledge to date out more quickly (IR1, IR4). Through studying high-potentials, key success factors for handling change were identified. Among these are learning-agility and learning from mistakes, readiness to reflect on self and alter own behaviour, ability to endure uncertainty, and a rather participatory leadership style (figure 11). (IR1.) By such statements the deep entanglement of change management, organisational culture, and leadership becomes vividly clear. The transition of change-agility and change-readiness from the management level to the employees seems a major determinant for successful future initiatives of corporations. Thus corporations and their management increasingly will have to transfer responsibility and provide trust towards the employees. (IR1, IR2, IR4.) However, at this point individuals might need corporate support and qualification to cope with this increased responsibility, e.g. in lifelong learning (IR1, IR4).

4.4.5 Disruptions and learning

Constituting one of the current mega trends, digitisation is stirring up all parts of economy. By nature, digitisation evokes change within corporations. IR2 reported that even though the overall know how in his sector will see no dramatic shifts in the future, the increased use of digital technology drives a vital need for continuous qualification and learning. While some companies approach the topic rather reactive and cautious, others already engage deeper into the matter. They try to alter learning methods and environments to the needs of participants and actively develop learning-agility. These efforts aim to embed lifelong learning into the corporate culture. Nevertheless, such organisations also realised that this might be a long way ahead. (IR1, IR4.)

Viewing learning from a more distant perspective, it also means the individuals' overall approach to filter, process and memorise information. In times of information overload leaders' approaches to learning are often based on own heuristics and lack efficiency and effectiveness. By utilising neuroscience principles in gaining a deeper understanding about the brain's functions and procedures, leaders can be empowered to align their learning strategies and tactics and substantially improve their learning performance. (IR9.)
 More and more companies are following a learner-oriented approach to training and development. In the future, programmes will increasingly pursue blended models of conceptualisations, drawing a main focus onto the practical application through learning on the job. (IR1, IR4, IR8.) As learning is most effectively pursued through experience, organisations are challenged to provide staff and leaders with various options for application and the acquisition of experience. As neuroscience suggests, this is the best way to shift mindsets and opinions sustainably and fast. Information has to be both new and emotionally relevant for the learners. (IR9.)

IR9 reported that lifelong learning is often misunderstood as everyone's ability to adapt anytime with any conceivable means. Organisations currently invest substantial resources in altering weaknesses that might impede future performance of staff in a particular position. Instead he suggested to focus on inherent and genetically determined talents, in order to enable quantum leaps in learning and mastery of skills. Identifying people's strengths and deliberately developing these proves substantially more efficient and effective with better results, than focussing on alleviating weaknesses. Instead of forcefully adapting

employees towards new business challenges by applying unifying development approaches, personnel should be deployed based on their talents and strengths. This provides individuals with energy and motivation, subsequently leading to highest performance. (IR9.) As some organisations already engage into this direction, employees and leaders will also see more individualised development planning that addresses strengths and needs of a single person (IR8).

The learning-agility is determined by the individual mindset towards learning and development. As skills and knowledge are outdating faster than ever, organisations are forced to create mindsets that foster the self-responsibility of staff for their individual development. While this supports corporate goal attainment and quicker adaption to change, it also bears benefits for employees as they improve their respective employability. Hence, people need to be brought out of a take-attitude towards self-initiative and activity. (IR4.) Especially the younger generations were raised in a dynamic world and are hence used to constant learning and development on a self-motivated basis. Here, companies will increasingly be in charge to set the right learning environments as well as providing relevant knowledge easily accessible in order to ensure the transfer of knowhow and knowledge. (IR7.)

As a consequence of digitisation and other forces which disrupt current business models and practises, leaders will face new strategies to connect with people virtually. While means of telecommunication and virtual collaboration are fast evolving and are increasingly utilised, leadership personnel still lack competence and qualification to cope with these developments. With a view to building trust, keeping in touch, and monitoring performance and goal attainment, a deeper understanding of behavioural triggers and patterns is considered to help leaders to get to grips with this challenge. (IR5.) Some companies already draw a focus onto enabling leaders to lead from a distance. A further dimension within virtual communication or collaboration is to bridge the cultural gap. Leaders increasingly face the challenge to not only lead virtual teams, but that such teams also consist of a diverse variety of nationalities and genders. (IR8.)

4.4.6 Innovation and creativity

For the first time in history, corporate success is determined by the ability to innovate fastest. While in the past particular knowhow ensured prosperity for decades, nowadays disruptive innovations by new market entrants manage to challenge traditional business models and displace large corporations within a few years. (IR9.) Good leadership and the provision of freedom can drive creativity. Also emotions play an important part in innovation and creativity. Organisational cultures should foster experimentation, collaboration, customer-orientation, and trust, in order to provide a healthy foundation for creativity. In any case, creativity has to be considered as a long-term approach and to be dependent on numerous triggers and determinants. (IR4.)

Leaders increasingly are challenged to provide an environment that fosters creativity and innovation. The act of leadership has to be based on respect for the individual and appreciation for diversity. Leaders substantially determine creativity of employees through their leadership style. When it comes to brain function that enables creativity, neuroscience has shown that a vast amount of brain regions is interlinked and contributing to the process. However, awareness about these topics is rare among leaders as they tend to see the brain through old models where it was considered to possess different parts that are responsible for only one individual response. Hence, it was deemed feasible that by triggering the exact region, creativity will arise. Neuroscience showed that this does not hold true and a number of preconditions have to be met in order to foster creativity. Not only leadership has to provide freedom and must be free of fear, also the physical environment matters. The reality in most organisations however is that their workspace design stems from an era of rationalisation, process optimisation, and a mechanistic conception of staff. This is shown to impede employee-satisfaction and hence performance and creativity. Most organisations seem to not have understood the full potential of the matter yet. Neuroscience can help corporations to gain access towards these topics, foster creativity, and incorporate such advances into their culture. (IR9.)

