Sustainable Management, Wertschöpfung und Effizienz

RESEARCH

Raphaël Murswieck

Innovation Performance in the 21st Century

Designing Business Related to Cultural, Digital and Environmental Challenges

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Sustainable Management, Wertschöpfung und Effizienz

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Raphaël Murswieck

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Designing Business Related to Cultural, Digital and Environmental Challenges

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Für die Familie an meiner Seite: Danke an meine Frau Sara für die endlose Geduld, meinem Bruder Kajetan, meinen Kindern Johanna und Christoph für die neugierigen Fragen und Danke an meine Eltern Verena und Axel für die endlose Unterstützung.

Introduction

The present introduction intends to provide a brief overview of the present thesis. The following Figure 1 outlines the structure of the present introduction. First, the motivation and the research objectives are discussed to introduce generally into the research subject. Then, the research questions are being specified, followed by the description of the methodologies used. Finally, the structure of the doctoral thesis is being pictured and presented in brief.

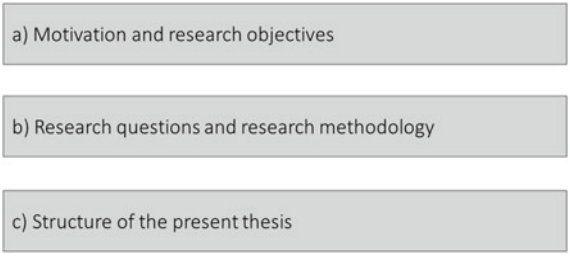

Figure 1 Overview of the introductive chapter. (Source: own representation)

a) *Motivation and research objectives*

Digital technologies are increasingly affecting our daily lives and disturbing existing markets internationally and business models, respectively. Furthermore, natural resources on earth are being exploited and waste, as a result of increasing demands and consumptions, is continuously increasing endangering our life by

pollution. Moreover, the risk of climate change has been commonly accepted as a topic of interest amongst policymakers and businesspeople.

These and more are reasons why the concept of the circular economy becomes more popular as it aims to prolongate dramatically the use of products, components and its natural resources far beyond of recycling and new technologies are seen as a chance to deploy the principles of the circular economy. Reusing, repairing, reducing and refurbishing are essential steps towards a more environmental- and social-friendly business where digital technologies can play a significant role to support the vision of transforming the current existing linear economy towards an economy with closed material loops.

However, this circular concept needs modified, and innovative business approaches for its deployment within most business sectors including the general acceptance amongst businesspeople and customers that the circular principles are beneficial by creating value and are not seen as a barrier or burden with increased production costs. For sure, the transition period might require additional innovation efforts for any organisation in the beginnings.

Nevertheless, thinking about chances and deployable ways to change business behaviour can lead to multiple positive effects for organisations. First, reducing the dependency on limited resources from within different countries from an international perspective will lead to more flexibility and freedom along the supply chain of critical materials. Secondly, organisations can increase their corporate reputation and differentiate themselves from the competition; thirdly, new business models can be created leading to additional revenue streams, for instance, by introducing sharing and leasing concepts—common principles of the circular economy to increase the product lifetime.

In this regard, digital technologies can contribute in fostering the circular philosophy, for example, by supporting organisations to increase their energy efficiency through minimising losses or, as another example, to collect, analyse and provide information on material compositions to improve the usage of the materials within manufacturing.

From a personal perspective, the author has participated in various, mostly international product-, process- and business model development projects in the power plant as well as the oil and gas industry for more than 12 years. During this time, the author had the chance to observe culture-related behaviour patterns amongst team leaders and employees from different countries. This has continuously led to the interest in culture-related business studies, which resulted finally also in giving lectures at university-level in intercultural management to engineering students.

The emerging, digital technologies at the end of the 2000s and in the 2010s have once more shown to the author within his working environment how organisational culture and individual beliefs can either enable or prevent innovation and affect the innovation performance dramatically. These learnings and working circumstances, as well as personal studies, have led to the assumption that corporate culture and civic-based culture interact somehow and influence innovation performance. Amongst others, thoughts on how business affects resources on earth came up especially within technical projects where the same technology was either used for the exploitation of limited crude oil resources or for the pumping of thermal water circulating in closed loops to extract heat for power generation purposes.
The European Union, with its 28 member states (including the United Kingdom in 2019) and millions of organisations within the single economic market, is facing continuous challenges in how to compete globally. Thoughts on finding adequate ways in how to improve the innovation efforts of organisations have finally led to the present thesis objectives.
The main research objectives intend to understand the influencing role of national-related cultural dimensions in the context of innovation performance on a national and organisational level, the role of digital technologies supporting business performance as part of innovation efforts and finally to evaluate ways to support organisations towards a more circular economy promising to create value.
In consequence, a managerial framework supporting organisations to increase their innovation performance shall be elaborated and developed as part of a culture-integrating business innovation model respecting on the hand the potential of digital technologies and on the other hand economic, environmental and social outcomes.

b) *Research questions and research methodology*

The present thesis is built on a mixed research approach considering to answer the following research questions:

- Does innovation performance correlate positively with growth on both, at the national and organisational level?
- To what extent is innovation performance connected to civic-based, cultural dimensions on a national and organisational level?
- How can cultural determinants support organisations in creating an innovation-supporting corporate culture, especially in the early stage of the innovation process?

- What are promising ways to support the idea creation in the fuzzy-front-end of the innovation process?
- Which role do digital technologies play supporting innovation performance?
- To what extent can digital technologies affect the transformational leadership style to promote business performance from a sales perspective?
- How can the principles of the circular economy be transformed into business actions creating value?
- How can organisations make use of culture-related determinants to support innovation performance?

Related to these questions, different studies were conducted aiming to elaborate on the one hand cultural determinants to support innovation performance especially in the critical early stage of the innovation process and to develop a suitable business innovation model to support practitioners of companies in their objectives to foster innovation results.
The studies performed are based on several methodologies such as quantitative statistical analyses based on available datasets provided, for example, to evaluate the relationship between cultural dimensions and innovation performance on a national and organisational level. Supplementing researches, as in the context of digital technologies or the circular economy, was based on explorative studies evaluating the performed surveys. One study focusing on the early stage of the innovation management was conducted by the method of participant observation for one year within a German-based startup company with the help of the so-called Grounded Theory Methodology in order to gain unbiased data.
As such, the present thesis is built on a mixed research approach, including quantitative and qualitative aspects.

c) Structure of the present thesis

The thesis is structured into two main parts, each of them composed out of 3 separate chapters. The first part is dedicated to an intensive literature review presenting the current state of knowledge in the field of research. The second part represents the findings based on the author's own contributions related to performed studies during the doctoral research period (Figure 2).
After the present introduction, the first chapter provides a literature review as a starting point into the subject by describing various elements from within the management of innovation. Nevertheless, prior introducing definitions and perceptions on innovation as well as the different types of innovation, first a general view is given by discussing in brief so-called business excellence models in the context

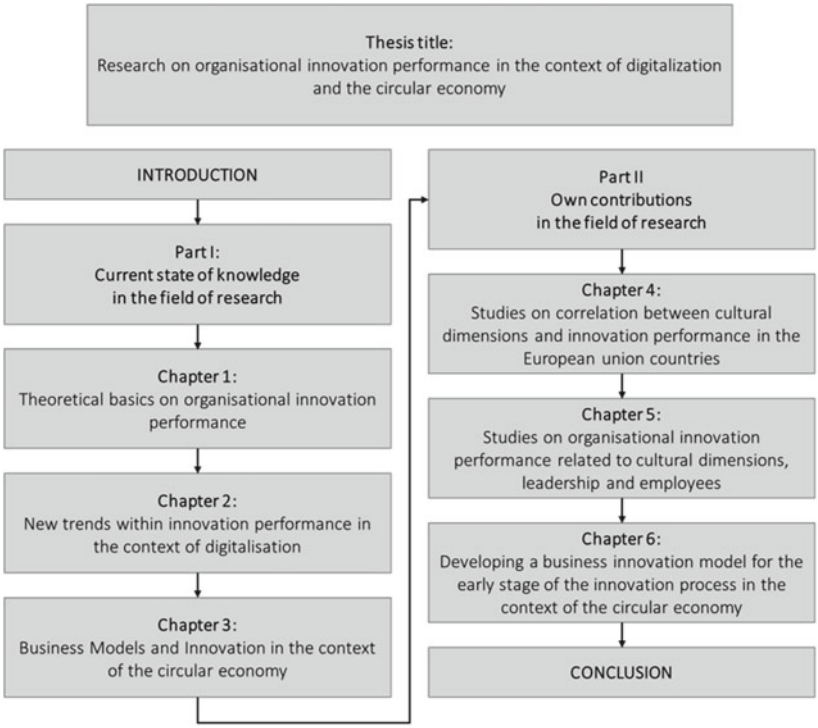

Figure 2 Structure of the thesis. (Source: own representation)

of the total quality management—philosophy. This refers to the fact that excellence framework sees innovation as crucial for achieving an outstanding business level. After that, pre-requisites of innovation performance are being described, and in this regard, the fundamentals of cultural aspects supporting innovation performance on a national and organisational context.

The second chapters deal primarily with innovations in the context of digital technologies and its potential of changing the rules of today's business habits. Therefore, aspects of integrating digital technologies into the business value creation process as part of business models are being introduced. Additionally, aspects of perception differences between habitual innovation processes and digital-solution-related innovation process are being introduced. A brief introduction into trends within digitalisation rounds up the chapter by outlining strategies defined

by the European Commission aiming also to support companies in their adoption of digital technologies as part of the innovation strategy.
Hereon, the third chapter builds on by introducing the concept of the circular economy as a generic, but strategic approach of business model innovation for any business sector addressing uprising environmental as well as social challenges providing the chance to offer new value propositions to customers. Combined with digital technologies and its radical potential for innovation along the value-added chain or as part of digital offerings, it has the power to face environmental and social challenges within the increased global competition. This leads to the bridging role of this chapter between digital technologies and their role in innovation activities by creating not only economical but environmental and social value as part of business models.
Finally, the second part of the thesis aims to address the elaborated gaps within innovation research, focusing on answering the mentioned research questions regarding the early stage of the innovation process.
The fourth chapter can be described as the starting point to elaborate innovation performance based on empirical datasets. Therefore, statistical analyses intend first to understand generally the relationships between innovation performance and national growth among the European Union member states on a macro-economic level. Second, the chapter includes further in-depth correlation analyses to evaluate possible influences of cultural-based factors on innovation performance. These regression analyses conducted show particularly comparative investigations on a microeconomic level as well as investigations related to innovations activities, sales impacts and employment impacts from within EU-based small-medium-enterprises.
The fifth chapter focuses on organisational subjects only. First, cultural determinants affecting innovation performance are being elaborated based on an intensive literature investigation focusing on innovation-supporting indicators and dimensions, bearing in mind the findings from within chapter one. A concluding synthesis describing essential cultural-related determinants and promoting an innovation-friendly corporate culture as a prerequisite of innovation performance is being presented. Secondly, digital technologies as part of innovation efforts and their influence on business performance, are being evaluated based on two separate explorative studies. First, the effects of the adoption of digital technologies on transformational leadership related to sales performance are being elaborated. Secondly, an assessment-based investigation on the employee's mindset on the impact of digital technologies on business performance as more holistic research is being analysed.

Studies focusing on two central aspects characterise the last chapter six: the elaboration and decision-making process of ideas as part of the innovation management process in the early stage and value creating as part of innovation efforts in the context of the circular economy.

Therefore, techniques for the idea evaluation in the early stage are being presented, followed by the mentioned one-year analysis performed within a German start-up. It aimed to analyse the innovation processes followed by a separate study whose aim was to test a circular economy's framework on its potential in measuring value creation as a result of innovative business actions.

The chapter concludes, finally, with an elaborated business innovation model respecting the findings and confirmed hypotheses formulated within the individual studies and aiming to support organisations actively to establish, monitor, maintain and improve their innovation activities.

In order to round up the present work, a conclusion is given to describe the essential findings of the thesis.

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Abbreviations

AI	Artificial Intelligence
B2B	Business to Business
B2C	Business to Customer
BE	Business Excellence
BIM	Business Innovation Model
BM	Business Model
BMI	Business Model Innovation
CE	Circular Economy
CEN	Communauté Européene de Normalisation
CIP	Continuous Improvement Process
CRM	Customer Relationship Management
DESI	Digital Economy and Society Index
DL	Deep Learning
DSM	Digital Single Market
EEF	Followers' Extra Effort
EEG	Electroencephalography
EFF	Effectiveness of leader's behaviour
EFQM	European Foundation for Quality Management
EFSI	European Fund for Strategic Investments
EIS	European Innovation Scoreboard
EMF	Ellen MacArthur Foundation
ERP	Enterprise Resource Planning
EU	European Union
FFE	Fuzzy Front End
GDP	Gross Domestic Product
GTM	Grounded Theory Methodology

ICT	Information and Communication Technology
IDV	Individualism versus Collectivism Index
IoT	Internet of Things
IPM	Innovation Performance Measurement
ISO	International Standard Organisation
IUS	Innovation Union Scoreboard
IVR	Indulgence versus Restraint Index
KPI	Key Performance Indicators
LTO	Long-term Orientation versus Short-term Index
MAS	Masculinity versus Femininity Index
ML	Machine Learning
MLQ	Multifactor Leadership Questionnaire
OECD	Organisation for Economic Co-operation and Development
PDCA	Plan-Do-Check-Act
PDI	Power Distance Index
PWC	Price Waterhouse Coopers
QMS	Quality Management System
R&D	Research & Development
ROI	Return on Invest
SAT	Followers' satisfaction
SII	Summary Innovation Indicator
SME	Small-Medium-Enterprises
SWOT	Strengths Weaknesses Opportunities Threats
TQM	Total Quality Management
TS	Technical Specification
UAI	Uncertainty Avoidance Index
USA	United States of America
VOC	Voice of customer
WVS	World Value Survey

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Part I

Current State of Knowledge in The Field of Research

Theoretical Basics on Organisational Innovation Performance

1

1.1 Organisational Performance as Part of The Business Excellence and Total Quality Management Approach

Referring to Collins (2010), good would be the opposite of excellent. Therefore, excellence in organisations can be described in achieving outstanding, unique results, whereby the respective assessment benchmark for this is usually based on the financial, hence, the economic performance of a company. The organisation's performance, however, should always be compared among companies from within the same market and comparable environmental conditions regarding the opportunities given and resources (Ghicajanu M. et al., 2015).

In general, the so-called "Business Excellence" (BE)—approach refers to the philosophy of "Total Quality Management" (TQM) (Jankal, 2014) with the primary strategic pillars people, products and processes within an organisation. In literature, strictly speaking, it is unclear whether BE is a further development of the TQM, a parallel development or just another name (Tickle et al., 2016). The world's well-known and recognised excellence—concepts and models are coming from the USA, Japan and Europe; however, they are all based primarily on the TQM principles aiming to increase the organisation's performance and differ only little to each other. The concept and the application of TQM require to be somehow anchored within the company applying a continuous improvement culture intended to incorporate all areas of the company (people, products, processes), including external influencing factors such as external stakeholders, for instance. The principles rely less on individual factors but instead include all interactions of all organisational areas. Measures are taken with the aim to achieve a high level of quality results in the interests of all stakeholders—such as

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customers, suppliers, owners and employees. It can be stated, that the TQM philosophy, which was emerging after the Second World War, represents a success story indeed. Significant technical improvements could be achieved with the help of statistical measurements, especially in markets with high production rates and high product batches (such as the automotive production), resulting in increased product quality and lower production lead times (Mitchell, 2015; Oakland, 2014; Pyzdek and Keller, 2013).

The TQM philosophy was ultimately developed steadily out of practice and led to production and quality management approaches such as Six Sigma and Lean Management (Gorecki und Pautsch, 2014; Oakland, 2014; Pyzdek and Keller, 2013) which set the process viewing in focus and less the product quality itself. Instead, the mastery of the processes leads to increased product quality. With this development, "TQM, Six Sigma and Lean provide maturity models and process frameworks that focus on the optimization of repetitive routines and even have standardized actions and analysis instructions for incidents" (Klein, 2018, p. 11) leading to a TQM philosophy in practice which is more likely concentrated on operational excellence and performance than on the whole company.

William E. Deming, one of the fundamental founders of the TQM, stated that measurements are essential for any improvement, describing clearly the intention of the TQM philosophy (Deming, 1984; Deming, 2012; Pyzdek and Keller 2013). Today, this approach has been understood generally and has become a standard within most manufacturing industries. The principles are quite easy to introduce, especially for manufactures with high lot sizes and repetitive processes where technical processes can be measured. A (technical) process improvement is relatively easy to achieve, for sure a strength of the TQM techniques. However, the adoption of these seems to be more difficult in manufacturing processes with rather small batch sizes, special projects or in general for non-technical processes, such as the management processes (Klein, 2018). The human factor as collective term for psychic, cognitive and social influencing factors in the context of socio-technical systems and human-machine systems was often neglected and thus redefined under the umbrella term "Soft Sigma" standing for new approaches where soft factors of people should be part of the philosophy. In numerous international studies it could be shown that individuals and their mindsets are critical when it comes to creating a positive corporate culture leading not only to continuous improvements but also to innovation performance (Albach et al., 1994; Kaasa, 2017; Pamfilie et al., 2012; Puumalainen et al., 2015; Rossberger, 2014).

Business Excellence (BE) thus refers not only on purely technical processes but intends to enhance the Total Quality Management mindset by respecting and integrating the human factor on the quality philosophy. The TQM—maturity

model from Baldrige in the USA, for example, is based on these thoughts (Brown, 2013) and defines success criteria like other BE models from all over the world. However, Klein (2018) sees only a moderate success in these models (and their application) in comparison to the success story of the TQM. He justifies his thoughts with the weak design of the BE—models which are mainly based on "enabling" and "resulting" performance aspects than on technical working tools or instruments to achieve outstanding results (Klein, 2018, p. 12).

BE models intend to transform the view from a full quality result- approach to a company-wide business process and model approach (Forbes and Ahmed, 2011; Langmaier, 2010). Anyhow, processes, as introduced by the TQM, remain to be essential for excellent results. As practice has shown, the challenging part of the BE philosophy is the human himself (Klein, 2018).

The mostly applied BE models are related to the Japan-based model, prevailed after Deming such as the European EFQM model of the so-called European Foundation for Quality Management (EFQM) and the American Baldrige model in the USA which all are internationally recognised. Nowadays, many further excellence and leadership models are existing throughout the world, even though they relate mostly somehow to the mentioned three models. They tend to be somewhat nationally applied in their respective home markets (Ghicajanu et al., 2015; Klein, 2018).

BE models relate on defined, weighted criteria from within different departments of the organisation (example Table 1.1). These are being reviewed and processed regularly by the company to develop the organisation towards a so-called excellence—level.

By comparing the various BE-model, the criteria are fundamentally similar. Single criterion might overlap or complement each other depending on the Excellence Model. They are used to derive detailed questions for the management and to develop tasks and measures to be worked off step-by-step. By doing so and by reviewing the questions of the appropriate excellence-level, the company can reach the next excellence-level accordingly when passed the initial level successfully. The processing of the tasks leads to continuous improvements within the company and thus to an excellent or high performing enterprise. However, the excellence development is based on the achieved results and is evaluated every year internally and externally by the associated BE-model associations, for example, by the EFQM and officially recognised by award ceremonies. The path towards Business Excellence, however, requires continuous support throughout the entire organisation, starting with the top management itself. Furthermore, this philosophy is to be implemented not in the short- or medium- term but in the

Table 1.1 Business Excellence models and their criteria in comparison

Deming Model -Japanese Model of TQM (importance of criteria)	Baldrige Model -American Model of TQM (importance of criteria)	EFQM Model - European Model of TQM (importance of criteria)
1. Policies (10%)	1. Leadership (10%)	1. Leadership (10%)
2. Organization (10%)	2. Information and analysis (5%)	2. Policy and Strategy (8%)
3. Information (10%)	3. Strategic planning (10%)	3. People management (9%)
4. Standardization (10%)	4. Human resource focus (17%)	4. Partnerships and Resources (9%)
5. Human resources (10%)	5. Process management (17%)	5. Processes management (14%)
6. Quality assurance (10%)	6. Business results and company performance (24%)	6. Customer Results (20%)
7. Maintenance (10%)	7. Customer focus and satisfaction (17%)	6. People Results (9%)
8. Improvement (10%)		7. Society Results (6%)
9. Effects (10%)		8. Key Performance Results (15%)
10. Future plans (10%)		

Source: Ghicajanu, M., Irimie, S., Marica, L., Munteanu, R. (2015), Criteria for Excellence in Business, in: Procedia Economics and Finance: Elsevier

long-term to anchor a broad culture of excellence within the company. Otherwise, no continuous improvements can be expected, and organisations will not have lasting performances (EFQM, 2018; Ghicajanu et al., 2015; Klein, 2018).

Finally, BE, or TQM, respectively, is supposed to represent much more than implementing a Quality Management System (QMS). TQM is a management philosophy based on strategy and leadership using various techniques for deployment and is for sure not based on a procedure only to set up and maintain like it is usually the case for QMS to comply with norms of the international standard organisation (ISO) such as the ISO 9001 (Radtke, 1997). However, it shall be pointed out, that the latest version of the ISO 9001—standard from 2015 now includes, for example, a section to set up and maintain a continuous improvement system as part of the QMS (ISO 9001:2015). As such, the BE models like the EFQM from Europe, also include the management of innovation as part of maintaining and excel customer satisfaction, ensuring long-term competitiveness.

1.2 Definitions of Innovation Management, Innovation Performance and its Evaluation

1.2.1 General Aspects of Innovation and its Definition Related to Organisational Performance

Though innovation is a broad, universal, iridescent but often imprecise word used by various market players to demonstrate competitiveness, it is also a term being subject to intensive researches and studies within the academic community to describe various kinds of usable novelties far beyond ideas and inventions from within organisations. Its meaning refers not only to new products and services—a shared understanding of innovation—but also to all kinds of processes, ways of distribution, marketing aspects, types of contracts, corporate identities as well as complete businesses models (Hauschildt et al., 2016).

Regardless type and context of innovation, it is commonly considered in being essential for organisations, especially in times of aggressive, global competition if they want to sustain in the long-term. Furthermore, it is seen as one of the most critical determinants for business performance in general (Camison and Villar-Lopez, 2014; Iturrioz et al., 2015) and as such also part of the excellence-models as mentioned earlier (EFQM, 2018).

As stated by García-Manjón and Romero-Merino (2012), the starting point, core and objective of investments in innovation is the expectation of sustainable organisational growth. This fact was also highlighted by the Organisation for Economic Co-operation and Development (OECD) in the context of the worst economic crisis in fifty years (OECD, 2010). Innovation is relevant in competition at both the national and organisational level (Cefis and Marsili, 2006; Tellis et al., 2009).

Despite some differences within scholars what specifies an innovation, it is a widely common understanding within the research that innovation implies a benefit through its application and that the novelty must be perceived as such. In this sense, it differs from a simple idea or also a complex invention, which both, however, might be part of the innovation process leading to the final innovation. Hence, the basic idea of innovation is to provide a benefit either to the economy in general, to an organisation, to users and as such to create additional value (Chesbrough et al., 2018; Claudy et al., 2014).

Differences in literature concern mainly the question if an innovation needs to be new to the market in general or if it is enough if the novelty is new to users. Anyhow, it is common sense that innovation must have been implemented (Välimäki et al., 2004; Gault, 2018).

By reflecting the beginnings of the innovation-concepts in the 1930s by Schumpeter, it can be mentioned that Schumpeter's typology seems still to be valid: innovation is not only related to the technology itself but also to economics as well as to the management of organisations. In the context of organisations, innovations can be structured through their appearance within the organisation into three dimensions of innovation: technical, organisational and business-related innovations (Schumpeter, 1934, p. 100 f.; Zahn and Weidler, 1995). Figure 1.1 represents the idea of the three dimensions of the so-called integrated innovation management related to Zahn/Weidler respecting the degree of organisational involvement.

The management of innovation is described as the realisation of innovation, in practice, usually as a synonym for the innovation process itself, from idea to launched solution (Goffin and Mitchell, 2009). In the strict sense, however, the management of innovation is far more complicated than a process as it can pertain all departments within organisations or be affiliated within the research and development department, marketing department or within the manufacturing or even human resources. This might be the reason why innovation, the process or the management of innovation is also the subject of various scientific disciplines as well (Adams et al., 2006). It includes aspects from within the business, economics, socials or technology, for instance (Ahmed and Shepherd, 2010) and such is to be considered as an interdisciplinary field of research.

The diverse possible views on innovation point up that the management of innovation is not limited to specific departments but requires an overall, vertical consideration inside the organisation. In this context, organisations need to describe themselves their understanding of how they want to define innovation and its importance related to their specific business model and the strategy. The determination is especially crucial when it comes to evaluating the innovation performance as it defines the way afterwards how innovation is managed accordingly within the organisation itself (Hauschildt et al., 2016).

The present thesis focuses its research findings on organisational innovation performance as a result of performant processes and its contribution to the organisation's business performance. Following the introduction above and keeping in mind the process-approach of the thesis, the following description by Roberts (1987) provides an adequate definition of the term innovation in the context of organisational innovation performance as it is related to both, the idea management and the benefits resulting in performance:

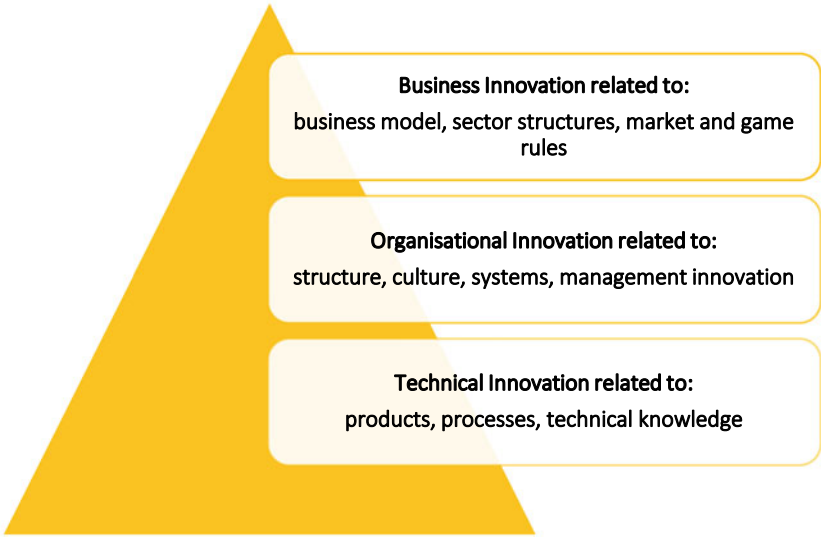

Figure 1.1 Dimensions of innovation as part of the integrated innovation management. (Source: own representation based on Zahn, E., Weidler, A. (1995). Integriertes Innovationsmanagement, in: Zahn, E. (Hrsg.) Handbuch Technologiemanagement, Stuttgart, pp. 351–376; Markides, C. (2006). Disruptive Innovation: In Need of Better Theory, in: Journal of Product Innovation Management, Vol. 23: pp. 19–25; Birkinshaw, J., Hamel, G., Mol, M.J. (2008). Management Innovation, in: Academy of Management Review, Vol.33(4), pp. 825–845)

Innovation = Invention + Exploitation

The invention process covers all efforts aimed at creating new ideas and getting them to work. The exploitation process includes all stages of commercial development, application, and transfer, including the focusing of ideas or inventions towards specific objectives, evaluating those objectives, downstream transfer of research and/or development results, and the eventual broad-based utilization, dissemination, and diffusion of the technology-based outcomes (Roberts, 1987, p. 3).

In consequence, organisations need first a clear picture of their innovation objectives in order to define innovation and to plan their innovation-related activities for increasing their business performance. The following chapters refer first to various perceptions on innovation in general before focusing on measurement aspects of innovation activities contributing to the business performance by setting the perspective on innovation indicators.

1.2.2 Perceptions of Innovation

The official, so-called Oslo-manual distinguishes four general types of innovation (OECD/Eurostat, 2005): product-innovation, process-innovation, marketing-innovation and business-model innovation. These distinctions refer to significantly optimised or entirely new types of innovation within these classes. Another popular perception is provided, for instance, by the Doblin Consulting company with a scale-like innovation distinction between two extreme positions (Figure 1.2), named the "10 types of innovation". On the left side, the internal-orientation and on the right side, the customer-orientation with an open-innovation-like approach is described (Doblin/Deloitte, 2015).

Figure 1.2 The ten types of innovations from an organisational to a market view. (Source: Doblin/Deloitte (2015), Ten Types of Innovation, Deloitte Development LLC [online] https://www.doblin.com/dist/images/uploads/Doblin_TenTypesBrochure_Web.pdf [Accessed 08.02.2018])

A complementary perception is given, finally, with the so-called innovation radar defined by 12 dimensions of innovation from which four are to be seen as orientation points (Figure 1.3): "the offerings created by the organisation, the customers to whom they are addressed, the processes it uses and the points used to ensure presence on the market" (Sawhney et al., 2006, p. 77).

Sawhney et al. (2006) point out that business innovation is about creating value for customers, and not just „things". Only by creating a value for customers, a correspondent value is generated for the company as well. Inferentially, innovation management is a value-adding process if well-managed with a customer-oriented approach.

Organisations can choose whether they prefer either in-house developments or if they prefer to involve customers in their processes to find new, innovative solutions (Hochmeier, 2012; Murswieck et al., 2017a) right in the beginning of the innovation process or later in between during the evaluation process. Involving customers is described as an open-innovation approach which promising to succeed as the rating of product ideas is consequently based on real market-related

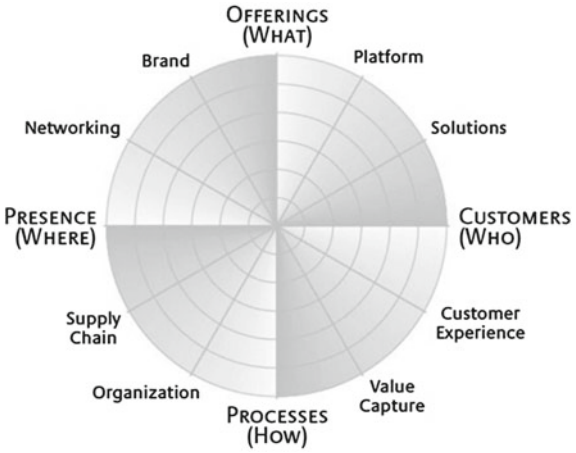

Figure 1.3 The innovation radar with four orientation points. (Source: Sawhney, M., Wolcott, R. C. & Arroniz, I. (2006), The 12 different ways for companies to innovate. MIT Sloan Management Review, 47(3), 28–34)

statements instead on uncertain internal assessments, opinions or faith (Kristensson et al., 2004; Lüthje, 2000; Ogawa and Piller, 2006; Shah, 2000; von Hippel, 1978).

Picking up customers challenges and involving them directly at the beginning of the innovation process can be a desirable marketing strategy regarding both fulfilling customer needs by innovative solutions and increasing the customers' dependency of the supplier for future contracts (Classen, 2015).

1.2.3 Conditions for Performant Innovation Management

If creating a value for customers is the primary target for (business) innovation (Sawhney et al., 2006), then setting the customer at the very beginning of the innovation process by involving the target group seems to be an effective and highly promising way in creating value for a company (Classen, 2015). Contrary to that view, which can be seen as the starting point for an open innovation approach, this understanding differs from the traditional view by Schumpeter (1934) where a „lonely" company creates innovation based on internal knowledge only: the primary source for new ideas are the employees. Evaluations, prototyping and

testing of new ideas leading to potential innovations are being performed only internally, meaning that a beneficial outcome of such new ideas is primarily based on trial and error. The decision process for moving forward or vanishing an idea is dependent on intimate knowledge only (von Hippel and Tyre, 1995).

Chesbrough (2003, 2006) specified this internal innovation process as „closed innovation model" and stated that today, organisations should instead „open" their innovation processes by involving external sources. According to him, this open innovation concept ensures a strong innovation leadership as more proven, reliable ideas and existing innovation could be monetarized. Even more: partnerships, spin-offs or venture capital would be additional positive outcomes of an open innovation approach if—for whatever reason—ideas were not realised internally within a closed innovation model.

In any case, for any innovation-friendly environment certain conditions need to be set accordingly to manage the way successfully in creating innovation: various theoretic and empiric studies confirmed that the organisations' cultural mindset is one of the utmost critical aspects to succeed with innovations neverminded if a closed or an open innovation—concept is applied (BCG, 2014; Ceausu et al., 2017; Tellis et al., 2009; Trimm, 2016;). However, what does this means exactly and what does it mean to an organisation to establish an innovation-friendly company culture and how can this be introduced—questions which seem to be justified to support organisations.

The critical condition is to establish an innovation-driven culture by creating a so-called innovative "ecosystem". According to Higgins and Wiese (1998), the working system can be described as an excellent and matching network of collaborators, motivated to achieve together outstanding results. The co-workers are intrapreneurial enablers, each of them with their tasks within the innovation process to push and form ideas to successful innovation. High trust and a resulting higher level of collaboration will lead to synergies and increase innovation performance.

Trust can be stimulated through a self-creating circular process based on participation, transparency and communication between the co-workers (Götz, 2006).

Researchers state that diversity within teams is much more promising to succeed with innovations: professional backgrounds, age, intro- and extroverted personalities are all enabling variables for innovation to increase the success if managed accordingly. It was even confirmed that different nationalities with their cultural background do promote innovations faster and even with fewer failures (Back et al., 2009; Boutellier and Völker, 1997; Chesbrough, 2006).

In detail view, however, it could be elaborated in several studies that the success and the management of innovations differ very well internationally due to cultural aspects: the innovation process itself, as well as the results, are influenced by the national background of personalities, their teams and its organisation throughout the different kinds of cultural particularities (Albach et al., 1994; Kaasa, 2017; Puumalainen et al., 2015; Rossberger, 2014).

As a side-notice, it shall be pointed out that innovation is not to be seen as equivalent to creativity: creativity is "the ability to use skill and imagination to produce something new" (Oxford Learner's Dictionaries, 2019) and can be seen as a fundamental feature of humans (Albach et al., 1994). Innovation, however, is the capability to make use of the ideas created and to monetarize these by adding value. Here, the company mindset establishment and the innovation-oriented management of the whole organisation and its employees is the key to succeeding with innovation.

Analysing and identifying a promising way of setting the prerequisites for managing innovation is the target of the present research respecting cultural aspects. The fuzzy-front-end (FFE) of such innovation creation processes is still not well understood (Rowold and Bormann 2015). Therefore, the present work analyses especially the starting point of the innovation creation process to get a deeper understanding of how innovations are created in the early stage and how innovation management is being executed.

1.2.4 Aspects of Measuring the Performance of Innovation

Innovation and its performance measurement can refer to different economic levels, from micro- to macro-levels and intermediate levels: while the micro-level is related to unique projects, the macro-level can either include multiple projects as well as innovation activities on a nation's economy level, market sector or enterprise level. Intermediate levels refer to project families (Figure 1.4). The criterion on what to measure, how and when has a direct influence on the performance output indicator and its meaningfulness, respectively. Technical, economic and other effects influence the overall performance of the organisation. As such, the question remains what a meaningfulness performance indicator is. Technical performance indicators such as the number counts of patents or economic performance indicators such as product related sales figures or even other indicators out of environmental or social origin, for instance, may be applied (Hauschildt et al., 2016, p. 397 ff.).

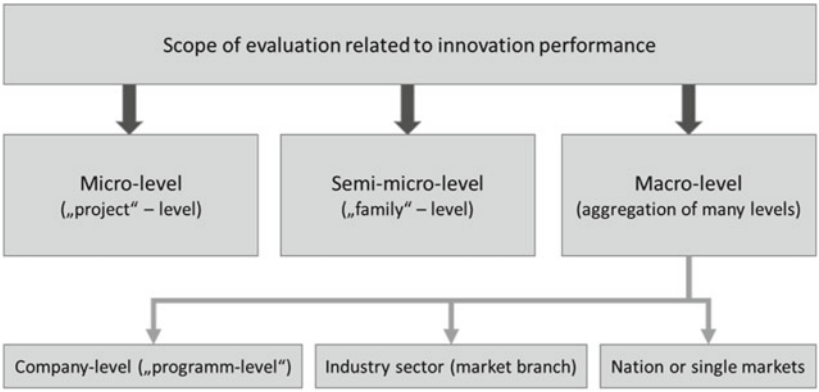

Figure 1.4 Scope of evaluation in the context of innovation performance. (Source: own representation, according to Hauschildt, J., Salomo, S., Schultz, C. and Kock, A. (2016). Innovationsmanagement. 6th ed. München: Verlag Franz Vahlen.)

Many studies have been performed to understand innovation performance and to derive appropriate indicators. However, the variety of research results show that there is no universal or generally accepted framework, nor have scholars agreed on indicators. Even in the seed phase of the innovation process—the so-called early stage of the innovation process—very few indicators exist to support organisations evaluating the potential of promising and upcoming ideas (Dewangan and Godse, 2014; Hagedoorn and Cloodt, 2003; Olaru, 2013). In consequence, each organisation needs to precise which performance indicators fit the strategy.

However, organisations are having more success with innovation than others have. The same applies to economies. In the following both, the nation and organisational levels of innovation performance are of interest from a starting point of view to understand possible enablers. Be it for policymakers or managers, understanding the implications of innovation-related determinants influence the decision-making process in how to foster innovation performance.

a) Innovation performance on a national, country-related level

Transferring the organisational objective of competitiveness with the help of innovation on a national level, the target remains: increasing the nations' strength. It is relevant for the economy that policymakers continuously emphasise to encourage innovation. For instance, the official objectives of the European Union (EU)

are that all member states invest a minimum of 3% of the gross domestic product (GDP) into research and development (R&D). In consequence, multiple EU funding programs have been established to support innovation activities in organisations such as out of the EU "Horizon 2020"—program (European Commission, 2019c; Montmartin and Herrera, 2015) and the newest release lasting until 2027 (European Commission, 2021) with a budget of 95.5 billion Euro.

On a nation's level, the GDP is seen as a typical indicator trying to picture the economy's performance level also related to innovation, despite ongoing discussions to include further indicators such as quality of life, quality of work, life expectancy and others in order to reflect the nation's welfare (Gotsch, 2012). Advantages in using the GDP, however, are for sure historically available databases and the fact that the indicator is an internationally accepted performance indicator. In contrast, due to political interests, the calculation methods or transparency may vary in some cases, making it difficult to compare the indicator internationally (Coyle, 2015). Still, the effects of innovations within an economy are expected to be represented somehow with the GDP (European Commission, 2019c) as analyses on single indicators and their impact have shown that specifically expenditures in R&D, public as well as private investments, increase the growth significantly of the GDP for a given country (Ciocanel and Pavelescu, 2015) as represented in Figure 1.5.

The crucial role of innovation for the nations' development is recognised in most countries worldwide. Hence, governments are interested in knowing which parameters strengthen the economy. On an organisational level, policymakers are engaged to know what actions promote the innovation performance of the companies supporting the increase of the GDP (Nasierowski and Arcelus, 2012) finally.

One measure implemented by the European Union (EU) is the so-called European Innovation Scoreboard (EIS), which is published every year since 2001, re-named Innovation Union Scoreboard (IUS). In the following, both terms are used simultaneously. The idea of the EIS is to provide an assessment of the innovation performance across all EU countries by collecting parameters from within all member states. The comparative analyses shall then support policymakers, influencers and organisations in the EU to discover their strengths as well as weak points in order to improve their innovation efforts accordingly (European Commission, 2019b).

However, some scholars doubt the meaningfulness of the innovation ranking, for example, due to its calculation method in averaging the single indicators. Some researches propose instead, focusing the calculation on the input and output indicators and their relation to each other (Edquist et al., 2018).

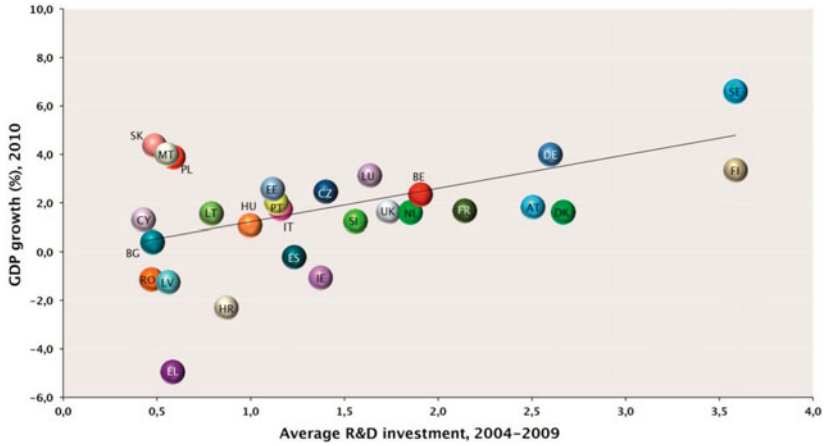

Figure 1.5 Gross domestic product of EU countries and expenditures in R&D [%]. (Source: European Commission (2019c). Horizon 2020—The New EU Framework Programme for Research and Innovation. European Commission, p. 3. [online:] https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/281113_Horizon%202020%20standard%20presentation.pdf [Accessed 17. May 2019])

As shown in a separate chapter the country-related EIS primary indicator, so-called Summary Innovation Indicator (SII), correlates with the EU—country's related GDP per Captiva: a higher EIS indicator generally leads to a higher GDP. In this sense, the SII-related ranking across the EU (Figure 1.6) seems to be eligible (Murswieck et al., 2017a).

The understanding of the EIS indicators seems therefore essential in the context of the present thesis, as the EIS provides an evaluation which is somehow also cultural-influenced, a core-prerequisite for performant innovation management within organisations (Maier et al., 2014; Albach et al., 1994).

The SII represents, in fact, an average composite indicator out of 27 unweighted singular indicators, grouped into ten indicator dimensions. These ten dimensions are furthermore assigned to four main indicators. Each of the 27 singular indicators is collected from within different but internationally accepted sources such as the OECD, World Bank, United Nations (Hollanders and Es-Sadki, 2018).

The four main indicators are *framework conditions, investments, innovation activities* and *impact* (Figure 1.7).

As introduced, each main indicator represents one specific area out of an innovation dimension supporting the increase of the main indicator. As an example,

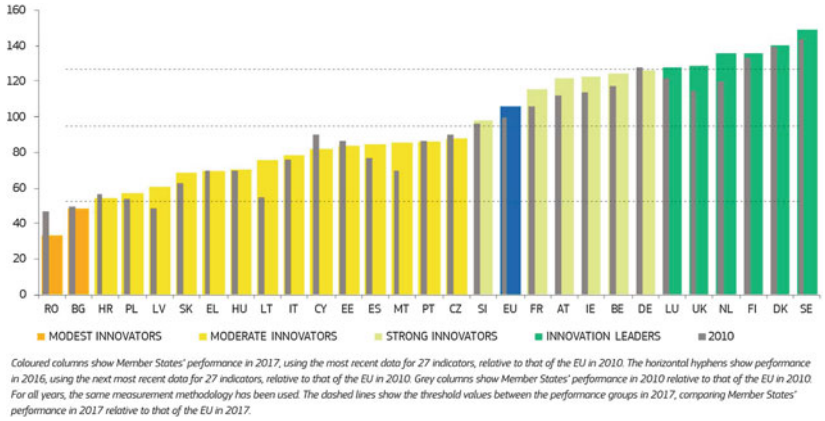

Figure 1.6 Performance of the EU Member States' innovation system according to the European Innovation Scoreboard. (Source: Hollanders, H. and Es-Sadki, N. (2018). *European Innovation Scoreboard 2018.* [online] Available at: http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm [Accessed 3 Apr. 2019])

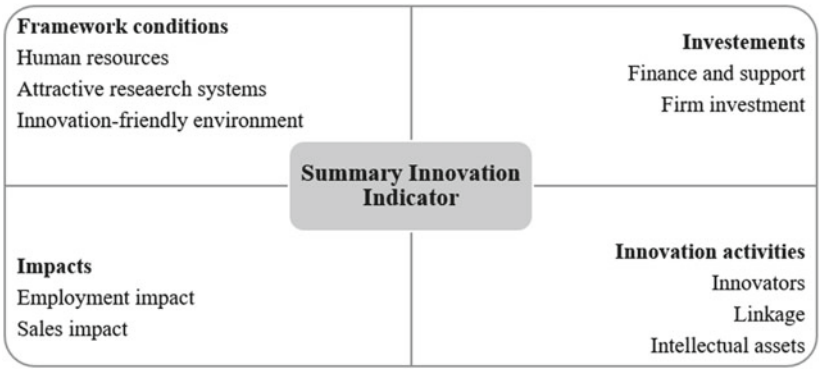

Figure 1.7 The four main indicators represented by the Summary Innovation Indicator of the European Innovation Scoreboard. (Source: owned representation based on Hollanders, H. and Es-Sadki, N. (2018). *European Innovation Scoreboard 2018.* [online] Available at: http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm [Accessed 3 Apr. 2019])

the main indicator *impacts* is composed of the two sub-dimensions *employment impact* and *sales impact*. *Employment* and *sales impact*, for instance, are themselves composed of single indicators provided by the statistical sources as mentioned above. The main indicator *impacts* is, in fact, a result of the innovation efforts measured within the three other main indicators with their respective sub-dimensions and single indicators. In contrast, all main indicators are somehow in a relationship supporting each other. Improvements of a single indicator are increasing the country-related SII in consequence (Hollanders and Es-Sadki, 2018).

b) Innovation performance on an organisational level

The Summary Innovation Indicator (SII) includes activities from within innovative firms. The definition of an innovative firm is related to the OECD/Eurostat (2005) as follows: "An innovative firm is one that has implemented an innovation during the period under review". This general definition provokes the question of which indicators are to be used to evaluate innovation performance on an organisational level. Literature provides meanwhile, an intensive quantity of innovation performance indicators, which have been intensively discussed more and more within the last decades, which is reflected by an increasing number of publications. In their study, Dziallas and Blind (2019) analysed scientific literature from 1980 to 2015 related to innovation indicators investigated worldwide. Based on the innovation dimension framework from Becheikh et al. (2006) they evaluated, amongst others, the characteristics of the innovation indicators along the innovation process in order to enlighten existing definitions, approaches and impacting factors on the innovation performance. The study reveals that especially in the early stage of the innovation process, only a few numbers of indicators are described compared to an increasing number of innovation indicators towards the end of the process. This outcome is explained with more available data on finished innovations/products (Dziallas and Blind, 2019).

In practice, however, measuring the performance of innovation ex-ante, hence, before the market release, is more critical: especially for company leaders dealing with limited financial, human and other business-related resources it is crucial to understand what determinants influence the innovation performance if they want to increase the innovation's process efficiency and final performance accordingly. Studies reveal that determinants are not yet fully understood (Becheikh et al., 2006; Evanschitzky et al., 2012; Dewangan and Godse, 2014).

Measuring innovation performance in the profit-oriented business context, however, is in most cases, a complicated matter. Interestingly, studies have shown

that companies often feel disillusionment from their investment into innovation (Birchall et al., 2011) while the right selection of appropriate key performance indicators (KPI), specifically for innovation, remains a challenge when it comes to measuring evolving, new and uncertain innovation projects (Kirchhoff et al., 2013; Banu, 2018). Studies have also revealed that organisations having introduced an innovation performance measurement (IPM)—systems rate their IPM often as not adequate or at least see a need for improvement to their satisfaction (Chan et al., 2008; Andrew et al., 2010).

Based on an empirical study within over 21,270 firms, Rosenbusch et al. (2011) find that "fostering an innovation orientation has more positive effects on firm performance than creating innovation process outcomes such as patents or innovative products or services" (Rosenbusch et al., 2011, p. 1). However, their study also confirms that the dedication of increased resources to innovation input processes affects the innovation-performance relationship positively (e.g. higher R&D budget). Anyhow, the objective of innovation activities must be to creating value to the market or users rather than creating only theoretical offerings (Rosenbusch et al., 2011) despite the fact that traditional concepts in measuring innovation performance have relied so far on easily accessible databases such as for patents or R&D budget (Hagedoorn and Cloodt, 2003; Flor and Oltra, 2004).

In this context, the primary factors need to be understood to create and cultivate an innovation-friendly organisation enabling to generate and evaluate promising ideas and concepts, especially in the beginning of the innovation process. The early stage and its surrounding aspects of the innovation process are responsible whether an idea is being generated, followed up or rejected. The early stage is also the phase, where the "go" within the innovation process is decided and where various resources are dedicated to the idea (Khurana and Rosenthal, 1998; Reid and de Brentani, 2004; Eling et al., 2016; Van Oorschot et al., 2017).

This thesis has an explorative character aiming to sketch suitable solutions for practitioners and leaders in the field of innovation management. It focuses on innovation performance by identifying innovation-supporting determinants and indicators in the early stage instead of on the process of measuring itself. The following chapter reflects the current state of knowledge regarding the critical factors supporting innovation performance on an organisational level. Thoughts, which measurements methods and KPI are to be used, should be entrusted to the strategic management: it remains unclear if metrics elaborated by researches are applicable, as they seem to be too theoretical (Adams et al., 2006; Cruz-Cázares et al., 2013).

However, it can also be observed that interest in finding suitable systems to foster innovation and its evaluation in practice is progressing. Scholars are registering the increased attention of managers as well as consulting companies to this subject: obviously, the need for finding deployable solutions is growing in order to reduce failures (Andrew et al., 2008; Chan et al., 2008; Dewangan and Godse, 2014).

1.2.5 Identifying Determinants on Innovation Performance

Although the evaluation of the innovation performance itself remains in practice a challenging task for organisations, the factors promoting innovation performance on an organisational level have been generally well determined within scholars. Various studies indicate, for instance, an innovation-oriented culture, organisational structure, knowledge and competency as well as strategy and R&D activities in being supportive to innovation performance (Ernst, 2003; Becheikh et al., 2006; Hauschildt, 2016; Ikeda and Marshall, 2016).

The earlier mentioned large-scale literature review performed by Dziallas and Blind (2019) based on the innovation dimension framework from Becheikh et al., (2006) reflects the fact that a full set of innovation dimensions and indicators have been studied during the last decades being assigned to organisational factors, contextual factors and the taxonomy of innovation (Figure 1.8). While academics have deeply analysed company-specific and market-related indicators, innovation process-related studies, in contrast, have been less frequently investigated, especially in the context of the early stage of the innovation process (Dziallas and Blind, 2019). Given the fact that research on indicators and affecting factors supporting innovation in the early stage are weak so far, scholars agree in general the existing gaps (Binder, 2014; Dziallas and Blind, 2019).

So far, the determinants named in Figure 1.8 and implemented in the proposed framework by Becheikh et al., (2006) represent the elaborated indicators influencing innovation out of empirical studies from 1993 until 2003 refined by Dziallas and Blind (2019). By definition, external, contextual factors impacting innovation are less likely to be influenced by the management of the organisation than the internal, company-related factors. Both, however, influence either direct or indirect the innovation performance as hard or soft factor (Dziallas and Blind, 2019).

The well-known Oslo Manual (2018) within academics recommends companies to measure more than only R&D expenditures, which are measured anyway in most companies. This refers, for example, to employees' training activities as

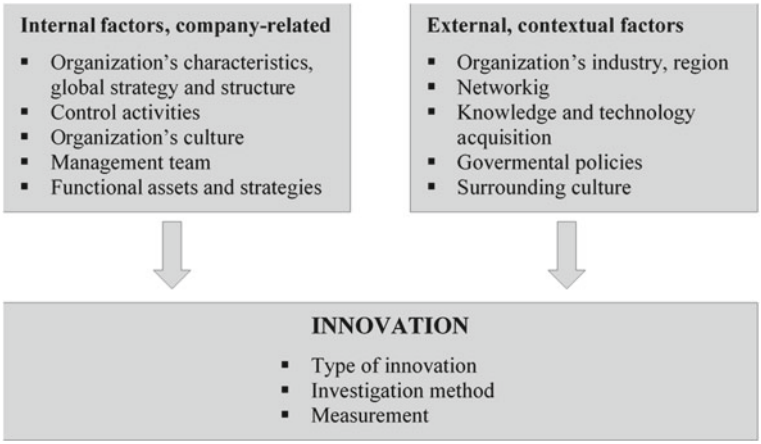

Figure 1.8 Conceptual framework of determinants related to innovation performance. (Source: own representation based on Becheikh, N., Landry, R. and Amara, N. (2006). Lessons from innovation empirical studies in the manufacturing sector: A systematic review of the literature from 1993–2003. Technovation, 26(5–6), pp. 644–664)

well as to activities related to Intellectual Property (IP), marketing, engineering / creative work, software and database, acquisition and lease of tangible assets and innovation management itself (OECD/Eurostat, 2018).

Knowing the principle determinants affecting innovation outcomes can support organisations in setting the fundamentals for performant innovation. These prerequisites shall ensure that the beginning of innovation can arise, after all, in the form of ideas. It is probably the most critical phase of the innovation process. Considering the high failure rate of many innovations (Binder, 2014; Munos, 2009; Verworn and Herstatt, 1999), it is moreover necessary to generate many thoughts for screening appropriate ideas. For this, the organisation's culture should encourage all employees of an organisation intrinsically to participate in all phases of the innovation process.

1.3 Cultural Aspects of Innovation Performance

1.3.1 The Organisational Culture and its Influence as a Determinant on Innovation Performance

Any innovation is the result of many ideas generated in the early stage of the innovation process. Ideas are the seeds strewed by the employees of an organisation based on their creativity but also as a result of stimulations out of the organisation. Therefore, an innovation-friendly culture is seen as a mandatory pre-condition for innovation of any kind and must be implemented within the organisation (Maier et al., 2013). Hence, it is worth to understand the principles of organisational working systems in the context of innovation culture with its characteristics supporting the performance of innovation.

Within the literature, various theoretical models often differ between open, flexible or organic organisations versus hierarchic, controlled or bureaucratic organisation systems. While the first approach is rated as being enabling creativity, the latter philosophy is instead seen as more preventive in the context of innovation performance (Hauschildt, 2016, pp. 99). However, the question would be to understand how culture, as part of organisations, can be controlled and also be taken as an advantage in order to influence the performance?

Understanding organisational culture as part of the company behaviour has been part of various researches and refers basically to values exchanged within the organisation. Managers, for instance, can embed values by describing behavioural expectations and influence as such outcomes on employees and the organisation, respectively (Mumford et al., 2002).

The systematic layer-model of corporate culture developed by Schein (1984) distinguishes three cultural layers related to non-visible values, unconsciously but sometimes exposed norms and mostly visible so-called artefacts which need to be interpreted, however.

Although some scholars consider organisational culture as being a single constructor stating that organisations do not have their own cultures but "are" cultures (Alvesson, 1993, p. 17), Schein's widely spread systematic view of organisational culture (Figure 1.9) shows that it is quite difficult to influence the organisation's culture (Hauschildt et al., 2016). Norms are in the proper sense reflections of the individuals' values manifested in observable artefacts. Therefore, conclusions to values cannot be drawn related to the artefacts in the other way around. Values are described as invisible notions, thoughts and principles which guide humans in their way of acting and judging within their lives (Oxford Dictionaries English, 2019) shaped by parents and the individual's environment.

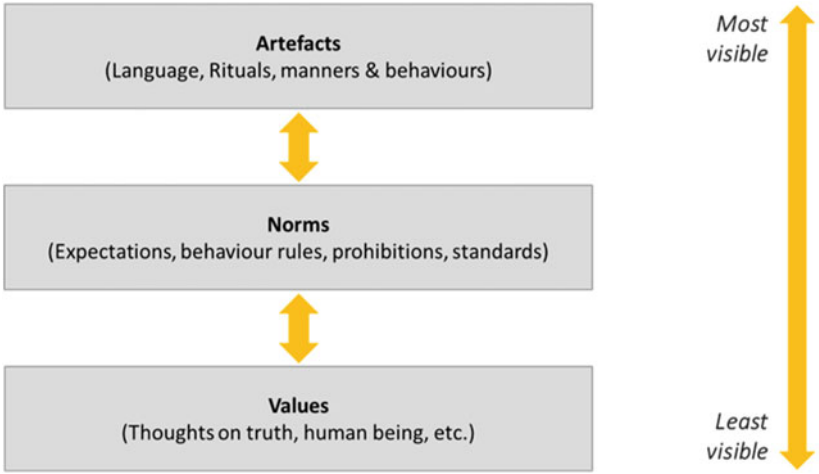

Figure 1.9 Cultural layers of an organisation supporting innovation. (Source: own representation based on Hauschildt, J., Salomo, S., Schultz, C. and Kock, A. (2016). Innovationsmanagement. 6th ed. München: Verlag Franz Vahlen AND Hogan, S. and Coote, L. (2014). Organisational culture, innovation, and performance: A test of Schein's model. Journal of Business Research, 67(8), pp. 1609–1621)

Despite the challenge to influence the invisible values and norms, the firms' officially defined culture is still essential when it comes to providing guidance to the whole organisation with its employees. In this function, it also has an integrating role for its members as well as new employees and allows to create a collective corporate identity. The management has the chance to influence the culture's framework to support innovation-friendly activities actively. Involving employees in the innovation process from the beginning, for instance, instead of developing creative ideas within separate teams helps to strengthen positive experiences with innovations. Throughout the organisation, the employees have the chance to replace inhibitory innovation-related values and instead to increase their confidence in participating in innovation (Hauschildt et al., 2016).

Gregory et al. (2009) state "that organisational culture influences firm effectiveness is an assumption implicitly held by many managers and management researches, although few empirical studies have provided detailed insight into the relationship". Hogan and Coote (2014) found fault that researches showed a gap between the relationship between organisational culture and innovation

performance. In their study, they wanted to confirm the intuitive belief in culture as determinant by testing a model based on Schein's cultural layer model (Figure 1.9). The empirical researches performed within service companies confirmed the role of culture as an influential factor to foster innovative behaviour (Hogan and Coote, 2014).

1.3.2 National-Related Culture as Affecting Determinant on the Organisational Innovation Performance

In his inaugural speech during an innovation congress in front of social organisations, Trimm (2016, preamble) stated, that the management of innovation would be promising "if they are compatible with the value system of the respective organisation, its resources and specific requirements".

As noted in previous chapters, culture does somehow influence innovation performance. Indicators have also been elaborated, and international studies regularly show that cultural factors do very well influence innovation performance in various manners. The question which factors generally influence the performance positively or negatively was also part of different studies. However, culture is difficult to catch, as described above. Humans do not show their cultural mindset directly. Researchers, therefore, tried to get into details by comparing business performance and innovation performance internationally within various industries and try to describe what factors were relevant for the performance. By doing so, other factors should also be respected, such as available resources, luck or also political circumstances (Christensen et al., 2016; Maier et al., 2013; Guan and Ma, 2003).

Nevertheless, international comparative studies could provide indications what supports and what breaks innovative behaviour generally. The Berlin Academy of Sciences and Technology's working group "Cultural Success Factors for technical Innovations" performed a multi-year study within different western-oriented countries known for different cultural behaviours (such as Germany, France, Japan, USA,..) in the 1990s. Their comparative organisational analysis confirmed basically the relationship between culture and innovation performance but also explained, that typical known differences in behaviour such as short- or long-term orientation as it occurs differently in the United States of America (USA) or Japan, for instance, are not necessarily positively or negatively affecting innovation performance (Albach et al., 1994).

It is known that the nations' culture results in different business behaviours. Individual freedom at work or obedience in contrast, for instance, directly affects

the team's behaviour within the hierarchy of any organisation. The management of such teams and their team members differ in consequence affecting the way in how business is managed. Hence, the way in how innovations are created differs as well (Albach et al., 1994; Hofstede 2017; Lewis, 2010;).

In today's globalised world, where the competition increased now also amongst international organisations, much more than on the level of a nation within the same cultural mindset, factors influencing the business performance gained interest within the research community. The so-named hyper-competition (Eckert, 2017) between companies increased internationally even further due to digital technologies enabling to create new business models affecting existing dominating market players. As such, the role of culture becomes more relevant to understand what positively influences the capability of securing a competitive edge continuously (Eckert, 2017).

Globalisation, digitisation and the natural limits of any resources have increased the pressure on any organisation to re-think about their offerings to satisfy customer needs and to compete continuously. Hence, innovation becomes more important to organisations and setting the right parameters to create a supportive organisational culture is today's key for executive management. In an international study based on 17 markets and 759 companies, Tellis et al. (2009) found the corporate culture to be the most important driver for innovation performance. The Boston Consulting Group (2014) also identified culture to be the most critical driver to support innovation on an international empirical study. Both studies describe characters such as "risk-permitting" or "collaborative" in being promising for performant innovation management (Tellis et al., 2009; BCG, 2014).

Such characters, however, are basically driven by national-related cultural factors and were elaborated and described intensively by Geert Hofstede (2017) with the help of meanwhile six cultural dimensions (Figure 1.10) sketched in the following (Hofstede, 2011; Hofstede 2019):

Individualism describes the character within nations where individual choices and decision are being respected. It refers to the interpersonal connection to a group or family and is also a measure by what extent the responsibility is taken for the group's interests. Collectivism would be the other extreme position. *Power Distance,* as another dimension, describes the intensity of hierarchic acceptance within individuals. High power distance societies accept an unequal distribution of power within individuals. *Masculinity,* in contrast to *Femininity,* can be observed in societies where strength and force are important. Feminine societies, however, are characterised instead by modesty than force. It is a virtue to have "sympathy for the underdog". *Uncertainty Avoidance* as fourth dimensions explains to which degree people take possible, expected risks and accept anxiety in consequence.

Figure 1.10 Cultural dimensions described by Hofstede. (Source: PWC. (2019). [online] Available at: https://www.pwc.com/gr/en/publications/greek-thought-leadership/culture-competitiveness-wealth.html [Accessed 17 May 2019])

The tolerance of ambiguity is relatively high in societies accepting uncertainty. Societies can also be described through time orientation. *Long-Term Orientation* versus *Short Term Orientation* is related to the strategic time horizon based on actions made and "deals with change". Long-term oriented societies are characterised by planning. Indulgence as one of the recent dimensions of Hofstede was discovered by Michael Minkov (Minkov and Hofstede, 2011) based on data from within the World Value Survey (WVS) and characterises "the gratification versus control of basic human desires related to enjoying life" (Hofstede, 2011, p. 8) and

by that the extent of enjoying life and freedom as an accepted value. In contrast, *Restraint* describes societies where life is seen somewhat as hard and individual human drives and having fun is less accepted.

However, Hofstede stated that those civic-based characters are not to be transferred one-to-one to organisational behaviours as individuals might follow other rules related to corporate culture. In a two-country based study, with limited meaningfulness as he states, Hofstede describes six organisational cultural dimensions which are related to organisations only (Hofstede, 2019): process-orientation versus results-orientation, job-orientation versus employee-orientation, professional versus parochial, open systems versus closed systems, tightly versus loosely controlled and pragmatic versus normative.

In contrast, a recent report published by Price Waterhouse Coopers (PWC) states, that cultural dimensions affect strongly the competitiveness of countries related to their GDP (Figure 1.11), hence, the productivity of companies (PWC, 2019).

Figure 1.11 Cultural dimensions' influence on competitiveness. (Source: PWC. (2019). [online] Available at: https://www.pwc.com/gr/en/publications/greek-thought-leadership/culture-competitiveness-wealth.html [Accessed 17 May 2019])

In the context of the findings from Hogan and Coote (2014) as well as Schein (1984)'s model of cultural layers within organisation, the cultural dimensions

described by Hofstede (2017) are always present within the employee's mindset influencing in any case the innovative behaviour of the organisation. Keeping in mind the initial seed phase at the beginning of any innovation within the innovation process, the innovative behaviour of each employee is relevant irrespective its national-culture mindset. However, civic culture is affecting each person's behaviour, especially as part of teams and within hierarchic structures as several studies and reviews of literature reveal (Albach et al., 1994; Becheikh et al., 2006; Kostis et al., 2018; Lewis, 2010).

Even it is known that national-related cultures have different business behaviours impacting innovation performance, few studies have concentrated so far on the early stage of the innovation process which aims to generate worthful ideas to create innovations of any kind. Still, researches lack in answering to what extent civic culture influences the early stage and the FFE, respectively. The question on how culture does influence the dealing with new challenges such as with the ongoing digitalisation and its strong power of disturbing existing markets in a global context is not answered, so far. However, it is certain that cultural inimitability influences the innovation process within all stages but especially in the most crucial phase of the innovation process where the fundament of innovation is set: the early stage (Binder, 2014).

2 New Trends Within Innovation Performance in the Context of Digitalisation

2.1 Characteristics of Digitalisation and the Effects on the Economy

2.1.1 General Aspects of Digitalisation and its Developments Influencing Business Innovation

In distinction to "digitalisation", the often ambiguously used term "digitisation" correspond basically to the transformation of analogue existence of data of text, music, pictures, video, data and other physical items into the coded, binary information format based on "ones" and "zeros" only. The digital format makes it finally possible to manipulate, store and distribute such digital objects within virtual networks. Digitalisation, in contrast, refers instead to make use of digital technologies based on coding. As such, digital technologies have the power to transform complete value chains within organisations, as well as economies at all in the long-term (Gartner IT Glossary, 2019; Kreutzer and Land, 2016). Digitalisation is seen as a "process of moving to a digital business" associated with new business models and revenue opportunities as well (Gartner IT Glossary, 2019).

Chip calculation improvements and data storage capacities made it finally possible to lever the potential of the digital technologies in the 2000s. The beginnings of the IT, however, in the 1950s and 1960s were already characterised by simple process automation and information exchange systems. Both public and private sector started to make use of it. Also, the term "artificial intelligence" (AI) occurred within science in the 1950s, but limits in computational capabilities hindered to transfer ideas into reality as it is possible today by contrast. Costly computer investments made it rather impossible, especially for smaller companies to be part

R. Murswieck, *Innovation Performance in the 21st Century*,
Sustainable Management, Wertschöpfung und Effizienz,
https://doi.org/10.1007/978-3-658-34761-1_2

of the early adopters. However, these early activities finally lead to a rapid increase in commercially used digital technologies and data processing. The 1990s were finally marked by advanced computer technologies and from there by the overcome of intercompany frontiers. E-commerce platforms and automated business processes penetrated businesses to an increasing degree. Data processing and information systems along the complete value-chain began to be integrated within the companies. Organisations could finally directly benefit from the enhanced processing systems by reducing their administration and logistic costs on the one hand and increased sales, respectively, with the help of new or additional business models (Amman & Dickel, 1998; Fleischhack, 2016).

The era of data-based solutions since the 2010s (Figure 2.1) leads to new opportunities, respectively, new business models. This effect is based on new digital innovations conceptualised with the help of new configurations of latest digital technologies such as robotics, virtual reality applications, 3D printing, data analytics or the so-called internet of things (IoT), connecting physical goods with the internet basically through sensors. The adoption of connectivity-related technologies becomes now more critical and the speed of deployment is accelerating within the European Union (McKinsey GI, 2016).

While in the beginnings of the digitalisation, digital technologies were only deployed by early adopters and uncertainties of resulting benefits were widely spread amongst organisations, empirical studies could prove that digital technologies have a positive impact on organisational performance and should be considered in any cases within the organisation's strategy (Strauss, 2013, p. 19).

2.1.2 Digitalisation as Global Megatrend Affecting the Organisation's Strategy

Contrary to closed markets within a single national economy in the very, very past, digital technologies have once more shown their influence on global competition. The power of digitalisation to create new customer needs, to develop new ways in delivering offerings and to fulfil customer's expectations in a much broader sense has completely changed the rule of games. Organisations are pushed to anticipate upcoming developments on a world's level if they want to perform in the future as well (Stern, 2008).

Digitalisation has been described in being part of six global megatrends of our today's time by Rothlauf (2010), strongly influencing the economy and any organisations on a global level. The internationalization of the markets with increased global mergers and acquisitions, the increased environmental challenges,

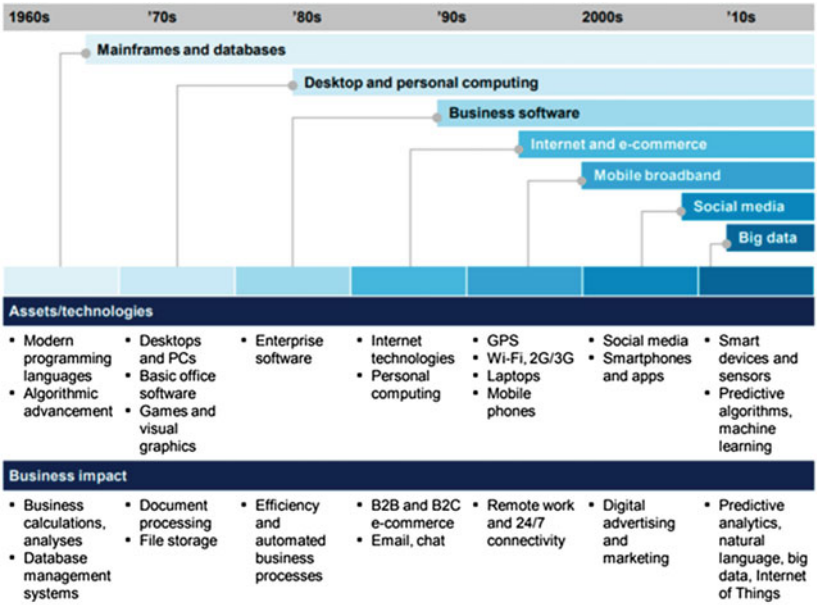

Figure 2.1 Periods of digital technologies affecting business. (Source: McKinsey GI, (2016). Digital Europe: Pushing the frontier, capturing the benefits. McKinsey Global Institute. [online] Available at: https://www.mckinsey.com/~/media/McKinsey/Business%20Functions/McKinsey%20Digital/Our%20Insights/Digital%20Europe%20Pushing%20the%20frontier%20capturing%20the%20benefits/Digital-Europe-Full-report-June-2016.ashx [Accessed 20. May 2019])

the changing of organisational cultures based on interdisciplinary teams as well as the influence by technologies, the various sociodemographic changes within the countries as well as significant increased customer expectations with mostly buyer-related markets by which organisations are confronted and finally as sixth megatrend the mentioned digitalisation with its increasing importance in the way of how communication and information of all kind is being processed and used.

In this regard, digital technologies have massively influenced the competition and in consequence, the (global) strategy of organisations. As Eckert (2017) is stating, the philosophy of a flexible organisation turns to be effective when it comes to developing innovation using the power of digital technologies for increasing the company's efficiency. In the beginnings of the deployment of digital

technologies, the core idea was just to automate single steps within the value-added chain, which afterwards turned out to be even more worthful by analysing the generated data. Today, the generated data is seen as a new form of resource out of which new services, products and complete business model innovations are being developed. The process of data mining as a new form of resource exploitation has led to new business models as well. Interfaces between data streams and humans have been meanwhile reduced or optimised, and it got even more comfortable to implement new digital technologies within the existing business processes. Online business, for instance, is still in the beginnings despite its steep increase since the 2010s (Eckert, 2017).

While the beginnings of innovation activities in the context of digital technologies in the 1990s were purely characterized by increasing the internal processes' efficiencies within operations, for example as part of TQM—approaches (Rothlauf, 2010; Lee and Berente, 2012), the move towards external-oriented innovations in the form of product and service-innovation has strongly impacted the perception of digital technologies within organisations and likewise customers (Yoo et al., 2012). New digital-related products or services providing benefits to customers has forced managers to re-think their offerings and innovation activities in the context of digital opportunities to pro-actively increase their competitiveness and in consequence their business performance (Nylén and Holmström, 2015).

In this context, Porter (2014) describes two important and unchanged principles creating competitiveness: either leading by costs or leading by differentiation (Figure 2.2) leading to value creation. Advantageous products, services or other forms of offerings form the fundament for differentiation.

Digital technologies, for instance, support organisations in both, reducing costs by increasing efficiency along the value-added chain and developing new digital-related offerings to differentiate from within the competition. Organisations need to understand and define what technologies they can make use of to adopt as part of their strategy (Eckert, 2017; Strauss, 2013; Nylén and Holmström, 2015).

It got obvious that organisations not considering digital technologies will have difficulties to sustain in the mid- or long-term. New competitors can enter initially balanced markets and disturb existing core businesses from more prominent market players by introducing new, advanced or simplified offerings to customers. Markets get finally mixed through new players formerly dominating in other sectors just because of new, digital solutions. Neverminded, the form of novelties, companies, face new challenges based on disruptive innovations, a description of making existing offerings obsolete and providing competitive advantages. In a general sense, such advantages are only of value for organisations if they can

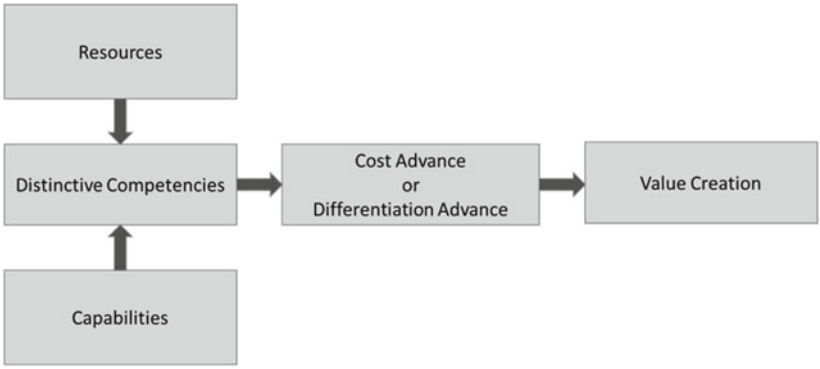

Figure 2.2 Competitive Advantage—model creating value, described by Porter. (Source: own representation based on Porter, M.E., (2014). Wettbewerbsvorteile (Competitive Advantage)—Spitzenleistungen erreichen und behaupten. 8th ed. Frankfurt am Main/New York: Campus-Verlag)

provide these with lower costs compared to the value creation itself (Porter, 2014, p. 23). Otherwise, the organisations' competitive edge might fail. Additionally, Porter argues that organisations are considered to evaluate the value chain instead of the value creation itself. In this context, organisations need an understanding of how innovation can be managed more appropriate as the process of digital innovation management show particularities (Nylén and Holmström, 2015).

2.2 Importance of Innovation Management in the Context of Digital Technologies

2.2.1 Aspects of Digital Technologies Contributing to Innovation Performance

Within all industries, organisations have meanwhile invested in hard- and software as well as in integrated concepts to make use of the digital potential. Nevertheless, the degree of digitisation differs within the business markets as well as in international comparison. While information technology-related companies are leading the adoption within the value-added chain, other markets such as the construction industry are far behind in efficiently integrating digital solutions as part of their business model (McKinsey GI, 2016).

Especially amongst digital-oriented start-up companies, the advantages of digital technologies and their strategic deployment into performant business concepts can be derived. Founders of digital-based business models and digital products see, contrary to non-digital founders, the gain of digital services and products in their ability to address their offerings to a much broader customer base through online-distribution channels. Furthermore, their business models are scalable, which leads to significantly improved costs per sale. In consequence, digital start-up companies are mostly present internationally and can grow much faster than non-digital companies. However, studies also reveal that digital founders feel much more challenged than non-digital founders within the traditional business model. Uncertainties of positive business results remain due to non-established or not-yet proofed business models. Interestingly, initial investments to set up and start the business seem to be comparable even though the ambitious growth targets of digital start-up more often require higher investments after the initial starting phase (Metzger, 2017).

The way in how digital-solutions-oriented companies develop innovation is generally the same as in traditional industries but show differences in terms of flexibility during the development phase itself (Nylén and Holmström, 2015). The innovation process is determined by a more flexible structure typically found within the software development industry (Conforto et al., 2014). The characteristics of digital technologies make it possible to show higher flexibility when it comes to addressing specific changes to the needs of internal or external customers. Additionally, the vast range of possible deployment of a single technology within various sectors is, for sure, a considerable advantage compared to physical products. The ability to change the application of one specific digital solution or even to adopt the business model by re-configuring a digital code demonstrates one of the key differences compared to traditional innovation processes where the outcome is more focused on one business case.

Moreover, new digital solutions can be created based on existing solutions. However, such usually incremental product innovation can suddenly show a radical type of innovation. This might be the reason for less felt control on digital innovation processes and where adapted frameworks specifically for digital innovation might be appropriate (Nylén and Holmström, 2015). Looking to the main four types of innovations (Figure 2.3) described by Henderson and Clarc (1990), the technological changes are based on combinations within existing or new core technologies and the linkage of their existing or new sub-components.

Established companies usually rely on their existing knowledge and solutions when innovating. Therefore, their innovation outcome usually is incremental or modular-related in order not to danger their built up knowledge over time. Radical

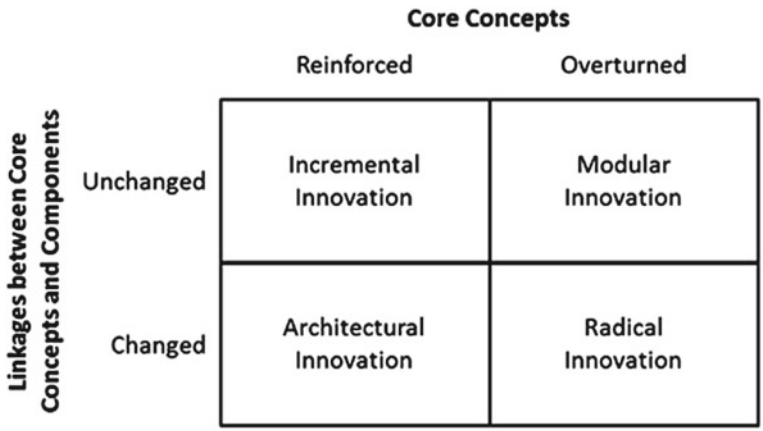

Figure 2.3 Conceptual types of innovation. (Source: Henderson, R., & Clark, K. (1990). Architectural Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms. Administrative Science Quarterly, 35(1), 9–30. doi:10.2307/2393549)

or architectural by contrast has the power to wipe out existing solutions of incumbent companies; the reason why traditional organisations are vulnerable (Bartman, 2016).

Kreutzer and Lang (2016) have introduced the meanwhile often cited term "digital darwinism" to describe a special kind of revolution when technologies and societies are changing faster than organisations can keep pace with it. Therefore, young start-ups can jeopardise established, big players if they are not able to adapt to technological and societal changes. They argue that not the strongest will survive in the long-term, but those companies being able to adapt to changes.

Keeping in mind the mentioned approaches of closed innovation and open innovation by setting customers in the driving seat, the capability of mastering technology-driven innovation seems to be equally relevant. In a recent study conducted in 2018 within 1603 French manufacturing firms, for example, a research team could show that a combined customer/technology orientation is more promising when it comes to performing with innovations than those organisations focusing on a single aspect only, technology or customer (Adams et al., 2019).

2.2.2 Managing Digital Innovation: Considerations on Uncertainties and Possible Approaches

Internet of Things (IoT)—solutions, as an example from within the newest digital developments, basically can connect any physical objects to the internet with the help of sensors. However, the connection itself does not create any value so far. With individually defined types of datasets streamed into a virtual network, it is offering multiple possible applications such as predictive maintenance analytics, operational efficiency recommendations, visibility on current workload, resource planning and more. Hence, the value generation is not always directly connected to a digital technology itself but instead on the employee's skills to create benefits out of it. Furthermore, companies will have to think about their appropriate business model related to the digital offerings especially when it comes to promoting new, unknown solutions to the market (Birnbaum et al., 2005; Eckert, 2017; Nylén and Holmström, 2015; Madakam et al., 2015).

Generally, decisions are taken by managers and usually refer to a profound understanding of the particular situation, the general strategic orientation of the organisation, the capabilities related to internal and external resources and of course to contextual influences.

The understanding of the potential and its expected time of return-of-invest (ROI), however, represents a burden. In this context, Linden and Fenn (2003) describe how emerging technologies can be evaluated by managers with the help of Gartner's Hype Cycle (Figure 2.4) representing different phases and their corresponding expectations providing deployable solutions:

The graph shall support organisations in their decision process and prevent them from investing too early in immature technologies or at least to provide an orientation if and when technology is expected to be productive. Contrary to other evaluation curves such as the "s-performance"—curve showing the performance over time of a specific technology or the "adoption"—curve showing the adoption and maturity of a given technology, the Hype cycle curve adds "expectation" as an additional dimension. According to the authors, the human factor is essential when it comes to evaluating the current readiness of emerging technology. Occurring new developments usually are discovered by medias irrespective its maturity level and awake confident expectation unable to fulfil such in practice, hence, generally showing a meagre adoption rate or insufficient results. Only after a particular time, the technology has been optimised through development loops of real-case test phases until adoption with relevant cost-savings is achieved (Linden and Fenn, 2003).

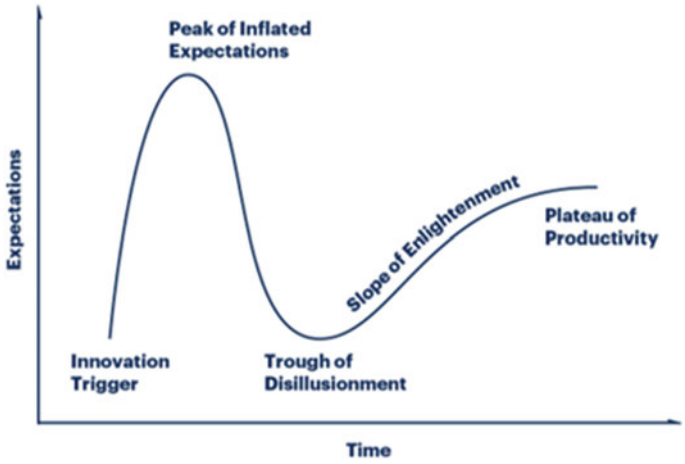

Figure 2.4 Gartner's Hype Cycle phase model for emerging technologies. (Source: Gartner Inc. (2019). Gartner's Hype Cycle phases. [image] Available at: https://www.gartner.com/en/research/methodologies/gartner-hype-cycle [Accessed 21 May 2019])

Historically, the Gartner's Hype cycle, introduced in the mid-1990 s, was created to support the organisation's in their strategic decisions but has been only recently discovered within research (Dedehayir and Steinert, 2016).

The latest Hype Cycle for emerging digital technologies (Figure 2.5), for instance, makes clear that many described technologies within newspapers, magazines or movies such as general AI or autonomous driving concepts are not yet ready for adoption and companies should be aware of it and circumspective (Gartner Inc., 2018).

Nevertheless, the cycle still represents a prediction with uncertainties, which should be considered by managers taking decisions when it comes to developing digital-related innovations. Nylén and Holmström (2015), therefore, suggest implementing managerial framework adjusted to digital innovations strategies (Table 2.1) respecting three main dimensions within the management of digital innovation: product-, environment- and organisation-related aspects. While the product dimensions incorporate user experience and value proposition meaning that the solutions shall not be complicated and provide comprehensible benefits for the customer, the environment-related dimension is related to the screening and understanding of digital solutions on the market accepted by the target group. However, understanding of digital technologies is being described as a challenge,

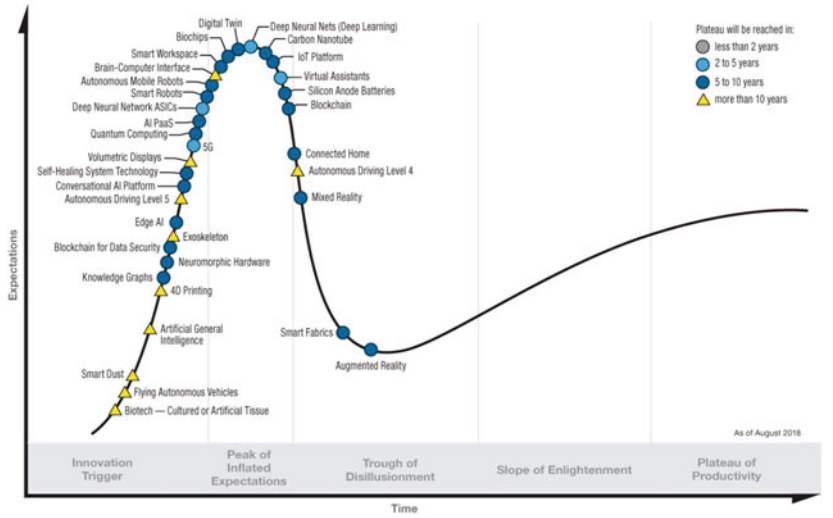

Figure 2.5 Gartner Hype Cycle for Emerging ICT Technologies 2018. (Source: Gartner Inc., (2018). Hype Cycle for Emerging Technologies 2018. [online] Available at: https://blogs.gartner.com/smarterwithgartner/files/2018/08/PR_490866_5_Trends_in_the_Emerging_Tech_Hype_Cycle_2018_Hype_Cycle.png [Accessed 18 May 2019])

especially for companies from within traditional businesses. Therefore, skills and improvisation are part of the described organisational dimension to foster understanding and the needed flexibility in developing digital-related radical or architectural innovation as per Table 2.1 (Nylén and Holmström, 2015).

2.3 Tendencies on Digitalisation Within the European Union

2.3.1 Strategic Considerations on Digitalisation Within the European Union

The EU is, in fact, an economic community and its target remain to promote economic growth within its union state members and to foster economic cooperation. In consequence, the EU is continuously observing the internal, single EU market but also global trends in order to ensure a leading position internationally. The

Table 2.1 Managerial framework for digital innovation strategy

Dimension	Area	Scope	Element
Product	User experience	Digital products and services must offer high levels of usability, possess carefully designed aesthetic properties, and evoke engagement.	Usability Aesthetics Engagement
	Value proposition	Digital innovation involves an articulated value proposition; i.e., a customer segmentation including strategic pricing and positioning of the product portfolio, dynamic bundling of product units, and carefully negotiated commissions to channel owners.	Segmentation Bundling Commissions
Environment	Digital evolution scanning	In order to identify opportunities for innovation, firms need to scan their digital environment. This involves gathering information on new digital devices, channels, and associated user behaviors.	Devices* Channels** Behaviors
Organization	Skills	In order to reap the benefits of digital innovation, firms need to acquire new skills both internally and externally while establishing new digital roles. In doing so, firms should promote continuous learning of the unique properties of digital technologies in order to secure dynamic innovation teams.	Learning Roles Teams
	Improvisation	The malleabiltiy and low cost of digital technologies affords a higher degree of improvisation. As a consequence, managers need to ensure that they provide organizational members with an improvisational space where structure and flexibility is balanced in such a way that the constraints maximize creativity, dedicated time is given, and improvisational efforts are coordinated to deal with overlaps and waste.	Space Time Coordination

* Hardware such as memory, processors, chips, PCs, smartphones, tablets, etc.
** Web services and platforms such as social media and app stores

Source: Nylén, D., Holmström, J. (2015), Digital innovation strategy: A framework for diagnosing and improving digital product and service innovation, Business Horizons, 58, pp. 57—67

international trading aspect beyond the EU borders should not be neglected as the single market represents the most significant trade region in the world (European Union, 2019).

From 2015 on towards 2019 including, the Commission has set ten areas of priorities (Figure 2.6) out of which the actions related to digitalisation, the so-called "Digital Single Market" (DSM)—strategy, is listed second after the "Jobs, growth and investment"—priority.

While the first strategic point aims to booster growth within the EU and support initiatives as well as strategic investments to create jobs within all member states by lowering investment barriers and providing funding through the European Fund for Strategic Investments (EFSI) to strengthen various economic sectors the

Figure 2.6 Ten strategic priorities defined by the European Commission 2015–2019. (Source: European Commission. (2015). The European Commission's 10 priorities. [online] Available at: http://www.europarl.europa.eu/news/en/headlines/eu-affairs/20150904IFG91614/from-jobs-to-migration-the-european-commission-s-10-priorities [Accessed 19 May 2019])

second, digital-related point is more specified. The DSM—strategy addresses specific topics to enable and foster the digital transformation among the economic actors and to simplify consumer's life of the EU citizens. Legislative initiatives concern, for example, the improvement of the access to the internet within the EU and breaking down legal barriers to increase the free, digital movement of all kind of goods including capital transactions, services and labour in between the member states such as actions against geo-blocking of online services. Also, the EU has decided to dedicate resources into strategic fields such as artificial intelligence technology (AI), cybersecurity as well into the development of a supercomputer infrastructure. It aims to boost the members state capacity to supporting "the development of leading scientific, public sector and industrial applications in many domains, including personalised medicine, bio-engineering, weather forecasting and tackling climate change, discovering new materials and medicines, oil and gas exploration, designing new planes and cars, and smart cities" (European Commission, 2019a, p. 4).

Similar to the European Innovation Scoreboard SII composite index (Figure 1.6), the European Commission has established a digital-related, so-called

"Digital Economy and Society Index" (DESI) which, in the same way as the SII, is a composite index summarizing indicators focused on digital performance comparison within the EU countries and providing a rating related to digital competitiveness (Figure 2.7).

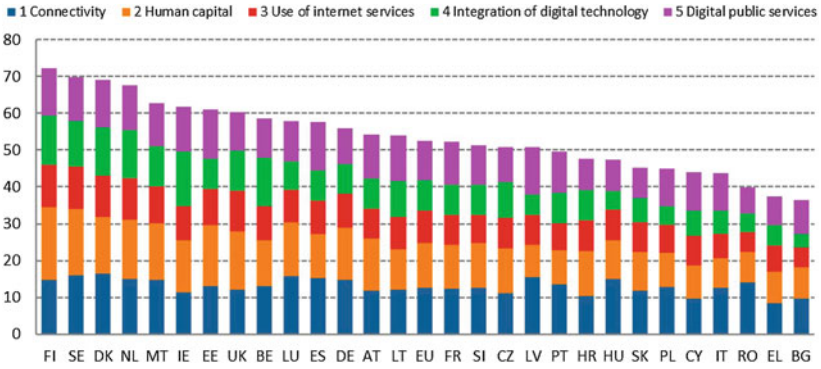

Figure 2.7 Digital Economy and Society Index (DESI) 2018 ranking within the EU member states. (Source: European Commission, (2020). DESI 2018. [online] Available at: https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=67086) [Accessed 28 June 2021].)

The DESI—composite index includes the degree of connectivity (infrastructure) within a given country as well as the level of digital skills supporting the deployment of digital technologies within public and private organisations but also the use of internet-related services by all inhabitants, the digitalisation itself within businesses and as a separate measure the degree of digital public services (European Commission, 2018).

Digital technologies and hereof, especially the upcoming AI-related solutions, are described by the Commission as a crucial driver of economic development for both the public and private sector. In contrast to other countries such as the USA and China as two internationally known extreme poles adopting AI, the strategy of the European Countries is to treat the technology with care in the context to ethical and legal impacts. The Commission itself has also committed to transforming their administration into a "user-focused and data-driven administration — a truly digital Commission" by 2022 in order to increase "efficiency, effectiveness, transparency and security" and to provide "EU-wide, borderless, digital

public services that are indispensable for the functioning of the European Union." (European Commission, 2019b, p. 3).

Surprisingly, none of the 20 most prominent companies in the world relying their business models on artificial intelligence is coming from Europe: eleven are headquartered in the USA, nine in China. In contrast, most scientific papers are not published by researchers from within the USA or China but from Europe. Within nearly 21.000 journals worldwide, about 60.000 papers are published yearly in the context of AI-related topics based on an analysis of the SCOPUS database. Out of these, about 17.000 papers are published yearly by researchers from within European countries (Eberl, 2019).

The increased interest in AI-based topics amongst researchers, policymakers and managers mainly from within large enterprises, is related to the manifold possible applications offering the high, disruptive potential for innovation and competitiveness. AI-based solutions aim to train machines or more specifically mathematic algorithms to perform tasks which are done by humans today based on personal experience and learnings with the strength of computational, calculation capacities resulting in very performant systems. AI systems need enormous amounts of qualitative worthful data to train the algorithms, such as within medical applications, for instance, aiming to detect cancer cells on x-ray photographs; the reason why performant data storage and processing technologies are needed. Deep Learning (DL) or Machine Learning (ML) refers to the same AI concepts but describe rather technological developments within AI history. Today, advanced AI systems are mostly working with the help of so-called neural networks with thousands of single computational neurons performing mathematic operations to imitate the human's brain learning principles. However, also applications with less complex and sensitive data are within the focus of AI solutions: increasing the efficiency along the value chain of organisations or improved customer-related marketing business actions with the help of data analytics systems (Buchanan, 2006; Ertel, 2016).

2.3.2 Adoption of Digital Technologies on an Organisational Level

As a statistic review by the European Commission demonstrates, large companies (with more than 249 employees) show a higher degree of digital technologies' adoption (Figure 2.8) explained by their advantages related to scale effects in investing in information and communication technology (ICT) specialists. In consequence, their ability and motivation to digitise their business are rather high

compared to small-medium-enterprises (SME). However, SME's show relatively high engagement within e-commerce and social media which might be reasoned in available and easy-to-access online platforms or solutions combined with directly sales-related expectation, hence, increasing the business performance (European Commission and Eurostat, 2018).