4.4.7 Talent management

Another identified key topic for HR as well as leadership is talent management. Influenced by the demographic shift, many if not all companies are facing increasing problems to satisfy their need for suitable experts and key personnel (IR1, IR2, IR4, IR8). The target group for such efforts mainly consists of the younger generation where attraction and retention increasingly proves difficult (IR2, IR4, IR7). Defining an attractive employer brand, living it internally and externally, and effectively communicating this brand towards the potential candidates in an emotional way is deemed an important strategy. Here not only HR is involved, but also leaders at all levels have to embrace the respective vision and goals in order to fill the model with life. (IR4.) IR7 also observed that younger generations are seeking more variety and dynamism. Talents choose employers according to career- and foreign assignment opportunities.

Furthermore, the future development of new hires also refers to the tasks of talent management. Especially qualifying them for continuous change is a key effort of companies to maintain competitiveness in the business. Learning and shaping change-agile mindsets is among the top priorities. (IR4.) Besides this, leaders are in charge to identify and continuously develop talent (IR3, IR7). While these employees may not yet have experience, they possess distinct traits such as learning-agility, analytical thinking, and quick comprehension, as well as a high intrinsic motivation, which are hard to train. Leaders are required to provide talents with opportunities to develop competencies and gain experience according to their strengths as they are likely to leave the company otherwise. (IR7.) IR9 viewed this only as an intermediate phase however. He deems enabling every individual to identify own talents and strengths as a necessity. Only if people recognise what tasks are joyful to them, they can be deployed according to their strengths. Organisations currently struggle to empower their employees in such ways. Neuroscience can help to fuel this transformation by spreading the knowledge on how brains function and work best. (IR9.)

4.4.8   High performance, stress, and health

Stress as such is neither good, nor threatening, it is just a physical reaction to stimuli. In terms of performance stress is an important variable to trigger advancements. Highest performance [*or peak performance*], originating from sports, is addressing individual as well as team approaches in order to perform at highest levels whenever needed. Emotions play an important role within peak performance, however most organisations suppress emotions due to uncertainty on how to handle the matter. On an individual level, high performance means to identify the optimum level of stress. Following the arousal-curve, the individually different load of required stress as well as the tolerable spectrum must be determined. This will enable leaders to react to people's differences as well as allocate tasks suitably and thus empower individuals to reach peak performance whenever needed. High performance teams have to achieve ambitious and outstanding results in no time as well as function ad hoc even though being assembled anew. Neuroscience helps to accomplish this stretch by offering models about empathy, mirror neurons and other transmitter substances that accelerate teambuilding as well as the overall performance. Such insights are brand new and not part of current leadership methods or models. (IR9.)

Through a rising awareness about the organisational cost of job-related stress, companies increasingly foster programmes to prevent and overcome related causes and effects. Respondent's unanimously told that the matter is very important and will play an even more important role in the future (IR1, IR2, IR3, IR4, IR5, IR6, IR7, IR8). IR9 saw one of the causes in a misinterpreted approach, towards efficiency and effectiveness. Organisations have to bear in mind that the peak performance zone is limited and has to be treated accordingly. Only if leaders apply the right ratio of tension and relaxation, they will be able to perform at highest levels without facing chronic stress. However, most organisations still pursue a wrong approach and overstrain leaders irresponsibly. Neuroscience can offer a deeper understanding of the underlying processes and triggers, leading to more responsible and deliberate use of personnel's resources. (IR9.)

IR6 reported frequent orders for stress-related topics in workshops and other formats. Also concepts for 'Healthy-Leadership' are being developed, however at an early stage yet (IR4). As the causes for workplace-related stress and following health issues are manifold and largely intertwined, a more holistically approach towards the matter is necessary. Triggers should not be viewed and tackled in isolation but interdependencies have

to be acknowledged. Mounting burnout-rates can be addressed by using neuroscience insights on an individual level. Adapting the conduct of life to the needs for sleep, adequate nutrition, exercise and other such areas is vital. Neuroscience provides valuable suggestions by offering approaches to deal with threatening situations that trigger stress responses as well as providing the body with sufficient resources in order to improve resilience. While sufficient sleep is still a taboo among most organisations, neuroscience indicates that it is a core ingredient for performance. (IR9.) IR8 viewed stress as an important topic, which leadership development measures should incorporate. She deems building awareness among leaders as well as building resilience as valuable and necessary.

4.4.9   Future prognosis for the application of neuroscience principles

IR4 considered the increased future use of neuroscience principles dependent on a growing body of studies and insights in the field. Only if intense research on validity of respective models leads to fulfilling certain quality criteria, these content will increasingly be applied for leadership development efforts. It might thus be a matter of time to overcome the threshold of conservatism and gain the acknowledgement as a reliable and valid branch of leadership development. IR5 backed the impression as she stated, the sole reason why her company is not yet incorporating modern models of management and leadership lies in a lack of validity and potential missing provability. Hence such companies seek a growing body of best practises and successful case studies before engaging in new endeavours.

IR6 from a subject matter expert and practitioner perspective considers the potential of neuroscience principles with business relevance as enormous and not at all utilised. IR9 specified this view, as he sees a main area of application within leadership. The social interaction within organisations is prevalent and people are rarely working in total isolation. Good ideas evolve through interaction and the connection of seemingly incompatible variables. Hence, leadership as a bridging function provides valuable terrain for the application of neurosciences. According to IR6, a main bottleneck however, is the currently weak link between science, providing insights, and the practitioners, applying such to corporate realities. This is determined to a large extent by the lack of sufficiently trained

and qualified facilitators and coaches, who can translate neuroscience insights into pragmatic models and concepts for business. Improving this missing link will cause increased applicability for neuroscience principles in business contexts in the future.