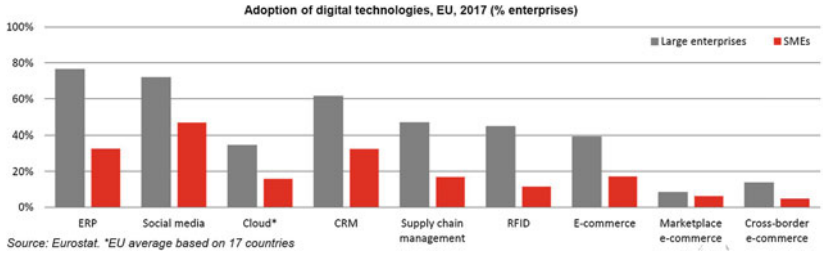

Figure 2.8 Adoption of digital technologies in the EU by SME and large companies, 2017. (Source: European Commission and Eurostat, (2018), Digital Economy and Society Index Report 2018—Integration of Digital Technologies, [online] Available at: http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=52243 [Accessed 20. May 2019])

However, the motivation to adopt digital technologies also sharply differs within the sectors. As expected and mentioned earlier, ICT—related markets lead the digital ranking while the construction sector shows a low degree of adoption (Figure 2.9). A comparison between European companies and more advanced companies from within the USA have revealed that higher degrees of digital technologies' adoption increase business performance significantly neverminded the sector. Therefore, investments in digital infrastructure, training and innovation should be considered by any organisation (McKinsey GI, 2016).

Therefore, it seems necessary to differentiate between mature technologies as ready-to-adopt solutions and digital, technological developments in the early stage, representing a much higher risk of investing.

The fastest growing deployment of digital technologies in a business context within the EU, for instance, are related to the usage of social media and portable devices (Figure 2.10). In this context, no significant differences can be observed between large companies and SME's (European Commission and Eurostat, 2018).

Still, within both large companies and SME, huge economic potentials can be derived from a general view everywhere in Europe, leading to increased wealth. In this sense, companies shall be furthermore be encouraged to invest in the digitalisation as in summary; it can be stated, that organisations not deploying

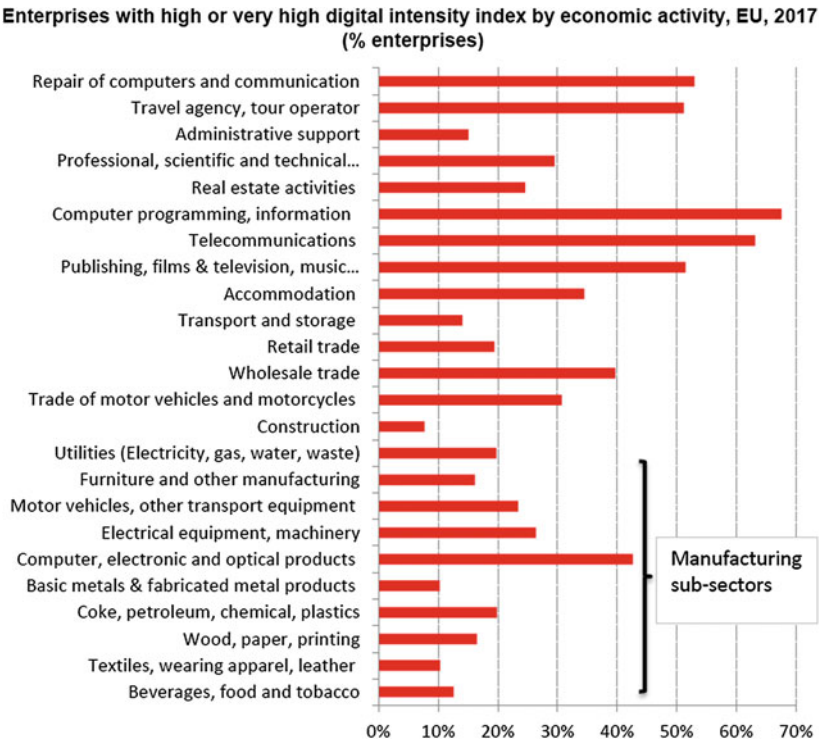

Figure 2.9 Digitisation within different economic sectors in the European Union, 2017. (Source: European Commission and Eurostat, (2018), Digital Economy and Society Index Report 2018—Integration of Digital Technologies, [online] Available at: http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=52243 [Accessed 20. May 2019])

digital technologies to their advantages might be "darwinised" as in the words of Kreutzer and Lang (2016).

Some parallelism with the digitalisation of the economy can be detected in the context of environmental or social aspects based on existing movements within society forcing organisations to re-think their business models (Barr, 2016; Clark and Dickson, 2003; Jonker, 2000). Despite the fact still being in the fledgling stages compared to digital solutions offering comprehensible solutions, the concept

Key indicators tracking digitisation processes	Year	% of EU28 enterprises		Variation 2017-2015 (pp)	
		Large	SMEs	Large	SMEs
Having a **web site** or homepage	2017	94%	76%	0	2
Website has some **interactive functionalities**	2017	74%	58%	2	3
Use any **social media**	2017	72%	47%	9	8
>50% of the persons employed **use computers** & Internet	2017	50%	40%	3	2
Fastest **broadband** connection is at least 30 Mb/s	2017	69%	37%	15	12
Have **ERP** software package to share information	2017	76%	33%	Not comparable with 2015	
Use Customer Relationship Management **(CRM)**	2017	62%	32%	0	1
>20% of workers with **portable devices** for business use	2017	38%	32%	7	5
Employ **ICT specialist**		75%	18%	-3	-1
Selling online (at least 1% of turnover)	2017	39%	17%	1	1
Share electronically **supply chain** management data	2017	47%	17%	-1	1
Exploit **B2C eCommerce**	2017	9%	7%	1	1

Figure 2.10 Degree of penetration and speed of adoption of the digital technologies monitored by the DII. (Source: European Commission and Eurostat, (2018), Digital Economy and Society Index Report 2018—Integration of Digital Technologies, [online] Available at: http://ec.europa.eu/newsroom/dae/document.cfm?doc_id=52243 [Accessed 20. May 2019])

of sustainability or more specifically of the circular economy is gaining increasing interest among both practitioners and the academic community as described in the following.

Business Models and Innovation in the Context of the Circular Economy

3

3.1 The Circular Economy—a Conceptual Framework

3.1.1 The Characteristics of the Circular Economy and its General Importance

The Circular Economy (CE) emerged amongst others out of the "cradle-to-cradle"—concept, a philosophy which aims to reuse resources after they have been already consumed in their primary form. By doing so, resources run circular instead of being discarded as waste as it is usually the case within traditional linear economy concepts (McDonough and Braungart, 2002). The deployment of the CE philosophy shows sustainable elements employing an improved balancing of economic, environmental and society's interest through increased efficient use of resources on earth. Scholars describe the development of sustainable businesses as a deployment of the CE business principles (Ghisellini et al., 2016; Murray et al., 2017). However, it is fallacious to presume that business models, systems or processes adopting CE principles are always sustainable as this might be only partially in some cases (Geissdoerfer et al., 2018).

In the last decade, the circular economy concept has found an increased interest within scholar (Lacy et al., 2015; Hannon et al., 2016; Hestin et al., 2016; Geissdoerfer et al., 2017; Pieroni et al., 2019; Bocken et al., 2019a) as well as within governments, organisations and the society as a whole (Geissdoerfer et al., 2017). Reasons can be found in the increased threat of limited natural resources, the limited access to such by global companies, the integrity of natural ecosystems, the rise of environmental pollution and associated health hazards as well as

R. Murswieck, *Innovation Performance in the 21st Century*,
Sustainable Management, Wertschöpfung und Effizienz,
https://doi.org/10.1007/978-3-658-34761-1_3

climate change (Geng et al., 2012; Ellen MacArthur Foundation, 2012; Su et al. 2013; Park and Chertow, 2014; Hestin et al., 2016; Ceptureanu et al., 2017).

Beside significant environmental and social effects, especially substantial financial benefits of some hundreds of billions US dollars for the European Union would be expected; for sure, some reasons why global players from within different industries such as Google (ICT), Renault (automotive manufacturing), Nike (footwear), H&M (fashion) or Unilever (food industry) have been attracted to deploy CE business models and to demonstrate engagement (Scott, 2015; Lewandowski, 2016).

The introduction and transition towards a circular-oriented economy depend, however, also from policymakers, the governments and their decisions (Ellen MacArthur Foundation, 2015a). Deploying the circularity on a micro-economic, hence, company-level is described in being depended on several prerequisites: the right choice of materials as well as the design of products, a global network, the adoption of new, suitable business models, and of course general enabling conditions (Planing, 2015).

From a time perspective, the adoption of the CE principles on an organisational level seems in general still to be in the beginnings, focusing instead on (partially) recycling than on fully reusing. Significant results could nevertheless be achieved, namely within the waste management industry. The CE characteristics, however, aims, on the one hand, to implement cleaner manufacturing patterns on an organisational level and on the other hand, to increase the awareness of the individual responsibility of both producers and consumers. Adopting renewable technologies or materials belongs to it likewise the usage of suitable and transparent policies in the context of a sustainable strategy (Andersen, 2007; Huamao and Fengqi, 2007; Sauvé et al., 2016;).

3.1.2 Description of the Circular Economy Principles and the Conceptual Design Translated into Business Actions

Given the fact that there is no final definition of the circular economy concept, scholars nevertheless agree that the core idea is formulated by closing the loops of resources (Lewandowski, 2016; Preston, 2012; Yuan et al., 2006). Lewandowski describes the circular economy as a "contemporary movement" which is based on "old ideas" such as "Regenerative Design, Performance Economy, Cradle to Cradle, Industrial Ecology, Biomimicry, Blue Economy, Permaculture, Natural

Capitalism, Industrial Metabolism and Industrial Symbiosis" probably conceptualized afterwards and defined by the Ellen McArthur Foundation (Lewandowski, 2016, p. 5). Ultimately, these school thoughts are described in being basically complementary to each other in focusing on waste elimination, thinking in (cascading) systems within the material lifecycle and by relying on the usage of renewable energies. This broadness supports the relationship between the circular economy and the idea of sustainability (Scott, 2015).

Indeed, from a practical business perspective, the Ellen MacArthur Foundation (EMF), launched in 2010, has actively contributed to influencing and promoting the CE idea. According to the EMF circularity is based on three main concepts "Design out waste and pollution", "Keep products and materials in use" and "Regenerate natural systems" (Ellen MacArthur Foundation, 2019a) distinguishing two primary cycles (Figure 3.1): the technical and the biological cycle. Within the technical cycle, materials are being restored or recovered, respectively, while the biological cycle is the only one of both where consumption occurs. However, unconsumed biological products are being regenerated in consequence. Both cycles are characterized by preserving or controlling natural, finite stocks. The utility of materials, products or components should be at highest by fostering effectiveness through the elimination of "negative externalities" (Ellen MacArthur Foundation, 2015a).

This new, restorative character redefines the way of treating resources, doing business and creating value (Joustra et al., 2013). Other scholars argue that the deployment of such circular business models requires innovative companies in any case (Golinska et al., 2015).

Another aspect described by the EMF is that organisations need to apply the so-called system thinking approach by respecting the complete value-adding supply chain from sourcing to supplying the goods to the buyer. Closing the loop in this sense means that the complete chain with its different stakeholders and material recovery activities need an overall view avoiding silo thinking. It is crucial that the economic adopters of the CE principles understand the whole supply chain of the respective goods with its different participants in order to reduce gaps within the cycle. Therefore, the relationship of the different stakeholders to each other need to be understood as well as possible consequences in order to set up a working CE system (Ellen MacArthur Foundation, 2015a; Meadows & Wright, 2009).

In this context, assessing the degree of circular principle's transition continuously into daily business has become of interest in the last years within researches and organisations. Moraga et al. (2009)'s research has revealed that the non-existing of a clear and standard valid definition of CE, might lead to

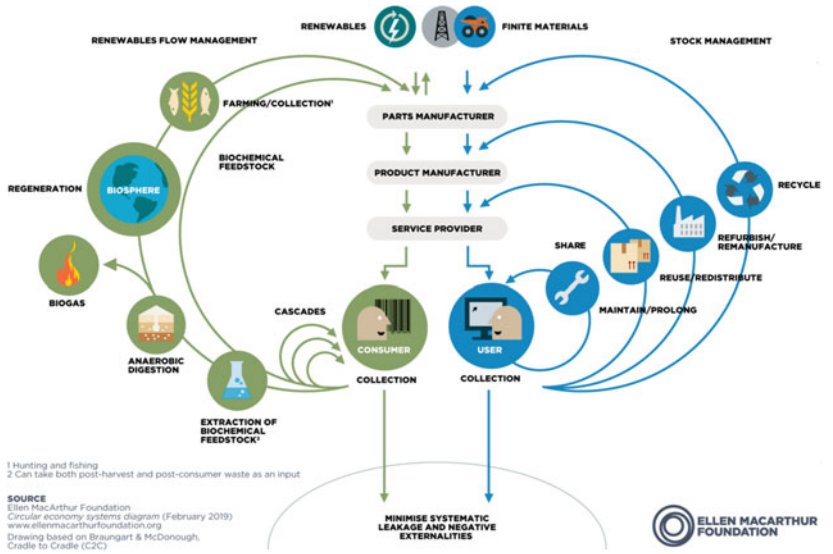

Figure 3.1 The biological and technical cycles of the circular economy. (Source: Ellen MacArthur Foundation (2015a). Towards a circular economy: business rationale for an accelerated transition. [online:] https://www.ellenmacarthurfoundation.org/assets/downloads/TCE_Ellen-MacArthur-Foundation_9-Dec-2015.pdf [Accesses 10 May 2019])

a confusing understanding of implemented CE indicators measuring the deployment performance. Most indicators "focus on the preservation of materials, with strategies such as recycling" (Moraga et al., 2019, p. 452) and do not respect the full range within all CE principles. Therefore, the authors advise not to use single indicators only.

Organisations transforming their business model respecting the circular economy's principles are considered to think about how to shift their operational measurements into appropriate business actions. For instance, EMF describes six concrete business actions resulting out of the three main circular principles with the help of the ReSOLVE framework, standing for Regenerate, Share, Optimise, Loop, Virtualize and Exchange. These were elaborated based on expert interviews and case studies by a working group consisting of the Ellen McArthur Foundation, McKinsey & Co and SUN (the German Foundation for Environmental Economics and Sustainability of the Deutsche Post: Stiftungsfonds für Umweltökonomie und Nachhaltigkeit GmbH). All six business actions were formulated to

foster "the utilisation of physical assets, prolong their life, and shift resource use from finite to renewable sources" (Ellen MacArthur Foundation, 2015b, p. 22). A brief description is given in Table 3.1.

In detail, the business actions are described as follows (Ellen MacArthur Foundation, 2015c): The first action "Regenerate" stands specifically for the shift towards the consistent use of renewable energies and materials instead of using limited, natural resources. Biological-based materials are being returned to the biosphere by the end of their life cycle if not recovered in another way. "Share" stands for the idea of slowing down the loop of usage through adopting the multiple uses of assets. Public and private sharing concepts, for instance, put a noticeable increase in the total utility of the product lifetime into practice. "Optimise" is characterised by the continuous improvement of the efficiency within the production of the goods along the value-added chain, including sourcing and usage after delivery.

Characterised by the usage of methods eliminating waste, time, and in consequence, money, this business action refers to the Lean Management—philosophy (Cambridge Dictionary, 2019).

The fourth action, "Loop", intends to keep products, materials and components within loops by considering remanufacturing, reusing or extracting bio-resources in the case of non-finite materials. Recycling of materials should only be thought about as the last option in the case of finite materials. "Virtualize" formulate the idea of thinking about non-materialized versions of existing products such as books or music. Finally, the last business action "Exchange" fosters the thought of replacing old materials by advanced materials or new technologies (examples: see Figure 3.2). The implementation of the six business actions related to the circular economy's principles is expected to be beneficial for the numerous economic sectors (Ellen McArthur Foundation, 2015c).

However, the potential is expected in being unequal (Figure 3.3) but underlines the potential within the different markets.

After all, Mentink (2014) concludes, that there are "several reasons why raw technical material inputs into our economy continue to be necessary and thus why a 100% circular economy is practically impossible". For instance, today's economy's affection to technical-based, artificial raw materials hinder imitating the nature's loops, which are characterized by zero waste within the bio-cycle. The school of thoughts, such as the mentioned cradle-to-cradle philosophy envisioning a waste-free circular economy, do not reflect the technology- and growth-oriented aspects of the global economy. Strictly and technically speaking, the circular economy would not allow any losses of materials during manufacturing processes (e.g. of cars composed out of metal parts and polymer components) and would

Table 3.1 ReSOLVE framework translated into business actions

Business action	Variables	Description
Regenerate	Energy recovery	Conversion of non-recyclable waste materials into energy
	Circular supplies	Use of renewable energy
	Efficient buildings	Localization of business activities in efficient buildings
	Sustainable product locations	Localization of business activities in sustainable production locations like eco-industrial parks
	Material leasing	The company sells the product or service functions, hence minimizing the environmental impacts
Share	Maintenance and repair	Product/service maintenance and repair extend product life cycle
	Collaborative consumption	Product or service enable collaborative consumption
	Product-Service System: Product lease	The company provide privileged use of a product or a service. The user is not the owner of that specific product or service
	Product-Service System: Availability based	Product or service is available for the customer for a specific period of time
	Product-Service System: Performance based	The revenue is generated according to delivered solution, effect or demand-fulfilment
	Return and reuse of products	Customers return used products for an agreed value. Collected products are resold or refurbished and sold
	Upgrading	The company replace components of its products with better quality ones
	Attachment and trust	Create products that will be loved, liked or trusted
	Use of own device	Customers use their own devices to get access to company products or services
	Hybridization	A philosophy according to which a durable product contains short-lived consumables
	Gap-exploitation	Exploit lifetime value gaps in company products or services
Optimize	Asset management	The company internally collect, reuse, refurbish and resale used products. It is different than *Incentivized return and reuse of products* by being the initiative of the company and not a prearranged agreement with the customer
	Produce on demand	The company is producing only when the products or services are ordered, without creating stocks
	Waste reduction	Minimize waste in the production process and before
	Product-Service System: Outsourcing	Make efficient use of capital goods, materials, human resources through outsourcing
Loop	Remanufacture	Restore products or products' components to required quality
	Recycling	Recover resources out of disposed products or by-products
	Upcycling	Materials are reused and their value is upgraded
	Circular supplier	Use supplies from material loops, bio based- or fully recyclable
Virtualize	Dematerialized services	Shift from physical to virtual for company's products, services or processes
Exchange	New technology	Use new manufacturing technologies

Source: Ceptureanu, S.-I., Ceptureanu, E.-G., Murswieck, R. G. D., Marin, I. C. (2018). Perceptions of circular business models in SME's. An empirical study using ReSOLVE framework. Amfiteatru Economic, 20 (48), pp. 310–324

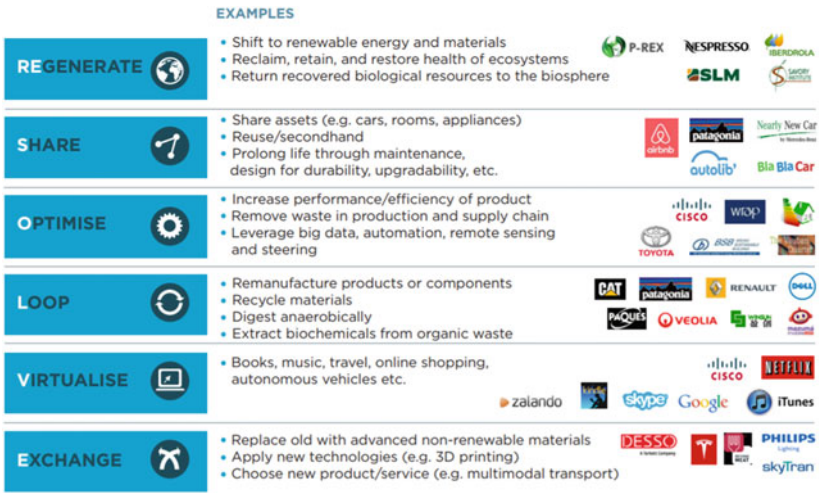

Figure 3.2 The ReSOLVE framework translating the CE principles into business actions. (Source: Ellen MacArthur Foundation. (2015c). Growth Within: A Circular Economy Vision for a Competitive Europe; Ellen MacArthur Foundation: Cowes, UK)

imply that all materials recovered and recollected are conveyed back to the (re-)manufacturing processes after usage. Furthermore, additional, new raw materials would not be needed anymore, as all materials formerly used can be recovered (Mentink, 2014).

However, the global economy is still growing every year by over 3%, requiring additional new resources every year (Statista, 2019). Today, 1% only of the plastics produced are made from so-called bioplastics which can support the natural raw material loop. Being either bio-based or biodegradable plastics, they experienced a steep increase in production over the last years supporting to envisage the environmental challenges such as reducing the CO2-footprint during manufacturing. Furthermore, it seems that bioplastics can replace nearly all plastics produced today. Interestingly, some fossil-based plastics can be biodegradable as well (European Bioplastics, 2018). In any case, the global demand leads to a steady increase of resources and today, not all materials can be recovered and re-used every time due to technological limits such as material fatigue reasons (Bathias, 1999; Milošević et al., 2018).

A further objection towards a fully deployed circular economy is being mentioned with the limits of energy production (Mentink, 2014): even in the case

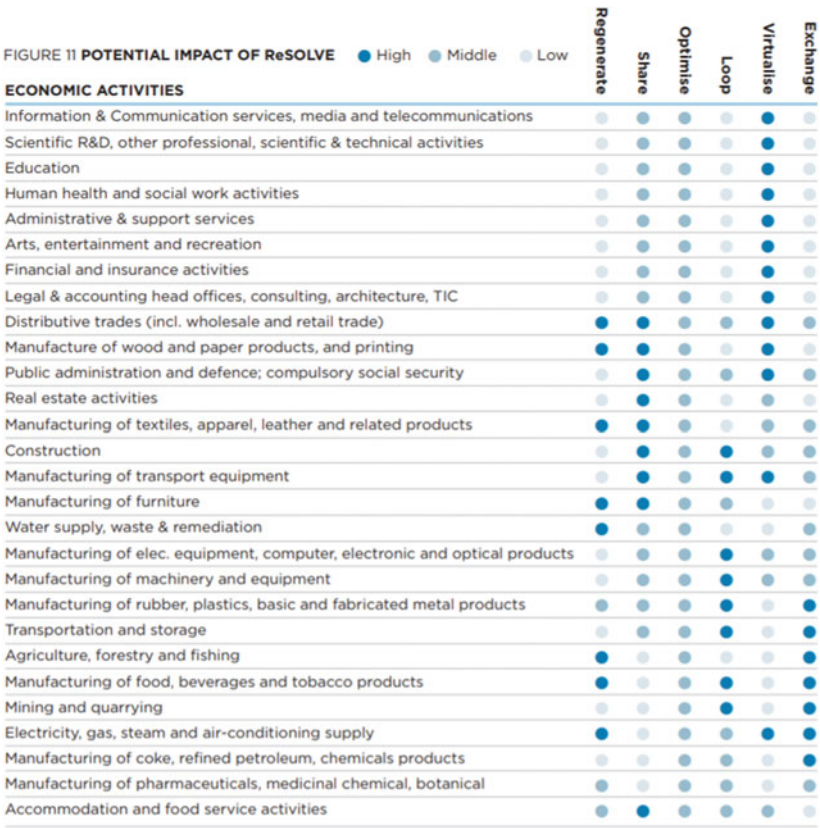

Figure 3.3 The ReSOLVE framework and its expected potential impact on economic sectors. (Source: Ellen MacArthur Foundation. (2015c). Growth Within: A Circular Economy Vision for a Competitive Europe; Ellen MacArthur Foundation: Cowes, UK)

global energy production is based on 100% renewable energy still the equipment for the power plants need to be produced. The production, however, is also characterised by high energy losses leading to the assumption that deploying the CE principles would require a very steep increase in energy efficiency as well. Concluding the mentioned technical-related aspects without taking care of political restraints on a global level, a fully 100% circular economy is quite impossible to achieve. However, the current linear-driven economy can be transformed into

a much more circular one by improving the current business models towards circular economy-oriented business models respecting environmental and social aspects as well (Figure 3.4).

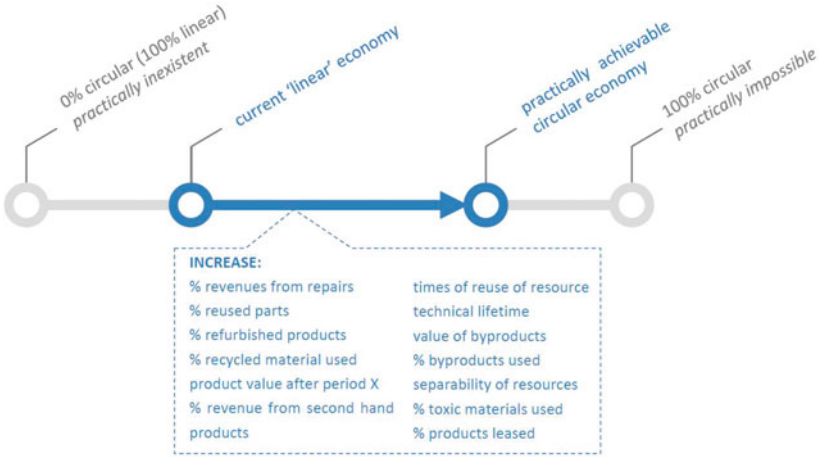

Figure 3.4 A paradigm shift from linear towards a more circular economy. (Source: Mentink, B. (2014). Circular Business Model Innovation—A process framework and a tool for business model innovation in a circular economy. Delft University of Technology & Leiden University [online] Available at: http://resolver.tudelft.nl/uuid:c2554c91-8aaf-4fdd-91b7-4ca08e8ea621 [Accessed 21. May 2019])

3.2 Business Model Innovation and its Relation to the Circular Economy

3.2.1 Circular Economy-Oriented Business Models

In general, Business Models (BM) are describing the way in how organisations are designing and delivering their offerings to their customers. In this sense, it represents a bundle of decisions how organisations generate ideas, create products and services and interact with stakeholders such as suppliers and customers but also others such as policymakers and shareholders or influencing NGO's. A business model shall support companies strategic-wise (Chesbrough, 2007) to achieve

competitiveness by "defining how to position in the market against competitors" (Urbinati et al., 2017).

An easy to apply and widely accepted business model is represented by the Business Model Canvas—systematisation, which represents a framework to support organisations independently of their business nature. Developed in 2004 by Osterwalder, later described and promoted by Osterwalder and Pigneur (2013), it aims to simplify the modelling process of a business by focusing on nine key factors, so-called "blocks", to perform as an organisation. Their systematization is seen as a reference work within practitioners as well as within the scientific community (Fritscher and Pigneur, 2010; Joyce and Paquin, 2016; Meertens et al., 2012; Zolnowski et al., 2014).

The term "canvas" signifies that the BM is written down on one single paper sheet (Figure 3.5). Indeed, the authors underline the simplicity, the flexibility for testing quick new business ideas and the transparency of the canvas method. It shall focus on the essentials of the business plan based on nine blocks setting the value proposition, hence, the customer into the centre of all business activities. Understanding customer needs, reducing existing barriers between vendor and customer and continuously increasing the value proposition put the advantages in the foreground of the canvas. Though it cannot replace a comprehensive business plan, the canvas sensitises the user to think about the multiple aspects prior running a business through thoughts related to the nine blocks as follows (Osterwalder and Pigneur, 2013):

- Customer segments: what are the markets, who are the customers, how are they characterised and grouped?
- Value proposition: what needs are being satisfied, what problems are being solved, what products/solutions/services are being offered to which customer groups?
- Channels (customer journey): how can the customers be reached best, through which channels are the customers served?
- Customer relationship: what relationship is being established with the customers, what should be done to increase and stabilise the relationship?
- Revenue streams: what are the customers paying for, what kind of services/products/ solution generate what turnover?
- Key resources: what is needed to deliver the products/solutions/services, what physical, intellectual or human-based resources mandatory?
- Key activities: what actions are needed to create the value proposition, what activities are relevant for the relationship with the customers, which are relevant to establish the distribution channels?

- Key partners: what external partners are needed, what suppliers are relevant, and which of them are existential?
- Cost structure & financial aspects: what are the main cost drivers related to activities and resources needed?

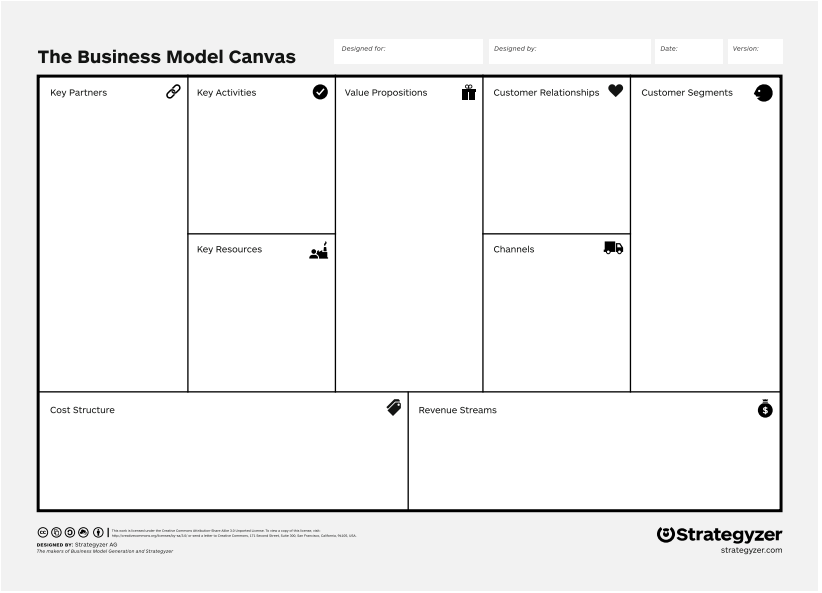

Figure 3.5 The business model canvas systematisation according to Osterwalder and Pigneur. (Source: Strategyzer, (2019). Business Model Canvas. [online] Available at: https://www.strategyzer.com/canvas [Accessed 21 May 2019], licensed under the Creative Commons Attribution-Share Alike 3.0:)

As delivering offerings to customers is a central aspect of a business model giving a business its main reason for existence, a new canvas has been elaborated: the value proposition canvas, according to Figure 3.6. This exceptional canvas is related to two blocks out of the central business model canvas in order to think in depth about a) customer segment/s with their issues and its relation to b) value proposition/s delivered to fulfil customer's needs (Strategyzer, 2019).

The business model canvas is an adaptive framework, flexible enough to work with any business. However, thoughts in how to respect the principles of the

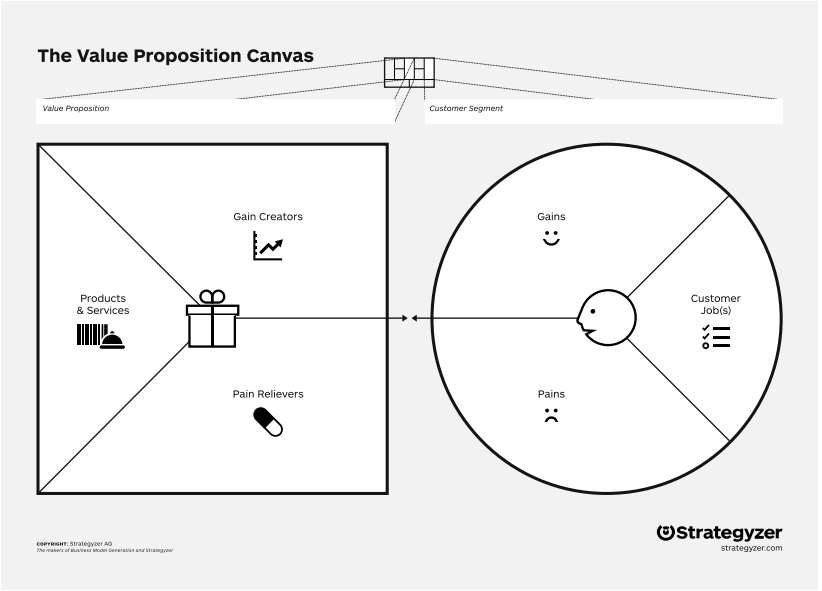

Figure 3.6 The Value Proposition Canvas. (Source: Strategyzer, (2019). Business Model Canvas. [online] Available at: https://www.strategyzer.com/canvas [Accessed 21 May 2019], licensed under the Creative Commons Attribution-Share Alike 3.0:)

Circular Economy or sustainability as part of organisational business processes and business models is seen as a new type of business model (Geissdoerfer et al., 2017; Ghisellini et al., 2016; Loiseau et al., 2016; Murray et al., 2017; Sauvé et al., 2016).

Therefore, specific CE- or sustainability-related business models such as the so-called "Triple Layer Business Model Canvas" described by Joyce and Paquin (2016) have been elaborated. For instance, the Triple Layer Business Model Canvas aims to support organisations to translate their current BM's specifically into sustainable and circular economy-oriented BM by integrating environmental and social aspects (Figure 3.7 and Figure 3.8). In this context, both additional canvas-layer shall complement the initial so far economic-related canvas elaborated by Osterwalder and Pigneur (2013).

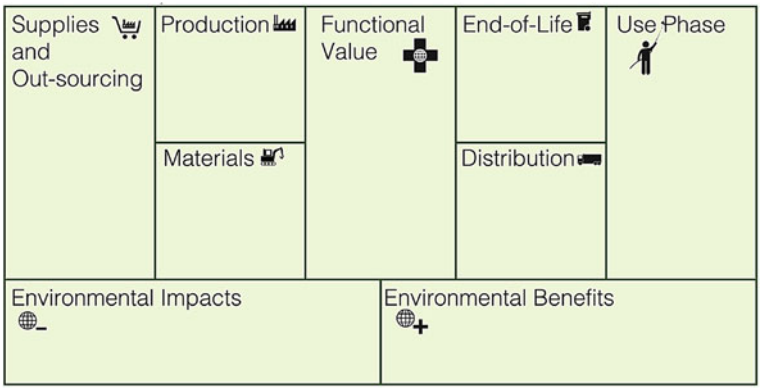

Figure 3.7 Environmental Life Cycle Business Model Canvas. (Source: Joyce, A. and Paquin, R. (2016). The triple layered business model canvas: A tool to design more sustainable business models. *Journal of Cleaner Production*, 135, pp. 1474–1486)

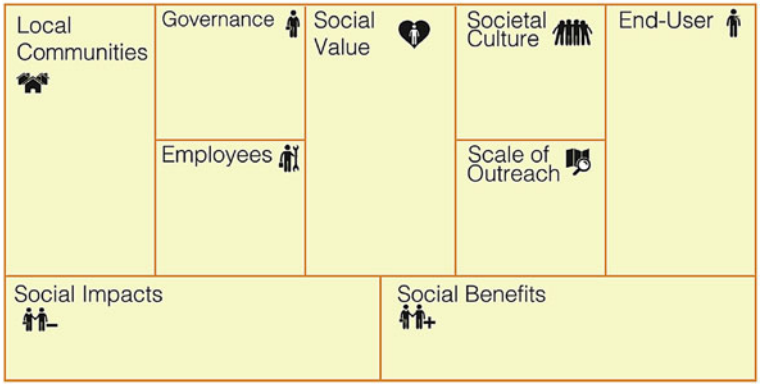

Figure 3.8 Social stakeholder Business Model Canvas. (Source: Joyce, A. and Paquin, R. (2016). The triple layered business model canvas: A tool to design more sustainable business models. *Journal of Cleaner Production*, 135, pp. 1474–1486)

The environmental-related, so-called "Environmental Life Cycle Business Model Canvas" is designed to reflect the environmental impacts of products or services. It shall support organisations to innovate the current phases of the goods

produced and services along with their life cycles as part of the whole business by thinking about all nine blocks and their translations into more environmental business actions. Similar as for the expected, economic-related benefits, the environmental canvas shall finally conclude in environmental benefits and reduce environmental impacts in consequence. In summary, the environmental layer aims to address a life cycle perspective when sketching a business model and its impacts (Joyce and Paquin, 2016).

Even though the Circular Economy's principle focuses more on environmental impacts by reducing and avoiding waste at all, the Triple Layer Business Model Canvas includes a social-related layer incorporating sustainability principles. Joyce and Paquin (2016) mention the missing consensus in measuring social benefits and impacts. However, the so-called "Social Stakeholder Business Model Canvas" intends to increase the wellbeing of all stakeholders such as employees, suppliers and partners and of course the customer to whom social aspects shall be of value when consuming the goods (Joyce and Paquin, 2016).

According to the authors, the existence of the three individual canvas (Figure 3.9) is intended to provide an in-depth system thinking approach to create value within the layers for all stakeholders. After all, the layers need to be aligned vertically by interconnections and coherent values when it comes to defining business-related decisions (Joyce and Paquin, 2016).

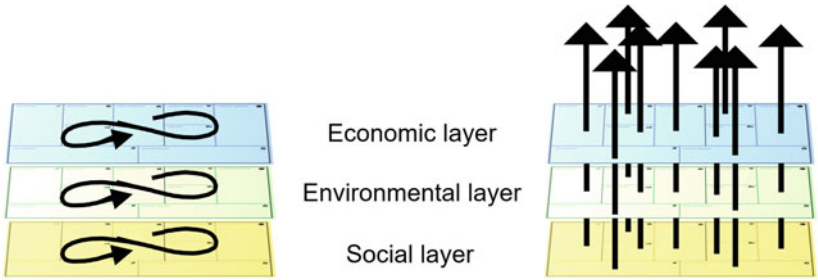

Figure 3.9 The triple layered business model canvas: horizontal and vertical coherence. (Source: own representation according to Joyce, A. and Paquin, R. (2016). The triple layered business model canvas: A tool to design more sustainable business models. *Journal of Cleaner Production*, 135, pp. 1474–1486)

Despite some differences on business models, researches on categorizing business models have led to the conclusion that the essential criterion is value creation (Ellen MacArthur Foundation, 2013; Lacy et al., 2013; Van Renswoude et al., 2015) representing the core proposition related to products, services offered or a combination out of it (De Jong et al., 2015). In practice, however, scholars argue that creating value remain a challenge (Bocken et al., 2019b). Other authors, however, suggest "design strategies for product life extension", "before-the-event techniques of cleaner production", the value in the context of "product-service-systems", or mixed ones to be essential criteria (Lewandowski, 2016).

By applying the earlier introduced ReSOLVE-framework, an analysis created by Lewandowski (2016) has revealed that most of the BM related either to sustainability or to the circular economy show overlapping typologies.

3.2.2 Business Model Innovation as Part of Organisational Change Deploying the Circular Economy Principles

In the first chapter about innovation in general, the universal character of innovation and the management of innovation was described. The variety of innovation types includes, likewise the innovation of business models as part of the organisational and strategic development.

It seems self-evident that a company's business model can be innovated. However, business model innovation (BMI) as a research topic has been addressed only recently within the last decade. In consequence, literature does not provide in-depth studies, contrary to the innovation management related to products, and processes as well as a strategic concept. It seems that literature has focused so far more on general aspects of BMI, such as on enabling factors or in contrast, barriers preventing BM innovation. Managers, however, need hands-on deployable support in order to transform their business models. Nevertheless, parallelisms between both types of innovation can be observed (Frankenberger et al., 2013).

Empirical studies have shown that organisations can gain competitive advantages against their competition by innovating their business models, also within existing markets. Some companies even evaluate BMI as being more promising than product or service innovations alone (Amit and Zott, 2010; Lindgardt et al., 2009; Mitchell and Coles, 2003). As described above, a significant concern when it comes to deploying sustainability or the CE philosophy is how to generate value aiming to keep or even improve the competitive edge. Having intersections to the CE principles, sustainability has been found not to conflict with economic benefits (Rauter et al., 2018), the challenges remain, however, in practice how to transform organisations keeping an eye on performance.

In this context, BMI should be understood as a holistic innovation management approach by involving the complete organisation and adapting the innovation process to the company's individual needs and possibly involve external stakeholders as well, especially in the case of the circular economy when it comes to respect the complete value chain closing the material loop (Amit and Zott, 2010; Antikainen et al., 2017; Planing, 2018).

Frankenberger et al. (2013), therefore focused their research on the aspect of describing a promising innovation process related to business models. Their so-called "4I"-framework consists of the four iterative steps based on Eveleens (2010) which can generally be observed also within innovation processes in general: initiation, ideation, integration and implementation. The authors outline that the division into several phases supports the organisation to be aware of what steps are needed before implementation. While the first step towards innovation, namely the "initiation"—phase, is characterised by picking up needs or requirements from within various sources such as customers, employees, partners or external stakeholders the more concrete "ideation"—phase is more related to specific ideas which are being worked out. This includes thoughts on alternatives and financial evaluations. The ideas selected are being carved out in the following "integration"—phase and developed as tangible solutions or products. The "implementation"—phase finally introduces the solution to the market (Eveleens, 2010; Frankenberger et al.,2013).

In their research based on 14 terminated BMI cases related to six companies in Germany and Switzerland, Frankenberger et al. (2013) applied the four described phases to study the applicability of these four phases in a BMI context to understand the challenges occurred. The outcome generally confirmed that the four phases elaborated by Eveleens (2010) could also be applied also to BMI, however, incorporate linear and iterative processes within the four phases with a higher degree of involvement on an organisational level (Figure 3.10).

Challenges such as "overcoming the current business logic" or "internal resistance" characterise common human-related barriers. Also, the "management of partners" has also been mentioned as a challenge as well as "pilot, trial-and-error and experimentation"—approaches within the implementation phase Furthermore, the research team outlined that the organisation's culture is to be considered especially within the initiation phase where it comes to capture potential change drivers leading to new innovative ideas. Another finding describes the need for superordinate coordination of the BMI activities: contrary to isolated innovation processes within R&D departments, for example, BMI processes need a more holistic approach (Frankenberger et al., 2013).

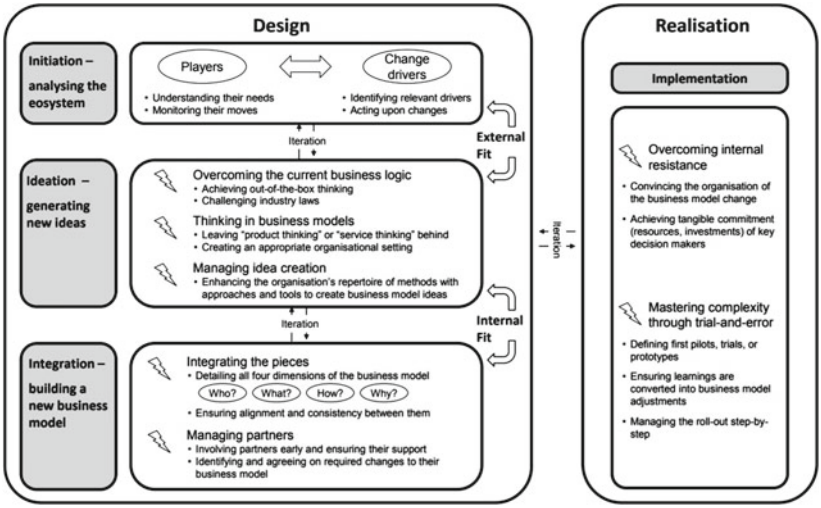

Figure 3.10 The 4I-framework with the phases of the business model innovation process and their key challenges. (Source: Frankenberger, K., Weiblen, T., Csik, M., & Gassmann, O. (2013). The 4I-framework of business model innovation: A structured view on process phases and challenges, International Journal of Product Development, 18(3/4), pp. 249–273)

Urbinati et al. (2017)'s proposal to introducing a taxonomy of CE-related business models based on two dimensions, the value proposition and the value network, can furthermore support organisations to classify and understand finally their business model related to the CE-principles. It differentiates a high versus a low grade of adopting the principles (Figure 3.11). In their study, the researchers tested their framework with the help of the companies' case studies officially listed by the Ellen MacArthur Foundation, adopting CE principles as described in the following. High degrees of value propositions & interactions as well as a high-value network are characterized by a high circularity adoption rate internally within production and employee involvement as well as externally by communicating actively to customers the adoption of the CE principles as this is considered as value generating. External partners such as suppliers are integrated within the adoption as well as part of the system thinking—approach. As per Figure 3.3.11, 43% of the companies show this pattern. 42% of the analysed firms are categorised as upstream circular only characterised by a high internal value network. Production processes, products and services are designed according to the CE principles; however, this is not communicated to external stakeholders as no value

is expected to deploy circularity and hence, cost efficiency is dominating. In contrast, downstream adopters focus their circularity on market-related activities for penetration reasons only, like the "use" and "re-use" principles.

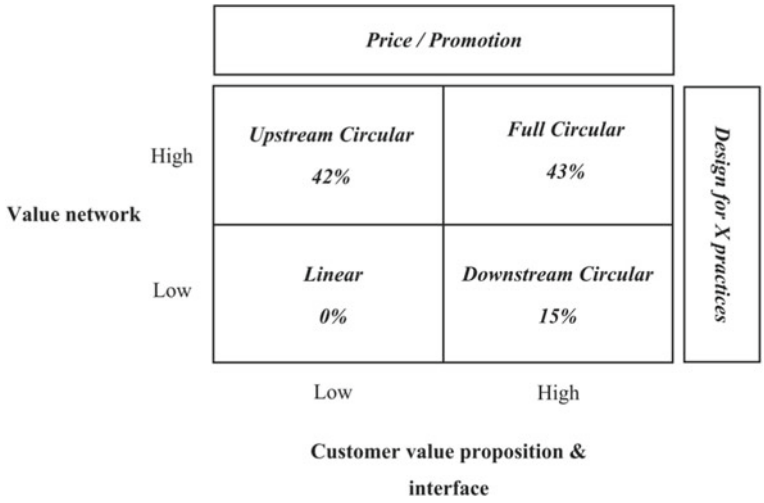

Figure 3.11 Taxonomy of circular economy's business model including mapping of organisations having adopted the CE principles. (Source: Urbinati, A., Chiaroni, D. and Chiesa, V. (2017). Towards a new taxonomy of circular economy business models. Journal of Cleaner Production, 168, pp. 487–498)

However, the internal adoption within production or design is underdeveloped or is not of relevance as the activities are revenue-oriented only. 15% of the analysed companies have been classified to be downstream-oriented (Urbinati et al., 2017).

The following three chapters build on the previous, theoretical chapters and are characterised by own research contributions in the correspondent fields of innovation performance, digitalisation and the circular economy. Setting the focus primarily on the determinants supporting innovation performance, the last chapter of the thesis is dedicated to the development of a managerial framework based on the research findings, considering the deployment of digital technologies to foster innovation on both, the economic level and circular economy level including social aspects of an organisation.

Part II
Own Contribution in The Field of Research

4 Studies on Correlation between Cultural Dimension and Innovation Performance in European Union Countries

4.1 Study on the Correlation between Innovation Performance and the Gross Domestic Product for the European Union Countries

4.1.1 Context and Research Framework

Analysing cultural peculiarities of nationalities and their characteristics influencing business performance is a research field that can identify cultural-related strengths to support organisations in their decision-making process. The present chapter intends to provide an introductive discussion from a general perspective to the subject by investigating the relationship between commonly accepted performance indicator on a national level and cultural indicators. The findings are related to doctoral researches performed and were partially published (Murswieck et al., 2017a).

Though the working group "Cultural Success Factors for technical innovations" Berlin could already identify in the 1990 s, based on a country-comparative analysis, that cultural aspect influences the performance of innovation (Albach et al., 1994) this field of research is still in focus of the research community. Organisations face an increased competition worldwide, mainly due to the globalisation which took place, and which gain rise again because of new, uprising digital technologies which have furthermore influenced the way in how business is

Electronic supplementary material The online version of this chapter (https://doi.org/10.1007/978-3-658-34761-1_4) contains supplementary material, which is available to authorized users.

R. Murswieck, *Innovation Performance in the 21st Century*,
Sustainable Management, Wertschöpfung und Effizienz,
https://doi.org/10.1007/978-3-658-34761-1_4

done globally. The access to broader sales markets has put goods suppliers internationally under price pressure, digitisation made it possible to develop entirely new business models, national organisations have merged to multinational companies in the case of smaller as well as large-scale enterprises and the way in doing business is influenced by new forms of globally emerged culture characteristics (Bereznoy, 2018; Bird and Stevens, 2003; Meyer, 2000; Ricks, 2003).

However, despite the fact of globalisation within the economy and migration worldwide, national-driven cultural characteristics and unambiguous behaviours still outweigh: a global culture is still not existent, and national-driven peculiarities remain as the latest performed World Value Survey (WVS) from 2010–2014 is showing (Inglehart et al., 2014). It seems evident that cultural characteristics influence the way how business is done and how innovation is managed (Tellis et al., 2009).

As an example, the general, initial trust in other people differs worldwide and shows the same primary classification mostly independent of sociodemographic situation such as gender, education, marital status. Over time, the percentages might vary within generations, but in general, the typical differences or attitudes do not show substantial volatile changes as can be seen in the examples for Germany and Romania (see Figure 4.1 and Figure 4.2). Hence, cultural differences amongst countries generally remain.

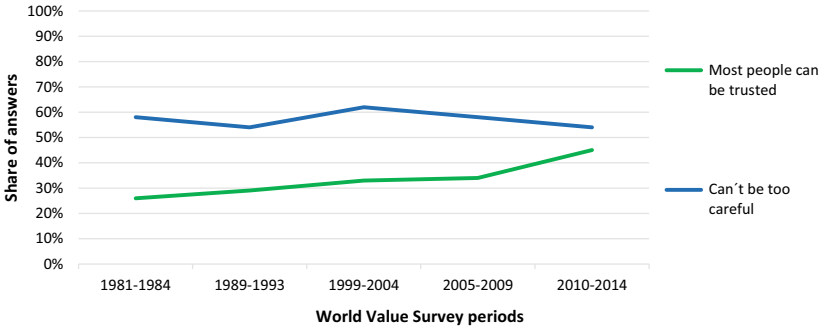

Figure 4.1 Answers in Germany to 'Can you (generally) trust most people?'. (Source: own representation based on WVS dataset by Inglehart, R., C. Haerpfer, A. Moreno, C. Welzel, K. Kizilova, J. Diez-Medrano, M. Lagos, P. Norris, E. Ponarin & B. Puranen et al. (eds.). (2014). World Values Survey: Round Six—Country-Pooled Datafile Version: www.worldvaluessurvey.org/WVSDocumentationWV6.jsp. Madrid: JD Systems Institute)

The graphs show that both countries differ in terms of how they evaluate generally trusting other people (the difference between 100% and the percentage of the answers is related to "no answer" or "do not know"). Trust, as in this example, is a value influencing the way of doing business (Albach et al., 1994; Gesteland, 2012; Inglehart et al. 2014).

As described in the context of innovation management in the previous chapter, the corporate culture was found to be a critical impacting factor on business performance. Out of various determinants elaborated, often risk-permitting, collaborating or idea-building and fast-thinking characteristics were named in being promising corporate culture characters and enablers for outperforming with innovation (Albach et al., 1994; BCG, 2014; Ceausu et al., 2017; Tellis et al., 2009)

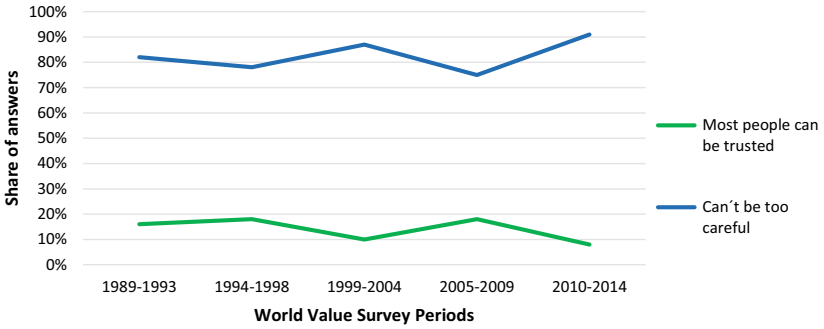

Figure 4.2 Answers in Romania to 'Can you (generally) trust most people?'. (Source: own representation based on WVS dataset by Inglehart, R., C. Haerpfer, A. Moreno, C. Welzel, K. Kizilova, J. Diez-Medrano, M. Lagos, P. Norris, E. Ponarin & B. Puranen et al. (eds.). (2014). World Values Survey: Round Six—Country-Pooled Datafile Version: www.worldvaluessurvey.org/WVSDocumentationWV6.jsp. Madrid: JD Systems Institute)

The rapid changes within the markets due to the mentioned global effects and the mingling of cultures within organisations have shown a shifting in the way of how business is done. Hence, elaborating evidence in culture-influenced innovation performance will very probably remain as an ongoing field of research.

4.1.2 Targets and Research Methodology

As a starting point for the researches on innovation performance and its culture-related influencing factors the present analysis aims first to understand if—related to the EU domestic market—the member states of the European Union benefit somehow from innovation-related activities. As introduced in the first chapters of the present thesis, the GDP is used to measure the welfare of a nation despite being aware that the GDP does not fully reflect the real wellbeing of a nation. However, the GDP is a common and worldwide standard performance figure when it comes to measuring the productivity of a country, which in turn should also depend on performant activities such as innovations. Therefore, the relationship between innovation performance and the GDP of each EU—28 country was analysed to get a reference point, based on two empiric and publicly available datasets: the SII composite index as first variable and the GDP per Captiva as the second variable as represented in Table 4.1.

Based on the performed literature review presented in the first chapters, the present analysis estimates a positive, existing and linear relationship between both values. In consequence, the H1 and H0 hypotheses were being formulated as follows:

HO: *there is no relationship between the SII performance value and the GDP*
H1: *there is a linear relationship between the SII performance value and the GDP*

For the analysis, various statistical calculations were performed: correlation calculations and the corresponding correlation determinations, the p-value calculation and residual analysis.

For the correlation calculation, the Pearson's "*r*" was chosen representing a product-momentum coefficient, hence, the relationship between a set of two values x and y (Aldrich, 1995; Taylor, 1990). In the present analysis, the GDP per Captiva was chosen to be the dependent y-variable, and the EIS-SII value the independent x-variable as the objective was to evaluate if an EIS-SII value positively influences the GDP per Captiva—value. The coefficient *r* is calculated according to the following formula:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \overline{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2} * \sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}} \tag{4.1}$$

Table 4.1 Dataset: GDP per Captiva and SII performance value per country

Member state [country]	GDP p. Captiva [EUR]	Innovation performance [SII]	EIS referenced performance group
Austria	37.500	119,1	Strong Innovator
Belgium	34.400	118,6	Strong Innovator
Bulgaria	13.700	46,6	Modest Innovator
Croatia	17.300	53,6	Moderate Innovator
Cyprus	23.700	73,3	Moderate Innovator
Czechia	25.300	82,7	Moderate Innovator
Denmark	36.900	134,1	Innovation Leader
Estonia	22.000	78,2	Moderate Innovator
European Union 28 average	*29.100*	*100,0*	*Average as reference*
Finland	31.700	128,4	Innovation Leader
France	30.700	107,1	Strong Innovator
Germany	36.100	121,0	Innovation Leader
Greece	20.200	66,9	Moderate Innovator
Hungary	19.800	66,1	Moderate Innovator
Ireland	51.900	113,5	Strong Innovator
Italy	27.700	73,7	Moderate Innovator
Latvia	18.600	57,0	Moderate Innovator
Lithuania	21.700	77,8	Moderate Innovator
Luxembourg	77.300	119,1	Strong Innovator
Malta	26.800	75,1	Moderate Innovator
Netherlands	37.800	127,1	Innovation Leader
Poland	19.900	53,7	Moderate Innovator
Portugal	22.300	81,4	Moderate Innovator
Romania	16.300	33,1	Modest Innovator
Slovakia	22.300	68,6	Moderate Innovator
Slovenia	23.800	95,9	Strong Innovator
Spain	26.300	76,8	Moderate Innovator

(continued)

Table 4.1 (continued)

Member state [country]	GDP p. Captiva [EUR]	Innovation performance [SII]	EIS referenced performance group
Sweden	36.400	140,9	Innovation Leader
United Kingdom	31.600	122,9	Innovation Leader

Source: own representation based on EIS European Innovation Scoreboard (2016), [online] Available at: http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm [Accessed 27. February 2017] AND Eurostat (2016), [online] Available at: https://ec.europa.eu/eurostat/web/national-accounts/data/database [Accessed 27. February 2017]

For any r close to + 1, a strong correlation is given, for any r close to -1 a strong negative correlation is described. However, a strong correlation (usually higher than + 0.7 or lower than -0.7, respectively) does not necessarily mean causation between two values. In this sense, it is useful to include further statistical calculations providing more meaningfulness, such as the coefficient of determination. It is calculated by squaring the correlation value *r.* Representing the per cent of variation within the y-value that can be accounted for variations within the x-value, r^2 shows how well the linear developed regression model is deployable. The p-value was additionally calculated in order to test the hypotheses formulated. The p-value describes the consistency with the H0-hypothesis defined earlier, which is assumed to be true related to a specified level of significance, so-called α-value. In the present analysis, the value α was set to $\alpha = 0.05$ according to commonly accepted approach within statistics. It describes the percentage of the accepted probability in deciding wrong related to the chosen hypothesis, despite the trueness of the H0—hypothesis (North et al., 2002; Taylor 1990).

As a second step, the study included a first analysis as well on relationships between countries' innovation performances and civic-based, cultural characteristics to understand possible cultural mindset differences and resulting key drivers as enabling factors to increase the innovation performance activities accordingly. By doing so, the validity of previous studies can, on the one hand, be evaluated, and on the other hand, an evidence-based analysis can provide information on correlating factors in the context of innovation performance despite ongoing changes due to globalisation. For this, the national-related cultural values out of selected countries were analysed in regard to both, innovation outperformers and modest innovation performers from within the EU 28 countries as per EIS definition.

The cultural values originate from the latest available national cultural dimensions database from Hofstede (2015), according to the following Table 4.2, whereas the abbreviations in the table correspond to the cultural dimensions (see also Figure 1.10) introduced in chapter 1.

Table 4.2 Cultural dimensions values of modest and leading innovators in the EU

Countries	pdi	idv	mas	uai	lto	ivr
Sweden	31,0	71,0	5,0	29,0	52,9	77,7
Germany	35,0	67,0	66,0	65,0	82,9	40,4
Bulgaria	70,0	30,0	40,0	85,0	69,0	15,8
Romania	90,0	30,0	42,0	90,0	51,9	19,9

Source: own representation based on Hofstede, G. (2015), National Culture Dimension data matrix, the base culture data for six dimensions of culture as presented in Cultures and Organisations 3rd edition 2010. [online] Available at: https://geerthofstede.com/research-and-vsm/dimension-data-matrix/ [Accessed on 12.02.2017).

Following abbreviations were used within the tables and graphs:

- Power Distance Index: pdi
- Individualism versus Collectivism Index: idv
- Masculinity versus Femininity Index: mas
- Uncertainty Avoidance Index: uai
- Long-term versus Short-term Orientation Index: lto
- Indulgence versus Restraint Index: ivr
- European Scoreboard Innovation Index: EIS

For the second analysis, extreme positions were selected in order to elaborate possible cultural-based differences related to innovation performance. As per the EIS definition, the less performant innovator countries Bulgaria and Romania and the more performant innovator countries such as Sweden and Germany were chosen. By doing so, it is expected to identify critical cultural dimensions promoting innovation performance for hereon ongoing studies and analyses.

In summary, the main target of the present study was to understand if and which strong characters of national-influenced behaviours might support innovation performance on a national level supporting a nations' development and growth, respectively.

4.1.3 Research Results on the Correlation between Innovation Performance and the Gross Domestic Product for the European Union Countries

By summarising the findings, the correlation between innovation performance and the economic effects could be confirmed in that way, that innovation performance—as it is defined and calculated as a composite indicator within the EIS—has a positive effect on the economy resulting in higher GDP—values. Hence, it can be stated that working on improving the country's summary innovation index (SII) will very possibly also increase its GDP value per Captiva. The findings' conclusions are based on the following calculations:

The calculated Pearson coefficient was calculated as $r = 0{,}7024$ based on all EU28 countries which can be interpreted as a principal positive correlation between both values, the independent SII—variable x and the dependent GDP per Captiva—variable y.

However, it shall be mentioned that the GDP per Captiva—values for Luxembourg and Ireland (both with the highest GDP per Captiva values) are actively impacting the coefficients. Both countries are exceptional cases in terms of tax regulation. In the case of Luxembourg cross-border workers' activities are additionally influencing the GDP value significantly. These circumstances support the attractiveness of the countries for a foreign organisation to settle down as tax-sitting location only without any extra workforce. In the case of Luxembourg people work there but are not necessarily settled and hence often not registered as an inhabitant. This effect is not reflected by the GDP per Captiva, which is respecting inhabitants within its statistics (Eurostat, 2018; Haering, 2016). Figure 4.3. shows the linear correlation between the SII values and the GDP per Captiva, including the perturbing values for Luxembourg and Ireland.

As it seems evident that both countries Ireland and Luxembourg influence the linear correlation through its tax-related, political effects, the performed residual regression analysis (see also the electronic supplementary material, Annex 3) of all EU28 show, that Luxembourg and Ireland are jumping out of the standard trend showing a variation anomaly (Figure 4.4).

Considerung the residual regression correction factors, the new resulting values for the estimated GDP per Captiva for Ireland and Luxembourg are given in Table 4.3.

By Fading out the individual effects of Luxembourg and Ireland, the residual impact provides a modified correlation analysis and show, in consequence, a more

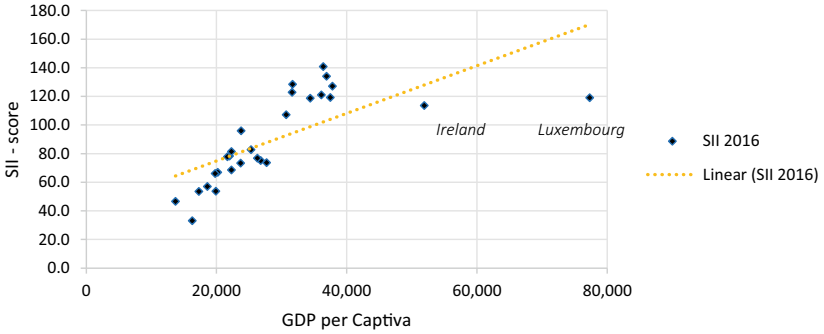

Figure 4.3 Linear correlation between GDP per Captiva and the SII score of the EU28 member states including the effects of Luxembourg and Ireland. (Source: own elaboration)

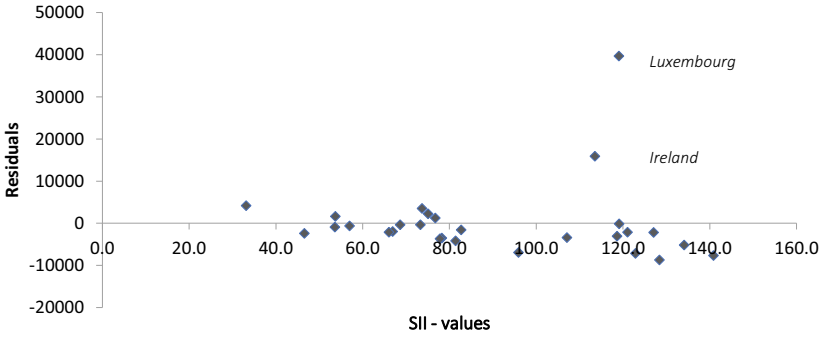

Figure 4.4 Residual regression plot related to the GDP per Captiva of the EU28 member states and the correspondent country SII score. (Source: own elaboration)

coherent picture of the relationship between innovation performance and economic impact (Figure 4.5) with a Pearson's value of r = 0,93757 representing a much stronger correlation.

The key figures of the regression analysis are given in Table 4.4 for both, the modified, corrected values and the original values in order to conclude the present study. A complete overview of the regression analysis figures is given in the electronic supplementary material, Annex 1, 2, 3 and 4.

The comparison shows that in both cases, a positive correlation is given with r-values of ~ r1 = 0.7024 and r2 = 0.9376. However, considering the p-value, the

Table 4.3 Modified GDP per Captiva values based on residual regression calculations for Luxembourg and Ireland

Member state [country]	Estimated GDP p. Captiva based on residual regression [EUR]	Innovation performance [SII]	EIS referenced performance group
Luxembourg	**37.628**	119,1	Strong Innovator
Ireland	**35.984**	113,5	Strong Innovator

Source: own elaboration

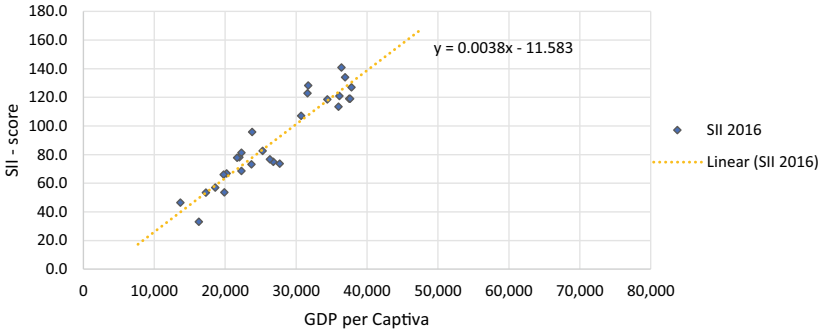

Figure 4.5 Linear correlation between GDP per Captiva and the SII score of the EU28 member states respecting the effects of Luxembourg and Ireland. (Source: own elaboration)

Table 4.4 Key figures of regression analysis between GDP per Captiva and the SII score of the EU28 member states

Regression analysis parameter	Values (original = 1)	Values (modified = 2)
Correlation (r)	0,70243362	0,93757448
Correlation determinant (r^2)	0,49341298	0,8790459
P—Value	0,68026773	0,00098414
Number of EU28 member states considered (#)	28	28

Source: own elaboration

original tableau showing a p-value of p1 = 0,68 would lead to the rejection of the formulated H1—hypothesis. Fading out the effects of Ireland and Luxembourg

with the help of the residual regression analysis leads to a modified p-value of p2 = 0,00098 which is much smaller than the set significance level α of 5%, leading to the rejection of the H0—hypothesis.

As stated above, the influence of tax policies on Ireland and Luxembourg impacts the correlation analysis. The present study follows the idea to correct the value "as if" tax regulation or GDP calculation would not or less impact the value. In this regard, a correlation between both, the GDP per Captiva and the innovation performance index SII is presumed to be given.

The purpose of the research aims in a further step to understanding the key cultural-related factors supporting innovation performance. Related to the SII itself, countries can improve their innovation efforts on different levels representing the different indicators of the SII (e.g. SME activities, public funding, research efforts and more; see also chapter 1). The present analysis did not include singular indicator calculations influencing the GDP at this stage. Therefore, statements regarding the increase of the GDP are only related to the increase of the primary SII value.

The SII is calculated instead on hard facts than on "hidden" facts such as the mentioned cultural values, which themselves, however, can stimulate innovation efforts. Therefore, the study included an introductory analysis to elaborate if cultural values on a national level generally influence innovation performance. As a sample, two leading innovating countries with their cultural and innovation performance values were compared with values of less innovating countries related to the SII, according to Table 4.1 and Table 4.2. The visual, comparative analysis was performed with the help of a radar chart as per Figure 4.6, showing each value within a heptagon. As can be seen, modest and leading innovators do not share the same cultural values from this point of view. Moreover, taking the present chart as a starting point for further studies, it seems that cultural dimensions, as they are described by Hofstede (2019), genuinely have specific characteristics with enabling or preventing factors related to innovation performance as calculated in the SII by the European Commission within the EIS (Hollanders and Es-Sadki, 2018).

Out of the radar graph, the following result is being derived:

First, the modest innovators share common values such as a high-power index (pdi) which the leading innovators do not share or at least much less. In contrast, the leading innovators share a high individualistic index (idv) which in turn, the modest innovator countries do not share. Masculinity (mas) seems not to play a role. However, Indulgence (ivr) and uncertainty avoidance (uai) seem both to influence but less obviously from a visual aspect.

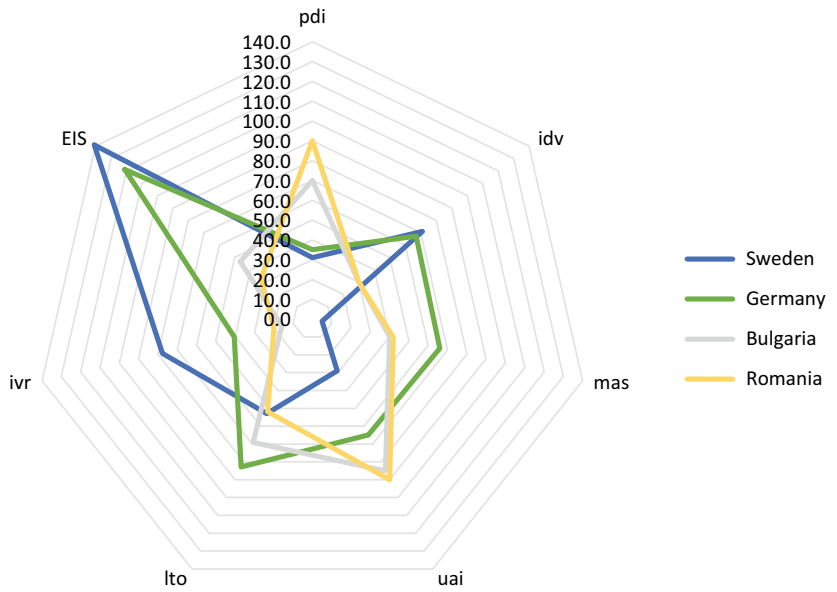

Figure 4.6 Sample of leading and modest country innovators within the EU28 member states and their national-culture values in comparison. (Source: own elaboration)

4.2 Study on Innovation Performance in the European Union countries and the Relationship to Cultural Dimensions

4.2.1 General Context of the Research

The present chapter refers to studies performed in 2018 by the author. It aims to amend specifically civic-, cultural-related determinants impacting the innovation performance to the research community with the help of comparative analysis within the European Union. Studies within the last 30 years have revealed that company-internal, as well as contextual factors such as civic-related factors, influence the innovation performance of organisations (see Chapter 1). On a national level, for example, civic cultures with risk-admitting characteristics have often been described in being more performant when it comes to identifying innovation determinants (Albach, 1994; Bayarçelik et al., 2014; Tellis et al., 2009).

Researchers state that diversity within innovation teams are much more promising when it comes to succeeding; age, gender, personal and professional background, intro- and extroverted personalities are described in being enabling factors to increase the innovation performance and output. Such teams need to be managed accordingly to lever the team's potential, of course. In the context of civic culture, it was also elaborated that team members with different nationalities do also promote innovations. In summary, such diverse teams do not only innovate more successful in terms of resulting business results but manifest their efforts in fewer failures and a faster innovation process (Back et al., 2008; Boutellier and Völker, 1997; Chesbrough, 2006).

Despite the positive effects of diverse teams on innovation, studies also show international differences related to innovation performance. The management and the resulting performance effects on innovation differ internationally based on cultural factors as have revealed studies by Tian et al. (2018): they consider significant influences on the innovation of both organisational and national culture. Cultural aspects even have direct effects on innovation management itself but also R&D expenditures, for instance, on a national level (Lopes and Serrasqueiro, 2017).

Looking to the innovation process, the national background of the individual persons involved in the innovation activities as part of a team and of the organisation, international comparative studies confirm differences influencing the innovation results due to cultural peculiarities (Albach et al., 1994; Kaasa, 2017; Puumalainen et al., 2015; Rossberger, 2014).

Shared knowledge within the organisation, for instance, as one of the critical determinants for innovation performance was discovered to be diverging as well within different national cultures. A study conducted to identify the will of different cultures to share information within the organisation by discussing and distributing knowledge acknowledged presumptions. The external environment such as the cultural imprint as well as the internal environment of an organisation affects the will of knowledge dissemination (Rivera-Vazquez et al., 2009) which is assumed to be impacting the innovation performance significantly.

In consequence, organisations should be aware of cultural barriers and overcome these by creating an adequate corporate culture. Promoting knowledge sharing supports the generation of new ideas actively and makes sure that new products, services or innovative processes and business models have been created on multiple aspects (Hernández-Mogollon et al., 2010). Also, in multilateral projects, for example, cultural peculiarities should be taken into consideration as those individual factors can break or boost the team's performance (Siakas et al., 2010).

There are multiple indications that national-related cultural characteristics influence the way in how innovation is seen and managed. However, investigations have shown as well that not only the attitude towards innovation is affected by cultural factors. Also, country-related policies and innovation activities are influenced by civic culture (Lahuerta-Otero and González-Bravo, 2018). This also refers to innovations within information and communication technologies (ICT), hence, digitalisation: one of the earlier described megatrends (chapter 1).

Bankole and Bankole could investigate that socio-cultural factors influence innovation and specifically, the adoption of ICT. There seem to be different levels of behaviours linked to cultural dimensions affecting the deployment of new technologies (Bankole and Bankole, 2017). In markets with increased global competition, this could be critical for the performance of organisations and nations, respectively.

4.2.2 Objectives, Research Methodology and data Origin

Literature has shown evidence in the subject to analyse national-related cultural aspects in the context of innovation performance. This study aims to address the gaps existing in the field of cultural determinants affecting innovation performance, generally on both nations and organisations' level by deducing out from empiric datasets. Scholars show by empirical studies that the cultural dimensions on a nation's level influence the innovation activities and results on an organisational level. From this starting point and in reference to the findings of the previous chapter, cultural aspects on the nation's level shall be investigated in more detail by comparing the innovation performance within the European Union members in-depth. Hereof, revulsive determinants could be the next reference point for ongoing studies on an organisational level.

The final aim could be described in getting a more precise understanding on how companies can improve their efforts in building innovative teams and an adequate innovative corporate culture to guide their organisation more effectively through the innovation process with the help of sensitised cultural-based mindset enabling innovation improvements. Table 4.5 provides an overview of the study's characteristics.

The present research analyses all current 28 countries of the EU on the correlation between the earlier described Hofstede cultural dimensions and the European Innovation Scoreboard composite index SII. By doing so, cultural commonalities of the different innovation performance levels within each country shall be elaborated, providing indications on essential key cultural drivers.

Table 4.5 Characteristics of the study on innovation performance in the European Union countries and the relationship to cultural dimensions

Aspect	Characteristics
Research target	a) Identifying civic-related cultural determinants (cultural dimensions) enabling and preventing the innovation performance on a macroeconomic level b) Deducing key cultural determinants related to innovation performance on an organisational level
Research period	March 2018—October 2018
Methodology	Analysis based on empirical evidence according to open access data resources: a) Summary Innovation Index (SII) as part of the European Innovation Scoreboard, edition 2017 b) The six cultural dimensions presented by Hofstede, the latest 3rd edition 2010

Source: own representation

For the analysis, the following open access databases were used:

a) The Summary Innovation Index (SII), calculated for Eurostat as a composite indicator of the European Innovation Scoreboard (EIS) by the Maastricht University (Hollanders and Es-Sadki, 2017). The SII provides a comparative overview of the innovation performance of the EU countries, its regional European neighbours and other countries for benchmark reasons. It includes universal factors such as education systems (number of doctorate graduates, lifelong learning activities and more), environmental conditions (broadband penetration, entrepreneur's activities and more), public and private investment activities, small-medium-enterprise product innovations, impacts on sales and employment, and more.
   The dataset used for the research can be found in the electronic supplementary material, Annex 5 for the SII primary indicator and Annex 6 for the SII sub-indicators.
b) The Hofstede six cultural dimensions, presented in Hofstede Cultures and Organisations latest 3rd edition 2010 (Hofstede, 2018). These cultural dimensions are related to the nation's behaviour and the mindset in their daily life and were first elaborated by Hofstede within its function as an employee at the global IT company IBM and its worldwide branches. The original data has been updated from time by time. However, as Hofstede is stating, the values do not show substantial changes over time. Values are changing very little as this

is dependent amongst others on generations (Hofstede, 2015). The full dataset used for the research can be found in the electronic supplementary material, Annex 5 as well.

For the tables and diagrams, the following indicator's abbreviations were used:

- Power Distance Index: pdi
- Individualism versus Collectivism Index: idv
- Masculinity versus Femininity Index: mas
- Uncertainty Avoidance Index: uai
- Long-term versus Short-term Orientation Index: lto
- Indulgence versus Restraint Index ivr
- Scoreboard Innovation Index: SII

A brief description of the EIS/SII and the Hofstede cultural dimensions were already given in chapter 1. Except for Cyprus, a full database is existing. In the case of Cyprus, only the EIS data and the data of the cultural dimension *indulgence versus restraint* is existing in the Hofstede database. Hence, Cyprus could not be included in all analyses.

Both databases were crosslinked and statistically analysed with the help of Pearson's correlation factor r to identify a possible linear relationship between country-related innovation performance and cultural influence related to the Hofstede dimensions. Additionally, the correlation determinants and the p-value were being calculated in case of linear correlation appearances (see also Section 4.1). In a second step, the present study includes the creation of so-called radar charts (spider nets) to visualise cultural commonalities of the individual countries and their innovation performance as introduced in the previous Section 4.1.

4.2.3 Results on the Relationship between Innovation Performance and Cultural Dimensions within the European Union Countries

The following correlation tableau (Table 4.6) based on Pearson's r is showing the relationship between the values of each cultural dimension and the dependent SII-value from within the EU member states. Two cultural-related dimension values are standing out of this analysis. The Power Distance Index (pdi) and the

Indulgence versus Restraint Index (ivr) show both the highest correlation with the innovation performance SII value. While Power Distance as an impacting cultural factor has been revealed more than once within scholar in negatively affecting innovation performance (Efrat, 2014; Kaasa, 2017), Indulgence seems to be affecting innovation performance positively.

Table 4.6 Correlation tableau between the six cultural dimensions and the SII 2016 value

	pdi	idv	mas	uai	lto	ivr	SII
pdi pearson r=	na	-0,55728	0,234799	0,555143	0,133237	-0,50544	-0,675694664
idv pearson r=	-0,55728	na	0,104311	-0,19176	0,171093	0,395365	0,552149841
mas pearson r=	0,234799	0,104311	na	0,13373	0,098663	-0,07649	-0,178413379
uai pearson r=	0,555143	-0,57848	0,13373	na	0,002945	-0,39077	-0,586842105
lto pearson r=	0,133237	0,171093	0,098663	0,002945	na	-0,40453	-0,077399558
ivr pearson r=	-0,50544	0,395365	-0,07649	-0,39077	-0,40453	na	0,811757398
SII pearson r=	-0,67569	0,55215	-0,17841	-0,58684	-0,0774	0,811757	na

Source: own elaboration based on Hollanders, H. and Es-Sadki, N. (2017), European Innovation Scoreboard 2017, ISBN 978–92-79–67685-7 ISSN 2467–4435 doi:10.2873/076586, Available online: https://ec.europa.eu/docsroom/documents/24829 (accessed on 20.08.2018) and Hofstede, G. (2018). National Culture Dimension data matrix, the base culture data for six dimensions of culture as presented in Cultures and Organisations 3rd edition 2010. Available online: https://geerthofstede.com/research-and-vsm/dimension-data-matrix/ (accessed on 20.08.2018).

The Indulgence factor, however, has been very poorly investigated in the context of its contribution to innovation performance as it represents a somewhat new cultural dimension described by Minkov and Hofstede (2011). Precursor studies have mostly not yet included the indulgence factor within their studies. Prim et al. (2017), however, found Indulgence to be essential in their analysis with the Global Innovation Index. In this context, the present analysis intends to minimise the existing research gap by including all six dimensions in the correlation analysis explicitly related to the European Innovation Scoreboard indicator SII including all EU members state and builds on the studies conducted and presented in the previous chapter (Murswieck et al., 2017a).

Masculinity, as well as Long-term Orientation as a cultural dimension, could both not be identified in influencing the nation's innovation performance. The correlation factor r between the mas-value as independent and the SII-value as

the dependent variable is extremely low with a correlation factor of r = -0,17841. Also, the correlation factor between the lto-value as independent and the SII-value as dependent variable show no significance with the factor of r = -0,0774. The cultural dimensions Individualism (idv) as well as Uncertainty Avoidance (uai), however, show a medium degree of influence. With a factor of r = + 0,552 for the relationship between idv and the dependent variable SII, an individualistic behaviour seems to affect innovation performance positively. The uai-related r-factor with a value of -0,5868 in return, influences the innovation's performance negatively. In the following, the analysis will focus only on the strong correlating variables Indulgence (ivr) as per Figure 4.7 and Power Distance (pdi) as per Figure 4.8 and include a linear regression analysis for both values.

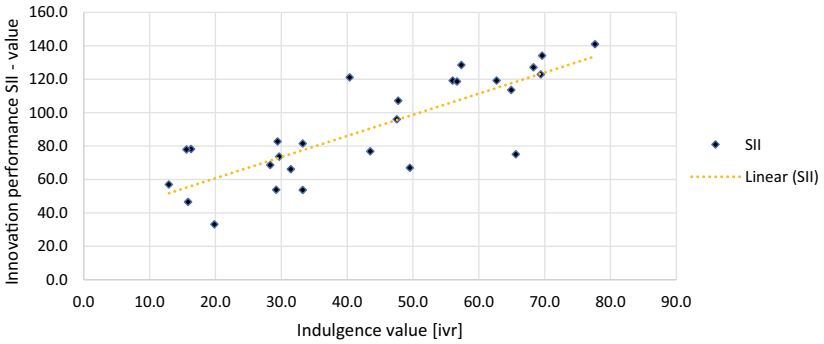

Figure 4.7 Relationship between the Indulgence and SII values within the EU28 countries. (Source: own elaboration based on Hollanders, H. and Es-Sadki, N. (2017), European Innovation Scoreboard 2017, ISBN 978–92-79–67685-7 ISSN 2467–4435 doi:10.2873/076586, Available online: (accessed on 20.08.2018) and Hofstede, G. (2018). National Culture Dimension data matrix, the base culture data for six dimensions of culture as presented in Cultures and Organisations 3rd edition 2010. Available online: (accessed on 20.08.2018))

The relationship between Indulgence and the SII values demonstrate a positive indication (Figure 4.7) and trend. Hence, increasing Indulgence values will generally lead to increased innovation performance values as well. In other words, inhabitants of countries with a higher degree of joy and exaltation and less feel of pressure in their life seem to have a higher capacity to create innovative behaviour.

The relationship between the power distance and the SII values, however, demonstrate a negative indication (Figure 4.8). It can be stated that higher pdi values generally will lead to a decrease in the innovation performance within

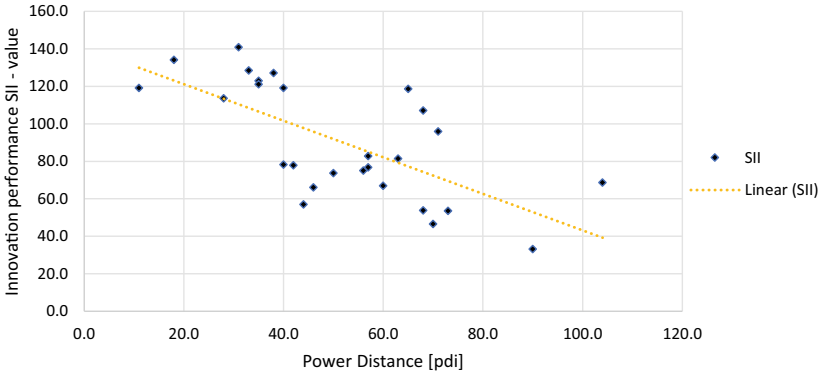

Figure 4.8 Relationship between Power Distance and SII values within the EU28 countries. (Source: own elaboration based on Hollanders, H. and Es-Sadki, N. (2017), European Innovation Scoreboard 2017, ISBN 978–92-79–67685-7 ISSN 2467–4435 doi:10.2873/076586, Available online: (accessed on 20.08.2018) and Hofstede, G. (2018). National Culture Dimension data matrix, the base culture data for six dimensions of culture as presented in Cultures and Organisations 3rd edition 2010. Available online: (accessed on 20.08.2018))

a country. In other words, inhabitants of countries feeling more dependent from powerful hierarchies seem to have a lower capacity to create innovative behaviour than inhabitants in countries where power is more equally distributed. In consequence, the distribution of power seems to be affecting the innovative behaviour of individuals.

In order to verify the relationships, a regression analyses were performed additionally (see full regression analysis results in the electronic supplementary material, Annex 7, 8 and 9). The results confirm an existing relationship by very low p-values far below the significance level of $\alpha = 5\%$ (Table 4.7):

The elaborated findings might lead to the conclusion that increasing indulgence and individualism characteristics could foster innovation performance on a nation's level while power distance, as well as uncertainty avoidance, should be avoided. Long-term orientation, as well as Masculinity as impacting factors, would be irrelevant variables to support or prevent innovation performance. However, such a conclusion could be a precipitate outcome without identifying further possible commonalities of similar countries in the context of innovation performance and elaborating empirical findings on this matter as well.

The following radar charts shall contribute in further analysis by visualising commonalties and differences amongst the countries and their allocation

Table 4.7 Linear regression analyses of Indulgence (ivr) and Power Distance (pdi) related to the SII composite innovation indicator

Linear regression analysis	**IVR Values**	**PDI Values**
Correlation with SII indicator (r)	0,8117574	0,675694664
Correlation determinant (r^2)	0,65895007	0,456563279
P—Value	2,7634E-07	0,000109835
Number of values considered (EU28 without Cyprus)	27	27

Source: own elaboration

to different innovation performance groups defined by the European Innovation Scoreboard (EIS). The EIS report divides the 28 EU member states into four innovation performance groups based on their SII values (Hollanders and Es-Sadki, 2017):

- "Innovation leaders" are characterised by a performance level, which is 20% higher than the EU average SII-value. This was the case for Denmark, Finland, Germany, the Netherlands, Sweden and the United Kingdom in the 2017 report on which relys the present analysis;
- "Strong innovators" are characterised by a performance level of 90% to 120% of the EU average score. In this group Austria, Belgium, France, Ireland, Luxembourg and Slovenia were allocated in 2017;
- The "moderate innovators" Croatia, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, and Spain, show a performance between 50% and 90% of the EU average score;
- The "modest innovators" show a performance level of 50% and lower of the EU average. This was the case for Romania and Bulgaria in 2017.

At first, a radar chart was created with the innovation leaders' group and the modest innovators (Figure 4.9). Apparent and most extreme differences between both groups in terms of different cultural dimensions related to the innovation performance SII values can be derived related to indulgence (ivr), individualism (idv) and power distance (pdi).

In consequence and related to Figure 4.9 the innovation performance on a nation's level is characterised by

- a rather high indulgence dimension value supporting innovative activities,

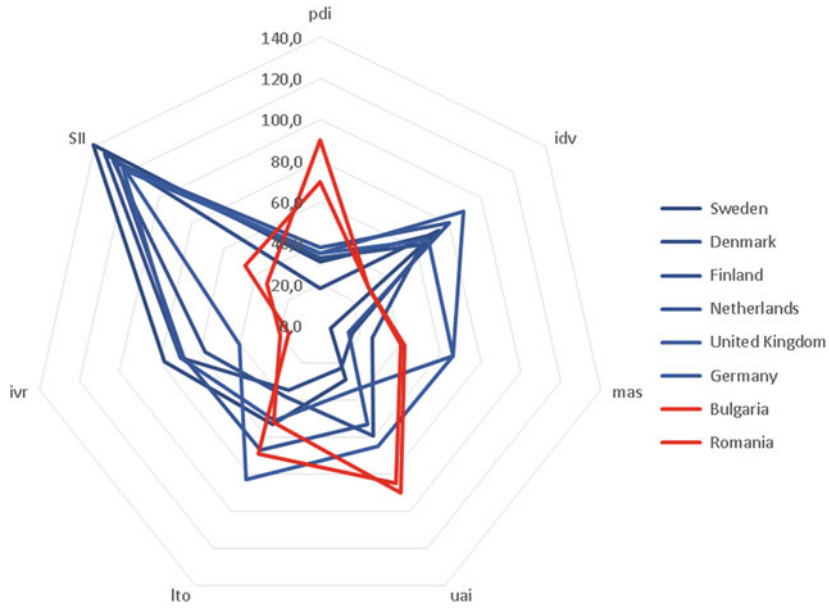

Figure 4.9 EU28 leading innovators values (SII and national cultural dimensions) compared to modest innovators values. (Source: own elaboration based on Hollanders, H. and Es-Sadki, N. (2017), European Innovation Scoreboard 2017, ISBN 978–92-79–67685-7 ISSN 2467–4435 doi:10.2873/076586, Available online: (accessed on 20.08.2018) and Hofstede, G. (2018). National Culture Dimension data matrix, the base culture data for six dimensions of culture as presented in Cultures and Organisations 3rd edition 2010. Available online: (accessed on 20.08.2018))

- a rather high individualism dimension value supporting innovative activities,
- and a rather low power distance dimension value to enable innovation.

Comparing the "modest innovators" group with the "strong innovators" group with the help of a radar chart, differences of cultural dimensions characteristics are less distinct than with the leading innovators (Figure 4.10).

Comparing both radar charts (Figure 4.9 and Figure 4.10), the evaluation of key drivers related to innovation performance on a nation's level can be described as follows:

- indulgence as an enabler of innovation performance on a nation's level remain;

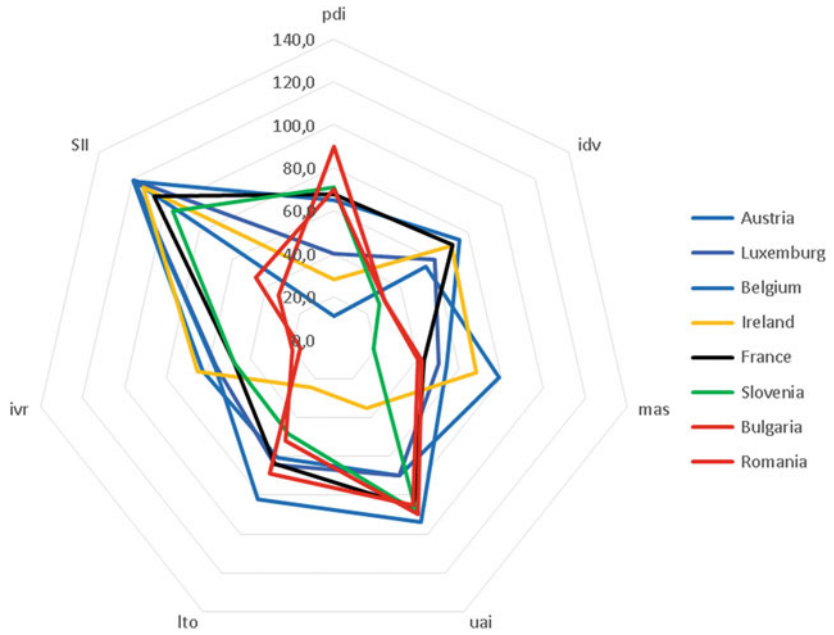

Figure 4.10 EU28 strong innovators values (SII and national cultural dimensions) compared to modest innovators values. (Source: own elaboration based on Hollanders, H. and Es-Sadki, N. (2017), European Innovation Scoreboard 2017, ISBN 978–92-79–67685-7 ISSN 2467–4435 doi:10.2873/076586, Available online: (accessed on 20.08.2018) and Hofstede, G. (2018). National Culture Dimension data matrix, the base culture data for six dimensions of culture as presented in Cultures and Organisations 3rd edition 2010. Available online: (accessed on 20.08.2018))

- individualism remains an enabling factor but seems not to be a mandatory precondition as in the case of Slovakia;
- power distance values, however, do not show a clear picture and the role as a preventer of innovation performance is weakening.

However, as the following radar charts (Figure 4.11) is demonstrating, a high indulgence dimension value does not necessarily lead to innovation performance: both, Malta and Greece show high ivr-values but at the same time a low SII value.