IR8 saw a main reason for the currently weak awareness of HR representatives in time constraints they are facing versus the mostly complex illustrated neuroscience principles with lacking practical applications. She suggests that relevant models and insights are formulated in 'digestible' formats, presented in renowned HR magazines. A key would be to ensure the practical transfer of principles into real business environments, at best illustrated with examples and best practises. An interesting personal observation she mentioned was that providers were not so much chosen by how valid they reason their applied models, but based on the trust in their professionalism as well as their ability to present best practises.

In terms of presenting insights to the participants of leadership development programmes, IR7 observed that pragmatic and easy-to-apply models are preferred by such audiences. He does not see a necessity for reasoning and expansive explanation of background knowledge. Rather participants seem to be content with the fact that these models are valid in general and focus on how they are applied and how these aid them within daily business. IR9 backed this by stating that translating neuroscience insights into pragmatic models is key to their applicability. Leaders do not have the capacity to educate themselves as brain-experts, parallel to their demanding function. They need to be shown how the insights prove valuable for them and how they can be applied. In the context of leadership development, it is key that participants not only understand but also practise the principles in the trainings. As the brain is largely interconnected and various variables determine a proper function, they also have to adapt their lifestyle towards the holistic approach that incorporates all aspects of life – from nutrition and physical exercise to arts.

4.4.10 Interpretation of findings

When reviewing the existent and emerging challenges for organisations, the VUCA world can be identified as the predominant force and driver that causes issues. As the term implies, endangerments for the organisational success are fast, rapidly shifting, highly interdependent, and almost never similar to preceding events which leaves generic action strategies ineffective. A pattern of core components for successful future countermeasures appears to encompass organisational culture as the guiding framework, leaders as the transmission entity that translate the corporate goals into pragmatic actions, and the people of an organisation who ultimately work towards attaining the corporate goals. These core pillars of an organisation are mutually dependent on each other and are affected by the VUCA world in various ways. To enable the organisational goal attainment, companies have to engage in a number of fields that are crucial in alleviating challenges holistically. The research findings unveiled that the different actions as for instance people leadership and continuous change affect each other on a social level e.g. by building up personnel's resistance to adapt if a leader fails to address their anxieties with a suitable leadership style. On the other hand, continuous change demands leaders to constantly develop themselves e.g. by building learning-agility and a respective mindset of readiness and joy in acquiring new skills and knowledge. Neuroscience provides a rich source for cues and principles on how different fields relate to each other and how to cope with subsequent challenges. As the social component is predominant in all challenges, these concepts fit perfectly to business realities. They provide a basis to approach corporate goal attainment more holistically and agile, utilising the full potential of human capital.

5 DISCUSSION

5.1 Synthesis and summary of findings

This thesis identified the status quo of awareness, relevance, and applications of neuroscience principles in leadership development. Additionally, promising fields for future application were discovered by considering prevalent or emerging drivers for HR and leadership. Organisations worldwide are facing numerous challenges such as disruptive innovations which put current business models into question. Leadership is increasingly under pressure to cope with managerial as well as people-leadership issues. At the core of all corporate efforts lies the interaction between human beings, a yet underestimated variable. This area of tension increasingly calls for pragmatic models of leadership development which approach core issues with a connected and result-oriented, rather than a scattered approach. While most current attempts seem to address these new necessities insufficiently, neuroscience can bridge the gap. The emerging scientific discipline is shown to unveil connections between different triggers and behaviours, all grounded in measurable and reliable scientific principles.

5.1.1 Awareness and relevance

Especially among HR representatives, the subject of neuroscience principles has gained an increasing awareness in the past years. While by 2012 only a fraction of this peer group was informed about the topic, increasing numbers of specialist publications and speeches aided to raise the numbers since then. Today HR executives possess awareness almost unanimously and as neuroscience principles already found their way in a few leadership development programmes, also deeper knowledge about the matter increases. The next step would now be to scour the market in order to find suitable cooperation partners. Leadership personnel in contrast holds a less distinct level of awareness concerning neuroscience principles. Information about supportive concepts is predominantly gained through personal interest. Only a fraction seems to be acquired by respective leadership development measures as the topic is still underrepresented in such formats. Here especially younger leaders whose development programmes were delivered within the last

two years seem to hold higher awareness, as programmes are more likely to already have been enriched by neuroscientific insights.

Even though HR's interest for neuroscience is mainly driven by functional aspects, the matter is not yet considered to vitally contribute to organisational success. Neuroscience principles are currently utilised to ground existing psychological and behavioural models as well as enriching contents of leadership programmes. However, several HR representatives already see a larger potential of neuroscience in the future. As the understanding and guidance of human behaviour is key to leadership, such models are seen to provide a more reality-based approach. Also learning and its neuroscientific implications are expected to aid in more effective competence acquisition, which is key to adapt to a VUCA world. In this context HR is increasingly under pressure to provide high-quality development programmes as organisations' are facing rising competition. Neuroscience principles provide scientifically grounded and valid approaches, compared to current, often questionable models for leadership development. Today's bottleneck however is the often missing transfer from neuroscientific theory to business practise which leaves organisations struggling to utilise the potential of neuroscience.

5.1.2   Current fields for application of neuroscience principles

Neuroscience principles are currently utilised by a minority of corporations and are rather scattered in terms of topics for application. External providers seem to hold the bulk of respective measures that encompass development programmes, keynote speeches, and singular workshops as the currently most widespread formats for respective topics. Contents with neuroscientific origin are often not explicitly termed 'Neuroscience' which leads to probably higher numbers of current applications than obviously observable. The different neuroscience aspects are often heavily intertwined which contradicts the prevailing division of development programmes' contents and focus areas. Here a more holistic approach that considers the connection of aspects has to be applied. As the main purpose for the application of neuroscience currently seems to be limited to reason existing leadership development models, they prove to be of especial value by convincing science- and fact-driven personnel. Due to the hard-science character and measurability of neuroscience, these audiences find essential 'soft topics' such as the role of emotions easier to understand, accept, and apply through neuroscientific models.