It seems that indulgence as an enabler of innovation performance can be predominated by a high uai-value (uncertainty avoidance) as well as a rather high

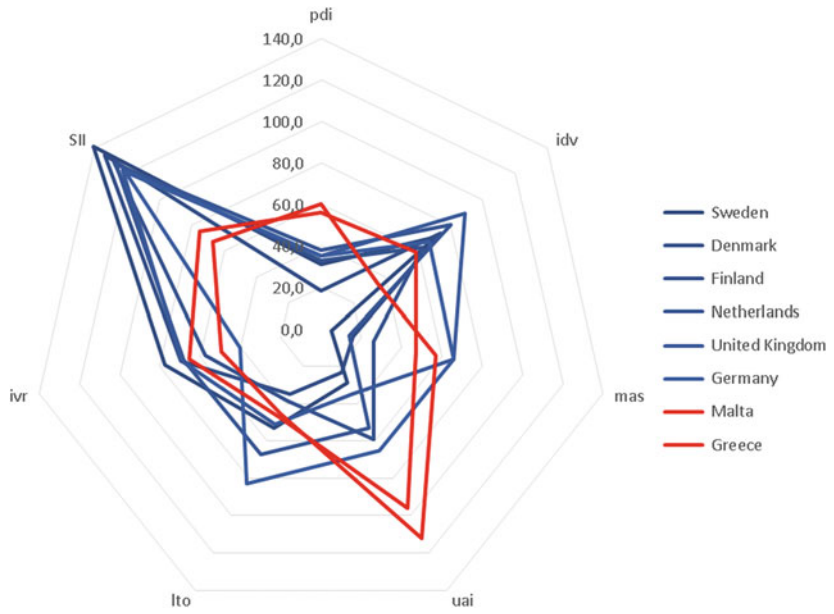

Figure 4.11 EU 28 strong innovators values (SII and national cultural dimensions) compared to Malta and Greece values. (Source: own elaboration based on Hollanders, H. and Es-Sadki, N. (2017), European Innovation Scoreboard 2017, ISBN 978–92-79–67685-7 ISSN 2467–4435 doi:10.2873/076586, Available online: (accessed on 20.08.2018) and Hofstede, G. (2018). National Culture Dimension data matrix, the base culture data for six dimensions of culture as presented in Cultures and Organisations 3rd edition 2010. Available online: (accessed on 20.08.2018))

pdi-value (power distance), both generally known as preventers of innovation performance. Though, by visualising together "innovation leaders" and "strong innovators" in a radar chart, this assumption can only be described as partially valid.

Figure 4.12 illustrates the spread of the country-related cultural dimension values within the most performant countries within the European Union. Anyhow, common characteristics can be described as follow:

- generally, indulgence remain a vital dimension and is often showing higher values supporting innovation performance;

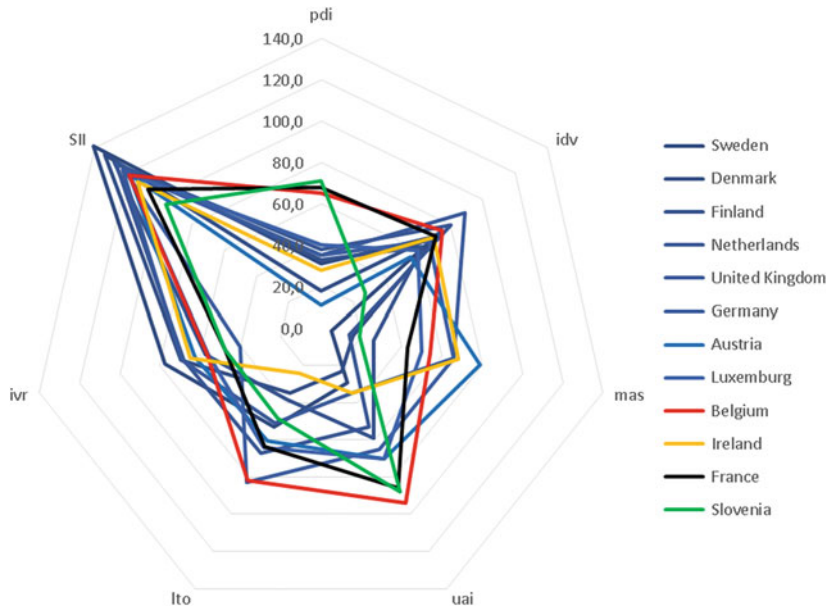

Figure 4.12 EU 28 leading innovators values (SII and national cultural dimensions) and strong innovators values in comparison. (Source: own elaboration based on Hollanders, H. and Es-Sadki, N. (2017), European Innovation Scoreboard 2017, ISBN 978–92-79–67685-7 ISSN 2467–4435 doi:10.2873/076586, Available online: (accessed on 20.08.2018) and Hofstede, G. (2018). National Culture Dimension data matrix, the base culture data for six dimensions of culture as presented in Cultures and Organisations 3rd edition 2010. Available online: (accessed on 20.08.2018))

- individualism as in the case of Slovenia seems not to be mandatory in any case;
- also, the importance of a deficient power distance value to foster the innovation performance (SII value) is not given in many cases, as it can be derived from Belgium's, France's and Slovenia's cultural dimension values.

Trying to jump onto the organisational level of innovation performance with help of the provided EIS database, the sub-indicators "innovators, employment and sales impact" were crosslinked to the Hofstede cultural dimensions of all EU28-countries (see also the dataset used in Annex 5 and 6 within the electronic supplementary material) with help of a further Pearson correlation analysis based

on formula (4.1). The following correlation tableau (Table 4.8) highlights again the importance of the cultural dimension "indulgence" showing the highest correlation (r = + 0,70057) with the indicator "innovators" which is related to the innovation activities of Small-Medium-Enterprises.

Table 4.8 Pearson correlation SII sub-indicators and national cultural dimensions of the EU 28 countries

Pearson correlation	pdi	idv	mas	uai	lto	ivr
innovators	-0,52016	0,292152	-0,0548	-0,24495	-0,1161	0,70057
Employement impacts	-0,36745	0,544952	0,181545	-0,5072	-0,18793	0,594813
Sales impacts	-0,28131	0,591447	0,422479	-0,50607	-0,00617	0,485655

Source: own elaboration based on Hollanders, H. and Es-Sadki, N. (2017), European Innovation Scoreboard 2017, ISBN 978–92-79–67685-7 ISSN 2467–4435 doi:10.2873/076586, Available online: https://ec.europa.eu/docsroom/documents/24829 (accessed on 20.08.2018) and Hofstede, G. (2018). National Culture Dimension data matrix, the base culture data for six dimensions of culture as presented in Cultures and Organisations 3rd edition 2010. Available online: https://geerthofstede.com/research-and-vsm/dimension-data-matrix/ (accessed on 20.08.2018).

The sub-indicator "innovators" is composed out of three single indicators and refers especially to SME's innovation results. In this context, innovation is described as process-, product-, marketing- and in-house related innovation result. The three single indicators are defined in the EIS report by Hollanders and Es-Sadki (2017) as follows:

1. SME's introducing product or process innovations
   = Number of SME's which introduced a corresponding innovation divided by the total number of SME's
2. SMEs introducing marketing or organisational innovations
   = Number of SME's which introduced a corresponding innovation divided by the total number of SME's
3. SMEs innovating in-house
   = Number of SME's which introduced a corresponding innovation divided by the total number of SME's.

The indicator is limited to SME's, as big companies generally innovate in any case and because countries with an industrial-related history have more large-scale enterprises than countries with few industries.

A multiple regression analysis of all cultural dimensions as independent value and the innovators sub-indicator as dependent value reveals that the ivr-value, hence, Indulgence, is confirmed to correlate showing a lower p-value than the significance level of $\alpha = 0{,}05$ (Table 4.9).

Table 4.9 Multiple regression analysis of cultural dimensions related to the innovators sub-indicator

	coefficients	*standard error*	*p-value*
intersection	2,950604954	59,9297843	0,961220894
pdi	−0,789266874	0,433626752	0,083735733
idv	−0,460062606	0,536153047	0,401014622
mas	0,113425685	0,274703991	0,684071797
uai	0,274865036	0,371773518	0,468293324
lto	0,713614403	0,464949691	0,140496503
ivr	1,736943985	0,438656692	0,000773051

Source: own elaboration

When looking to the "innovators"-indicator out of the SII data and creating a new country performance ranking, then some performant countries are being vanished from the top-12-list. Moderately performant countries (related to the primary SII-score) are graded higher, surprisingly. This view on innovation performance set its focus on innovation activities of the SME's only and fade out all other indicator influencing the SII main score. According to this idea, Table 4.10 illustrates the top 12 leading countries related to the innovators sub-indicator and the SII primary indicator in comparison.

The modified ranking based on the "innovators" sub-indicators let Portugal and Greece jump into this overview while the United Kingdom and Slovenia are being vanished out of the top 12 list. The full regression analysis is given in the electronic supplementary material, Annex 10.

However, a radar chart (Figure 4.13) based on the new top 12 leading countries according to the "innovators" sub-indicator and the correspondent national cultural dimensions values do not indicate which cultural dimension is predominant.

Analysing the relationship between civic-driven characteristics with help of the Hofstede cultural dimensions as well as the country-related innovation performance reveal that nations may differ in their innovation score because of the cultural values of their citizens (Shane, 1993) as well because of each organisation (Chen et al., 2017) which could generally be confirmed by the present study. The

Table 4.10 Ranking of leading countries based on SII main score and the "Innovators" sub-indicator with the cultural dimension "indulgence" (ivr)

Eu 28 leading and strong innovator countries based on SII value				EU 28 leading innovator countries based on EIS indicator "Innovators"			
Countries	ivr	SII 2016	EIS Group	Countries	ivr	Innovators	EIS Group
Sweden	77,7	140,9	Innovation Leader	Ireland	65,0	146,6	Strong Innovator
Denmark	69,6	134,1	Innovation Leader	Belgium	56,7	139,1	Strong Innovator
Finland	57,4	128,4	Innovation Leader	Germany	40,4	131,5	Innovation Leader
Netherlands	68,3	127,1	Innovation Leader	Luxemburg	56,0	122,6	Strong Innovator
United Kingdom	69,4	122,9	Innovation Leader	Austria	62,7	122,3	Strong Innovator
Germany	40,4	121,0	Innovation Leader	Finland	57,4	121,8	Innovation Leader
Austria	62,7	119,1	Strong Innovator	Netherlands	68,3	109,6	Innovation Leader
Luxemburg	56,0	119,1	Strong Innovator	Sweden	77,7	109,1	Innovation Leader
Belgium	56,7	118,6	Strong Innovator	France	47,8	104,4	Strong Innovator
Ireland	65,0	113,5	Strong Innovator	Greece	49,6	101,2	Moderate Innovator
France	47,8	107,1	Strong Innovator	Portugal	33,3	100,2	Moderate Innovator
Slovenia	47,5	95,9	Strong Innovator	Denmark	69,6	96,3	Innovation Leader

Source: own elaboration based on Hollanders, H. and Es-Sadki, N. (2017), European Innovation Scoreboard 2017, ISBN 978–92-79–67685-7 ISSN 2467–4435 doi:10.2873/076586, Available online: https://ec.europa.eu/docsroom/documents/24829 (accessed on 20.08.2018) and Hofstede, G. (2018). National Culture Dimension data matrix, the base culture data for six dimensions of culture as presented in Cultures and Organisations 3rd edition 2010. Available online: https://geerthofstede.com/research-and-vsm/dimension-data-matrix/ (accessed on 20.08.2018).

findings also show that the cultural dimension "indulgence" has the most robust relationship with the innovation performance within the EU 28 members states. Based on the results, some conclusions for more sustainable deployment of an innovation-friendly environment can be considered as follows.

Indulgence as a cultural dimension influences the innovation performance-level of the SII primary indicator and leads the national cultural dimension value ranking as an enabler of the innovation activities related to the sub-indicator "innovators". The dimension "individualism" plays a more important role than "power distance" but less than "indulgence". The determination of performant innovating SME's companies, however, cannot be derived from the SII main score: innovation performance on an organisational level related to process-, product-, marketing-, and in-house innovations is not linked to a specific cultural dimension. However, the cultural dimension "indulgence" still shows the highest correlation.

In any case, countries showing a higher value of both "indulgence" and "individualism" are more performant. The management within public and private organisations can still make use of this knowledge by fostering an open-minded organisational culture fostering an innovation-friendly environment (Pamfilie et al., 2013), for example, for generating more promising ideas. Employees enjoying work within a rather non-restrictive atmosphere, equipped with a certain

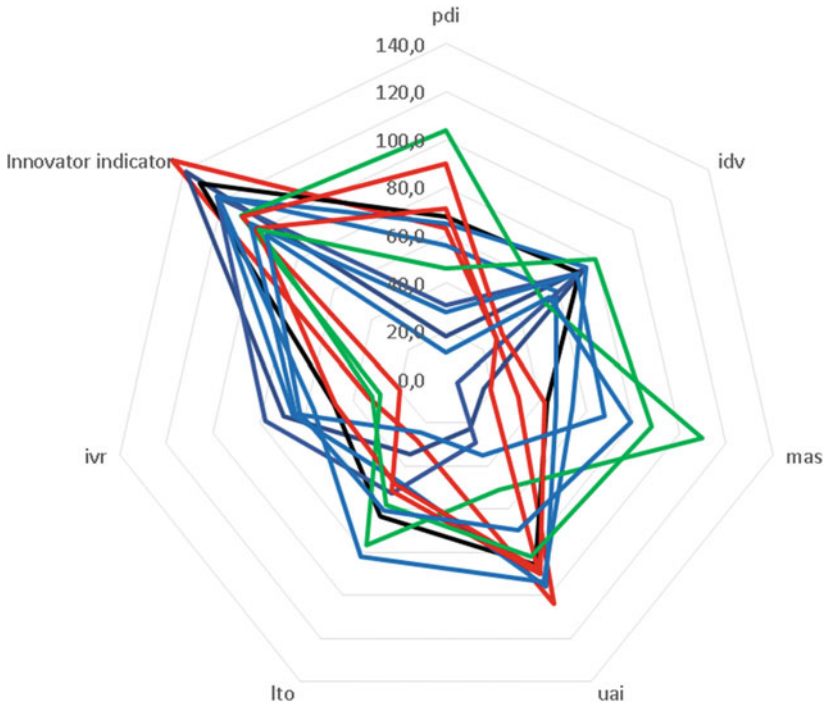

Figure 4.13 Top 12 leading countries based on the SII—innovators indicator and their correspondent national cultural dimensions. (Source: own elaboration based on Hollanders, H. and Es-Sadki, N. (2017), European Innovation Scoreboard 2017, ISBN 978–92-79–67685-7 ISSN 2467–4435 doi:10.2873/076586, Available online: (accessed on 20.08.2018) and Hofstede, G. (2018). National Culture Dimension data matrix, the base culture data for six dimensions of culture as presented in Cultures and Organisations 3rd edition 2010. Available online: (accessed on 20.08.2018))

degree of freedom within the decision process are more likely to adopt innovative behaviour. Furthermore, employees being able to generate inconvenient ideas without any anxiety related to possible sanctions by the management shall be able to support a performant innovation process as well. The increased innovative behaviour should influence the development of more promising ideas in the beginnings, hence, leading to increased innovations on a macroeconomic level in order to improve the country's innovation level.

5 Studies on Organisational Innovation Performance Related to Cultural Dimensions, Leadership and Employees

5.1 Analysis of Cultural Determinants Supporting the Innovation Performance on an Organisational Level

5.1.1 Context and Research Framework

While the previous chapter had its focus on the understanding of national-culture characteristics and their contribution to innovation performance on a macroeconomic level aiming to deduce first assumptions, the present chapter analyses existing studies through literature research in order to determine cultural values supporting innovation performance on an organisational level.

The research on organisational culture emerged in the 1980 s as theory defining the way in how employees perform their tasks including solving (daily) challenges, conflicts, treating customers etc. and is likely to be a social variable observed in behavioural patterns. Like for people, the organisational behaviour forms an own personality with values and beliefs leading to an own, individual corporate culture inside the organisation (Dauber, 2012; Hatch, 1993; Schein, 2010).

In the context of innovation management and competitiveness, the organisational culture plays a vital role as it has a direct impact on the organisations' performance. Employees are the source when it comes to developing new products, services or business models. An organisational culture can stimulate the

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Sustainable Management, Wertschöpfung und Effizienz,
https://doi.org/10.1007/978-3-658-34761-1_5

starting point of innovation by high, promising creativity or negatively influence the innovation process by few, unpromising ideas as well. Companies with employees being open for new ideas, exchanging ideas, enhancing and pushing ideas through the organisation to succeed, have a more significant potential for innovation leading to more competitiveness. However, supporting elements are also to be found in systems and organisational structure, which help the employees to act in a promising way (Bodemann et al., 2015; Terré i Ohme, 2002).

The ability to taking advantage of innovation and its contribution to organisational performance is part of the developed culture. Analysing the characteristics of a working innovation culture within organisations has shown that employees consider the subject "innovation" to be the responsibility of everybody (Bolton, 2013).

Establishing an innovative culture is seen as being essential to enable the capabilities for the creation of performant innovations (Bullinger et al., 2007). Within the literature, indicators have been intensively discussed to measure the innovation culture. Values and beliefs are responsible for the personal development of the employees in the context of their motivation in contributing to innovation activities (Menzel et al., 2007). Amongst other indicators, the percentage of managers trained in innovation and creative techniques, for example, is being described as a possible indicator; also, the amount of time which is being invested by managers purely for innovation activities instead of for daily tasks. (Chiesa et al., 1996; Hittmar et al., 2015). A literature review on innovation indicators described in scientific relevant databases from 1980 to 2015 performed by Dziallas and Blind has revealed that ~ 10% of the scholars have dealt with indicators on the innovation culture (Dziallas and Blind, 2019).

Despite the common understanding that an innovation-friendly culture is mandatory, literature still reveals differences when it comes to specifying the cultural characteristics needed to enable and foster an appropriate innovative culture. Risk-admitting characteristics, however, are common cultural factors which are being described generally by scholars to set the fundamentals for an innovation-friendly corporate environment (Ceausu et al., 2017).

5.1.2 Objectives and Research Methodology

The approach of the present study can be described as follows: first, literature was being reviewed and described with attention on essential factors of organisational culture supporting innovation performance. Second, the dimensions are

being analysed on cultural determinants with a relation to beliefs, values or attitudes to identify innovation supporting civic-based characteristics bearing in mind previous analysis performed in the context of culture dimensions (chapter 4). For this, a synthesis was created whereas cultural values are identified amongst the determinants of the organisational culture described within literature.

Understanding which cultural characteristics enable or prevent an innovative behaviour can actively support leaders of organisations to improve the fundamental prerequisites for increasing the innovation performance. Managers and responsible leaders in organisations can then proactively be trained to influence the innovation process, especially in the early stage of the process where ideas are being created, formulated and exchanged within the organisation.

The review on existing literature was based on keywords listed in double-blind reviewed articles or published reports in the English language. A selection of databases was being used. Table 5.1 provides a systematic overview of the study's characteristic and methodology.

Table 5.1 Characteristics of the research on analysing cultural determinants supporting innovation performance

Aspect	Description
Research target	• Elaborating cultural determinants supporting an innovative, organisational culture derived from innovation supporting dimensions • Creating of a synthesis incorporating elaborated cultural determinants supporting innovation performance on an organisational level
Research period	March 2017—December 2017
Form of research	Literature review based on international databases: • Web of Science • Scopus • ScienceDirect / Elsevier • Google scholar listed publications Criteria for the selection of articles: • Included keywords within the search: dimension OR determinant OR factor OR indicator AND innovation culture • English articles only • Context: organisational culture supporting product or process innovation • Relevance on cultural-related impact: beliefs, values, attitudes of individuals/employees, focusing on indulgence-related aspects

Source: own representation

In summary, the objective of this study is to analyse and to work out the existing literature specifically on identified cultural-related aspects impacting the innovation performance on an organisational level.

5.1.3 Research Results on Cultural Determinants and their Contribution to Innovation Performance on an Organisational Level

In summary, the findings can be described as follows: if organisations want to succeed with innovation, their organisational culture shall have the capability to understand the meaning of learning: learning out of mistakes made, learning out of (un)successful projects and learning in how to improve continuously the organisation (Ceausu et al., 2017; Maier et al., 2014; Terré i Ohme, 2002;).

In this regard, the approach is related to the globally well-known and established continuous improvement—cycle "Plan, Do, Check, Act" (PDCA), firstly introduced by W. A. Shewhart in 1939 as part of his thoughts on continuous process improvements (CIP), later widely introduced within the industry by his colleague E. Deming (Johnson, 2002; Moen 2009). Today, the PDCA-cycle is not anymore purely deployed in the context of manufacturing processes but rather on the level of business strategy. Hence, strategic initiatives, such as the management of innovation (Terré i Ohme, 2002) are planned by identifying the problem (Plan—phase), for instance, related to customer needs. Once clearly understood and ideally already well defined, the initial phase is followed by the development and implementation of appropriate problem-solving solutions (Do—phase). The evaluation of the desired results (Check—phase) aims to control the defined objectives in the initial Plan—phase, for example, with the help of KPI's. Once the solution is successfully deployed, the Act—phase closes the cycle by keeping the PDCA—cycle running and searching for ways on how to improve the results and by continuously rethinking the way in how ideas are created and processed in the context of innovation management (Sokovic et al., 2010; Pietrzak and Paliszkiewicz, 2015). As such, the management of innovation shall not only be understood as a process in general but as a continuous improvement process in order to reduce the risk of luck continuously (Drucker, 2002; Drucker, 1957; Terré i Ohme, 2002).

The literature review reveals the diversity of innovation-friendly culture within an organisation and its contribution to innovation performance. Various constructions of cultural aspects related to innovation performance exist based on empirical field studies as well as theoretical frameworks. Nevertheless, commonalties within

the description can be derived when it comes to summarising the various factors into dimensions impacting the innovation performance. As a minimum, five essential dimensions come up again and again in various studies on organisational culture supporting innovation activities, sometimes, however, described within seven dimensions (Maher, 2014; Maher, 2019) or even nine dimensions (Hogan and Coote, 2014).

Following the minimum approach with five dimensions described within scholars, the following influencing factors are mentioned when it comes to creating an innovation-friendly organisation: *values, strategy, structure, behaviour & communication* and finally *leadership* (Ceausu et al., 2017; Losane, 2013; Olaru et al., 2016; Popescu, 2016). These five aspects, sometimes in another diction, are described in being essential to think about when it comes to creating a prospective, innovation-friendly organisational culture. Each of these determinants can be broken down into concrete business actions which can be measured as well, either as a binary function or on a scale, related to the degree of attention and adoption into the organisation. The determinant *values* comprise up to seven business actions supporting an innovative-friendly culture. Providing a certain degree of freedom to the employees in their daily work, promoting a risk-taking attitude (within a defined frame), trust amongst co-workers, openness to new approaches, creativity, flexibility which is often needed when it comes to reach a target or serve the customer and finally the capability of continuous learning as described introductory are all impacting innovation. It is not enough to talk about these values or to write them down. The values need to be deployed by acting so. In this sense, leaders must act and show that they stimulate and respect the values. The aspect *strategy* describes innovation in being a strategic goal, integrating customers expectation and the ability to think future-oriented rather than relaxing on past achievements. In a systematic context, *structure*, the organisation should not promote silo thinking of each department within the organisation but rather stimulate collaborative work, flexible (interdisciplinary) project teams with changing team leaders based preferably on competence and motivating aspects than on hierarchic thinking. *Behaviour & communication* intends to promote a positive and encouraging organisations' atmosphere with a support-thinking-approach among the employees neverminded the individual's hierarchy's department or function and should ensure an interaction by establishing a trusting relationship. Being open for new and maybe inconvenient ideas can moreover help to shape the future as well (Losane, 2013; Olaru et al., 2016). The last aspect of supporting innovation is *leadership,* which intends to make sure that all determinants mentioned above are being introduced, followed up and promoted by the higher management.

Motivating the people to achieve the goals by setting directions and implementing appropriate tools (such as rewarding systems but also management behaviour aspects) are the most critical goals to establish an innovative culture within the organisation (Popescu, 2016).

In contrast, sanctioning mistakes is an innovation-killer, according to the authors (Losane, 2013; Popescu, 2016) while satisfaction with the job and the commitment to the corporate culture has been already revealed in the 1990 s to affect innovativeness (Harris and Mossholder, 1996; Odom et al., 1990).

Today, the research on corporate culture and its effects on job satisfaction stimulating innovative behaviour is still part of recent studies amongst the different public and private sectors internationally. It is found that congruence of employee's expectations with the corporate culture is critical, and the role of leadership is decisive. Transformational leadership supporting employee involvement are found to be supportive elements to stimulate innovation, especially when employees can commit themselves to the organisation's values (Ali and Farid, 2016; Arifin et al., 2018; Carvalho et al., 2018; Saha and Kumar, 2018).

From a non-scholar but practitioners' perspective, The Boston Consulting Group (BCG) describe no general aspect or dimension, such as value, but name the cultural determinant in a more precise and practical way. Analysing so-called "breakthrough"—innovators in their Global Innovators survey (BCG, 2014), BCG figured out cultural metrics which support innovation more than others. *Risk-permitting* and *collaborative,* for instance, are characters which differ within organisations described as supporting innovation as mentioned earlier. Furthermore, *High prestige, balanced costs attitude, commitment* and *full-time* innovation approach have also been elaborated by the BCG as well as innovation supporting company values. However, not all have been mentioned in such an explicit way within scholars. Nevertheless, they should be considered as complementary factors enabling innovation performance within the present study.

As an outcome of the performed literature review, Table 5.2 represents the final synthesis elaborated concerning the culture-related determinants on an organisational level bearing in mind the cultural dimensions supporting innovation performance as described in chapter 4 within the analyses performed.

The synthesis concentrates preferably on national-based cultural factors than on universal aspects. For example, *strategy* as a revealed dimension within literature is an essential factor influencing innovation performance. However, the strategy itself is also a result of cultural-related mindset. In this sense, a specific cultural influenced strategic factor was chosen, such as "time orientation" or "risk-taking organisation". Both cultural determinants decide how organisations will setup their strategy, for example. The identified degree of "individual

responsibility" within the synthesis, as another example, can be referred to the dimension *values* according to the mentioned authors above but reflects a more behavioural outcome and description. Same refers to inter-"hierarchic communication patterns" and to individual "openness and flexibility" aspects. According to this idea, the elaborated synthesis of the literature tries to focus on the cultural determinants impacting the described aspects or dimension described above. On the other hand, the synthesis tries to link the elaborated cultural determinants to national, hence civic-based, cultural dimension, such as described by Hofstede (2015). In this context, the synthesis provides a new approach in how to consider civic-based aspects of the multiple perceptions existing in the literature on the key dimensions affecting innovation performance.

Table 5.2 Synthesis of cultural-related determinants supporting innovation performance on an organisational level

#	Cultural determinant	Definition, Items and possible indicator/s	Citations
1	Openness & flexibility	High and open attitude on innovation and willingness of learning, compatibility of innovation with personal employee's attitude within the daily workflow, open to change, problem-solving attitude, access to knowledge; listening to customers, overcoming technical barriers, >responsiveness to new ideas >training on innovation techniques	Amabile (1988); Astebro and Michaela (2005); Bolton (2013); Howell and Boies (2004); Khazanchi et al. (2007); Losane (2013); Mumford et al. (2002); Olaru et al. (2016); Pamfilie et al. (2013)
2	Teamwork and inter-hierarchical collaboration & communication pattern	High degree of communication and collaborative work between colleagues and the organisation's hierarchy >number of meeting hold: formal & informal >project-related, changing team leads	Amabile (1988); Garcia-Morales et al. (2011); Maher (2014); Pamfilie et al. (2012); Sonnentag & Volmer (2009); Song & Swink (2009); Suwannaporn and Spence (2010);

(continued)

Table 5.2 (continued)

#	Cultural determinant	Definition, Items and possible indicator/s	Citations
3	Power, individual responsibility & intrapreneurship	Degree of power distributed within the organisation, individual responsibility, initiative and accepted autonomy, >number of decisions taken autonomously without hierarchy involvement >number of decisions taken autonomously without team involvement	Mumford et al. (2002); Binnewies et al. (2007); Song & Swink (2009); Gomzales-Benito et al. (2015); Al-Mubaraki et al. (2015)
4	Risk-taking attitude	Degree of accepting uncertainties, valuing risk-taking, investing in uncertain ideas, offering employees to experiment without negative consequences in case of failure >ratio of ideas to new products to sale >percentage of the budget reserved for innovation, R&D	Dewett (2004); Aiman-Smith et al. (2005); Salomo et al. (2007); Tellis et al. (2009); Murro (2013); Maher (2014)
5	Strategic time orientation	Long-term versus short-dated business activities and initiatives, financial funds reserved for R&D and innovation projects >average time planned from idea to market >number of strategic created opportunities	Kerssens van Drongelen and Cooke (1997); Lumpkin et al. (2010); Hittmar et al. (2015);

Source: own elaboration based on literature review

To provide another perception, Maher (2014), for instance, figured out the so-called 7 key-dimensions of organisational culture that distinguishes highly innovative organisations from less innovative companies. These dimensions can

support executive management in assessing the status-quo of the innovation culture. The organisation's innovation culture can then be strengthened by setting the focus on the appropriate dimension*: relationship, risk-taking, resources, knowledge, goals, rewards and tools.* Each of these dimensions is being associated with further determinants. These dimensions again complement the various described determinants or dimensions but set the attention on other aspects.

In consequence, the elaborated synthesis tries to reflect the different views on innovation-impacting factors within literature but set the focus on the cultural-based core aspects. Moreover, it shall offer ideas on possible measurable indicators (KPI's) on how to measure the correspondent aspect, also as partly identified within the literature.

5.1.4 Suggestions on Supportive Leadership Business Actions Related to Cultural Determinants in the Context of Innovation Performance

The principles of adding successfully real value to the innovation efforts are based on values, behaviours shared and cultivated among the employees, systems implemented, resources provided and the overall strategy of the organisations' management giving direction and tools. The development of a supporting innovation-friendly culture is a complex task to deploy by managers as a culture cannot be implemented artificially but needs the right leadership adoption and employees being open enough to create together an efficient working system to achieving business goals.

The elaborated synthesis, as per Table 5.2 with a focus on civic-based cultural determinants supporting the development of an innovation-friendly culture, can sensitise and assist managers in developing their leadership skills. Given the fact of the elaborated effects of the determinants *Openness & flexibility, Teams and hierarchy behaviour & communication pattern, Power and individual responsibility/intrapreneurship, Risk-taking attitude* and *Strategic time orientation*, managers are considered to work on these aspects by increasing the level of awareness of each of these cultural determinants. The conceptual design of the synthesis includes proposed indicators to measure the deployment of the respective determinant.

However, managers are encouraged to set their key performance indicators (KPI) concerning the determinants reflecting individual possibilities and objectives of the organisation. In any case, organisations or the respective management

is advised to implement measurable KPI's in order to make transparent the correspondent performance level.

As an additional mechanism, the degree of cultural awareness and its deployment can be assessed by the organisation with the help of a scaled rating performed on a regular company assessment. It is considered to use a 6-step-scale (as per Figure 5.1) in order to avoid indifferences by offering an average value.

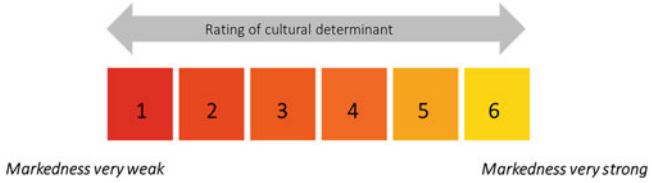

Figure 5.1 Suggested scale for evaluating the degree of cultural determinant deployment influencing the innovation performance. (Source: own representation)

Each cultural determinant is a sum of multiple items. As such, each item should be evaluated in order to calculate the mean value as the resulting, assessed degree of adoption. A very strong degree of adoption of the individual cultural determinant item would be marked with 6, a very weak with 1, respectively.

Based on the assessment outcome, the management can start defining specific business actions in order to increase the relevant degree of weak items. It is considered to involve the employees in the defining process.

The suggested evaluation form related to the elaborated synthesis should only provide a starting point to organisations for assessing the status-quo of the corporate culture based on innovation-supporting determinants (Table 5.3). A regular assessment can furthermore monitor the progress of the defined business actions increasing the innovation-friendly culture.

The testing and validation of the suggested measurement system should be part of further empirical based studies.

The following chapter comes back to the subject of digital technologies introduced in chapter 2, promising to support organisations in their innovation activities, increasing business performance. As such, the elaboration of digital technologies' effects is of interest.

Table 5.3 Suggested evaluation form to assess the degree of cultural-related determinants supporting innovation performance

#	Cultural determinant	Item	Observation notes and rating (1 = very low …. 6 = very high)
1	Openness & flexibility	Innovation attitude and willingness Willingness to learning Open to change Problem-solving attitude Access to knowledge Listening to customers Overcoming technical barriers	1–2–3–4–5–6 1–2–3–4–5–6 1–2–3–4–5–6 1–2–3–4–5–6 1–2–3–4–5–6 1–2–3–4–5–6 1–2–3–4–5–6 MEAN: X1
2	Teamwork and inter-hierarchical collaboration & communication pattern	Degree of communication Collaborative work between colleagues and the organisation's hierarchy	1–2–3–4–5–6 1–2–3–4–5–6 1–2–3–4–5–6 MEAN: X2
3	Power, individual responsibility & intrapreneurship	Degree of power distributed within the organisation Individual responsibility Initiative and accepted autonomy	1–2–3–4–5–6 1–2–3–4–5–6 1–2–3–4–5–6 MEAN: X3
4	Risk-taking attitude	Accepting uncertainties Risk-taking investing in uncertain ideas offering employees to experiment without negative consequences in case of failure	1–2–3–4–5–6 1–2–3–4–5–6 1–2–3–4–5–6 MEAN: X4
5	Strategic time orientation	Long-term business activities Long-term initiatives product-wise Financial funds reserved for R&D and Financial funds for innovation	1–2–3–4–5–6 1–2–3–4–5–6 1–2–3–4–5–6 1–2–3–4–5–6 MEAN: X5

Source: own elaboration based on research findings

5.2 Study on the Effects of Leadership on Business Performance by the Adoption of Digital Technologies as Part of Innovation Efforts

5.2.1 Context and Research Framework

The research on leadership styles and its effects on organisations has shown that a mix of transformational and transactional leadership style has been most promising when it comes to increasing the business performance (McCleskey, 2014; Shannanhan et al., 2012; Walumbwa and Wernsing, 2013) as described in this chapter. The present explorative study on leadership styles completed in 2018 sets the focus specifically on the influence of digital remote technologies used by sales managers as part of sales processes. The findings were published as part of the doctoral researches (Dünnweber, M., Murswieck, R., Arp, A.K., and Fortmüller, A. 2018).

In brief, transformational leadership intends to increase the business performance by intrinsic motivation: the behaviour of the leader shall influence his employees by actions and support them to develop and strengthens their skills while bringing closer meaning for their targets. The aim is that employees are inspired to perform their task mainly independently while being creative (Bass and Riggio, 2013).

Contrary to the transformational style, the transactional leadership is being defined as more restricted: generally, employees sometimes feel compelled by their manager when it comes to achieving defined targets. Results are being valued by impalpable incentives such as positive evaluations but also by real incentives like promotions and commissions (Burns, 2005). In practice and related to the management of sales teams, it is known that a transformational style is more promising and successful. An individual mix of both styles, however, can furthermore increase the results (Schwepker, 2010; Shannahan et al., 2012).

Nowadays, electronic technologies such as emails, video chats or chat rooms as part of customer relationship management systems and others have altered the forms of communications and have reduced the interpersonal contact within employees (Mayfield & Mayfield, 2017; Dennis, 2013). New working models such as distance working, or home office are meanwhile universally accepted working styles implemented more and more by organisations in order to improve the work-life-balance and to increase the employees' satisfaction as well as motivation. The effect of leading teams by using digital methods such as deploying remote technologies within organisations has been analysed in some studies.

Avolio and Kahai (2003) described the process of managers in deploying specifically digital technologies to influence the thinking of their employees as "E-Leadership". In a study performed in 2009 by Purvanova and Bono, two categories of teams were compared with a surprising outcome: transformational management techniques seemed to be even more successful when applied to teams using remote technologies. Teams, where the team leaders had (mainly) always face-to-face contact with their employees, had a much lower performance level than those who had seldom contact with their team leader in person. However, the study was not performed in a specific sector or department. Therefore, the study intends to elaborate if the performance level of virtual sales teams would be even higher when applying both management styles.

5.2.2 Targets and Research Methodology

Based on the theoretical findings, both the transformational leadership as well as the transactional leadership are principally promising ways in succeeding with remotely managed teams. Regarding sales performance (outcome, results), a combination of both leadership styles was confirmed in previous studies for achieving the best results without any clarification related to remotely managed sales teams. The present research aimed to understand whether team leaders are managing specifically sales teams remotely outperform compared to sales teams, which are managed face-to-face or not. In order to answer this research question, the present study deployed an online questionnaire based on the "Multifactor Leadership Questionnaire" (MLQ) according to Avolio and Bass (2004), validated and accepted within the scientific community (Posner, 2016; Rowold, 2005).

The standardised questionnaire is categorised into four sections: transformational leadership, transactional leadership, the laissez-faire style, and an outcome scale. The dependent outcome scale is referring to "followers' extra effort" (EEF), "effectiveness of leader's behaviour" (EFF) and "followers' satisfaction" (SAT) with their leader. As the objective was to evaluate the outcomes related to sales performance, the questions in the fourth category, "outcome" were explicitly tailored to sales and its performance. Therefore, the indicators were defined as "extra effort in sales", "effectiveness in sales" and "satisfaction in sales". In order to identify the sales teams which are managed remotely, an additional question related to the degree (percentage) of remote-based interactions between leader and sales team was defined.

The following Table 5.4 provides an overview of the study's characteristics.

Table 5.4 Characteristic of the study on the effects of leadership on innovation performance in the context of digital transformation

Aspect	Characteristics
Survey period	Quantitative questionnaire from 25th November 2017—12th January 2018
Form of collection	Online survey with 117 fully answered questionnaire.
Regional focus	German-speaking countries Germany and Austria
Execution of the survey	Performed online by the authors
Survey addressees	Professional salespeople: sales managers and sales people
Questionary base	45 single questions acc. to the MLQ-X5 form by Avolio and Bass (2004) from Mind Garden Inc. (official distributor) tailored to "sales performance" plus one additional question identifying remote sales teams (see sample questionnaire in the electronic supplementary material, Annex 11).
Precursor studies (reference point)	Shannahan et. al, 2013 Purvanova & Bono, 2009

Source: own representation

The online survey was addressed to sales professionals within various industries in the German-speaking countries, Germany and Austria. Therefore, the employed scoring key provided by the official questionnaire distributor Mind Garden Inc. to identify the leadership style was used. The additional questions supported to classifying the participants into a "remotely managed" and "face-to-face managed" sales team. With these two categories, the results, out of the MLQ-questionnaire, could be crosslinked in order to validate or to reject three formulated hypotheses:

H1: Transformational leadership correlates positively with the success of a remotely managed team in sales

H2: Transactional leadership correlates positively with the success of a remotely managed team in sales

H3: The combination of transformational and transactional leadership correlates positively with the success of a remotely managed team in sales

For the study, the leadership styles were divided into three different categories based on the participants' answers:

Managers behaviour is more than half transformational and less than half transactional: category transformational manager

Managers behaviour is more than half transactional and less than half transformational: category transactional manager

Managers behaviour is more than half transformational and more than half transactional: separate category

Furthermore, defined two categories related to remotely managed sales team:

- Communication of salespeople is more than 20% face-to-face: category 1
- Communication of salespeople is maximum 20% face-to-face: category 2

As mentioned, the MLQ-questionnaire was adjusted related to sales. Hence, the category "outcome" was defined as follows: performant sales teams were identified when the specified scores of "extra efforts", "effectiveness" and "satisfaction" all achieved more than half of the points.

5.2.3 Research Results on the Effects of Leadership on Innovation Performance in the Context of Digital Transformation

In total, 117 sales businesspeople participated in the survey from within 21 industries. With a share of 42% women (49 persons) and 58% of men (68 persons), the survey was quite balanced gender wised. As per Figure 5.2, 80% of the participants declared having an academic background, while 20% do have an apprenticeship or a high school diploma.

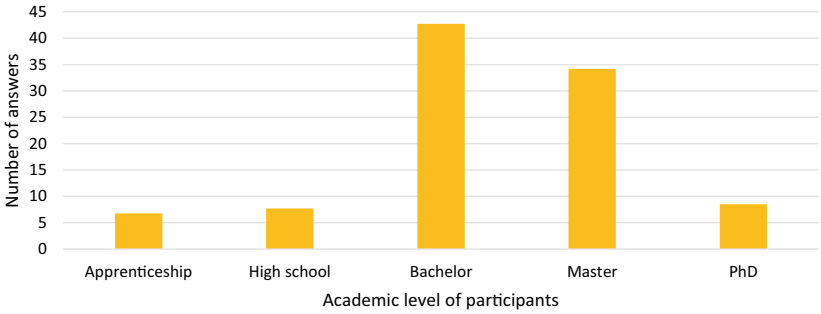

Figure 5.2 Academic background of the study's participants. (Source: own representation based on findings)

Among all participants, the distribution of the participants' job experiences varied from less than a year of experience to more than ten years (Figure 5.3). As most of the participants (83,3%) stated in having a job experience from at least one year, the findings related to the relevant remote or distance working experience can be considered in being meaningful.

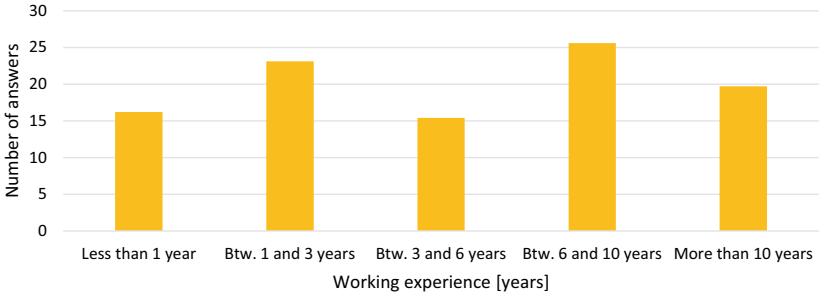

Figure 5.3 Seniority level of the study's participants. (Source: own representation based on findings)

The evaluation of the questionnaire shows that based on the participant's answers, 54,7% of the sales teams are managed by a transformational leadership style. While a purely transactional leadership style manages only 2,56% of the participants, the second biggest category of salespersons sees themselves managed by a combination of both the transformational and transactional leadership style (see the following Figure 5.4).

Remembering the precursor studies we took as reference point, our study confirms that sales teams being managed by a combination of transformational and transactional leadership styles as well as purely transformational leadership style promise most success: 68% of the sales teams with combined leadership styles and 66% respectively for sales teams managed by a purely transformational leadership style show a high-sales performance level considering the defined sales success indicators. The sales teams which were managed purely based on a transactional leader are only successful in 33% of the cases.

In order to confirm or reject the formulated hypotheses, the main target was to prove that remotely managed sales teams are more successful than face-to-face managed sales teams. Hence, we analysed the performance level of the two categories „maximum 20% face-to-face" and „more than 20% face-to-face" interaction.

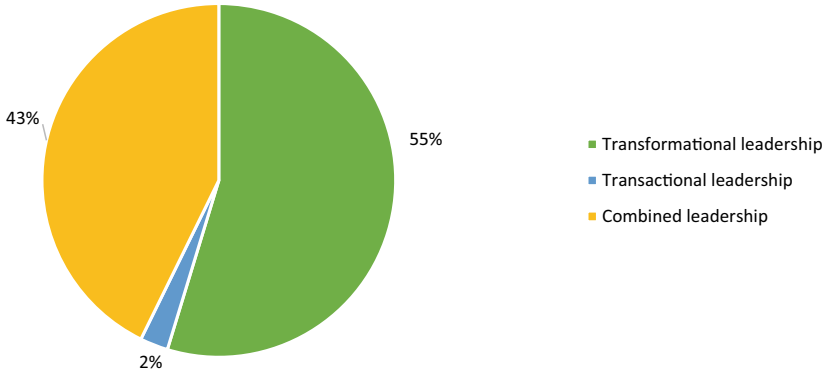

Figure 5.4 Assessment related to the leadership style [in %]. (Source: own representation based on findings)

Overall, it could be confirmed that a combination of both leadership styles is the most effective managing styles (followed by the transformational leadership style and then transactional leadership style). However, a closer look on the analysis showed that the most appropriate leadership-style in the context of sales results correlates positively with both, remotely managed and face-to-face managed sales teams as well, but the effect is even stronger. Sales teams managed by their leader in person with a combination of both leadership styles have a success rate of 61%. Sales teams managed by remote electronic technologies and employing both leadership styles show a success rate of even 79% (Figure 5.5).

Sales teams managed by transformational leadership with a maximum of 20% face-to-face are less successful (62%) than the second category managed by distance supported by electronic technologies (72%) as per Figure 5.6.

In summary, the studies consider encouraging sales managers to lead their teams using a combined leadership style. Additionally, digital technologies such as remote communication technologies should be considered as part of innovative processes to increase sales performance. In this regard, the present findings meet recommendations to invest and adopt digital technologies to raise competitiveness (Kreutzer and Lang, 2016; McKinsey GI, 2016; Murswieck et al., 2017b).

In the following chapter, a more holistic study approach shows that in the context of digital technologies' deployment, different perceptions among employees might hinder the unfolding of innovative solutions. The multiple possibilities of

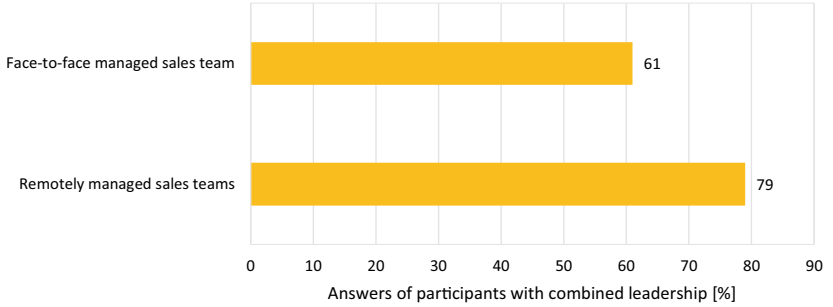

Figure 5.5 Sales performance employing a combined leadership style. (Source: own representation based on findings)

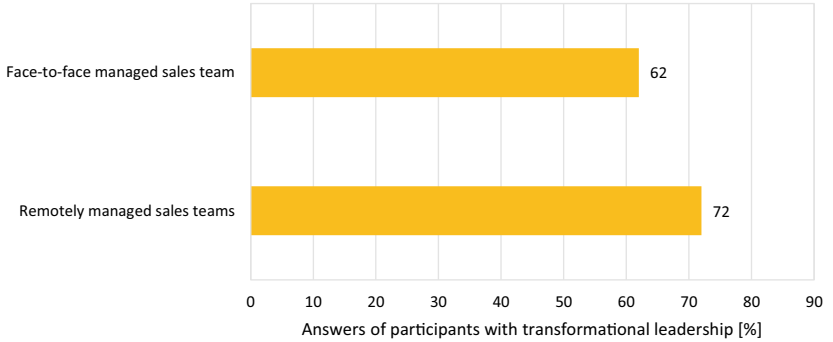

Figure 5.6 Sales performance employing a transformational leadership style. (Source: own representation based on findings)

digital innovations along the value chain of organisations are shown in the following work by setting its research focus also on the adoption of such technologies along the value-adding chain.

5.3 Study on the Employee's Digital Assessment, Deployment and Rated Impact of Digital Technologies on the Business Performance

5.3.1 Context of Assessment and Research Framework

The following chapter is related to a study performed in 2017 aiming to assess the today's grade of digitisation and potential along the value-added chain in organisations based on the employee's opinion within the different business markets in the German-speaking countries. The research performed during the doctoral studies was partially published in the context of the adoption of digital technologies along the value-adding chain (Murswieck et al., 2017b).

Especially by the end of the 1990 s with the final breakthrough of the internet the vast application range of digital technologies have contributed significantly to create new business models and moreover to increase the business performance of all kind of organisations. From today standard communication tools such as email up to Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) and other software, cloud services or nowadays more and more upcoming Internet of Things (IoT) applications and artificial intelligence algorithms have shown its radical potential for innovation. However, the crucial phase of data processing and the automation of information workflow began in the 1960 s (Fleischhack, 2016).

As discussed in chapter 2, the today's internet capabilities combined with new digital technologies have allowed to crosslinking data streams offering competitive edges within all sectors in any markets which are seen as a chance to reducing costs and increasing sales at the same time by innovative organisations. However, the investment and more important the usage of digital technologies within organisations differs still between the different markets as well as in international comparison, as the study "Digital Europe: Pushing the frontier, capturing the benefits" published in 2016 by McKinsey has shown (Mc Kinsey GI, 2016).

According to Porter (2014, p. 68) analysing the value chain instead of the value creation itself is more appropriate in order to create the organisations' competitive edge and to sustain as cost-leader or differentiator in the market. Organisations avoiding digital technologies as a tool for optimizing their value-added chain might risk their competitiveness. The value chain itself is being described as the "full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use" (Kaplinsky and Morris, 2000, p. 4).

5.3.2 Targets of the Assessment and Research Methodology

For the present study, the McKinsey GI study was chosen as a precursor study as it represents an adequate reference point for the assessment: how well do organisations, and their employees respectively, see themselves well prepared for the digital time-age? What investments have they made already and where do they see themselves a lack of knowledge in order to go ahead and transform their organisation?

The assessment aimed to gain information on how business insiders from within different markets with different seniority as well as knowledge level assess digital technologies as being a crucial mandatory factor to increase the business performance of their organisation by optimising operational costs, increasing sales or even develop entirely new business models. The findings can provide the necessary information for the management to better understand the organisations' cultural behaviour related to the investment, usage and acceptance of digital technologies. Therefore, the study intended to analyse the digital mindset, digital knowledge and the estimated competence level for the adoption of new digital technologies. The rating differences of each participant related to the professionals' background shall furthermore provide a more in-depth understanding. The second aim was to understand the grade of digitisation along the value-added chain as well as the impact on the investments made as this might provide additional information on the unused digital potential within the organisation to innovate specifically processes. Finally, the assessment makes it possible to calculate the grade of digitisation for each sector in comparison along the value-chain out of the provided ratings.

The selected research methodology (Table 5.5) was not only chosen based on the academic tenor of the research team but also to meet scientifically accepted quality criterions such as the process of information acquisition and the empiric examination method. Therefore, the present assessment represents an explorative origin study with the help of a quantitative survey. It was performed in the German-speaking countries Germany, Austria and Switzerland with the help of an online-only questionnaire addressed to business peoples from 15th to 31st January 2017 in the German-speaking online business networking platform XING. The following table outlines the research characteristics.

As the survey was only addressed within the online networking platform XING, a primary digital interest for digital technologies of the platform members is being considered advantageous for the answer's quality.

As one aim of the study was to identify specific particularities, and typical characteristics of the business peoples' background (seniority level, education…)

Table 5.5 Characteristics of the study on the employee's digital assessment, deployment and rated impact of digital technologies

Aspect	Characteristics
Survey period	Quantitative questionnaire from 15th January—31st January 2017
Form of collection	Online survey with 131 fully answered questionnaire (out of 199 reached businesspeople who opened and started the form) representing ~ 65% response rate.
Regional focus	German-speaking countries (Germany, Austria, Switzerland)
Execution of the survey	Performed by the authors with the help of online sosciesurvey.de—platform
Addressee of the survey	Businesspeople within German-speaking online business forums (XING)
Data volume	42 single questions (hereof 9 sociodemographic questions)
Precursor studies (reference point)	The search for Excellence in Digital, 2013 (Strauss, 2013); Digital Europe: Pushing the frontier, capturing the benefits, 2016 (McKinsey Global Institute 2016)

Source: own representation

sociodemographic questions were polled as well. Where appropriate, a 6-step-scaling including an additional field value "unknown" were provided to the participants in order to ensure a graded rating avoiding an average value as it would be the case for a 5-step-scaling.

The full questionnaire can be found in the electronic supplementary material, Annex 12.

5.3.3 Results, Key Findings and Conclusion

a) *Sociodemographics*

From a sociodemographic view, 131 participants out of 199 reached business-people have filled out the online questionnaire representing a return rate of approximately ~ 65%. Out of these, 70% were male, and 30% were female, whereas 45% were executive employees and 43% non-executive employees. The remaining 12% were students, trainees and others (not specified). As per the following Figure 5.7 the participants' age ranged from 20 to 67 years.

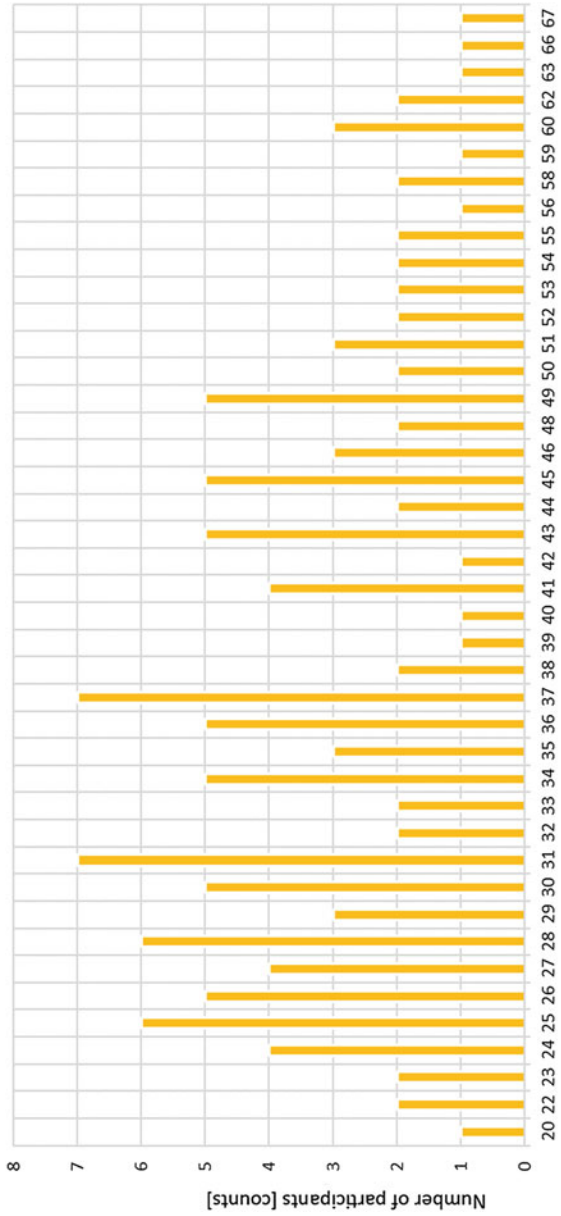

Figure 5.7 Ages of the survey's participants. (Source: own representation based on findings)

Most of the participants were rather well educated: 70% of them hold a university degree (Bachelor, Master's or Doctoral Degree) and more than 20% are students or are enrolled in an academic apprenticeship program.

As per Figure 5.8, 49% of the participants are from within three major sectors only: Professional Services, IT & Communication (ITC) or Basic goods manufacturing are the dominating sectors within the present study. Hence, market-related findings will instead focus on these three markets.

The research has revealed, indeed, different and sector-independently age classes in the context of digital knowledge, mindset as well as the way on how digital technologies are being seen and rated:

- young (professionals) up to 30 years
- experienced professionals from 31 to 50 years and
- senior professionals from 51 years on

All three classes show common characteristics when it comes to evaluating the impact of digital technologies as described in the followings.

b) *Impact, usage and skills related to digital technologies as seen by professionals*

Even though over 80% of the surveys' participants confirm that digital technologies have a strong or even very strong impact on the economy in general, differences can be described when it comes into details. Only 58% confirm a strong or very strong dependency digital technologies impacting the own market and organisation. Looking at the three groups of professionals as introduced above; however, some particularities can be described up front.

In general, young professionals have a much higher digital affinity, and user experience than seniors do have (Paul and Stegbauer, 2005): the reasons are described in being associated with the rapid development of the digital technologies in the early years of the 2000 s. The less digital experience of elderly businesspeople is, nevertheless, compensated by a higher level of seniority, leading to much more working experience and the capability to understand the market functionalities in the traditional way. This leads to the assumption that the impact of digital technologies on business performance should be seen and rated differently from within the three described groups. In this regard, the experienced professionals, as the intermediate group, play a bridging role between both fringe groups: they grew up, surrounded by the upcoming IT technologies, when the disruptive potential was still unknown in its wideness as well as with the internet while developing their business skills and learning from existing market rules. In this

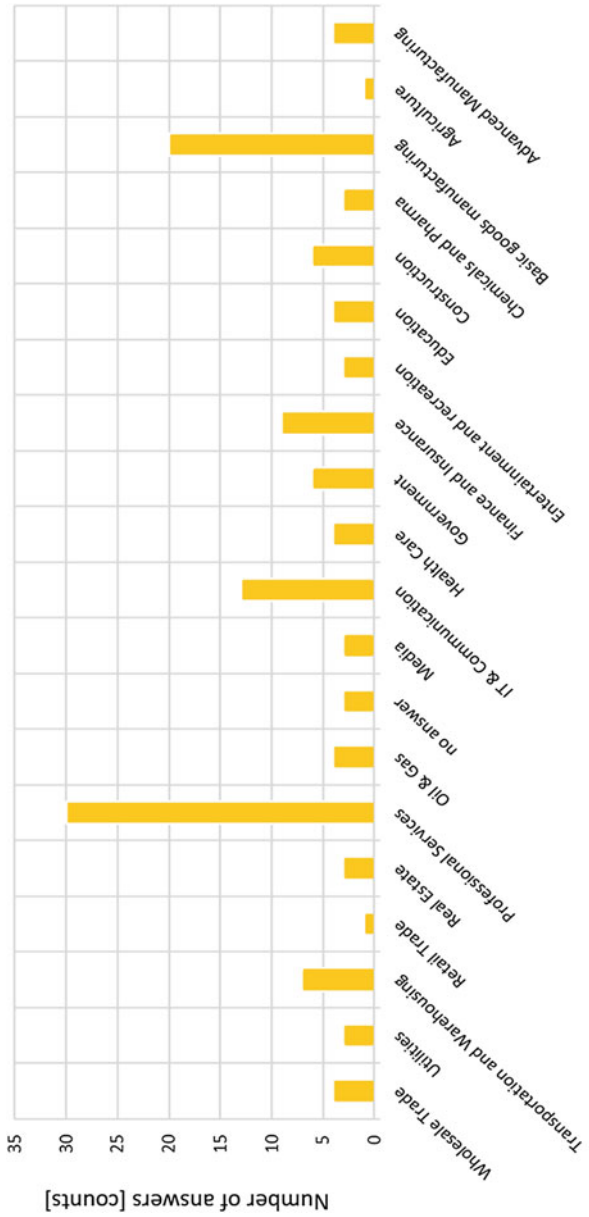

Figure 5.8 Sectors from within the participants. (Source: own representation based on findings)

sense the today's intermediate, experienced group of professionals with ages in between 30 and 50 years seem to understand both, the young professionals as well the senior professionals. They might be able to lever unused digital potential best as the findings show:

As seen in the following Figure 5.9, only 29% of the young professionals state that enough investments have been made into digital assets. This includes software and hardware products, or IT-services sourced. Thus, the majority, 68%, claim that much more efforts are needed.

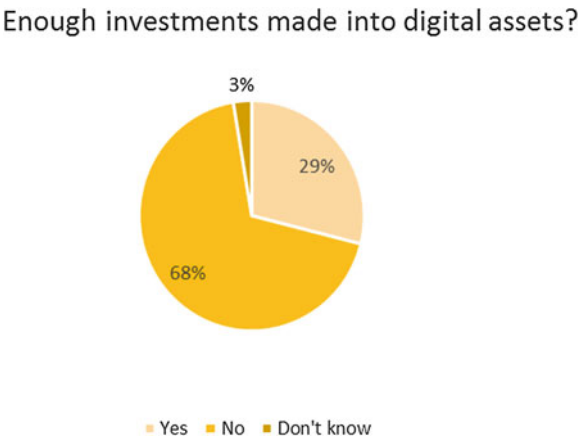

Figure 5.9 Young professionals' evaluation of investments in digital assets. (Source: own representation based on findings)

Comparing the young professional's evaluation with the one of the experienced group the differences between such become obvious: even 83% of the experienced professionals seek for more investments into digital technologies contrary to 12% stating the existence of enough investments made in digital technologies (Figure 5.10).

Interestingly, the experienced professionals are the group with the highest claim to invest much more in digital assets: relatively, only 61% of senior professionals do share this opinion (Figure 5.11) while 39% seem to be satisfied with the current situation compared to only 12% of the experienced professionals.

Asked for the general expected financial impact by investing in digital technologies, all three groups agree and see a positive correlation between investments

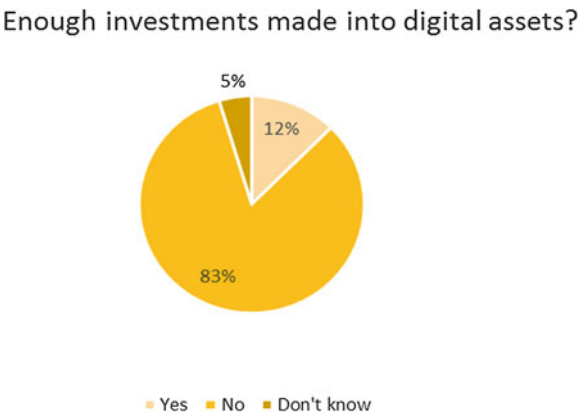

Figure 5.10 Experienced professionals' evaluation of investments in digital assets. (Source: own representation based on findings)

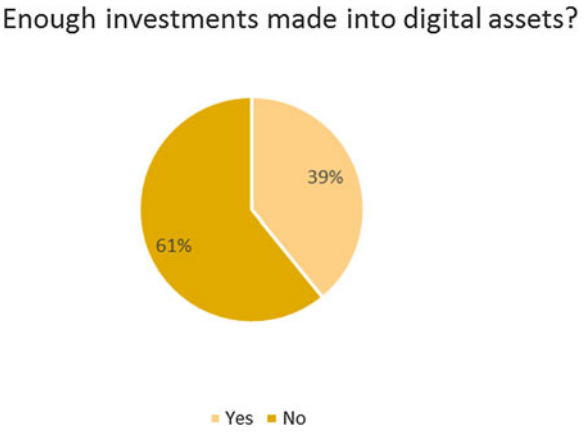

Figure 5.11 Senior professionals' evaluation of investments in digital assets. (Source: own representation based on findings)

and economic benefits: 70% of the seniors, 63% of the experienced and 79% of the young professional's state that digital tools will increase the organisations' profit.

When it comes to assessing the specific usage of provided digital tools to the employees and its estimated impact on the corporate financial results, however, differences within the younger and experienced group can be observed. No change according to the senior's group (70%) but the experienced professionals see a higher impact with 83% of the participants and even 92% within the young professionals. Seniors do not see any difference between buying and using digital technologies as they might assume that they are used anyway when bought. However, tools are not always used as they could be. The lack of digital skills for using new technologies within organisations seems still to play a role as could be elaborated as well.

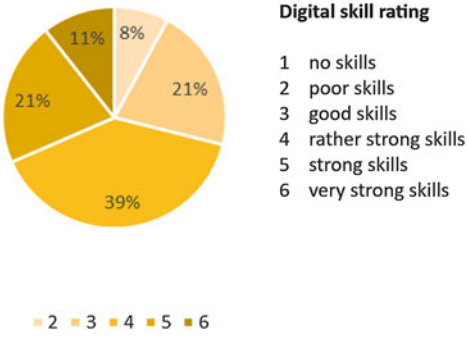

Figure 5.12 Young professionals' evaluations of digital skills within their organisations. (Source: own representation based on research findings)

While young professionals estimate a rather high existence of digital skills (Figure 5.12) among the organisations' employees (71% rather strong, strong or very strong skills), seniors estimate even a higher internal grade of existing digital skills with a total of 87% (Figure 5.14).

Only the experienced group of professionals see the apparent need for improvement in order to fully exploit the potential of digital technologies (Figure 5.13): 52% confirm rather high skills compared to 48% estimating weak skills.

Organisations' grade of digitisation as seen by the professionals

The following evaluation concentrates on the rated grade of digitisation. The authors clearly understand that the individual ratings by each participant have uncertainties. Based on 131 responses in total for all markets, the results are—so to speak—to be indications only, if related to a single market. Moreover, the rating of each participant is considered in being subjective and also depends on parameters such as knowledge in digital technologies as well as the understanding

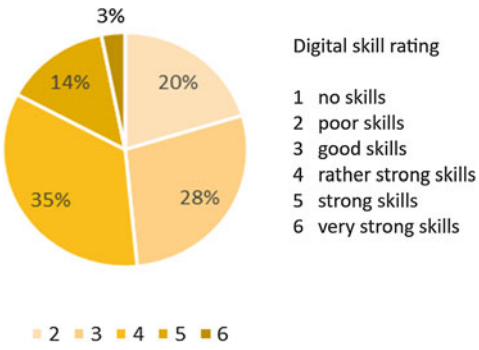

Figure 5.13 Experienced professionals' evaluations on digital skills within their organisations. (Source: own representation based on research findings)

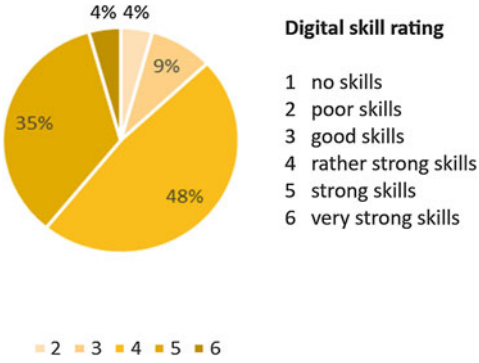

Figure 5.14 Seniors' professionals' evaluations on digital skills within their organisations. (Source: own representation based on research findings)

of its usage in the specific field within the organisation. Especially in large-scale organisations, it is quite not possible to understand the grade of digitisation in other departments. Hence, the evaluation must be read with care and represents only meaningfulness when the background is understood.

Nevertheless, the following results were being compared with the precursor study as defined reference point published by McKinsey GT (2016). The digitisation grade of each sector could generally be generally confirmed although the ranking might show little differences. However, the general assessment outcome shows very comparable classes. This leads to the assumption that at least for the three selected markets with the highest number of participants (professional services, ITC and basic goods manufacturing), the data collected can be meaningfully analysed. The performed assessment specifically related to the usage of digital technologies along the value-added chain overall markets seems to be the

first of its kind: as far as reviewed within the academic literature, no research has been performed so far. Further studies in this field might provide new, additional findings.

In the following, the participants' organisations' grade of digitisation is being compared with the estimated competition's grade of digitisation.

The evaluation of the competitions' grade of digitisation compared to the own one is indistinct: all three age groups of professionals (young, experienced and senior) are not able to provide an explicit rating. Overall participants and sectors, 40% evaluate in having a lower grade of digitisation, 27% just do not know, and the remaining 33% estimate in having higher digitised their organisation. Young and experienced professionals show similar ratings: 31% of the young and experienced professionals' rate their owns' organisations grade of digitisation higher than the one from the competition, 41% from the experienced professionals and 45% from the young professionals estimate in having a lower degree of digitisation. The senior professionals estimate a much higher grade of digitisation (48%) compared to only 22% stating in estimating being less digitised as the competition (Figure 5.15).

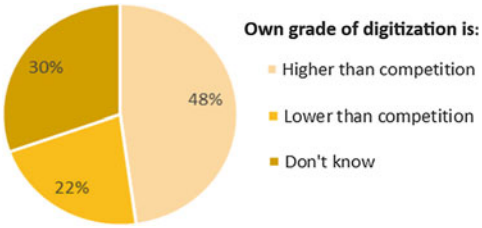

Figure 5.15 Seniors' professional's rating on their own grade of digitisation compared to the competitions grade of digitisation. (Source: own representation based on research findings)

A meaningful assessment with regards to market specific analyses can only be performed for the mentioned, three relevant markets "professional services", "ITC" and "basic Good Manufacturing". Except for the ITC sector, the other two markets evaluate a higher own grade of digitisation compared to the competition. However, uncertainty remains high, especially within the basic good manufacturing sector (Figure 5.16).

In this regard, it shall be mentioned that especially evaluations of individuals are very dependent on specific knowledge, the expertise in the relevant fields as well as on the own working environment. Professionals working within domains such as consulting, marketing, sales or affiliated areas, for instance, are considered in having higher insights from within the market than inside-oriented job

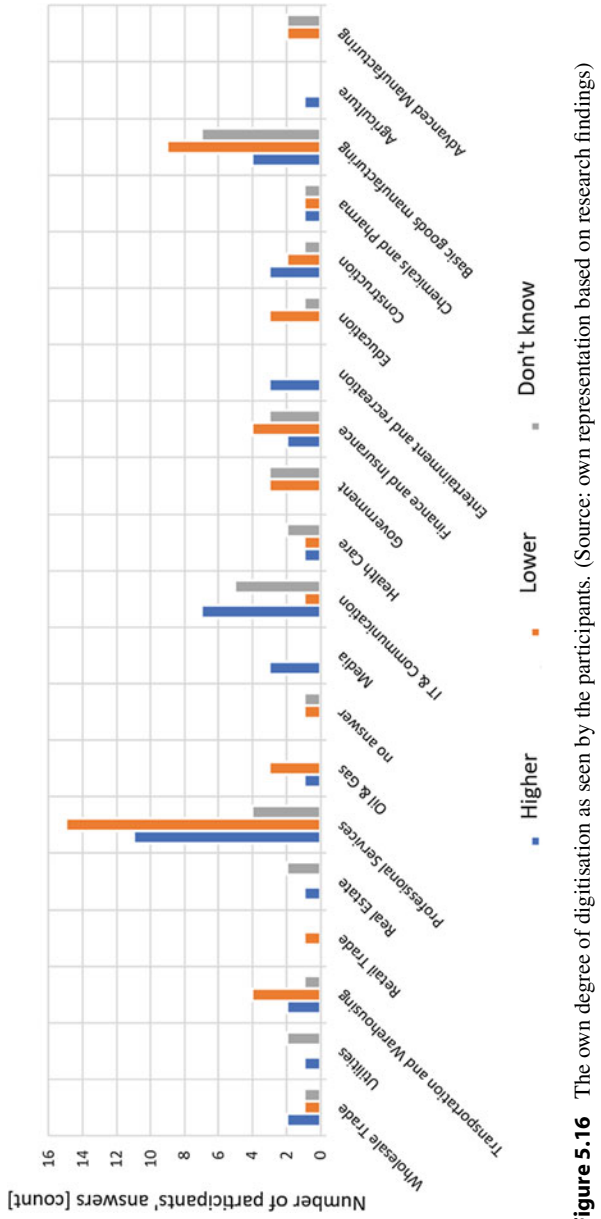

Figure 5.16 The own degree of digitisation as seen by the participants. (Source: own representation based on research findings)

profiles. Those external-oriented jobs get deeper market-related insights than positions within the organisation. Still, organisations are usually non-transparent for outsiders: on the one hand, organisations can influence their image on the market with the help of various marketing and PR activities. On the other hand, organisations are themselves observing the market and are also generally influenced by the competitors in their marketing activities. Especially in markets where the affinity for digital technologies is high and where new trends and developments are evolving fast, an image-wise competition can occur in order to be attractive for customers. However, not always the (technology-based) image is representing the real competence of organisations as seen by the market. Uncertainty remains in any case.

Deployment of digital technologies

The previous findings have shown that digital technologies are in usage within all markets. One key element of the study was to evaluate in which organisations' business activities digital tools are already implemented to improve efficiency. Depending on the maturity level of individual digital elements, some standard tools such as the usage of electronic communication channels (e.g. email, video-chat systems and other) are deployed within every department. Others, as it is the case for recently upcoming technologies such as artificial intelligence algorithm (e.g. as an analytic tool for churn analytics within marketing activities), are deployed not in all but single markets and departments. Email is by far the most deployed digital technology in organisations overall professionals with 98% of usage. Depending on the market, organisational technologies such as Enterprise Resource Planning (ERP), Customer Relation Management (CRM)—Systems, electronic online shops, cloud storage systems or newer technologies such as Internet of Things (IoT) are deployed very different depending on market or type of customer (business-to-customer (B2C) versus business-to-business (B2B) market) when looking to the three selected markets where the findings provide specific indications. For example, 25% of basic good manufacturers use eShops, while 13% of professional services and 8% of ITC organisations make use of it. This is surprising as eShops is a rapidly increasing market, and the technology is developed. However, it seems that cloud services, for example, are convenient because the usage of such cloud-based services (storage, software…) is higher than expected: 35% of the basic good manufacturer, 50% of professional service providers and even 77% of ITC companies make use of it. Far behind within all sectors are still IoT—applications which are, nevertheless, seen today as the next "big innovation" to increase the business performance.

As mentioned above, the research included an assessment of the deployment of digital technologies according to Porters' definition of the value-added chain (Porter, 2001; Porter, 2014). In this context the assessment shows that today's digital technologies' deployment is in progress within the complete value-adding chain overall all markets: based on a rating from 1 (low) to 6 (high deployment of digital technologies), "Human Ressources (HR)" is less digitized than any other part of the chain. "Infrastructure" as the backbone of each organisation, by contrast, show the highest deployment of digital technologies overall markets (Figure 5.17).

Grade of Digitalization within the value-added chain per sector	Inbound Logistic	Production	Outbound Logistic	Marketing&Sales	Customer Service	Sourcing	Technology	HR	Infrastructure	Average
Media	4,00	5,00	5,00	5,33	5,00	4,50		4,50	4,67	4,75
Agriculture					6,00	2,00	6,00	3,00	6,00	4,60
Entertainment and recreation	4,00		5,00	5,00	4,67	5,00	6,00	3,33	3,67	4,58
IT & Communication	3,57	4,00	4,67	4,00	4,82	4,00	5,08	4,17	4,36	4,30
Real Estate	3,50	4,50	5,00	3,50	3,50	3,00	4,00	4,00	5,00	4,00
Education	4,00		3,00	4,00	4,00	4,00	3,67	4,33	3,75	3,84
Chemicals and Pharma	4,00	3,67	4,00	3,00	3,50	4,00	4,00	4,00	4,33	3,83
Health Care	3,00	4,00	3,00	4,33	3,33	3,67	4,00	4,00	5,00	3,81
Professional Services	2,90	4,25	3,46	3,81	3,91	3,28	4,06	3,28	4,07	3,67
Advanced Manufacturing	3,50	5,33	3,50	3,00	2,67	3,00	3,67	3,00	4,00	3,52
Transportation and Warehousing	3,67	2,25	3,67	3,67	4,20	3,00	3,60	3,80	3,00	3,43
Construction	2,33	3,00	3,50	3,50	3,33	3,75	3,25	3,50	4,00	3,35
Finance and Insurance	3,00	3,50	3,20	3,75	3,50	3,00	3,17	2,88	4,13	3,35
Basic goods manufacturing	3,36	3,41	3,53	3,39	3,33	3,33	3,59	2,80	3,25	3,33
Wholesale Trade	4,25	3,00	3,67	3,50	3,00	3,00	2,33	2,50	3,25	3,17
Government	3,50	4,00	2,00	2,80	3,00	3,20	3,00	2,40	3,00	2,99
Retail Trade	4,00	4,00	5,00	2,00	2,00	3,00	2,00	2,00	2,00	2,89
Utilities	2,33	2,50	2,00	2,00	3,00	4,33	3,50	2,00	3,33	2,78
Oil & Gas	2,25	2,00	2,00	2,50	2,00	2,25	2,25	1,00	3,25	2,17
Average	3,40	3,65	3,62	3,50	3,62	3,44	3,73	3,18	3,90	

Figure 5.17 Grade of digitisation along the value-added chain among the various sectors. (Source: own elaboration based on research findings)

The graduation between the selected sectors "ITC", "professional services" and "Basic good manufacturing" correspond to the graduation order as found by the precursor study of McKinsey GT. In this sense, the findings for the three selected markets are considered in being coherent: with a high affinity for digital technologies, the "ITC"-market is leading the trio with a digitisation score of 4,3 followed by the market of "professional services" (score of 3,7) and "basic good manufacturing" (score of 3,3). This seems not to be a surprise as the "ITC" sector is likely to be highly affiliated with digital technologies. Within all three markets,

the Porter- chain link "Technology" represents the highest grade of digitisation and "Inbound logistics" the lowest grade.

Summary and conclusion of the performed study

The present research has given a more in-depth view of digital technologies used in organisations provided by businesspeople from within different markets. Furthermore, the answers offered an understanding of the professionals themselves and their digital attitude as well as their judgement perceptions on the deployment of digital technologies in their organisation. At this stage, it can be stated that especially the experienced professionals do often not have the same position as their younger or older colleagues.

Based on the present survey outcome, this intermediate group between 31 and 50 years recommend much more investments in digital technologies, acknowledge a higher relation between the usage of such technologies and the expected financial impact, see rather low than high digital skills within their organisation.

Bearing in mind the grade of digitisation within the different markets and their deployment in the respective departments, the un-used potential for increasing the business performance is rather high. Considering furthermore that over 80% of the participants see a high impact on the economy, the risk of not anticipating more efforts is high.

It would be wise for the (top) management of organisations to continuously observe the market for new trends within digitisation and automation, to review the own grade of digitisation along the value-added chain and to think about their current business models to enhance the organisations' performance by respecting digital technologies within their innovation activities.

The last chapter complements the previous chapters' findings by investigating the innovation activities of a settled startup company from a holistic research approach and by testing a circular business framework aiming to analyse the value outcome related to innovation activities. Before developing a managerial framework as concluding work based on the studies performed within the doctoral studies, a literature analysis is conducted focusing on elaborating suitable techniques for the evaluation of ideas within the fuzzy-front-end (FFE).

6 Developing a Business Innovation Model for the Early Stage of the Innovation Process in the Context of the Circular Economy

6.1 Study on the Organisational Innovation Process Concerning the Early Stage of Idea Evaluation

6.1.1 Context of research

The following chapter is related to researches performed in 2018 in which techniques of idea evaluations were analysed as methods for the generation of innovations within organisations. In this regard, the study focuses on the early stage of the innovation process.

The need for continuously more promising ideas within companies is to be found in the increased pressure through globalisation as well as a shift from a seller to a buyer-oriented market which has forced organisations to increase their quality and process efficiency. The last century, companies have mainly focused their efforts on the optimisation of production processes to gain competitive advantages. Nowadays, the grade of lean production has reached a performant level, and further ameliorations are mainly achieved by integrating data-related technologies (see chapter 2 as well). Competitive edges are related to the response of new requirements which arise out of continuously rapid changes from within the markets. Reasons are for sure the upcoming new, digital-based technologies, still the emerging markets and continuous political imbalances worldwide. Hence,

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organisations need to react appropriately in order to sustain in the long-term. Answers can be found in new services, products, processes or even new business models to satisfy customers and to increase the business performance.

More and more, organisations have learned that innovation is today the key for sustainable performance by offering suitable solutions to customers respecting the value generation. However, mastering the innovation process is still a challenge for quite a lot of organisations. The unpredictable character of innovations and its initial ignition can lead either to losses or to profits. Often organisations concentrate only on what they do than on how the market is developing in such a way that they are not anymore able to react in a proper way to adapt themselves and their offerings (Vlachaki, 2010). For instance, looking to the 15 most valuable companies traded at the stock market since the year 2000, only a few companies are still on the list. Most of them were practically overwhelmed by technological changes and disruptive solutions offered by competitors (Desjardins, 2018). Even if there is no guarantee for innovation success, studies have shown that innovative organisations endure numerous challenges and are even able to increase their profitability over time (Gassmann & Sutter, 2011).

However, how can organisations increase their innovation performance? Beside an innovation-friendly corporate culture, managers need to encourage their employees to identify new opportunities continuously.

Once employees generate ideas in the early stage of each innovation process, the innovation team and the managers need somehow to evaluate the innovative potential of each promising idea. Even if the starting point of the innovation process is not clear, it is suggested using techniques which will help to understand and evaluate the so-called "fuzzy-front-end" (FFE) where ideas are still vague and the potential unclear. However, out of them, very few will be real opportunities and even less will turn into profit. In this context, empiric studies have revealed that an open innovation approach by involving customers is more promising when it comes to evaluating ideas in the FFE. Unbalanced hierarchy involvement, by contrast, can influence the assessment in two different directions. A positive influence can be achieved by offering methods such as idea evaluating systems only. Negative influence can be observed when controlling the evaluation process itself. Therefore, mechanisms are to be considered to ensure an objective and comprehensible way to evaluate ideas (Keum and See, 2017; Thanasopon et al., 2016; Murswieck et al., 2018; Wooten and Ulrich, 2017). Additionally, studies have also confirmed with the help of electroencephalography (EEG) measurements that the phase of idea evaluating is once more stimulating the brain activities and supporting to rethink effectively about occurred ideas within the screening process

(Hao et al., 2016). The evaluation of ideas, hence, can be described as an effective phase supporting the innovation outcome.

This critical, initial phase of the innovation is the beginning of a process where ideas, suggestions or any other stimulus are being generated and either accepted or rejected (Hauschildt et al., 2016). In order to minimise the risk of rejecting promising ideas within the FFE, the present research performed intended to identify available and proven techniques based on empiric studies to support managers in the idea evaluation phase.

6.1.2 Targets and Research Methodology

Especially the FFE—phase of the innovation process is still an uncharted field of research (Binder, 2014). Hence, the purpose of the study is to review existing methods of evaluation and to track down applicable methods for managers of any organisation regardless of their knowledge in the field of innovation management. Nowadays, ideas are needed within all departments and not only in the traditional R&D department. Keeping in mind that ideas need to promote the business performance, managers but also specialised staff need simple-to-apply techniques for evaluating ideas leading to promising innovations. Similar to the context of innovation indicators, evaluations of ideas are often too theoretical and not deployable in the day-to-day business where time is limited and resources costly. In some cases, training would be needed to understand the evaluation techniques, and in other cases, methods might not be suitable even if they are simple to understand. In practice, effective methods are needed which

- are quick to understand by the person in charge,
- simple to deploy within the daily business and
- which are useful to use for accepting or rejecting ideas in the initial phase of innovation.

The selection of the presented evaluation methods is based on a literature review and the analysis of existing studies in this field of research. Related to the FFE of the innovation process, the main question to be asked is, if an idea will generate enough value to the customer and the organisation, respectively, or not.

The principal characteristic of the study is shown in Table 6.1.

In this regard, the present study conducts a comparison of the different methods selected. Before the presentation of the findings, however, a brief introduction of

Table 6.1 Characteristics of the study

Aspect	Description
Research target	Selecting appropriate techniques for the evaluation of ideas within the innovation process as part of the idea management
Research period	December 2017—April 2018
Form of research	Literature review based on international databases: ScienceDirect / Elsevier Google scholar listed publications Criteria for the selection of articles: Included keywords within the search: (evaluation OR screening OR methods OR tools) AND (innovation OR idea) AND (early stage OR fuzzy front end) English or German articles Context: innovation management and innovation process Relevance: applicable to SME's, easy to deploy, no or little training need for understanding

Source: own representation

the innovation process is given to make the FFE phase more visible as part or within the early stage of the innovation process.

6.1.3 Results and key Findings Related to the Study on the Organisational Innovation Process Concerning the Early Stage of Idea Evaluation

To understand the context of idea evaluation techniques, first, an overview of the innovation process is given. Without going into details, different models of the innovation process within the literature are existing, starting from three phases (Van de Ven, 1990; Verloop, 2004; Hansen and Birkinshaw, 2007) up to seven phases (Tidd et al., 2001) within the process.

Most innovation process models applied today, however, were already developed in 1990 but are still in use. The often adopted model within R&D departments in the industry is the so-called "Cooper's Stage-Gate"—process (Figure 6.1) where ideas are being investigated within the first two stages. The model is quite lean and easy to deploy, which might be the reason for its high market penetration.

A more stringent but more complicated process, for instance, is the so-called "Pflichten- und Lastenheft" (Ebert et al., 1992) from Germany. It is a specification

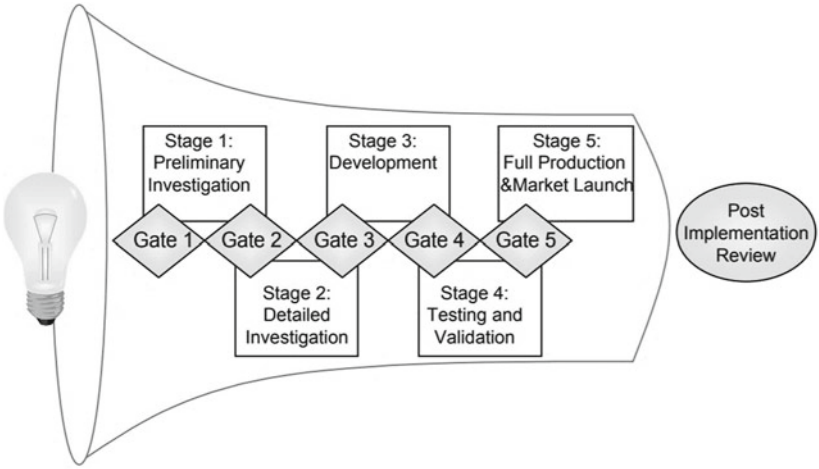

Figure 6.1 The 3rd generation innovation stage-gate-process acc. to Cooper. (Source: Cooper, R. G. (1996). Overhauling the new product process, Industrial Marketing Management, 25 (6), pp. 465–482)

requirements sheet based on a problem-approach (Figure 6.2) but also considering aspects of the company-strategy and typically found in technological-oriented product developments in German companies. Both models include the evaluation of the ideas occurred as part of the process in the early stage.

As a reference for the present analysis, Figure 6.3 shows the generic innovation process according to the technical specification (TS)—definition of the Communauté Européene de Normalisation (CEN) with simplified 6 phases including an additional assessment and improvement phase respecting in this regard the earlier mentioned PDCA-approach (CEN, 2013). Neverminded the type of innovation process model, basically all start somehow with the generation of the ideas, the management of the ideas, respectively, prior to the developing, exploiting and launching of the idea. In any case, the successful introduction of an idea to the market as an innovation of any kind by creating value to organisations is dependent on the initial idea itself; this is to be seen neverminded if it is a product, a service, an optimisation of a process or even a new business model. Therefore, ideas need to be selected before further processing within the innovation process.

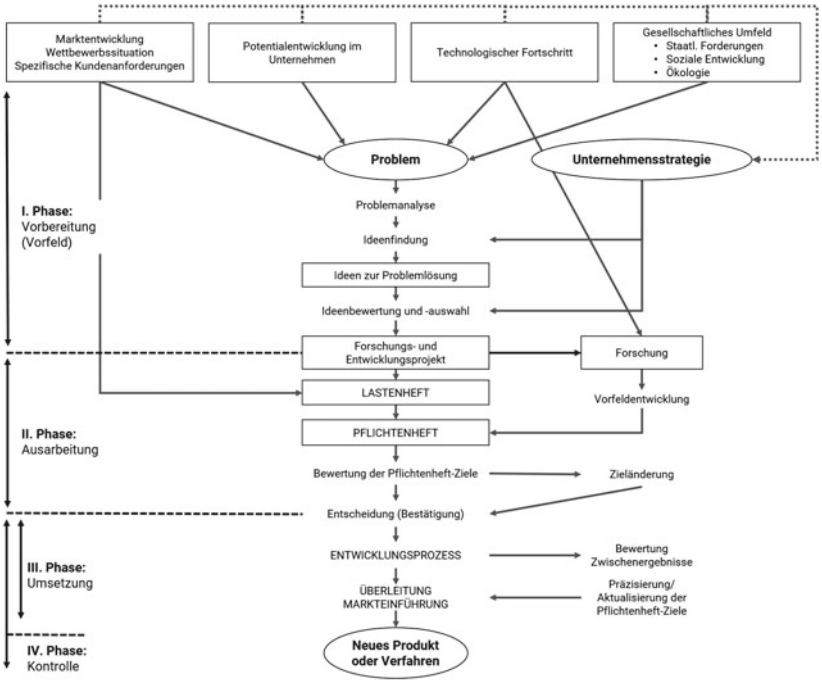

Figure 6.2 Specification requirements sheet as used in Germany as part of the idea evaluation process. (Source: own representation according to Ebert, G., Pleschak, F., Sabisch, H. (1992). ‚Aktuelle Aufgaben des Forschungs- und Entwicklungscontrolling in Industrieunternehmen' in: Gemünden, H. G./ Pleschak, F. (Hrsg.), Innovationsmanagement und Wettbewerbsfähigkeit, Gabler: Wiesbaden)

There are various methods which were developed in the past and nowadays still existing to evaluate the potential of an idea are promising to reduce the risk of failure (Dumitran et al., 2013; Gavriş, 2017).

Keeping in mind the objective of the present study to identify "easy-to-implement"—techniques for practitioners two main groups of methods were being carved out:

- The methods of checklist
- The methods of evaluation matrix

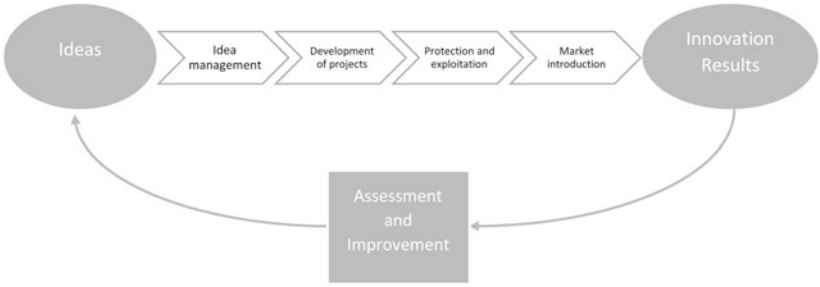

Figure 6.3 The innovation management process as described in CEN/TS 16555–1. (Source: own representation based on CEN (2013). CEN/TS 16555–1. [online] Available at: https://standards.cen.eu/dyn/www/f?p=204:110:0::::FSP_PROJECT,FSP_ORG_ID:35932,671850&cs=13A816A57184977C465944D2F2E2C5645 [Accessed 28 May 2019])

All methods elaborated are to be used whenever ideas occur, also within the individual steps of the innovation process.

a) *Methods of checklist*

This type of idea evaluation is not only quite common in practice, but there is also a wide range of various checklists available, handbooks and software to evaluate and plan business ideas. Ideas for business arise very often in organisations.

In the following three types of checklists are briefly presented being suitable specifically for small-medium-enterprises in their adaption and for deployment:

- Scoring the suitability of business ideas
- Evaluating ideas for a business or product
- Evaluating new product ideas

The first checklist, "Scoring the suitability of business ideas", is related to answering multiple questions by scoring each of them usually from 1 to 3 (3 being the score with the most substantial influence/importance). In principle, when all questions are answered, scored respectively, the scoring sum of each idea is calculated while the idea with the highest score is the "best" which should be selected.

An example of such scoring checklist is being shown in the following Table 6.2.

Table 6.2 Checklist "Scoring the suitability of business ideas"

Checklist questions	Business ideas				
	B1	B2	B3	B4	B5
Are you familiar with the operations of this type of business?					
Does the business meet your investment goals?					
Does the business meet your income goals?					
Does the business generate enough profits?					
Do you feel comfortable with the business?					
Does your family feel comfortable with the business?					
Does the business satisfy your sense of status?					
Is the business compatible with your people skills?					
Is there good growth projected for the overall industry of the business?					
Is the risk factor acceptable?					
Does the business require long hours?					
Is the business location-sensitive?					
Does the business fit your personal goals and objectives?					
Does this business fit your professional skills?					
TOTAL					

Source: own representation based on Rebernik, M. (n.d.). Module 4: Idea evaluation methods and techniques. [ebook] University of Maribor. Available at: https://pdfs.semanticscholar.org/10eb/1b821901aa1ad92692514607f9043102b920.pdf [Accessed 25 Feb. 2018].

In the case of a more detailed evaluation of a business or an idea, the presented scoring system might not be enough. Especially entrepreneurs and managers who want to identify the potential of their ideas related to a product or a complete business case the checklist as per Table 6.3, developed by the Princeton Creative Research Institute, is more suitable.

Each question needs to be answered preferably with details and some with arguments to pass the first screening stage.

Table 6.3 Checklist "Evaluating ideas for a business or product"

Checklist questions	Answer/ Arguments
Have you considered all the advantages or benefits of the idea? Is there a real need for it?	
Have you pinpointed the exact problems or difficulties your idea is expected to solve?	
Is your idea an original, new concept, or is it a new combination or adaptation?	
What immediate or short-range gains or results can be anticipated? Are the projected returns adequate? Are the risk factors acceptable?	
What long-range benefits can be anticipated?	
Have you checked the idea for faults or limitations?	
Are there any problems the idea might create? What are the changes involved?	
How simple or complex is going to be the idea's execution or implementation?	
Could you work out several variations of the idea? Could you offer alternative ideas?	
Does your idea have a natural sales appeal? Is the market ready for it? Can customers afford it? Will they buy it? Is there a timing factor?	
What, if anything, is your competition doing in this area? Can your company be competitive?	
Have you considered the possibility of user resistance or difficulties?	
Does your idea fill a real need, or does the need have to be created through promotional and advertising efforts?	
How soon could the idea be put into operation?	