At the moment, neuroscience principles find inclusion to leadership, change management, learning, stress management, and high performance topics. In leadership, explanatory models on how human behaviour is triggered are integrated in order to increase leaders' awareness about the impact of their leadership behaviour. This also directs existent leadership styles and models, as younger leaders are expected to alter the current models on how leadership is applied and inspired. Lastly, leaders are provided with information on the role of emotions for motivation, decision-making and further areas of influence.

Human behaviour and its triggers during change initiatives are a field of application for neuroscience within change management contents. Here the SCARF$^©$ model finds utilisation in order to reduce threat and maximise reward so as to enhance motivation and willingness to change. Also a focus on the role of emotions within change processes aids in guiding employees and leaders through times of change, as shifts of own behaviour are more readily accepted when they are emotionally relevant to the individual.

In order to increase change agility but also to adapt competencies to rapid shifting necessities, learning is a vital resource. While the majority of corporations seems to still follow classroom-oriented learning, increasing numbers of HR executives are trying to incorporate more brain-friendly approaches in order to utilise the potential of learning. Blended learning, where theoretical input is immediately applied within the business environment, aids in a more sustainable transfer of knowledge. Also repetitive discussion of key topics, sequentially designed programmes, and the interconnection of topics or the connection to previous knowledge is used to deepen learning. However, beyond corporate development offerings leaders and employees are increasingly given self-responsibility for learning. This demands not only a shift in mindset from receiving to actively engaging in learning, but also to acquire skills in how to learn best.

While stress is a main topic within organisations only a fraction incorporates these matters into their leadership development programmes. It is not yet seen as an integral part of leadership matters and hence mostly branched off to corporate health management. Some companies are however starting to create models for 'Healthy Leadership' as they identify the connection of stress-related implications and leadership. In terms of the positive as-

pects of stress, some corporations are engaging in high performance models as for instance peak performance. The underlying desire is to create High Performance Teams that enable ground breaking innovation and achievements.

Finally, neuroscience is not only applied to leadership but also holds an increasing importance for marketing and sales. The role of emotions within the purchase-process is viewed to bear huge potential. Hence, neuromarketing is another field of interest for organisations.

5.1.3   Promising fields for the future application of neuroscience principles

The majority of corporations' challenges that are prevalent or emergent origin from the sphere of disruptions such as digitisation, increasing competition, demographic shifts, globalisation, and subsequent change – hence the VUCA world. The organisation itself was found to essentially base on the core columns 'leaders', 'people', and 'organisational culture', that determine the attainment of organisational goals (figure 12). Countering the external triggers and forces, several actions have to be taken, in order to alleviate negative effects on the corporate goal attainment or utilising emergent business opportunities. These core action areas constitute a basis for potential future application of neuroscience principles. In comparison to the current applications for neuroscience principles within leadership development formats, the identified fields for potential future application incorporate a broader variety. At the same time these matters show a deep interconnectedness and often interdependency which illustrates the need for connected thinking when approaching topics through leadership development programmes. Just like the different brain regions are deeply intertwined and several entities are involved for individual processes, the approach to tackle business challenges has to become more holistic.
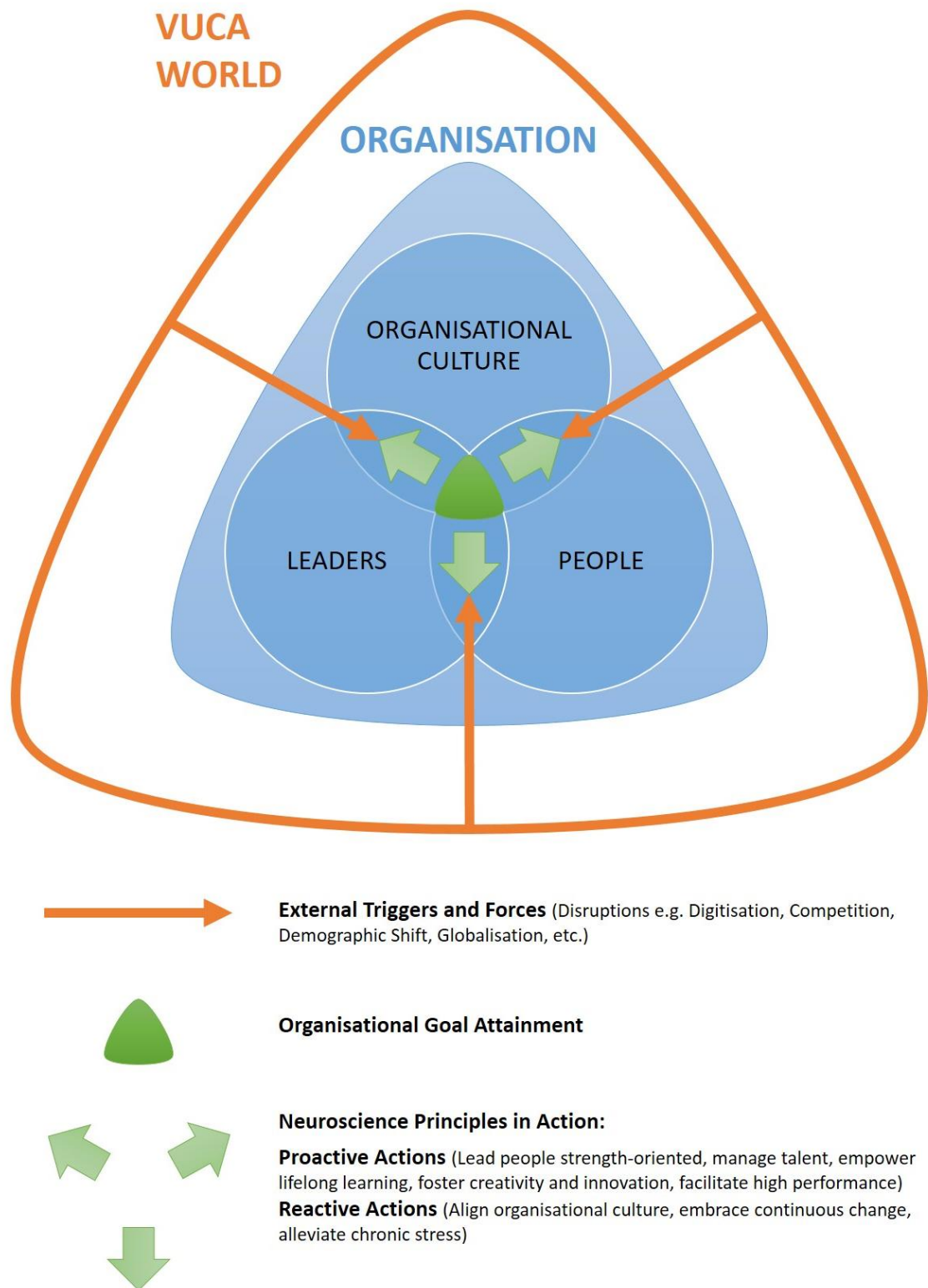
FIGURE 12: The organisational core columns in the VUCA world – neuroscientifically inspired actions to counter challenges.