Source: own representation according to Princeton Creative Research Institute and based on Entrepreneur.com (n.d.). Idea Evaluation Checklist. [online] Available at: https://www.entrepreneur.com/article/81940 [Accessed 20 Feb. 2018].

An alternative for the selection of product or service ideas is the following so-called "21-point invention evaluation checklist" (Table 6.4) where certain criterions are being checked.

Table 6.4 Checklist "Evaluating new product ideas"

Criteria	Compliance with criteria
General Criteria	
Is your idea legal?	
What is its environmental impact?	
Is it safe?	
Is it high quality?	
Will it have wide social acceptance?	
Will it have any negative impact?	
Industry Criteria	
Who is your competition?	
Does your product require the assistance of existing products?	
Is there just one product or a line of products?	
Will pricing be competitive?	
Market Criteria	
Does your idea fit into a trend?	
Is there a need for it?	
Is it seasonal?	
Is it a fad, or does it have long-term value?	
Who will buy it?	
Does it need instructions?	
Product Criteria	
How much will it cost to get your idea to market?	
Does it require service or maintenance?	
Is there a warranty?	
Does it need packaging?	
Is it the simplest and most attractive it can be?	

Source: own representation according to Entrepreneur.com (n.d.). 21-Point Invention Evaluation Checklist. [online] Available at: https://www.entrepreneur.com/article/81922 [Accessed 28 May 2019].

The 21-point invention evaluation checklist respects several parts prior to launching especially products or services and might also provide further thoughts not taken into consideration.

All three checklist methods presented have the main advantage that they are easy to use and implement by entrepreneurs, managers and innovation experts. Furthermore, they can be used one after the next to generate new aspects of an idea on the one hand and to select then the best idea out of several on the other hand. In all cases, the checklists support managers in their efforts to managing ideas in the early stage of the innovation process by focusing on the essentials of an idea: the worthiness of an idea for the organisations' targets.

b) Methods of evaluation matrix

The following, more sophisticated but still applicable method to apply when evaluating ideas is explained based on the checklist example shown in Table 6.5 Instead of evaluating each idea individually, various ideas related to a specific topic can be rated within one sheet and selected accordingly. This method is also known as "grid analysis" or "Analytical Hierarchy Process (AHP) matrix" or other names sometimes with little variations but always supporting the decision-making process with the help of a rating and weighting of different ideas upon defined criterions.

Table 6.5 Method of evaluation matrix

Criteria	Importance	Alternatives					
		Option A		Option B		Option C	
		Rating	Score	Rating	Score	Rating	Score
C1							
C2							
C3							
Total							

Source: own representation based on Rebernik, M. (n.d.). Module 4: Idea evaluation methods and techniques. [ebook] University of Maribor. Available at: https://pdfs.semanticscholar.org/10eb/1b821901aa1ad92692514607f9043102b920.pdf [Accessed 25 Feb. 2018].

The idea evaluation with the help of a matrix can help when defined criterions are cross-linked so several, available options, solutions or just ideas. Therefore, different criteria which shall be the base for scoring the idea needs to be defined in advanced. The definition depends on the organisations' targets or the business case. The criterions are listed in the vertical axe of the table, and the options might be listed in the horizontal axe. Examples of criterions can be chosen from

the previously presented checklists. Each criterion shall be given a priority-score (the highest number being the most important and the lowest the less important criteria). Each option will be rated related to each criterion. If the rating is performed with numbers again, then the highest number should be the best rating (e.g. 3 being the highest to the criteria, 0 being the lowest) in order to multiply the rating with the important factor of the criteria leading to an option related total score. However, also other scoring systems are suitable depending on the number of criterions and options which form the complexity. At this point, it is figured out that ideas might be improved after the evaluation. The scoring system helps not only to evaluate ideas but also to understand the current state of the ideas.

In principle, the methods of evaluation based on a matrix shall provide an overview which of several ideas are most promising to succeed and impulses which idea might need to be improved prior to further processing.

The selected methods are an excerpt of many existing approaches within literature which were identified. The presented checklists aim to be easily implemented for any situation within the innovation process. Mostly, these techniques are being also used in spontaneous meetings as discovered in a separate study: they can occur in written or even in oral form when related to quick and rough evaluations (see the following chapter).

Organisations can adapt the checklists and methods according to their individual needs and can use them as a starting point within the innovation process. However, there are also limitations: the success of innovation cannot be guaranteed as the type of questions as well as the rating of the ideas are made by humans. As far as possible, standardised questions (e.g. the presented 21-point checklist) should be chosen related to the organisations' target. Even more, the evaluation should be based preferably on facts & figures than on feelings. Hence, using specific criteria can increase the efficiency within the innovation process and the effectiveness in choosing the right idea.

Other techniques not mentioned, such as the Strength-Weakness-Opportunities-Threats (SWOT)-analysis, might be more famous and widely used. However, especially the evaluation of ideas within the innovation process should instead be based on predefined, listed criterions with the help of checklists than on an open approach in order not to lose sight of specific aspects defined, for instance, within the organisation's strategy. Therefore, all checklists and criterions should be adapted to the organisation's value-adding objectives. Nevertheless, techniques like the SWOT—analysis do help in sensitise on specific topics and can, for example, be used prior to the evaluation of ideas.

In summary, the research's purpose was to identify adequate techniques for evaluating ideas correctly in the early stage of the innovation process. Innovations are crucial to survive and to make a profit. As Porter (2001), the well-known thought leader in value proposition is stating, the risk in generating and choosing ideas should not be left to chance but rather be based on specified processes (Porter, 2001). In this regard, the adapted checklists and evaluation matrix respecting the central vision of an organisation can support managers in their idea management.

The following chapter is related to the analysis of a start-up company and more specifically, to the study of the early stage of its innovation process. Interestingly, the presented techniques were applied at the beginning of each appearance of new ideas. Especially new companies where the need for generating turnover is crucial are confronted with thinking several times about the right idea prior investing time and money into a new idea.

6.2 Explorative Study on the Early Stage of the Innovation Process in the Context of Customer Satisfaction

6.2.1 Context and Research Framework

In the previous chapter "easy-to-apply-techniques" for the evaluation of ideas as part of the fuzzy-front-end of the innovation process were discussed and identified. The present chapter builds on and is related to a one-year explorative FFE-study performed in 2016/2017 (Murswieck et al., 2018) with a review assessment performed in 2018 to test the assessment from based on the elaborated synthesis (Table 16). As part of the doctoral researches, a pump manufacturing start-up company could be investigated, providing in-detail findings related to the innovation process in the early stage.

Existing researches have shown which conditions need to be fulfilled in order to increase the innovations' performance (Tellis et al., 2009; Ceausu et al., 2017; Trimm, 2016; Hochmeier, 2012): starting with an open-minded, innovation-friendly mindset, organisations sow the seeds for promising ideas and set the starting point for successful innovation activities. Theories and practical, relevant models have been described out of field studies, and the process of innovation has been studied intensively. Though the research on innovation management is a quite well-established field within science, still many organisations fail when it comes to managing innovations to success. Causes might be found in missing adoption of existing methods and tools. Alternatively, the increased dynamics of

business environments might perturbate the innovation performance due to new competitors, technologies or working conditions.

In many cases, it can be stated that the successful management of innovation especially in the beginning of the innovation process is not yet well explored and understood as the variation on how the seeds of innovations are being treated differs within organisations. The right way to generating, selecting and processing the right ideas in the early stage often remains "fuzzy". Especially in SME's or young organisations and start-ups defined innovation processes are not existent. By keeping in mind the fundamental aim of an organisation to profitably succeed within the increased global competition, it is crucial to explore chances for carving out competitive edges continuously. In this context, it is known that the early stage, and the fuzzy-front-end respectively, of the innovation process, is a field of research which needs still to be understood and where organisations need to adapt successful systems (Rowol and Bormann, 2015; Binder, 2014).

The following study provides the chance to gather in-depth data to the research community and to contribute to closing existing research gaps.

6.2.2 Targets and Research Methodology

Innovations occur variously and arise from within different sources inside and outside the organisation. The present study concentrated on the innovation process and ideas occurrence, which were born based on specific customer impulses or general, market-related impulses respectively aiming to provide mainly:

- information on how innovations are being generated in the FFE and treated in the early stage within the innovation process
- and to identify an understanding of the selection methods used whether an idea is being pursued or rejected.

The research design of the study aimed to conduct informal interviews and field observations of a German pump manufacturing start-up company (see Table 6.6) in order to identify working habits and finally to formulate a hypothesis related to the early stage of the innovation process.

For the study, the Grounded Theory Methodology (GTM) was chosen to apply according to Strauss and Corbin (1996) as it provides a recognised research approach within the social science community if it comes to perform in-depth explorative studies. Furthermore, it allows the researchers to gather data based on a qualitative method. As repeatedly mentioned, the FFE as part of the early

Table 6.6 Characteristic of the study the early stage of the innovation process in the context of customer satisfaction

Aspect	Characteristics
Observation period	October 2016 until October 2017
Review assessment	April 2018
Form of collection	Field observations informal interviews of management informal interviews of employees
Research object	German-based start-up company created mid-2015 Manufacturer and dealer of oil pumping systems
Execution of the survey	Performed by the author: field notes according to the Grounded Theory Methodology (GTM), iterative collection mode

Source: own representation

stage of the innovation process is still an unchartered field within research, and therefore, the chosen methodology shall provide unbiased data material to the research community. The principle idea of the GTM is to explore and formulate new theories and models out of empirical field observations. In this context, the GTM, according to Strauss/Corbin, offers an intermediate research methodology between both theoretical research poles: the positivism position on the one side and the constructivism position on the other side (Albeck, 2016; Brand, 2009). The latter one refers to a non-measurable reality due to its individualities; the positivism view, by contrast, is oriented to the natural science where the observed reality can be measured and proved. The GTM, however, aims to derive theory from data which is "systematically gathered and analysed through the research progress" and shall provide "insights, enhance understanding and provide a meaningful guide to action" (Strauss and Corbin, 1998, p. 12).

Starting with observations, performing (informal) interviews or analysing documents are proven techniques to be used by working with the GTM. In brief, three main aspects are described within the GTM in order to create a theory enabling users to take advantage out of it: describing, conceptual ordering and theorising or constructing (Figure 6.4). Theorising incorporates both the describing and the conceptual ordering and is the result of constructing a theory based on the data created. Therefore, the process of theorising starts with the description based on field observations, interviews or material found within the research object. Conceptual ordering builds upon the description made by structuring and

categorising the content (data out of description). This is made with the help of organising the data based on properties or dimensions, for example.

Figure 6.4 Understanding the aspects of the Grounded Theory Methodology. (Source: own representation based on Strauss, A.L. and Corbin J.M. (1996 [1990]), Grounded Theory: Grundlagen qualitativer Sozialforschung. Beltz/PsychologieVerlagsUnion Weinheim)

In the study performed first, all activities in the meetings were generally observed and only later selected with relation to innovation. In a second step and all further steps as part of an iterative process, occurred ideas and the processing flow was observed, including their degree/dimension of intensity (according to the GTM). Finally, they have been checked in how they lead to innovation or not. Based on this "organising process" a model was explicitly sketched for the early phase of the innovation process purely related to the observations made.

6.2.3 Results on the Early Stage of the Innovation Process in the Context of Customer Satisfaction

The observed start-up company based in Germany can be described as a manufacturing company which designs, engineers and assembles pumping systems for the crude oil exploration. Therefore, large assembly and testing equipment need to be bought and set up prior manufacturing of the products. Related to key figures and performance aspects the observed start-up company increased its total assets and equities significantly (installation of production machines) out of customer orders and separately negotiated supplier contracts without the need to be financed by a bank (Figure 6.5). In this regard, the start-up company can be described as performant during the observation period as the setup of the company (manufacturing) as well as the backlog order situation was favourable and well developing.

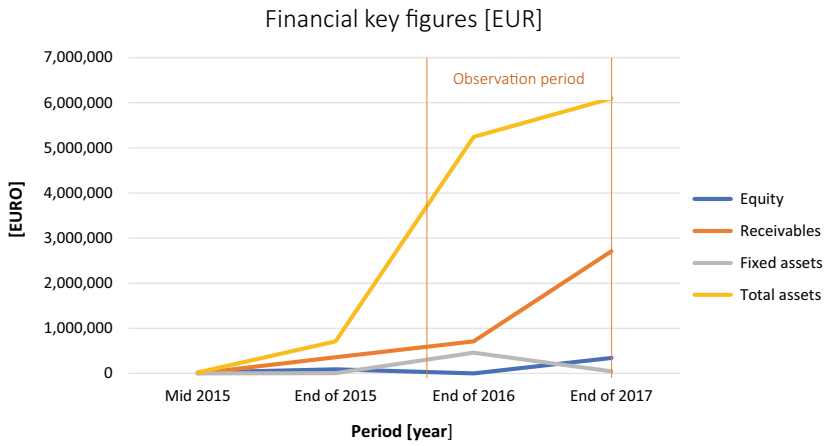

Figure 6.5 Financial key figures of the observed start-up company. (Source: own representation based on officially published company data on www.bundesanzeiger.de)

As described in the following in detail, the overall outcome of the observations made during the one-year-study showed that a relationship-oriented marketing approach mostly drove the company's activities. By that, the start-up could register a high and continuous order intake based on customer-oriented solutions. The development of innovations was mainly driven by both customer requests and demands resulting out of market expectations.

a) *Topics of interests in management meetings*

The open approach of the GTM allowed the author to observe and to take notes of the observations made during the multiple management meetings of the company without any formal interview. The meetings did not take place in a regular cycle but were convoked when needed in terms of urgency and when strategic decisions by the managing director were needed.

Though no formal rule or delegation of authority existed, only decisions with a higher financial impact (mostly more than 2k EUR) needed to be approved by the managing director. In total, roughly 2–4 meetings per month were analysed in 12 months.

The following subject ranking provides an overview of the topics discussed in the form of so-called "categories" which reflects the ordering process of the

descriptions based on the GTM. Figure 6.6 shows the most discussed topics within the management meetings by counts (larger surfaces result in a higher amount of counts within the discussions as typically performed within the GTM).

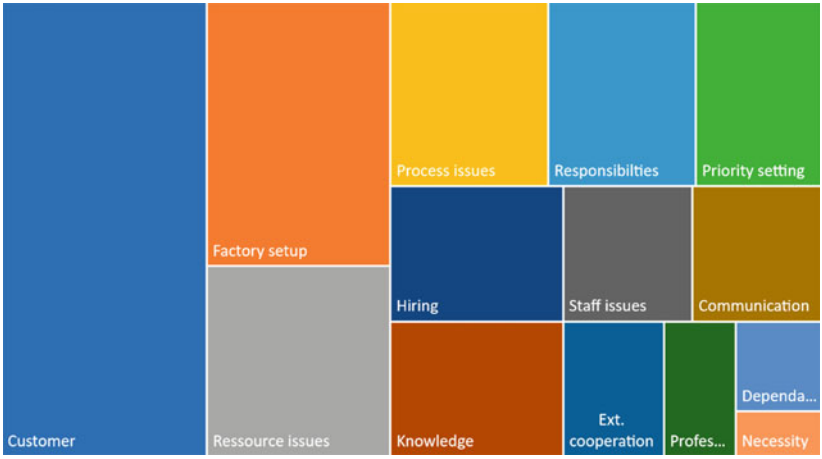

Figure 6.6 Elaborated categories by the importance of subjects within the management meetings according to the GTM. (Source: own representation based on research findings)

By far, the category "customer" was identified to be most in the focus of the discussions. The second most focused topic was the setup of the factory, followed by resources and process issues (third and fifth topic).

In some cases, the categories are linked to each other or strongly dependent on each other. In the following, a brief description/ meaning is given for each category prior to switching to the next outcome related to the management of innovation.

Customer:	expectations and requests related to products, projects and the company
Factory setup:	topics related to the installation of machines and equipment in order to manufacture the products
Resource issues:	described bottlenecks related to financial of human resources
Process issues:	topics related to unclear or not defined processes within the organisation

Responsibilities:	issues related to unclear responsibilities either of departments or individuals
Priority setting:	Discussions related on what tasks have a higher priority based on existing resources (linked to "resources issues").
Hiring:	discussions related to hiring new people to counteract resource issues (linked to resource issues)
Knowledge:	topics related to missing knowledge to fulfil a task
Staff issues:	topics related to personal staff issues such as performance, illness or others
Communication:	all topics related to misunderstanding or non-communication between the departments (linked to process issues)
External cooperation:	topics based on external interactions such as suppliers and partners in order to execute customer orders
Professionalism:	Discussions in which the outside company image was the topic (linked to the customer)
Dependency:	all topics were external dependencies were discussed (mainly customer dependency -> linked to the customer)
Necessity:	All other topics which were related to "must do's" in order to run the business

Bridging the linked topic as just described and creating a new overview with the number of real counts the following Figure 6.7 still demonstrates the influential role of the customer and its expectations. As seen in the following, expectations and request are being treated with care and taken seriously aiming to fulfil and satisfy the customers.

The customer remains the most important topic within the meetings despite other internal topics. After all, the other categories are also somehow linked to the customer as the target is to deliver the requested solutions. The findings show that the customer plays a significant role, hence, that the start-up is external-oriented despite significant resource issues to run the company efficiently.

The following statements made by the founder/managing director during the meetings provide moreover an impression on how the customer was set in the centre of basically all activities during the setup phase of the company:

- *"No action shall be performed unless the customer is willing to pay for it in a given time."*
- *"We only do things for what the customer is paying us or for what he is expecting."*

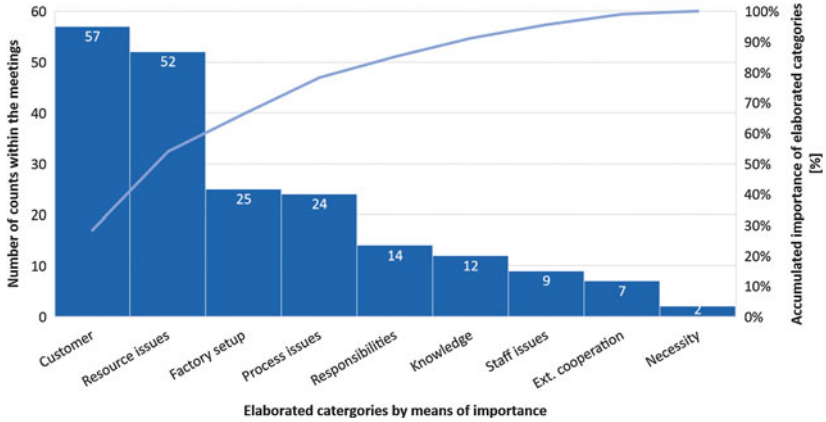

Figure 6.7 Elaborated main categories by counts after the ordering process. (Source: own representation based on research findings)

- *"Customers shall always get what they expect."*
- *"The customer shall have the feeling that we know what we are doing."*
- *"The [new] factory shall look professional and busy when the customer is coming."*
- *"All actions shall only be executed if this helps to serve the customer."*

These declarations show how important the customer was rated. What can be read out of these statements is, furthermore, that also actions should be performed even if they provide sustainably, added value for the company setup itself (except the fact that the customer is satisfied and will place an order which, in consequence, is of value for the company). Ultimately, it depends on the expectations of the customers.

However, what expectations do the customers have? In order to answer this question, the continuous observations were focused on this question keeping in mind to find key elements in how ideas are being generated for innovation.

At this point, the characteristics of the GTM gets evident: the flexible research concept is seen as a strength of the GTM as it allows an adaptive analysis process during the observation aiming to answer the research question(s) on an iterative approach.

b) Fulfilling customers' expectations

Within the GTM, it is common practice to generate so-called "memos" to visualize linkages between elaborated main- and so-called sub-categories. Six sub-categories related to the main category "customer" were identified when it came to an understanding of what expectations should be fulfilled by the start-up company. Some might be rated in being trivial or even as a basic requirement or as not as easy to understand when it comes to fulfilling. The sub-categories were elaborated based on the same meetings mentioned above plus accompanied customer visits and meetings.

Source: own representation based on findings

The memo generated for the category "customer" (Figure 6.8) incorporates the following six business action. First, the setup and maintaining of an integrated quality management system related to ISO 9001:2015, including an environmental management system related to ISO 14001:2015. Secondly, an organisational excellence approach, as described within the TQM philosophy (see chapter 1). Thirdly, the deployment of a reliable supply-chain management system to ensuring high delivery reliability; Fourthly, on-site technical field service to install, maintain and repair the delivered pumping systems; Fifthly, a customer-oriented product and solution development considering ongoing needs and challenges to meet future demands; Sixthly, also a high factory base load.

While the latter expectation was not formulated by the customer but by the managing director, all others were direct expressions by "voice of the customer" (VOC), so to speak in SixSigma language. The basic high load was described by the managing director in being a mandatory expectation as this would suggest high market demands and increase the organisations' attractiveness.

It could be observed that the fulfilment of the expectations was prioritised within all departments through repetitive communicating within internal and informal meetings. In consequence, measurements were taken within the organisations to address the expectations accordingly. Figure 6.8 summarises the outcome of the business actions by the end of the observation period. In summary, most customer expectations could be addressed successfully despite some inconvenient ways of fulfilments. Three requests were fulfilled partly only; the other three could be fully met. The scoring from 0% to 100% is related to the customer satisfaction observed during customer visits or to related KPI's, some as a binary option only. For instance, receiving certifications could either be 100% fulfilment (certificates received by the third party) or 0% achievement (certificates not received) while others are being rated on a scale.

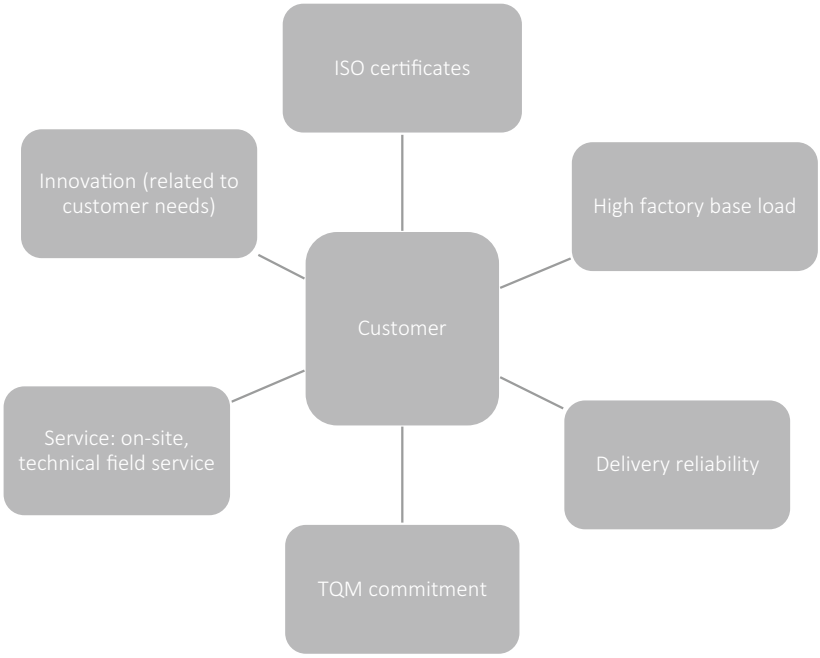

Figure 6.8 GTM-memo of the category "customer" and its expectations. (Source: own representation based on findings)

A description of each sub-category, including the observations of the measures, can be found in the electronic supplementary material (Annex 13).

In the following, the fulfilment of the request "Innovation" is being described which was conducted with a focus on the early stage of the innovation process in order to describe the process and management of innovations.

c) The early stage of the innovation process

Bearing in mind the innovation process, according to CEN/TS 16555–1 (see section 6.1), the management of ideas is the first step after the idea has been raised. Two aspects were of interest: first, identifying the way how ideas are generated. This initial phase is "fuzzy", and the origin of ideas is vague and cannot always to be identified. For the present study customer- and market-related ideas which came up during the meetings, informal discussions and interviews were registered. Also, the question of how ideas are treated afterwards and driven to

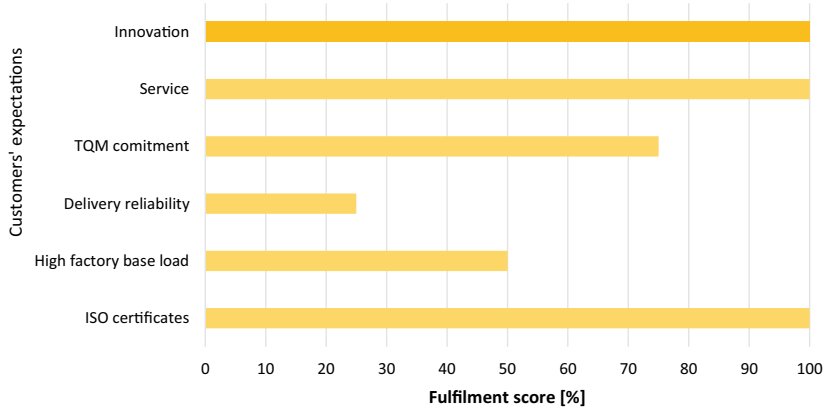

Figure 6.9 Fulfilment of "customers' expectations". (Source: own representation based on findings)

success was of interest. This phase is typically the management of ideas (see section 6.1).

As a side note: even by trying to count all ideas occurred during the observation period through registering each of them, it is for sure not possible to have full visibility as the author was not able to be present physically each time when an idea occurred within the organisation. A formal solution capturing the ideas, for instance, in a software system was not existent. However, this could be beneficial in order not to lose ideas.

The following Figure 6.10, however, provides an indication where ideas have been occurred based on 102 idea counts in total, which might be interesting for the research community. However, it is for sure not representative for all ideas which came up within the start-up. Anyhow, for the study, the origin and completeness of the ideas are not needed as the intention is more to get an idea of the origins.

Based on the overview above, informal places such as the "coffee corner" seem to be more stimulating (35% of the ideas generated) than formal places such as planned (strategic) meetings (11% of the cases). Furthermore, customers play an essential role when it comes to collect promising ideas (28% of all ideas). At this point, it can be mentioned as well that the observed company does not have any formal innovation process described. However, an informal, repetitive process could be observed how upcoming ideas are being treated.

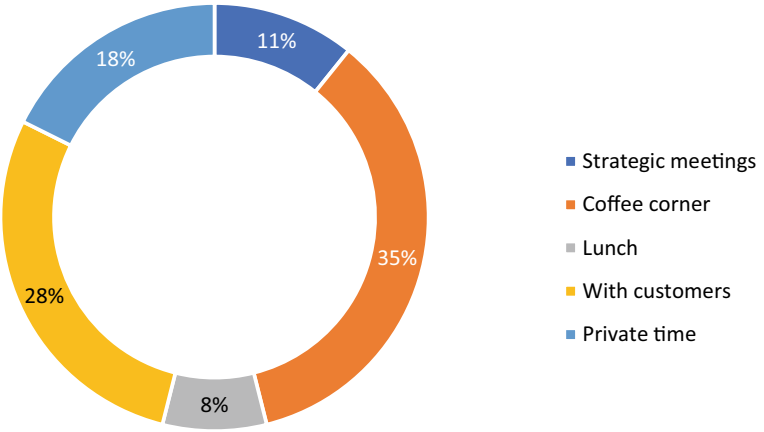

Figure 6.10 Origin and place of generated ideas within the FFE. (Source: own representation based on findings)

Ideas were being discussed within colleagues first, and if this exchange were considered in being somewhat positive, then the idea would be later informally communicated to the managing director, either in a one-to-one dialogue or within a strategic management meeting. In most cases (~ 80%) the idea was not rejected systematically but kept in mind by the idea owner (or salesperson in case of a customer-relater input) until idea-related tasks assigned by the managing director were executed. One statement came up regularly related to all product-related ideas:

> *"No action shall be performed unless the customer is willing to pay for it in a giving time"* (Managing Director's original voice).

This condition was like a first filter or screening process within the phase of managing ideas. A first evaluation of the idea followed an informal but stringent dialogue based on unwritten questions such as:

1. *Does the idea generally fit the company's strategy?*
2. *Is the idea and already existing as a solution within the market/competition?*
3. *Is the idea related to a customer need and is the customer willing to pay for it?*
4. *Is the idea related to a one-time business, or is it long-term oriented?*
5. *Does the idea affect the current business or resources?*

6. *Are there other (similar) ideas or options which are more promising?*

These questions were not to be answered systematically like a checklist in written but came up verbally in this or a similar way. Following the discussion, a final and straightforward yes/no—decision was taken to proceed. The decision was taken either by the managing director or—if he would be indifferent—by the idea owner and the executive management team. Two aspects then drove the ongoing idea evaluation:

1. Technical feasibility → involvement of Director R&D
2. Financial impact → involvement of Sales Director and Director Finance

Once the relevant departments clarified the aspects, the managing director could take the final decision. In detail, R&D should estimate the impact of the idea on resources (hours development, investments for development or prototyping) and the ability to scale the business within the production (is it a one-time business or a solution which can be sold more than once). Finance should make an ROI evaluation based on various key figures from within the departments R&D, sales and production. As a particular matter of fact, it was the strategy to develop only ideas if a positive return of investment could be expected with the first (!) order placement or within a defined order volume. Even if this strategy might not be long-term-oriented, the reason could be found in the limited financial and human resources due to the set-up of the company. Limited resources forced the team to concentrate on immediate value-adding or order intake related actions. If the technical and financial analysis was promising, the decision was taken to proceed and to develop the idea to a commercial solution for fast commercialisation. Otherwise, the idea was rejected immediately. Even if not in the focus of the study, it was remarkable to determine the different time period of the different phases or stages of the informal process. While the first "phase", where the ideas are being generated, discussed, developed and evaluated took about 1–3 months, the second phase (technical feasibility and financial calculation including the decision to proceed or not) took only 1–2 weeks.

d) The organisational structure and cultural characteristics

Despite the rather strong power of the managing director in taking strategic decisions related to investments (> 2k EUR), related to distributing limited human resources (bottlenecks were observed with regard to manpower within product design and internal sales, R&D and production), related to employment policies

(engagement of new staff and contracts) as well on image-related marketing decisions (e.g. final decisions on text or designs related to online or print marketing), a high degree on individual responsibility and freedom could be observed in the day-to-day business.

A hierarchic structure with three levels could be determined as per Figure 6.11 but with balanced power distribution. Real strategic decisions were taken always taken by the Managing Director. Operations-wise, however, power concentrations increased reciprocally.

Figure 6.11 Reciprocal power distribution within the organisation as part of the observed style of leadership. (Source: own elaboration based on research findings)

The additional assessment within the present study revealed moreover that most elaborated cultural determinants as per the elaborated synthesis (Table 15) were identified within the observed organisation (Table 6.7).

According to the assessment, the organisation's culture in the context of innovation-enabling determinants has a rather low strategic and risk-taking attitude while openness and flexibility, as well as the distributed power and individual responsibility/intrapreneurship, are high-scored. The collaboration and communication pattern is considered in being good to strong.

Regarding the communication pattern, a separate analysis was undertaken in order to understand communication behaviour (see electronic supplementary material, Annex 14). Here, a rather cascading, hierarchic communication pattern could be observed. However, some employees/workers had constant communications to the Managing Director sometimes leading to misunderstandings between

Table 6.7 Assessment of cultural-related determinants

#	Cultural determinant	Item	Observation notes and rating (1 = very low …. 6 = very high)
1	Openness & flexibility	Innovation attitude and willingness Willingness to learning Open to change Problem solving attitude Access to knowledge Listening to customers Overcoming technical barriers	5 5 4 6 5 6 5 MEAN: 5,14
2	Teamwork and inter-hierarchical collaboration & communication pattern	Degree of communication Collaborative work between colleagues and the organisation's hierarchy	5 5 4 MEAN: 4,67
3	Power, individual responsibility & intrapreneurship	Degree of power distributed within the organisation individual responsibility initiative and accepted autonomy	5 5 6 MEAN: 5,33
4	Risk-taking attitude	Accepting uncertainties Risk-taking investing in uncertain ideas offering employees to experiment without negative consequences in case of failure	2 4 1 4 MEAN: 2,75
5	Strategic time orientation	Long-term business activities Long-term initiatives product-wise financial funds reserved for R&D and financial funds for innovation	5 4 1 5 MEAN: 3,75

Source: own representation based on research findings

the three hierarchic management levels, especially between the department leaders and the employee/worker—level (Figure 6.12).

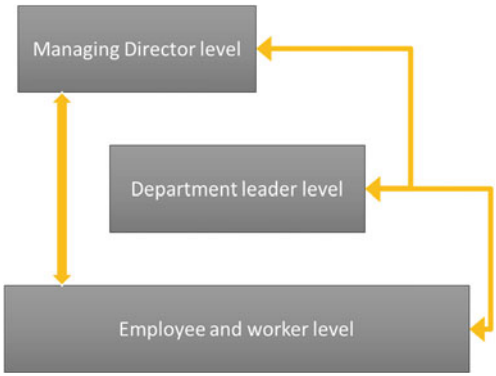

Figure 6.12 Observed inter-hierarchic communication pattern. (Source: own elaboration based on research findings)

e) Concept for the early stage of the innovation process

Based on the specific findings, a model, especially for the early stage of the innovation process, was sketched. Therefore, the first part of the existing innovation process, according to CEN/TS 16555–1 has been broken down: idea generation and the management of the idea. The study showed that the idea generation is like an impulse (= stimulus) to the organisation which needs to be discussed and roughly evaluated (phase 1) prior to a serious analysis with help, for instance, of a technical feasibility check and a financial evaluation (phase 2). The result of phase 2 is the response either to proceed with the idea or to reject it. Only if the idea is proceeded, it will be developed within a project. However, in our study, it could be observed that for some products, no development was performed, but an offer to customers was directly created based on the "phase 2"- calculations. In this case, the management team was confident in manufacturing the new product without a prototype based on experience only. In another case, sub-suppliers with the relevant experience were involved in order to make an offer directly to the customer.

The following Figure 6.13 shows the identified scheme of the management of ideas as observed focusing on the early stage.

While the first phase is minted by the discussion of the idea, the exchange of thoughts within the team members and the managing director (verbal evaluation), the second phase is dominated by facts & figures (proof of concept) leading to a decision how to proceed with the idea.

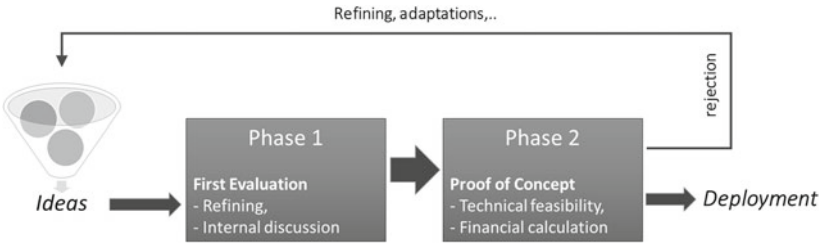

Figure 6.13 Observed idea management in the early stage as part of the innovation process. (Source: own elaboration based on research findings)

f) Conclusions

The methodological approach of the grounded theory helped to analyse the start-up company, which is described in focusing on customer needs aiming to obtain orders from the beginnings of the business activities. The observations revealed insights such as focal points of the business activities and more precisely culture-related patterns from within the organisation and finally the way in how ideas are being treated as part of the informal innovation process.

6.3 Study on Business Models in the Context of Innovation Performance and the Circular Economy

6.3.1 Context and research framework

The following section broadens the insights gathered in the previous chapters from a value perspective by analysing the effects of organisational efforts made in the form of concrete business actions and their correlation with the creation of value to organisations. As introduced in chapter 3, the creation of value with regard to economic aspects is still more evident than value creation regarding environmental or social aspects. However, environmental and social aspects become more of interest amongst (end-) customer, thus, respecting environmental and social aspects can generate increased value and as such provide benefits as described within the triple layer business model canvas.

The present study is related to a survey performed with businesspeople in the German speaking countries within the plastic industry using the material within

their manufacturing process. It was specifically performed to elaborate the mentioned ReSOLVE framework in the context of a pragmatic translation of the circular economy's philosophy as introduced in chapter 3. As such, it intends also to confirm a previous study performed specifically within the Polyvinylchloride (PVC) Joinery Industry (Ceptureanu, S.-I., Ceptureanu, E.-G., Murswieck, R. G. D., Marin, I. C. (2018)) which is herewith taken as a reference point. However, the study presented in the following has an explorative character focusing on the German plastic manufacturing market.

In this study the main circular economy principles (preserve, optimise and foster) translated into the six actions *Regenerate, Share, Optimize, Loop, Virtualize and Exchange* (*ReSOLVE*) shall be evaluated if they basically support value and as such can support innovation performance due to new ways in delivering offerings to the customers.

It is known that organisations willing to increase their revenues and competitive advantage need ideas in how to overcome market barriers such as increased competition or restrictions related to public regulations. Especially in the context of the Circular Economy, organisations need innovative products and services to master sustainable development respecting the circular economy's philosophy such as environmental, social and technological aspects (Ness, 2008; Mathews and Tan, 2011; Ren et al., 2013; Naustdalslid, 2014, Golinska et al., 2015; Küçüksayraç et al., 2015).

The plastics industry is not only an interesting but also a suitable research subject in the context of the present thesis as the study encompasses various characteristics which round off all previous chapters. First, Germany is seen as an important market in the context of plastics with major chemical companies producing plastic raw materials out of crude oil such as BASF SE in Ludwigshafen, Germany. Moreover, plastic is widely used in our daily life (such as within the construction, packaging industry, technical components and consumer goods). PVC, for instance, belongs to the most sold plastics in the world (Ceresana, 2017) with a share of 16% of the global demand for plastic. The chemical and more precisely the plastic industry is basically a conventional industry affecting the economy on a global level. Secondly, various plastics are officially acknowledged materials which can harm human's health due to its softeners during manufacturing but also by using the material itself. This is the reason why more and more plastics with softeners are being vanished. Public decision makers are discussing additional ways about the restricted use of it, which will furthermore affect the chemical industry as well as manufacturers and all processing companies (Thornton, 2002; European Commission, 2016). In consequence, organisations will have to think about how to withstand new restrictions and customer expectations effectively. Thirdly, plastic is heavily polluting the environment due to its toxic and

complex by-products with some of them being difficult to recycle (European Commission, 2004).

In this context, plastic has suffered in the past in its reputation also amongst consumers, and organisations need to think about innovative ways in how to succeed in the long-term if they want to sustain. This is where the concept of the Circular Economy joins the game as it can also be described as an operationalisation of sustainable business development (Ghisellini et al., 2016; Murray et al., 2017) which needs innovative business concepts along the value-added chain to grow and sustain. Balancing economy, environment and society by an increasingly efficient and environmentally friendly usage of the existing resources, the Circular Economy concept can support organisations to develop their business models more sustainable as an alternative to current economic development models and by that also contribute to improve social aspects (Ness, 2008; Ellen MacArthur Foundation, 2012).

Unfortunately, most of the studies existing on circular business models seem to be descriptive only. Furthermore, studies usually refer to a specific kind of circular business model and its characteristics instead of applying it to business actions related to organisations which is a core intention of the present thesis as for practitioners' theoretical aspects are less of value. Organisations need precise support on how to deploy promising ideas leading to value. Hence, the ReSOLVE (*Regenerate, Share, Optimize, Loop, Virtualize and Exchange)*—framework developed by the Ellen MacArthur Foundation (2018) was chosen for the present study as it is considered in being adequate by respecting the principles of the circular economy and is characterised by concrete business actions more specifically.

6.3.2 Targets and Research Methodology

The present research aims to explore two aspects: first, if the mentioned precursor study can be confirmed in general in the way that specific translations of a circular business model into business actions are creating value, and secondly to understand which business actions may support organisations in their efforts to create value within the plastic industry in general. Moreover, differences in an international context can be evaluated.

As methodology a correlation analysis is performed according to the Pearson's formula (1) presented in chapter 4. Therefore, *Value Creation* as an unweighted composite value out of five single values based on individual questions was chosen to be the dependent variable to be set in relation to the sub-values of the six related business actions out of the ReSOLVE model. *Value Creation* represents a core parameter when it comes to delivering offerings to the market in the context

of the circular economy as described in chapter 3. As such, the study follows the reference study mentioned.

The outcome shall also help entrepreneurs with practical considerations in creating additional competitiveness from the beginnings of their business. The characteristics is given in Table 6.8.

Table 6.8 Characteristics of the ReSOLVE study

Aspect	Characteristics
Main Target	Identifying the relationship between the ReSOLVE framework business actions based on the Circular Economy principles and Value Creation
Survey period	September—October2018
Form of collection	Questionnaire acc. Annex 15 (see electronic supplementary material) via online survey collection form
Regional focus	Germany
Survey addressees	Small-Medium-Enterprises within the plastic manufacturing industry
Questionary base	31 single questions, hereof 26 based on the six business actions translated out of the ReSOLVE framework and 5 related to Value Creation
Reference point	ReSOLVE empirical study performend by Ceptureanu et al. (2018)

Source: own representation

In this context, the study aims to support organisations, and its management respectively, to use an environmental-oriented business model as part of their business model innovation approach in order to assess and optimise their efforts in the context of the circular economy principles. Innovations make only sense to organisations if they create a specific value to it; this is the reason why *Value creation* was chosen as an innovation performance output—indicator as a promising outcome aiming to generate competitive advantage, additional revenues, constant long-term revenues and to determine improved resource management as well as to create beneficial partnerships with various stakeholders.

Based on the ReSOLVE framework as an appropriate multidimensional model specifically for the circular economy philosophy, the questionnaire covered 26 questions out of the six dimensions of the circular economy concept and further five questions related to *Value Creation* as the depended parameter. The questions used refer to the reference study which validated the questionnaire (see also Annex 15 and 16 within the electronic supplementary material).

6.3.3 Results Related to Business Models in the Context of Innovation Performance and the Circular Economy

The present analysis is based on 19 businesspeople' responses from within the plastic industry in Germany. Despite the low quantity of responses, it provides an indication and could generally confirm the reference study. However, further investigations should help to gather more precise outcomes. An overview of the sample structure is given in Table 6.9.

Table 6.9 Sample structure of the participants from within the plastic industry

Comany size	Number of participants	Share within the sample
<20 employees	1	14,29%
21—50 employees	12	57,14%
51 -100 employees	5	23,81%
101—250 employees	1	4,76%

Source: own elaboration

Keeping in mind the targets of the study, the evaluation of the relationship between the ReSOLVE business actions and Value creation, a correlation tableau was created between *Value Creation* as the dependent variable (composite variable) and each sub-variable of the six main independent values (*Regenerate, Share, Optimize, Loop, Virtualize and Exchange).* The results generally confirm that half of the business actions can create value and as such offer the chance to generate innovative solutions in general. However, not all actions are directly linked with Value creation. Furthermore, as the number of responses were rather low the significance level could not be verified at this stage of the research. Nevertheless, the indications provide a good starting point for further studies and in-depth analyses.

The following explanations are related to the overview of the calculations provided in Table 6.10.

As for the business action *Regenerate* and its contribution to *Value Creation*, four variables out of five show a rather high correlation: *Energy Recovery, Circular supplies, Efficient Buildings* and *Material leasing.* It seems that the investigated organisations are using already non-recyclable waste as a source of energy for

Table 6.10 Correlations between ReSOLVE and Value Creation variables

ReSOLVE Business Action	Pearson's r
Business action 1. Regenerate	
Energy recovery	**0.88**
Circular supplies	**0.70**
Efficient buildings	**0.83**
Sustainable product locations	0.11
Material leasing	**0.70**
Business action 2. Share	
Maintenance and repair	0.10
Collaborative consumption	0.32
Product-Service System: Product lease	**0.77**
Product-Service System: Availability based	0.02
Product-Service System: Performance based	0.12
Return and reuse of products	0.15
Upgrade	0.07
Attachment and trust	**0.74**
Use of own device	0.36
Hybrid model	0.05
Gap-exploitation	0.16
Business action 3. Optimize	
Asset management	**0.88**
Produce on demand	**0.86**
Waste reduction	**0.87**
Product-Service System: Outsourcing	**0.72**
Business action 4. Loop	
Remanufacture	0.29
Recycling	**0.81**
Upcycling	0.24
Circular supplier	0.40
Business action 5. Virtualize	
Dematerialized services	0.32

(continued)

Table 6.10 (continued)

ReSOLVE Business Action	Pearson's r
Business action 6. Exchange	
New technology	**0.77**

Source: own representation based on findings

heating, electricity or fuel and that they use renewable energy to run their business. Furthermore, plastic is mainly used for functional reason in order to reduce the environmental impacts of hazardous material. As such, the findings confirm generally the precursor study. In contrast, however, the location of the manufacturing or the usage of energy-efficient buildings play a somewhat role with a high correlation of r = 0,83.

For the second business action, *Share*, only 2 variables out of 11 do play a role considering *Value Creation*: *Product lease as well as Attachment and Trust.* For sure, creating beneficial offerings to customers with the aim to increase the relationship between supplier and customer is promising as it was also elaborated in the study presented in the previous chapter. Also, the trend in offering leasing instead of selling the product has become more popular also since constant income can be generated.

The third business action out of the ReSOLVE framework, *Optimize*, seems to be the most important value creating factor within all sub-variables. *Asset management, Produce on demand, Waste reduction* as well as *Outsourcing* are strong correlating variables with *Value Creation.* Participants confirmed that they only manufacture when demand is existence (project or market-oriented just-in-time delivery business) and take care of their assets when it comes to collect material internally or reuse material and refurbish or resale used products. Also, waste reduction before and within the production is in their focus. The flexibility in outsourcing certain processes to increase the efficiency of capital goods, materials and human resources was also highlighted and shows a correlation.

Regarding the business action *Loop*, only the sub-variable *Recycling* plays a role by reusing disposed products or by-products. This includes external materials but mainly reusing scrap from internal manufacturing processes. However, *Upcycling* (increasing the value by reusing materials on an innovative way), *Remanufacture* (restoring products to "as new" quality) or the integration of *Circular suppliers* (themselves applying the principles or supplying bio-based or fully recyclable materials) do not play a role when it comes to *Value Creation.* As such, this confirms the precursor study as well.

The action *Virtualize*, however, does not play a role at all. There is no shift from physical to virtual processes in their business. Like above, this outcome confirms the precursor study as well. This might be explained by the nature of the physical-based production business.

Finally, for the last business action of the ReSOLVE framework, *Exchange*, a correlation between *New Technology* and the dependent variable *Value Creation* could be identified. The participants declared in using new technologies within their production.