Lead people strength-oriented

Leaders are at the forefront of organisational success as they transform the corporate vision and goals into peoples' engagement and performance, while acting as catalysts for dynamic and rapidly shifting business realities (figure 12). They are challenged to understand the underlying triggers that generate intrinsic motivation among staff and enabling these to perform at highest levels. This comprises providing employees with meaning and joy at work through increasingly participatory as well as coaching leadership styles. Leaders also need to shift from mistake-avoidance towards strength-orientation in order to leverage the potential of staff. Reducing threat and fear by following the five dimensions of the SCARF© model can substantially enhance work satisfaction, innovativeness and overall performance of people. Leaders are also increasingly demanded to address younger and elder employees at the same time which necessitates the understanding of respective motivational triggers and needs. Lastly, globalisation and digitisation drive virtual communication and collaboration. Leadership personnel is challenged to lead and build trust from a distance which increases the necessity to gain a deeper understanding about behavioural triggers and possible cultural differences.

Align organisational culture

As the corporate culture guides leaders' and staff's performance and efforts towards organisational goal attainment, it increasingly gains centre stage for corporate success. In times of continuous adaption to a VUCA world, the culture will remain the only steady constant within organisations. Following this vital role of culture, it depicts one of the core columns of organisations (figure 12). The alignment of the culture towards substantial and meaningful corporate values, ethics, and a desired and powerful corporate spirit is essential. Thereby the culture has to represent both the de facto core values that are derived from the corporations' core competencies, as well as values that are meaningful for leaders and staff. It should not be underestimated, that organisational culture can substantially obstruct adaption and change if the respective individual mindsets and habits collide with necessary shifts in behaviour and mentality. A main driver in this context is the sense of purpose an organisation provides to its people. Here neuroscience principles can help to understand what drives people and how respective values, ethics, and the corporate spirit might influence individual's behaviours.

Manage Talent

Attracting, acquiring, and retaining the right people remains a core variable for organisational success (figure 12). While the creation of an attractive and authentic employer brand belongs to the core tasks of HR, leaders are more than ever in charge to fill the corporate promise with life. As younger generations increasingly seek dynamism and variety in their tasks and career, understanding the underlying behavioural triggers (e.g. through the SCARF© model) aids leadership personnel in succeeding herein. Even more important is the leaders' responsibility to identify and develop talent and hence substantially participate in the talent management process. Here they have to act as role models to foster learning- and change-agility and provide opportunities for the development of competencies and the acquisition of experience. Having a deeper understanding on behavioural triggers and how the brain performs and learns best, helps leaders to yield better results. However, as a further step, in the future the individuals themselves have to be empowered to identify and build on their personal strengths. This strength-based leadership will help to deploy staff according to their innate preferences and talents which subsequently will pay off in terms of joy at work, a higher intrinsic motivation, and hence the basis for highest performance. Organisations and leaders are challenged to provide staff with suitable tools to identify their talents, opportunities to gain experience and competence, as well as offering more permeable organisational charts to provide people with tasks and positions that suit their strengths.

Embrace continuous change

Through the various triggers and forces that impede all core areas of organisations, the necessity to constantly evolve and adapt, challenges corporations at all levels. While change itself may be seen as an event, the triggered transformational process will have the most fundamental ramifications for all corporate entities. A key to provoke and sustain adaption is to enable people a participation in the process, motivate them to change, and take them along the way. As neuroscience shows that people only change when this shift is emotionally relevant to them, leaders are challenged to gain a deeper understanding of motivational triggers and the role of emotions within such processes. Threat and reward has implications for willingness and agility to change whereby the SCARF© model can aid in understanding behaviours. Leaders are especially required to act as role models for their employees. Key success factors for high potential leaders who succeed in change encompass a distinct learning-agility and willingness to learn from mistakes, the readiness for self-reflection and change of own behaviour, the ability to endure uncertainty, as well

as a rather participatory leadership style. Apart from this, staff is increasingly self-responsible to increase change-readiness e.g. through continuous adaption of knowledge and skillsets.

Empower lifelong learning

Change as a result from triggers such as digitisation evokes the necessity for continuous qualification and reskilling of leaders and employees. Organisational culture holds an important stake in this context as it directs and shapes individual mindsets on how to approach learning. Thereby leadership is the essential interface which transforms a learning-minded culture into concrete actions. In times of information overload people are lacking suitable methods to process and memorise information. A deeper understanding on how the brain acquires new information and how it functions best can significantly aid in enhancing the personal learning routine and performance. At the same time neuroscience suggests to shift towards learner-centric approaches like blended learning which facilitates an immediate practical application of new knowledge or skills, as well as continuous repetition to improve learning transfer. Even though neuroscience does not provide instant models to foster learning, the insight that information has to be new and emotionally relevant to stick, provide a profound basis to design more successful development programmes.

From a strength-based view, lifelong learning might also be misunderstood as the ability to adapt to anything at any cost. However, it should focus more on existent talents or strengths that are innate in people. Only if learning builds on individual strengths, quantum leaps in performance will be possible as people will feel more energised, joyful, and hence intrinsically motivated. This approach will hold the key requirements for highest performance. Thus, organisations are increasingly asked to provide leaders and staff with individualised development planning as well as opportunities to apply and enhance their inherent talents and strengths. Lastly, corporations will not be able to suffice people's need for learning consistently. Leaders and employees will have to take over more responsibility for development and learning where leaders are constantly challenged to act as role models for lifelong learning. Younger generations might show a higher competence in self-directed development as they experienced this as their youth-reality to acquire new skills e.g. to operate new digital equipment. In this context, corporations are required to provide the right learning environment both physically, to give space for learning, as well as providing the corporate knowledge easily accessible.

Foster creativity and innovation

For the first time in history, corporate success is determined by the ability to innovate fastest. Young start-ups that disrupt and slash the business models of large and well-established corporations illustrate respective developments drastically. Knowhow and competitive advantage date out faster than ever. A key success factor for innovation is creativity. Neuroscience shows that creativity is not a cognitive state that can be forced, but rather a result of various essential prerequisites that are mutually dependent. Furthermore, it constitutes a long-term process rather than an instant action, which has to be paid attention to. Leaders are required to provide a suitable framework that includes freedom, experimentation and failure-tolerance, collaboration and trust. These advancements possibly require a style of 'good leadership' which is essentially a placeholder for leaders' need to understand the variables that cause a brain to function at its best and generate creative insight. Especially providing leadership without fear (by e.g. following the SCARF© model), respect for the individual, and gratitude for diversity can be linked to good leadership practises that foster innovation. But also organisational culture has to support creativity and innovativeness in order to guide the behaviour of leaders and staff. Visible aspects of such can be a corporate tendency to accept and embrace emotions as important part of innovativeness as well as the physical working environment that inspires openness, collaboration, and at the same time quiet spots for deep thinking.

Facilitate highest performance

Despite its negative connotation it is undeniable that a certain amount of stress is required to spark performance. With regard to the peak performance model, leaders have to be able to know their individual stress-threshold for high performance, as well as understand that it is only a limited state of performance which has to be triggered responsibly. Neuroscience provides the scientific basis to allow the identification of the respective zone as well as its purposeful activation. As a consequence, leadership personnel will be able to share this important insight with their employees, empowering these to take care about themselves while acting more responsible in the allocation of tasks. In this context neuroscience principles such as attention and focus help to minimise distractions in order to increase working performance and effectiveness. On a team level the formation of high performance teams can be supported by neuroscience principles as for instance empathy, mirror neurons, and transmitter substances. These help to build the essential trust within a newly assembled team in order to achieve outstanding results within minimum time.

Alleviate chronic stress

If stress continues at high levels for prolonged periods of time, the human body's stress response system overreacts and leads to adverse effects of chronic stress. This matter, often culminating in burnout symptoms, is rapidly increasing in all parts of economy and society. It often seems to stem from a misinterpretation of efficiency and effectiveness that does not accept the human performance as a limited and valuable resource. Just as the peak performance model illustrates, leaders have to be aware that the right ratio of tension and relaxation is necessary to endure a high and healthy performance level. However, stress depends on much more factors that incorporate dimensions outside the workplace as for instance sufficient sleep, adequate nutrition, and healthy social relationships. Corporate culture can be a barrier to tackle these issues when stress is seen as a weakness and subsequently is suppressed. Hence stress management in corporations should be seen as a holistic approach that starts with corporate culture and ends with individual awareness, and is not seen as an isolated symptom which is treated by corporate health management solely. Organisations have to take responsibility in empowering employees to adapt their personal lifestyle and workplace behaviour, in order to counter burnout and other health impediments. This will not only lead to increasing productivity, but eventually also to higher satisfaction and intrinsic motivation which makes turnover less likely.

5.2   Limitations of research and critical valuation of results

The current work examined a rather small scope by including German corporations only. Hence, generalisations beyond this section should not be made. In this regard the thesis should be viewed as an initial probe of the matter, to inspire and spark further research that focusses on distinct findings and paradigms.

Time constraints did not allow to include a broader sample of interviewees. Especially a greater diversity in respondents with leadership responsibility might have led to more insights from the recipient's' side of development programmes. In terms of the sample, distribution cannot be considered to suffice uniformity. As the commissioning company was providing the majority of interview contacts, respondents were already familiar with neuroscience principles to some extent. Especially in terms of awareness this might have biased results. Furthermore, it can be assumed that mostly respondents with at least some

knowledge in the topic have replied, while others hesitated to participate. Therefore, further verification studies could help to prove the current findings.

Conducting interviews mainly via telecommunication might have had implications on the relationship of trust between interviewee and interviewer. However, as this means of communication is standard among the respective respondents and measures such as anonymity were provided to reduce hesitance, this issue can be considered as being of less impact.

5.3   Suggestions for further research

As the current results suggest, the interest in and applications of neuroscience principles with business-relevance are growing. While interview insights from German corporations seem to correlate with findings from other countries, a further examination of a geographically broader scope can help to validate results and enable generalisations by quantitative research. Also the scope of industry or company-size might be adapted to examine respective readiness for neuroscience principles among the different entities. Such foci could encompass:

- Awareness, relevance and applications of neuroscience principles in Europe / G20 states / APAC / BRIC.
- Emergent challenges for leadership and organisations principles in Europe / G20 states / APAC / BRIC.
- Awareness, relevance and applications of neuroscience principles in traditional industry.
- Awareness, relevance and applications of neuroscience principles in services sector.
- Awareness, relevance and applications of neuroscience principles in small- and medium sized enterprises.