In summary, half of the business actions (*Regenerate, Optimize* and *Exchange*) do contribute for sure to the creation of value related to the principles of the Circular economy while the actions *Virtualize* does not contribute. *Share* and *Loop* do support *Value Creation* only partly with some sub-actions while its overall contribution to it cannot be confirmed at this stage of the research.

The testing of business models, especially in the context of the Circular Economy with a focus on SME is still an uncharted field of research, especially on an international level. In this regard, the study has shown first possible relationships within German-based organisations in the plastic industry.

However, it shall be pointed out, that the present study is a starting point only to evaluate the relationship between the ReSOLVE framework and the creation of value within the German market, specifically within the plastics industry. Limitations are for sure the low number of responses making it difficult to conduct meaningfulness analyses; hence, to perform a full regression analysis.

The last chapter, finally, incorporates all presented studies performed by developing a managerial framework supporting organizations to increase their innovation performance with respect to the use of digital technologies on the one hand and on the other hand by aiming not only economic benefits but also environmental and social benefits as part of their creation of value. By doing so, it is expected that organisations can differentiate most and sustain in the long term their competitive edge on the global markets.

6.4 Developing a Business Innovation Model based on the process approach and the "Plan-Do-Check-Act" (PDCA) -based innovation-related cultural framework

6.4.1 Considerations on Developing a Managerial Framework Supporting Innovation Performance Related to Cultural Determinants

Despite the fact, that innovation management itself has been in the focus of numerous studies worldwide, and as such represent a common, accepted field within academics, it is surprising that, so far, the empiric-based theory could not be fully translated in the broadest sense into business actions supporting organisations in their day-to-day business. It seems that organisations still lack full comprehension and practical guidance in how to execute performant innovation management respecting all various, enabling key drivers.

It is expected that the increase of competition will furthermore be intensified by contextual factors such as, amongst others, upcoming digital technologies and environmental circumstances on a global level. These and further aspects will force once more domestic companies to transform themselves continuously. Hence, improvements on how to increase the rate of performant innovations related to products, services, processes and complete business model become more of interest.

The present chapter aims to complement existing studies and moreover to round up existing business and process-related models respecting the research results obtained in the field of innovation culture, leadership and employee involvement as part of the management of innovation to create value. In this regard, various factors such as the five forces described by Porter (2014), affecting the performance of innovation, need to be respected by the management as well if organisations want to succeed. The performance level defined with the help of KPI's need to address demands out of the market or fulfil customer-based expectations to create value as part of the organisation's business model.

Two aspects were considered by integrating the elaborated, enabling cultural factors of innovation performance: firstly, the process approach based on the continuous improvement philosophy applied to the management of innovation and secondly, the more holistic approach of business model innovation respecting the context of the circular economy. Therefore, the development of an organisational business innovation model (BIM) as a prefixed scheme to support organisations

in their innovation activities integrated into their business processes appears promising. For that, the primary PDCA-based innovation-related cultural framework is being developed as the core of the BIM as described later.

6.4.2 Developing the "Plan-Do-Check-Act" (PDCA)-based Innovation-related Cultural Framework

a) *Addressed aspects for the framework development*

As various studies have confirmed, the organisational culture is described in being crucial when it comes to succeeding with innovations as discussed in the first chapter. Successful companies are aware of the human factor, its creativity, connected potential and intrapreneurial spirit to develop promising ideas for performant innovation. Developing an innovation-friendly corporate culture from the ground, however, is often connected to active, individual leaders such as companies' founders who are motivated to set up a new business. In this context, the findings of the performed studies have contributed to translating the elaborated factors into a sustainable framework accordingly.

The development of the PDCA-based innovation-related cultural framework incorporates two essential research findings: the culture-related determinants as the foundation for innovative behaviour within the organisation and the interaction between management and employees by deploying a transformational leadership style, both supporting innovation performance preferably especially in the crucial early stage of the innovation process. However, as the establishment of an innovation-friendly corporate culture—level is a permanent process, the adoption of the PDCA-cycle approach is suitable, also due to contextual changes affecting the culture.

In this regard, the developed framework follows the BE- and TQM-philosophy as introduced in the beginnings to "install and make permanent climate where employees continuously improve their ability to provide on-demand products and services that customers will find of particular value" (Ciampa, 1996, p. 22).

b) *Framework structure, composition, application and organisational deployment*

Before presenting the final structure of the framework and its organisational deployment, the principle composition and application of such are being introduced.

A useful point to start with is to assess the status-quo within the organisation, focusing on culture-related factors only. For this purpose, the author suggests constituting the assessment on two integral parts: a more holistic national-related cultural dimension assessment and a more specific organisation-related cultural determinant assessment providing both the needed groundwork to create a Strengths-Weaknesses-Opportunities-Threats (SWOT)—analysis. The SWOT—profile enables the management to set the initial reference point. It is generally known as a standard technique applied within the industry to create awareness of a specific subject and to plan further, appropriate business measurements (LTU, 2019).

Figure 6.14 shows the principle scheme of a SWOT analysis, with its four quadrants from which the identified "opportunities" and "threats" are usually out of control. The "strengths" as well as the "weaknesses", however, are usually in the control of the organisation. Nevertheless, all four quadrants allow the management or decision taker to define actions on what to work on in order to develop the strengths continuously and minimise the weak points accordingly. In the present context, the strengths are referred to as enablers of innovation performance.

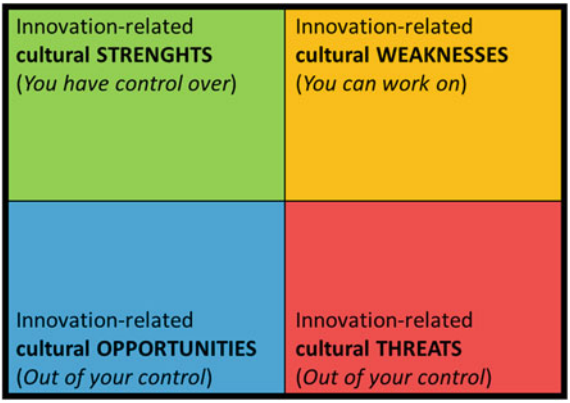

Figure 6.14 Innovation-related culture-based SWOT landscape. (Source: own representation)

Remembering Schein's model of cultural layers describing the visible and invisible characteristics of culture, the invisible layer "values" represents both, opportunities and threats in the context of supporting an innovation-friendly culture. This deepest layer might affect specifically the innovation behaviour as

shown in section 4.2 but can rarely be identified. Therefore, the author assumes that culture-related opportunities, as well as threats, are too challenging to be identified by an assessment contrary to strengths and weaknesses.

The conducted studies have shown, that most national-related dimension, as formulated by Hofstede (2019), provide mostly meaningfulness on a nation's level but not necessarily correlations with the firms' innovation activities. Indulgence, however, has always shown the highest and most comprehensible correlation with innovation also in an organisational context; hence, it should be considered as a decisive influencing factor. The remaining five dimensions only provide limited meaningfulness on a microeconomic level and should, therefore, be interpreted with care. Figure 6.15 is showing the suggested procedure to assess the status-quo of the cultural mindset within the organisation based on:

1) the national-related cultural dimensions considering especially indulgence as an innovation-promoting dimension characterised by the extent of enjoying life and freedom as an accepted value (section 4.2),
2) and the elaborated organisational cultural determinants (section 5.1) considering
   - openness and flexibility describing the employee's attitude towards innovation activities in general such as open to change, problem-solving attitude and more,
   - team and hierarchy behaviour & communication pattern describing the degree of horizontal and vertical (open) communication within all employees,
   - power, individual responsibility & intrapreneurship describing the degree of power distributed within the organisation and the acceptance individuality,
   - risk-taking attitude describing the degree of acceptance of uncertainties and the freedom of experimenting without individual fear,
   - strategic time orientation describing the organisation's attitude related to long-term versus short-term decisions, for example, on budgets and associated expectations.

The assessment should be conducted by involving all employees of the organisation by using, for instance, the cultural dimension questionnaire developed by Hofstede (see also the electronic supplementary material, Annex 1), to calculate the cultural dimensions scores firstly and secondly to measure the degree of innovation-enabling determinants with the help of the synthesis out of section 5.1.

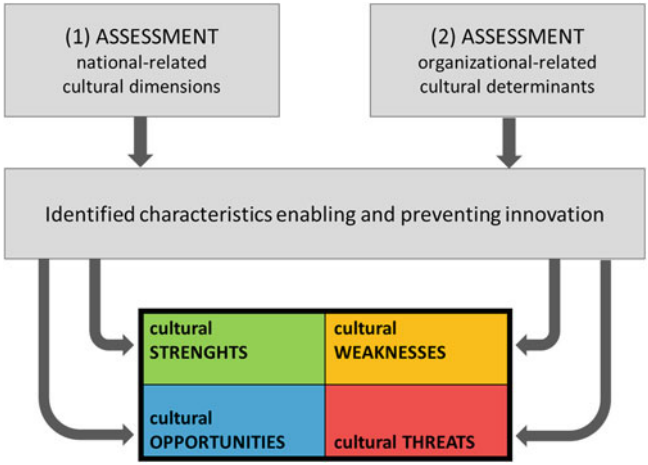

Figure 6.15 Procedure on creating innovation-supporting awareness with SWOT analysis. (Source: own representation)

The identified culture-related characters can then be assigned to the four quadrants of the SWOT scheme whereas only a low indulgence dimension score should be assigned to the threats-section as it is considered to originate from within deep values and where the control is at least limited. For the other five national-related cultural dimensions, no accurate prediction with regards to organisational innovation performance can be stated, based on today's scientific state of knowledge. At this point, the author refers to the next subchapter making notes to the limitations of the present national-based cultural assessment. The developed scale—based assessment of the synthesised innovation-enabling determinants (1 = very low up to 6 = very high) out of section 5.1 can be classified either to the strengths or to the weaknesses depending on the scores. The author advises assigning all values from 1–4 to the weaknesses corner of the SWOT—quadrant. The reason is to be found within the next phase: the definition of the strategic actions to increase the cultural-based potential level within the company. The organisation shall, at this stage, define what actions should be undertaken to develop the strengths, to minimise the weaknesses and to overcome the threats.

It is essential to involve also employees and hierarchic levels as improving the innovation capability is part of the process in building together a suitable corporate culture. If existent, the department for Human Resources (HR) should support in establishing personal developments plans to foster collaboration, trust and joy

amongst the employees. Team leaders of each hierarchic level up to the C-level shall be sensitised to inspire their employees at work as part of the cultural development process. Diverse team constellation can furthermore foster the dynamics to form performant teams and to increase creativity (Bouncken et al., 2016; Hauschildt et al., 2016; Rickards and Moger, 2017). Moreover, evaluations related to the interaction between leader and employee in the context of innovation can be applied additionally (Kauffeld et al., 2004). However, these aspects are included in the elaborated synthesis to start with the improvement process.

Remembering Rosenbusch et al. (2011)'s findings introduced in the beginnings, it is essential to focus on the innovation orientation inside the organisation and to allocate resources for its deployment than on the innovation outcome itself. In this context, the author considers focusing on a shared understanding of the organisation what business actions shall be defined in order to develop the innovation culture continuously based on the initial SWOT analysis.

Finding appropriate KPI's depends on the business model, however, ideas were given as part of the elaborated synthesis on the cultural determinants (section 5.1) as well as in the initial discussions on innovation indicators. Nevertheless, the author suggests actions in the field of innovation knowledge and competence as described by Hittmar et al. (2015). For example, training on innovation techniques are considered in being supportive for the development of the innovation culture.

Based on the research on the effects of leadership, a transformational leadership style was being confirmed in being most promising, also in the context of the deployment of digital technologies. Hence, Figure 6.16 incorporates the interactive role between leaders and their employees affected by culture-related settings. Both leaders and their teams, including the individual employees, have the chance to influence the cultural development using collaboration and initiation of change. It outlines that culture can be influenced actively to increase, specially the enablers of innovation based on the identified culture-related factors.

As the development of culture within a company is seen as a continuous improvement process offering the chance to increase the innovation-oriented culture accordingly, the developed framework follows the continuous improvement philosophy as described with the help of the PDCA approach. Therefore, the task of the organisation consists to continuously work on the development of the innovation culture by performing regular cultural-based assessments.

Following the PDCA approach as per Figure 6.17, the updated scheme offers a more precise understanding to monitor strong and weak points regularly in order to ensure a long-term, performant organisation within an increasing competition. Planning the innovation-friendly culture is related to defined business

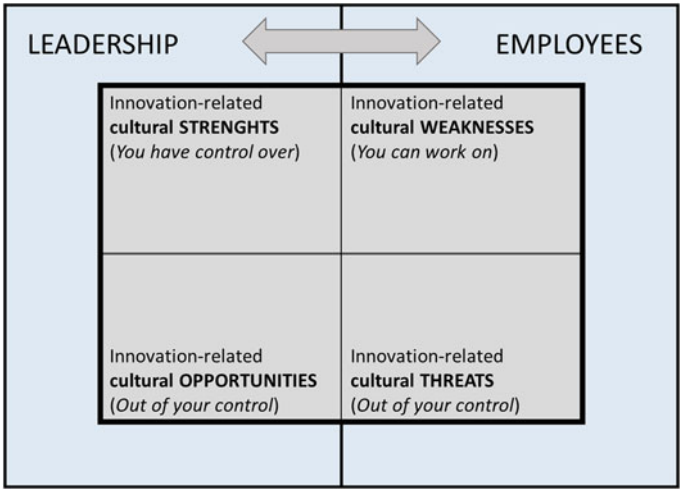

Figure 6.16 The role of leadership and employee interaction as part of the innovation-supporting culture. (Source: own representation)

actions based on communicated and agreed indicators following by the doing-phase, which ensures the actions are being performed. The Check-phase, however, relies on both, defined innovation output indicators related to successfully launched innovations as well as the actions related to the innovation culture improving itself. Subject to the results of the Check-phase, the Act-phase defines whether the formulated indicators were being appropriate. If so, the measurements can be standardized, and the indicators should be implemented within the organisations' KPI-system. Otherwise, the more appropriate indicators can be implemented, and further actions related to the innovation culture must be taken.

Bearing in mind the ongoing digital technological developments and its radical potential to completely disturb existing markets, organisations, brands and specifically existent business models (Desjardins, 2018), the present framework intends to support organisations to continuously reflect their innovation-related cultural potential as contextual factors are continuously affecting the corporate culture (Becheikh et al., 2006; Porter, 2014).

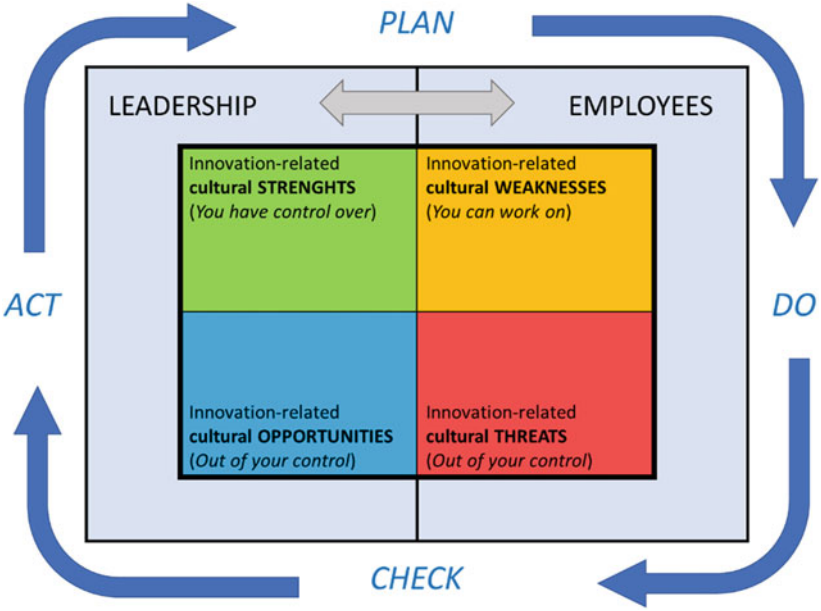

Figure 6.17 Developed PDCA-based innovation-related cultural framework respecting leadership and people involvement supporting innovation performance. (Source: developed by the author based on studies conducted)

6.4.3 The Innovation-related Cultural Business Innovation Model in the Context of the Adoption of Digital Technologies and the Principles of the Circular Economy

The proposed framework unfolds its potential when it is pro-actively integrated as a part of innovation-related business models, for instance, as a tool for defining business actions on a management level, before starting with innovation activities.

The developed managerial PDCA-Cycle based framework as per Figure 6.17 respecting the culture, the leadership role and the employee's involvement supporting innovation performance are not to be seen as an isolated process. It is continuously influenced through the organisation's strategy and for certain other aspects as well from within the organisation. Also, existing resources, their limitations and capabilities are influencing the innovation culture as they might be out of control, such as it is the case of regulations, directives or policies. The customer,

as well as additional stakeholders such as company owners, suppliers and more, have expectations which moreover do influence in various ways. These influences, however, need to be considered when it comes to evaluate and develop value propositions and benefits. These benefits include pari passu economic, environmental and social aspects (also see Figure 32) if respecting the principles of the circular economy, including social aspects. In consequence, occurring ideas as they may arise or be influenced from within internal and external sources (organisation, capability-based, stakeholders) shall be managed within the innovation process with respect to the continuously unfolding potential of the innovation-supporting corporate culture in order to generate performant outcomes. Therefore, generated innovation need to be assessed as this is one primary aspect of the innovation management process (remember Figure 6.3).

Figure 6.18 sketches the described idea by adding the essential leveraging effect within our time age: the role of digital technologies as part of the innovation process. Based on the conducted studies, the organisation is considered to take advantage of the digital potential by including thoughts on possible adoption within all innovation activities. Current offerings from within all three types of value propositions (economic, environmental and social) can be enhanced if the management and the employees are able to understand the implication of digital solutions. Furthermore, digital concepts influence external forces and provide new ideas integrating such technologies within the development of innovation. This can refer to market offerings as mentioned but as well as to internal benefits along the value-added chain (see section 5.2).

The described business innovation model BIM tries in this regard to sensitise on three essential aspects. First, the cultural force to influence the innovation performance significantly and irrespective of external circumstances. Secondly, the power of it to address ideas to improve the business towards a more sustainable level respecting environmental and social benefits as well by offering new, additional values to customers. And thirdly, the BIM intends to continuously think about the implementation of digital technologies as the present thesis has shown that digitalisation has the power to lever the organisational performance completely.

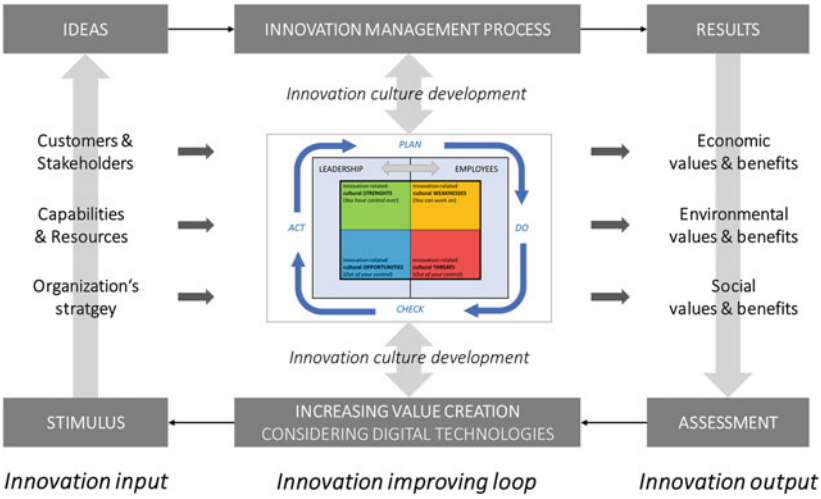

Figure 6.18 Elaborated Business Innovation Model based on the process approach and the PDCA-based managerial innovation-culture framework. (Source: own elaboration based on research finding)

6.4.4 Considerations on the Effects of Implementing the Elaborated Business Innovation Model within Organisations, its Limitations and Further Research Suggestions

The elaborated culture-based and process-oriented business innovation model, so-called BIM, intends to set the focus preferably on the development of innovation-supporting culture as a prerequisite for innovation performance than on the innovation outcome itself.

The research was performed on various methodological approaches by purpose to bring findings from within different perspectives together and to examine these in order to elaborate a commonly valid model to support organisations in their daily business activities. With the help of empiric databases, the relationship between cultural dimensions and innovation performance on a national level could be shown. Despite statistically proven limits to derive national performance to an organisational level, the essential finding, that the "indulgence"-factor generally supports innovation performance on every level has supported to elaborate more specific innovation-supporting determinants deployable to companies. Additional

explorative studies based on surveys addressing the impact of digital technologies to business performance as well as an in-depth study with help of the grounded theory methodology have revealed that corporate culture, leadership and the degree of employee involvement play all prerequisite roles when it comes to increasing the organisation's performance in the context of innovation management. Furthermore, the research on the ReSOLVE-framework testing the deployment of the principles of the circular economy into business actions have shown that new, innovative ways in running a business have in principle the potential to create value; an essential criterion when it comes to succeeding with new ideas.

However, irrespective the multiple studies performed during the doctoral research period, the present work could not cover all aspects as it represents an interdisciplinary field in a broader sense. At first, the study of humans in general, the nature of differences within human characters, their various psychological behaviour patterns at work and aspects on change management on an organisational level could not be included as psychology as such represents an own, specialized field within the scientific community (Arnold et al., 2005; Barrick et al., 2013; O'Donovan, 2007). However, where possible, findings of these field of researches were being respected, for example, on the elaboration of the cultural determinants-synthesis affecting the innovation performance on an organisational level. Secondly, due to limited resources and time restrictions, the author was not able to test the developed innovation related cultural framework and the BIM in a long-term study within multiple business sectors and in an international context which is considered in being worthful. Based on such a study, it is expected that the adoption within existing business models may require unforeseeable individual adjustments leading to an adapted framework.

However, the elaborated innovation-related cultural framework and the business innovation model was designed to keep it somewhat simple, aiming to be deployed within various industries on the one hand and in various business contexts, on the other hand.

Conclusion

Strategic thoughts on how organisations can fulfil best their function within a society have been discussed intensively within the academic community, policy-makers and practitioners. The accepted role of organisations as a powerful actor within economies by employing millions of people and producing essential products and services including needed public welfare goods is being commonly acknowledged despite controversial discussions, for instance, such as on environmental degradations or disputable working conditions. Nevertheless, the existence of organisations in modern societies is strategic-wise essential and indisputable in the context of creating social wealth. Productivity and innovation strengths of companies have been often described in being the primary drivers for society's wealth increase (Hiß and Nagel, 2017).

In this regard, it is not surprising that governments are working continuously on initiatives to avoid bankruptcy amongst organisations and instead foster innovation aiming to increase the nation's wealth. Beside funding programs as discussed introductive in section 1.2, the EU ministers of justice decided, for example, a new directive in 2018 in order to ease the insolvency proceedings throughout the EU. The directive intends to support companies in financial difficulties by providing organisational restructuring capabilities at an early stage to avoid as far as possible bankruptcies and layoffs (European Commission, 2018b).

However, in practice, the importance of innovation and its consecutive management is mostly known within large-scale enterprises only or mostly at digital start-up companies willing to survive in the first years with new, innovative solutions. Other companies, however, might not identify the potential of innovation, usually when continuous incomes are being generated. Innovation becomes at the

R. Murswieck, *Innovation Performance in the 21st Century*,
Sustainable Management, Wertschöpfung und Effizienz,
https://doi.org/10.1007/978-3-658-34761-1

latest of interest of such executives when sales figures do not stop to drop continuously or when cash becomes tight, leading to financial challenges. Moreover, when salaries or supplier commitments cannot be paid anymore, the situation becomes even more uncomfortable and in some cases, existence-threatening for the organisation. In such a precarious situation, the pressure on management to become creative and to seek appropriate solutions increases, of course.

Even though many organisations have recognised the need for innovation, still multiple organisations fail in practice and get overwhelmed by international competition attacking their business models. The methods described by Porter (2014) to outstand and sustain either by cost leadership or differentiation are for sure valid approaches. However, in a more digitised world with the steadily increased competition due to natural limits of resources, entirely new business models, and changing customer expectations, innovating business models become more promising than relying on cost leadership only. Hence, the research on differentiation by improved or new business models respecting uprising digital technologies on the one hand and resulting environmental impacts on society, on the other hand, are of increased interest to support organisation on their innovation efforts (Bashir and Verma, 2017; Eckert, 2017; Kreutzer and Land, 2016).

The present thesis primary objective was related to the understanding of the pre-requisites of performant innovation management by creating, maintaining and continuously improving an innovation-supporting organisational culture at the beginning of any innovation activity. By respecting both the chances of digitalisation to increase innovation performance as well as the principles from the circular economy as a value-adding factor addressing environmental and social aspects can help to improve the competitiveness of organisations in the long-term. However, many studies have been performed to understand innovation performance and to derive appropriate indicators. The variety of research results show that there is no universal or generally accepted framework yet, nor have scholars agreed on indicators. Additionally, in the seed phase of the innovation process, the so-called early stage of the innovation process, very few indicators exists to support organisations evaluating the potential of promising and upcoming ideas (Hagedoorn and Cloodt, 2003; Dewangan and Godse, 2014).

As such, the thesis aimed to contribute addressing specifically the challenges in the early stage of the management of innovation by elaborating both cultural determinants supporting innovation performance at the beginning of the process and the value aspect by adopting digital technologies and circular principles within business models in order to increase the company's strength.

Therefore, the thesis has been structured in two main parts. The first part of the thesis intends to outline the current state of knowledge through intensive literature research. Also, it aims to identify current trends within the field of research (chapter 1–3) in order to ty the first part to the second part of the thesis. The second part, by contrast, is characterised by own research contributions addressing elaborated and specific gaps within academics and by the aim to support practitioners in their day-to-day innovation performance management (chapter 4–6).

The studies conducted rely on a mixed research methodology-approach involving empiric-based analysis from within publicly available databases as well as explorative surveys performed aiming to gather suitable new findings for the various research questions formulated in the introduction.

The multiple aspects found during the doctoral studies allowed to include these to the elaborated managerial framework developed in the last chapter.

The final development of the business innovation model BIM is based on the idea to innovate continuously the business activities itself without innovating the business model as a whole in any case. It aims to sensitise and to reflect the business results continuously as part of the innovation management process which shall always include an assessment based loop to consider continuous improvements in order to increase the respective values and benefits for customers. Therefore, the process approach of the generic innovation process was adopted. Moreover, the PDCA-philosophy was adopted as part of the innovation-related cultural framework within the developed BIM in order to continuously improve the innovation capabilities grounded in cultural, behavioural aspects. Both both principles are often described in being most critical for business performance in general (Camison & Villar-Lopez, 2014; Iturrioz, Aragon & Narvaiza, 2015), mainly because the generation of ideas is the first step in creating innovations and, hence, are mandatory.

The literature review within the chapters one, two and three have shown the following essentials:

Chapter 1, including all sub-chapters, is mainly about the characteristics of innovation, its perception, its management and needed prerequisites. As such, an innovation refers not only to new products and services as it usually understood but also to all kinds of processes, ways of distribution, marketing aspects, types of contracts, corporate identities as well as complete businesses models (Hauschildt et al., 2016). The management of innovation is commonly considered in being essential for organisations, especially in times of aggressive, global competition (Camison & Villar-Lopez, 2014; Iturrioz, Aragon & Narvaiza, 2015) and as such also part of so-called excellence-models which intend to lever the organisation's

performance continuously (EFQM, 2018) in the style of the Total Quality Management (TQM). In contrast to ideas or invention, innovation is characterized by the exploitation of an idea; hence, the successful market launch.

Several studies have reveald that the success and the management of innovations differ internationally due to cultural aspects. The innovation management process itself as well as the innovation performance seem to be influenced by the national background of personalities, their teams and the organisation due to the different kinds of cultural particularities (Kaasa, 2017; Puumalainen et al., 2015; Rossberger, 2014; Albach et al., 1994). This starts with the idea generation itself and the management of it through the development up to the market launch. However, the fuzzy-front-end (FFE) as part of the very early stage of the innovation creation process is still not well understood (Rowold and Bormann 2015). Therefore, the present work analysed especially the starting point of the innovation creation process to get a deeper understanding of how innovations are created in the early stage. As culture has been mentioned often as an influencing factor related to innovation within literature, chapter 1 included literature reviews on innovation performance on an national level focusing on the European Union member states available statistics. The European Innovation Scoreboard (EIS), for instance, provide an assessment of the innovation performance across all EU countries by collecting parameters from within all member states. The comparative analyses shall then support policymakers, influencers and organisations in the EU to discover their strengths as well as weak points in order to improve their innovation efforts accordingly (European Commission, 2019b). However, cultural determinants are not part of the EIS statistics. Therefore, chapter 4 includes analyses to evaluate the relationship between cultural dimensions and innovation performance.

The literature review in chapter 2 deals with the digitalisation of organisations as well as its contribution to innovation performance by making use of digital technologies. As such, they have the power to transform complete value chains within organisations, as well as economies at all in the long-term (Gartner IT Glossary, 2019; Kreutzer and Land, 2016) being part of six global megatrends of our today's time strongly influencing any organisations on a global level (Rothlauf, 2010). Digitalisation is able to positively support both, reducing costs by increasing efficiency along the value-added chain and developing new digital-related offerings to differentiate from within the competition. In many cases, companies need to understand and define what technologies they want to make use of to increase their competitiveness (Eckert, 2017; Strauss, 2013; Nylén and Holmström, 2015). Apparently, the human factor is essential when it comes to evaluating the current readiness of digital technology (Linden and Fenn, 2003).

The understanding of emerging digital technologies, however, is being described as a challenge, especially for companies from within traditional businesses. Skills and improvisation are, therefore, needed to foster the needed flexibility in developing digital-related innovation as per Nylén and Holmström (2015). As a statistic review by the European Commission demonstrates, large-scale enterprises (with more than 249 employees) show a much higher degree of digital technologies' adoption than small-medium-enterprises (SME). This is explained by their advantages related to scale effects in investing in information and communication technology (ICT) specialists. In consequence, their ability and motivation to digitise their business are rather high compared to SME. However, available and easy-to-access online platforms or combined solutions seem to support SME's to adopt digital offerings aiming to increase their business performance (European Commission and Eurostat, 2018) at least as part of their e-commerce and social media activities.

Within both large-scale enterprises and SME, huge economic potentials are being described by Kreutzer and Lang (2016) supporting growth and wealth in Europe. In this sense, companies shall be furthermore encouraged to invest in the digitalisation and to strength their innovation activities. Organisations not deploying digital technologies to their advantages might be "darwinised" as in the words of the authors. Therefore, chapter 5 deals with digitalisation as part of innovation efforts.

Finally, chapter 3 rounds up the theoretical part one of the thesis, by focusing on two future-oriented aspects. First, business model innovation in general and secondly the adoption of the principles of the circular economy as an upcoming subject due to increased environmental and social challenges. It seems self-evident that a company's business model can be innovated. However, business model innovation (BMI) as a research topic has been addressed only recently within the last decade. This might be the reason why literature does not provide a wide range of studies, contrary to the research field of innovation management related to products, and processes or as a strategic concept. Nevertheless, parallelisms between both types of innovation can be observed. However, organisations need hands-on deployable support in order to transform their business models. (Frankenberger et al., 2013).

In general, a business model shall support companies strategic-wise to achieve competitiveness by "defining how to position in the market against competitors" (Urbinati et al., 2017). A widely accepted business model is represented by the Business Model Canvas, a framework to support organisations independently of their business nature. It was developed in 2004 by Osterwalder to simplify the

modelling process of a business by focusing on nine key factors. Their systematization is seen, nowadays, as a reference work within practitioners as well as within the scientific community (Fritscher and Pigneur, 2010; Meertens et al., 2012; Zolnowski et al., 2014; Joyce and Paquin, 2016).

However, thoughts in how to respect the principles of the Circular Economy or sustainability as part of organisational business processes and business models is seen as a new type of business model (Loiseau et al., 2016; Ghisellini et al., 2016; Sauvé et al., 2016; Murray et al., 2017; Geissdoerfer et al., 2017) as additional aspects need to be considered.

Given the fact that there is no final definition of the circular economy concept, scholars nevertheless agree that the core idea is formulated by closing the loops of resources (Yuan et al., 2006; Preston, 2012; Lewandowski, 2016). Two primary loops or cycles are being described. Within the technical cycle, materials are being restored or recovered. The biological cycle, however, is the only one of both where consumption occurs. However, un-consumed biological products are being regenerated in consequence. Both loops are characterized by preserving or controlling natural, finite stocks (Ellen MacArthur Foundation, 2015a). This new, restorative character redefines the way of treating resources, doing business and creating value (Joustra et al., 2013). Other scholars argue that the deployment of such circular business models requires innovative companies in any case (Golinska et al., 2015).

Therefore, specific CE- or sustainability-related business models such as the so-called "Triple Layer Business Model Canvas" described by Joyce and Paquin (2016) have been elaborated. For instance, the Triple Layer Business Model Canvas aims to support organisations to translate their current BM's specifically into sustainable and circular economy-oriented BM by integrating environmental and social aspects. In this context, both additional canvas-layer shall complement the initial so far economic-related canvas elaborated by Osterwalder and Pigneur (2013).

Empirical studies have shown that organisations can gain competitive advantages against their competition by innovating their business models, also within existing markets. Some companies even evaluate BMI as being more promising than product or service innovations alone (Mitchell and Coles, 2003; Lindgardt et al., 2009; Amit and Zott, 2010). As described above, a significant concern when it comes to deploying sustainability or the CE philosophy is how to generate value aiming to keep or even improve the competitive edge. Having intersections to the CE principles, sustainability has been found not to conflict with economic benefits (Rauter et al., 2018), the challenges remain, however, in practice how to transform organisations keeping an eye on performance. Therefore, chapter 6 deals

with several aspects of innovation: the seed phase of innovation (idea management and evaluation), the early phase of the innovation process and the testing of a circular-economy framework on value creating aspects.

In this context, BMI should be understood as a holistic innovation management approach by involving the entire organisation and adapting the innovation process to the company's individual needs. External stakeholders should also be involved, especially in the case of adopting the principles of the circular economy as closing the material loop needs the involvement of the complete value-chain (Amit and Zott, 2010; Antikainen et al., 2017; Planing, 2018).

The author's research contributions are based on part one and are described within chapters four, five, and six. They have shown the following results and conclusions:

The research results in section 4.1 on the correlation between innovation performance and the gross domestic product for the European Union countries were based on regression analysis and generally confirmed the correlation between innovation performance and national growth. Therefore, the primary indicator from within the European Innovation Scoreboard (EIS), so-called Scoreboard Innovator Index (SII) and the GDP per Captiva values were being used. Both databases are being provided by Eurostat. Despite some irregularities from within the GDP values from Ireland and Luxembourg due to special local tax regulations, the relationship between both values could be confirmed leading to the underlying assumption that innovation supports growth and national wealth in a general context.

Section 4.2, the study on innovation performance in the European Union countries and the relationship to cultural dimensions focused then to understand possible relationships between the national innovation performance SII-values from within the EU member states as well as cultural-related dimensions. Hence, the same SII values as within section 4.1 were used but investigated on correlation with cultural dimensions as provided by Geert Hofstede (2015) for each EU country except for Cyprus, where only a cultural dimension score is being provided for the "indulgence"—value. In consequence, Cyprus could not be part of all analyses. The regression analysis and the radar chart analyses for all remaining EU member states offered a split view on influencing determinants.

Two cultural-related dimension values are standing out of this analysis. The Power Distance Index (pdi) and the Indulgence versus Restraint (ivr)—index show both the highest correlation with the innovation performance SII value. While Power Distance as an impacting cultural factor has been revealed often within scholar in negatively affecting innovation performance (Efrat, 2014; Kaasa, 2017), Indulgence by contrast seems to be affecting innovation performance positively.

The Indulgence factor, however, has been yet very poorly investigated. Its contribution to innovation performance is instead new as it represents a somewhat new cultural dimension described by Minkov and Hofstede (2011).

The overall outcome of this study showed that indulgence could be seen as the most critical dimension for innovation performance. Individualism by the contrast, which is often described as promoting as well seems not to be mandatory in any case as it could be shown in the analysis with Slovenia. Also, the importance of a deficient power distance value to foster the innovation performance (SII value) is not given in all cases. This is clearly shown in the cases of the national innovation performances for Belgium's, France's and Slovenia's cultural dimension values.

Moreover, the analyses on a more organisational level showed that correlation between innovation activities (the innovators—index within the SII) related to small-medium-enterprises (SME) mainly relies on indulgence as well while other culture-related factors do not confirm a clear relationship considering the defined performance groups defined by the EIS. Indulgence seems to play an important role when it comes to supporting innovation performance.

Indulgence characterises "the gratification versus control of basic human desires related to enjoying life" (Hofstede, 2011, p. 8) and by that the extent of enjoying life and freedom as an accepted value. In contrast, restraint describes societies where life is seen somewhat as hard; individual human drives, and having fun is, therefore, less accepted. However, precise determinants supporting innovation performance on an organisational level seems still to miss in the context of indulgence.

Chapter 5 deals with three different aspects: first, the idea to follow up cultural determinants supporting specifically organisations in their effort to create an innovation-friendly culture; secondly and in the context of the deployment of digital technologies, the aspect of transformational leadership supporting innovation performance as described and confirmed within literature; and thirdly, the aspect of employee's involvement by investigating the mindset specifically on the adoption of digital technologies supporting innovation and competitiveness.

Specifically, section 5.1 continues the idea of investigating cultural determinants based on an intensive literature review to elaborate a synthesis with cultural determinants enhancing the previous analyses. Within the literature, many perceptions of cultural determinants supporting innovation performance or innovation culture exists. Most of these, however, are being based on spongy dimensions such as "strategy", "values", "behaviour" and more. Precise determinants focusing on the innovation culture to establishing and to fostering innovation performance as well as to being able to support organisations in taking concrete business actions seem to miss. Therefore, the elaborated synthesis intends to close this gap.

The synthesis with a focus on civic-based cultural determinants supporting the development of an innovation-friendly culture can sensitise and assist managers in developing their leadership skills. Given the fact of the elaborated effects of the determinants *Openness & flexibility, Teams and hierarchy behaviour & communication pattern, Power and individual responsibility/intrapreneurship, Risk-taking attitude and Strategic time orientation*, managers are considered to work on these aspects by increasing the level of awareness of each of these cultural determinants. The conceptual design of the synthesis includes also proposed indicators to measure the deployment of the respective determinant.

Section 5.2 is related to a study analysing the effects of leadership on business performance by the adoption of digital technologies as part of innovation efforts. A survey performed amongst sales teams with the help of the globally accepted Multifactor Leadership Questionnaire (MLQ) reveals that the usage of digital remote technologies as part of the transformational leadership style can furthermore increase the sales performance. In summary, the study considers encouraging sales managers to lead their teams using a combined leadership style. Additionally, digital technologies such as remote communication technologies should be considered as part of innovative processes to increase sales performance. In this regard, the present findings meet recommendations to invest and adopt digital technologies to raise competitiveness (Kreutzer and Lang, 2016; McKinsey GI, 2016; Murswieck et al., 2017b).

Section 5.3 deals with the study on the employee's digital assessment, deployment, and rated impact of digital technologies on business performance. The assessment aimed to gain information on how business insiders from within different markets with different seniority as well as knowledge level assess digital technologies as being a crucial mandatory factor to increase the business performance of their organisation by optimising operational costs, increasing sales or even develop entirely new business models. The research has revealed, indeed, different and sector-independently age classes in the context of digital knowledge, mindset as well as the way on how digital technologies are being seen and rated:

- young (professionals) up to 30 years
- experienced professionals from 31 to 50 years and
- senior professionals from 51 years on

All three classes show common characteristics when it comes to evaluating the impact of digital technologies. Even though over 80% of the surveys' participants confirm that digital technologies have a strong or even very strong impact on the economy in general, differences can be described when it comes into details.

Only 58% confirm a strong or very strong dependency from digital technologies impacting the own market and organisation. Looking at the three groups of professionals as introduced above; however, some particularities can be described differentiating the three groups.

In general, young professionals have a much higher digital affinity and user experience than seniors do have. The reasons are described in being associated with the rapid development of digital technologies in the early years of the 2000s. The less digital experience of elderly businesspeople is, by contrast, compensated by a higher level of seniority, leading to much more working experience and the capability to understand the existing market functionalities in the traditional way. This leads to the assumption that the impact of digital technologies on business performance should be seen and rated differently from within the three described groups. In this regard, the experienced professionals, as the intermediate group, play a bridging role between both fringe groups: they grew up, surrounded by the upcoming IT technologies, when the disruptive potential was still unknown in its wideness as well as with the internet while developing their business skills and learning from existing market rules. In this sense the today's intermediate, experienced group of professionals with ages in between 30 and 50 years seem to understand both, the young professionals as well the senior professionals. They might be able to lever unused digital potential best as the findings show, hence, shall be actively involved in innovation activities.

Based on the present survey outcome, the experienced professionals (intermediate) group between 31 and 50 years recommend much more investments in digital technologies. This request is based on their estimated high relation between the deployment of such technologies and the expected financial impact. However, they also see a somewhat accumulated need to invest more in digital skills within their organisation. In contrast to the other two groups, they see lower existing digital skills within the complete organisation.

Bearing in mind the grade of digitisation within the different markets and their deployment in the respective departments, the un-used potential for increasing the business performance is rather high. Considering furthermore that over 80% of the participants see a high impact on the economy, the risk of not anticipating more efforts into digital technologies as well as specifically in training is high. It would be wise for the executive management of organisations to continuously observe the market for new trends within digitisation and automation, to review the own grade of digitisation along the value-added chain and to think about their current business models to enhance the organisations' performance by respecting digital technologies within their innovation activities. This includes continuous training as mentioned and to include digital technologies as part of their innovation efforts.

Therefore, however, skills are mandatory in order to understand both technology and application potential.

The last chapter 6 is dedicated to the development of an integrated business innovation model (BIM) based on the process approach of innovation management and the continuous improvement philosophy deployed on innovation culture respecting the previous findings described. First, however, three more studies were conducted to support the BIM-development by elaborating three aspects: suitable evaluation methods of ideas as part of the innovation management process, understanding the early stage of the innovation process based on an in-depth study and the testing of the circular economy framework ReSOLVE described in chapter 3 on its deployability into business actions creating value.

The first sub-chapter 6.1 is related to the study on the organisational innovation process concerning the fuzzy-front-end FFE of idea evaluation. Based on a literature analysis respecting multiple techniques in how to evaluate ideas occurring in organisations, the objective was to identify effective methods which a) are quick to understand by the person in charge, b) simple to deploy within the daily business and c) which are useful to use for accepting or rejecting ideas in the initial phase of innovation. Therefore, the methods of the checklist and the methods of evaluation matrix were being selected as appropriate evaluation methods. Both provide the possibility to adapt the tasks on the checklist or to adapt the questions as part of the checklist to the organisation's strategy. Furthermore, some questions/tasks can be weighted by importance. In contrast to other evaluation methods, checklists are easy to adopt and need no specific training as they are self-explanatory. Contrary to the simple checklist, the matrix methods enable organisations to compare different ideas with each other in order to select the most appropriate one.

However, there are also limitations: the success of innovation cannot be guaranteed as the type of questions as well as the rating of the ideas are made by humans. Hence, using specific criteria can increase the efficiency within the innovation process and the effectiveness in choosing the right idea.

Section 6.2 describes an explorative study explicitly performed on the early stage of the innovation process in the context of customer satisfaction. For the study, the Grounded Theory Methodology (GTM) was chosen to be applied according to Strauss and Corbin (1996) as it allows to generate data based on a qualitative method. As such, it intends to complete databased knowledge from within field observations.

The fuzzy-front-end (FFE) as part of the very early stage of the innovation process is still an unchartered field within research, and therefore, the chosen

methodology shall help to close gaps within academics. The study was conducted within a start-up company from within the pump manufacturing industry. During the observation period, this company was characterised by high performant sales results based on an intensive customer-orientation as the studies reveal. Most ideas generated could be observed not in strategic meetings but either from within the customer and within informal discussions between employees. Also, it could be observed that a reciprocal power distribution within the company is existing: strategic power was concentrated towards the management and moreover at the managing director while operational power concentration with a high degree of freedom was assigned to the employees. This could be confirmed within the additional assessment review performed after the year based on the synthesis of cultural determinants from within the previous chapter (see above). Related to the analysis on the early stage, the study revealed that for some products, no development was performed, but an offer to customers was directly created based on proof-of-concept calculations. In this case, the management team was confident in manufacturing the new product without a prototype based on experience only. In another case, sub-suppliers with the relevant experience were involved in order to make an offer directly to the customer.

The last section 6.3 refers to the study on business models in the context of innovation performance and the circular economy. It is related to an explorative survey conducted with businesspeople from within the plastic industry in Germany and was specifically conducted to elaborate the relationship between the business actions out of the ReSOLVE framework introduced in section 3 as a pragmatic translation of the circular economy's philosophy and value creation. In summary, half of the business actions (Regenerate, Optimize and Exchange) do contribute for sure to the creation of value related to the principles of the Circular economy while the actions Virtualize does not contribute. Share and Loop do support Value Creation partly while its overall contribution to it cannot be confirmed. Based on these outcomes, it can, however, be concluded that the deployment of circular economy's principles can mostly contribute to creating value.

The final section 6.4, finally, is based on the development of a Business Innovation Model BIM based on the process approach and a PDCA-based innovation-related cultural framework as part of the BIM.

The development of the PDCA-based framework incorporates two essential research findings: the culture-related determinants as the foundation for innovative behaviour within the organisation (see synthesis elaborated) and the interaction between management and employees by deploying a transformational leadership style, both supporting innovation performance preferably especially in the crucial early stage of the innovation process. However, as the establishment of an

innovation-friendly corporate culture—level is a permanent process, the adoption of the PDCA-cycle approach seems suitable, also due to contextual changes affecting the culture. By bearing in mind ongoing digital technological developments and its radical potential to change business rules, the present framework intends to support organisations to continuously reflect their innovation-related cultural potential as contextual factors are continuously affecting the corporate culture (Becheikh et al., 2006; Porter, 2014).

The described business innovation model BIM tries in this regard to sensitise on three essential aspects. First, the cultural force to influence the innovation performance significantly and irrespective of external circumstances. Secondly, the power of it to address ideas to improve the business towards a more future-oriented level respecting environmental and social benefits as well as by offering new, additional values to customers. Moreover, thirdly, the BIM intends to continuously think about the implementation of digital technologies, as the present thesis has shown that digitalisation has the power to lever the organisational performance completely.

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