Beyond this, neuroscience is not only limited to leadership development, but provides a promising potential within staff development and training as well. Gaining insights about this enormous field of potential application might bear yet hidden advancements in the quality and effectiveness of the whole workforce.

The inquiry on current and future applications of neuroscience principles solely relied on the identification of threats towards the business, meaning the challenges and adversities to overcome. However, it should be mentioned that neuroscience also finds application in the utilisation of business opportunities. Hence further research may also incorporate the application of neuroscience principles for such positive cases.

REFERENCES

Albach,H., Meffert, H., Pinkwart, A. & Reichwald, R. 2015. Management of Permanent Change. Springer Fachmedien, Wiesbaden, Germany.

Bühner, R. 2005. Personalmanagement. Oldenbourg Wissenschaftsverlag, 3rd ed., München, Germany.

Cacioppo, J., & Patrick, B. 2008. Loneliness: human nature and the need for social connection. W.W. Norton and Company, New York, USA.

Chartered Institute of Personnel and Development (CIPD) 2014a. Learning and talent development annual survey report 2014. CIPD, London, UK.

Chartered Institute of Personnel and Development (CIPD) 2014b. Neuroscience in action: Applying insight to L&D practice. CIPD, London, UK.

Christian, D. 2011. The history of our world in 18 minutes. TED2011. Watched: 1.6.2016. http://www.ted.com/talks/david_christian_big_history .

Clap, W., Rubens, M., Sabharwal, J. & Gazzaley, A. 2011. Deficit in switching between functional brain networks underlies the impact of multitasking on working memory in older adults. PNAS, vol. 108, no. 17, April 26, 2011.

Cunningham, I. 2010. Leadership development in crisis: leadership development hasn't made much difference to organizations. Development and Learning in Organizations: An International Journal, Vol. 24 Iss. 5, 5–7.

Day, D. 2001. Leadership development: a review in context. Leadership Quarterly, 11(4), 581–613.

Deloitte University Press (DUP) 2016. Global Human Capital Trends 2016. Deloitte Development LLC, USA.

Development Dimensions International 2015. Global Leadership Forecast 2014 2015. Development Dimensions International Inc. - Center for Analytics and Behavioral Research, Pittsburgh, USA.

Elger, C. 2009. Neuroleadership – Erkenntnisse der Hirnforschung für die Führung von Mitarbeitern. Haufe Verlag, München, Germany.

Gordon, E. 2000. Integrative Neuroscience: Bringing together biological, psychological and clinical models of the human brain. Harwood Academic Publishers, Singapore, 163–171.

Gray, J. 1990. Brain systems that mediate both emotion and cognition. Cognition and Emotion, 4(3), 269–288.

Gross, J. 2014. Handbook of Emotion Regulation. Guilford Press, New York NY, USA.

Heimann, A. 2007. Zu viel des Guten: Führen ohne Angst. Manager Magazin. Read: 12.5.2016. http://www.manager-magazin.de/unternehmen/karriere/a-463377-3.html

Holtbrügge, D. 2015. Personalmanagement. Springer Verlag, 6th ed., Berlin & Heidelberg, Germany.

IR1 – 9 (Interview Respondent). Label to indicate different respondents' statements within interview results. Further details to be found in chapter 4.1.

Karp, T. & Helgø, T. 2008. The future of leadership: the art of leading people in a "post-managerial" environment. Foresight, Vol. 10 Iss. 2, pp. 30–37.

Kauffeld, S. 2016. Nachhaltige Personalentwicklung und Weiterbildung: Betriebliche Seminare und Trainings entwickeln, Erfolge messen, Transfer sichern. Springer Verlag, 2nd ed., Berlin & Heidelberg, Germany.

Kienbaum 2015a. Ergebnisbericht HR-Trendstudie 2015. Kienbaum Consultants International, Gummersbach / Germany.

Kienbaum 2015b. Agility – überlebensnotwendig für Unternehmen in unsicheren und dynamischen Zeiten; Change management-Studie 2014/2015. Kienbaum Management International GmbH, Gummersbach, Germany.

Kim, J. & Diamond, D. 2002. The Stressed Hippocampus, Synaptic Plasticity and Lost Memories. Nature Reviews Neuroscience 3(6), 452–462.

Kuebler-Ross, E. 1969. On Death and Dying. Macmillan, New York, USA.

Kuss, A., Wildner, R. & Kreis, H. 2014. Marktforschung: Grundlagen der Datenerhebung und Datenanalyse. Springer Fachmedien, 5th ed., Wiesbaden, Germany.

Lindner-Lohmann, D., Lohmann, F. & Schirmer U. 2008. Personalmanagement. Physica-Verlag, Heidelberg, Germany.

Maguire, E., Woollett, K. & Spiers, H. 2006. London Taxi Drivers and Bus Drivers: A Structural MRI and Neuropsychological Analysis. Wiley Periodicals Inc., Hippocampus 16, 1091-1101.

Mayer, J. & Salovey, P. 1997. What is emotional intelligence? in Salovey P. & Sluyter D. (editors), Emotional development and emotional intelligence: Implications for educators. Basic Books, New York, USA, 3–31.

Matrix, 2013. Economic analysis of workplace mental health promotion and mental disorder prevention programmes and of their potential contribution to EU health, social and economic policy objectives. EU Health Programme, Executive Agency for Health and Consumers.

McDermott, A., Kidney, R. & Flood, P. 2011. Understanding leader development: learning from leaders. Leadership & OD Journal, Vol. 32 (4), 358–378.

Meager, K. & McLachlan, J. 2014. The future of leadership development: how can L&D professionals design and develop our next generation of leaders? Development and Learning in Organizations: An International Journal, Vol. 28, (5), 6 – 9.

Medina, J. 2014. Brain Rules: 12 Principles for Surviving and Thriving at Work, Home, and School. Pear Press, 2nd ed., Seattle, USA.

Merzenich, M. 2004. Growing evidence of brain plasticity. TED2004. Watched 2.6.2016. http://www.ted.com/talks/michael_merzenich_on_the_elastic_brain

Peters, T. & Ghadiri, A. 2011. Neuroleadership: Grundlagen, Konzepte, Beispiele. Gabler Verlag, Wiesbaden, Germany.

Petrie, N. 2014. Future Trends in Leadership Development. Center for Creative Leadership, Greensboro NC, USA.

Pychyl, T. 2009. Self-regulation Failure (Part 4): 8 Tips to Strengthen Willpower. Read: 26.5.2016. https://www.psychologytoday.com/blog/dont-delay/200903/self-regulation-failure-part-4-8-tips-strengthen-willpower

Rathey, J. & Hagerman, E. 2013. Spark: The revolutionary new science of exercise and the brain. Little Brown and Company, New York, USA.

Rock, D. & Cox, C. 2012. SCARF in 2012: updating the social neuroscience of collaborating with others. NeuroLeadership Journal (4).

Rock, D. 2011. Brain at Work. Campus Verlag, Frankfurt, Germany.

Rock, D. 2008. SCARF: a brain-based model for collaborating with and influencing others. NeuroLeadership Journal (1), 44–52.

Rock, D. & Schwartz, J. 2006. The Neuroscience of Leadership. Strategy+business magazine, issue 43, PricewaterhouseCoopers Strategy & LLC, New York, USA.

Rowold, J. 2015. Human Resource Management. Lehrbuch für Bachelor und Master. Springer Verlag, 2nd ed., Berlin & Heidelberg, Germany.

Schumpeter, J. 1912. Theorie der wirtschaftlichen Entwicklung. Duncker&Humblot, Leipzig, Germany.

The Boston Consulting Group 2008. Creating People Advantage. The Boston Consulting Group Inc., Boston / USA.

Van Velsor, E., McCauley, C. & Ruderman, N. 2010. The Centre for Creative Leadership Handbook of Leadership Development. Jossey-Bass–Wiley, 3rd ed., San Francisco CA, USA.

Waldman, D., Balthazard, P. & Peterson, S. 2011. Leadership and Neuroscience: Can We Revolutionize the Way That Inspirational Leaders Are Identified and Developed? Academy of Management Perspectives, February 2011.

World Economic Forum 2015. The Human Capital Report 2015. World Economic Forum, Cologny – Geneva, Switzerland.

World Economic Forum 2016. Executive Summary. The Future of Jobs. Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution. World Economic Forum, Cologny Geneva, Switzerland.

Yerkes, R. & Dodson, J. 1908. The relation of strength of stimulus to rapidity of habit-formation. Journal of Comparative Neurology and Psychology (18), 459–482.

APPENDICES

Appendix 1. Interview Guide

INTRODUCTION

Personal introduction & stating general aim of research inquiry:
Proceeding of interview:
Planned duration of Interview:
Information about voice recording:
Denomination of name:
Function, company sector & size:
Short thematic introduction about context of the work / research:
Final check:

QUESTION BLOCK 1

Aim: Identify *awareness* about / *relevance* of neuro-concepts in leadership development.

Sample questions	What is your personal perception of neuroscientifically related concepts in business?	Should help to get a first impression about the personal knowledge & probable opinion towards neuroscience principles in business.
	How would you generally describe the **awareness** of your organisation towards neuroscientifically related concepts?	Identify, if neuroscience principles are generally known within organisation. Probably also organisations attitude towards.
	How would you generally describe the **relevance** of neuroscientifically related concepts for your organisation?	Identify, if neuroscience principles are generally viewed as helpful means to support organisational / HR goals.

QUESTION BLOCK 2

<u>Aim:</u> Identify **fields of present** or emerging **application** within leadership development.

<table>
<tr>
<td rowspan="4">Sample Questions</td>
<td>Does your organisation currently apply any neuroscientifically related contents in leadership development?</td>
<td>Unveil current applications. [Expected to be a rare or non-existent case]</td>
</tr>
<tr>
<td>Do your leadership programs contain contents such as "stress response", "Neuroleadership", "brain-friendly learning", "emotional regulation", "peak performance", "focus and attention", "habit change (change management)"?</td>
<td>Participant might not be aware of already existing neuroleadership content as it is not explicitly termed as such – question should help to uncover these unconscious facts.</td>
</tr>
<tr>
<td>What are your current focal points for leadership development? Which organisational needs / leadership challenges have to be addressed?</td>
<td>In case previous question is negatively answered.
Identify the core topics of HR and/or leadership, related to organisational goals – should help to understand the current drivers for HR / leadership.</td>
</tr>
<tr>
<td>What role do stress / lifelong learning / change management / employee-centred leadership etc. play for attaining your organisational goals?</td>
<td>In case previous questions do not lead to results – introduces question block 3 "identify future opportunities".</td>
</tr>
</table>

QUESTION BLOCK 3

<u>Aim:</u> Identify opportunities for **future application** of neuroscience principles to cover present and future HR challenges.

Sample Questions	What are currently HR's / leadership's highest priorities / biggest challenges?	Identify the currently overarching drivers within HR or leadership.
	How do these translate into the highest priorities in leadership development?	Identify the related leadership development drivers / challenges in order to unveil unserved needs that offer potential for neuroscientific concepts.
	How might priorities / challenges shift in the next 3 years?	How do experts view future challenges for their organisation / department? Which emerging needs are connected to developments?
	What competences / skills / knowledge do you expect your leaders to need to acquire in order to cope with future challenges?	Get distinct fields that might need specific training / development in the future. *[These might bear chances for the application of neuroscience concepts].*
	By reviewing the past questions and your answers – which valuable applications can you imagine for business related neuroscience principles?	Getting the participant to reflect on all that was said and possibly sharing some needs that have not been mentioned before.

CLOSING

Formal closing of the interview part and expression of gratitude:
Further proceeding:
Final remarks:
Farewell: