

AN EMPIRICAL INVESTIGATION OF THE RELATIONSHIP BETWEEN
CORPORATE SUCCESS AND THE IMPLEMENTATION OF AGILE PRINCIPLES
IN THE MANUFACTURING INDUSTRY IN THE GSA REGION

by

Christian Gronau, MBA

DISSERTATION

Presented to the Swiss School of Business and Management Geneva

In Partial Fulfilment

Of the Requirements

For the Degree

DOCTOR OF BUSINESS ADMINISTRATION

SWISS SCHOOL OF BUSINESS AND MANAGEMENT GENEVA

September 2025

AN EMPIRICAL INVESTIGATION OF THE RELATIONSHIP BETWEEN
CORPORATE SUCCESS AND THE IMPLEMENTATION OF AGILE PRINCIPLES
IN THE MANUFACTURING INDUSTRY IN THE GSA REGION

by

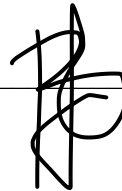
Christian Gronau

Supervised by

Prof. Dr. Leif Erik Wollenweber

APPROVED BY

Vasiliki Grougiou
Dissertation Chair

A handwritten signature in black ink, consisting of stylized, overlapping loops and lines, positioned to the right of the text 'APPROVED BY' and 'Dissertation Chair'.

RECEIVED/APPROVED BY:

Rense Goldstein Osmic
Admissions Director

Dedication

The doctorate in business administration naturally involved countless hours of research, investigation and reflection, discarding theories, drafts and commitments. On such a journey, you need someone who motivates, supports and builds you up when the work seems endless and the progress is not immediately visible. In this relationship, I would like to express my deepest gratitude to my wonderful wife, Pia.

I am especially thankful for her support and understanding of my need to embark on this doctoral journey.

Acknowledgements

In order to even begin the undertaking of a doctoral thesis in business administration, I received support from several people who had a genuine interest in accompanying me on part of this journey. I am deeply grateful for your invaluable contributions to my research and will cherish them.

First and foremost, I would like to express my heartfelt thanks to my doctoral supervisor, Prof. Dr. Leif Erik Wollenweber. His guidance, his ideas that often inspired me to think, and his valuable feedback, coupled with his unique and wonderful character, were crucial to my research.

I would also like to thank my dear colleague Dipl.-Inf. (FH) Katja Kamin. The discussions and exchanges with Katja on the topic of agile transformation have always been very motivating for me. Special thanks also go to my former colleague and friend Patrick Kahl, M.A., for his creative way of questioning things to my remarks and the mutual exchange of useful ideas in the context agility and working models. Furthermore, I would like to thank Dr. Frederike M. Oschinsky for her input as a friendly reviewer and catalyst.

I would like to express my sincere thanks to the experts who participated in my study and thus enabled me to obtain valuable results for my research.

Last but not least, I would like to thank the SSBM Geneva team. Your support, whether technical or in relation to specific regulatory issues, was simply outstanding. Thank you very much.

ABSTRACT

AN EMPIRICAL INVESTIGATION OF THE RELATIONSHIP BETWEEN CORPORATE SUCCESS AND THE IMPLEMENTATION OF AGILE PRINCIPLES IN THE MANUFACTURING INDUSTRY IN THE GSA REGION

Christian Gronau
2025

Dissertation Chair: Vassiliki Grougiou
Co-Chair: Aleksandar Erceg

The dissertation “*An empirical investigation of the relationship between corporate success and the implementation of agile principles in the manufacturing industry in the GSA region*” investigates the relationship between business success and the introduction of agile principles in the manufacturing industry in Germany, Switzerland and Austria (GSA region). The aim of this work is to capture the impact of agile principles on business success in the manufacturing industry, to provide practical insights for decision-makers, and to deliver scientific input.

The need for this research stems from the fact that, despite its widespread use, agility has not yet been investigated in depth in relation to the manufacturing industry in the GSA region. Based on this, the following research questions were defined: which agile principles are most effective? How does the introduction of agile principles influence company metrics such as time-to-market, product quality or cost efficiency? Furthermore, what best practices already exist?

The methodology of the work is based on a mixed-method approach. Quantitative data were collected through an expert survey in which employees and managers were

asked about agile principles, their introduction and their effects. In order to gain further insights into the experience of practitioners, the analysis was supplemented by two expert-interviews.

The results of the research show that agile principles such as continuous improvement, self-organising teams and collaborative working have a positive influence on efficiency, product quality, time-to-market and employee satisfaction. It should also be emphasised that clear management support, targeted training and a cultural change within the company are decisive factors for success. Barriers were also identified, such as technological limitations and silo-like structures.

In summary, the study concludes that the introduction of agile principles in the manufacturing industry in the GSA region is not only possible but also sensible, if it is individually adapted, strategically supported and culturally anchored. The work thus provides scientifically grounded insights into the effectiveness of agile approaches in a traditionally structured industry and contributes to improving the manageability of agile transformations in practice.

TABLE OF CONTENTS

List of Tables	xi
List of Figures	xii

CHAPTER I: INTRODUCTION..... 1

1.1 INTRODUCTION.....	1
1.2 RESEARCH PROBLEM	3
1.3 PURPOSE OF RESEARCH.....	4
1.4 SIGNIFICANCE OF THE STUDY	5
1.5 RESEARCH PURPOSE AND QUESTIONS.....	7

CHAPTER II: REVIEW OF LITERATURE..... 10

2.1 DEFINITION OF AGILE	10
2.2 DEFINITION OF AGILE PRINCIPLES	11
2.3 DEFINITION OF AGILE MANUFACTURING	13
2.4 AGILITY AS A FACTOR FOR SUCCESS.....	14
2.5 AGILITY AS A WORKING MODEL AND CULTURAL ELEMENT	15
2.6 DEFINITION OF TRADITIONAL TRANSFORMATION AND AGILE TRANSFORMATION	16
2.7 COMPARISON OF AGILITY AND CONVENTIONAL MANUFACTURING APPROACHES.....	18
2.8 UNDERSTANDING THE GSA REGION: KEY CHARACTERISTICS AND THEIR IMPACT ON THE MANUFACTURING INDUSTRY	19
2.9 CORPORATE SUCCESS: DEFINITION AND MEASUREMENT.....	25
2.10 CRITICAL SUCCESS FACTORS AND BARRIERS.....	27

2.11 THEORETICAL FRAMEWORK – SCRUM	31
2.12 THEORETICAL FRAMEWORK – KANBAN.....	34
2.13 THEORETICAL FRAMEWORK – SCRUMBAN.....	37
2.14 THEORETICAL FRAMEWORK – SCALED AGILE FRAMEWORK (SAFe®).....	39
2.15 THEORETICAL FRAMEWORK – SCRUM AT SCALE (S@S).....	42
2.16 THEORETICAL FRAMEWORK – LEAN AGILE	45
2.17 SYNTHESIS OF THE LITERATURE AND ITS LIMITATIONS.....	46
CHAPTER III: METHODOLOGY.....	48
3.1 OVERVIEW OF THE RESEARCH PROBLEM	48
3.2 OPERATIONALISATION OF THEORETICAL CONSTRUCTS	49
3.3 RESEARCH PURPOSE AND QUESTIONS.....	50
3.4 RESEARCH DESIGN.....	52
3.5 POPULATION, SAMPLE AND PARTICIPANT SELECTION	54
3.6 DATA COLLECTION PROCEDURES AND INSTRUMENTATION	56
3.7 DATA ANALYSIS	56
3.8 RESEARCH DESIGN LIMITATIONS.....	60
3.9 CONCLUSION.....	61
CHAPTER IV: RESULTS.....	63
4.1 CONCEPTUAL FINDINGS	63
4.2 COMPARISON AND SYNTHESIS OF GROUNDED THEORY ANALYSES	74
4.3 RESEARCH QUESTION ONE: IMPACT OF AGILE IMPLEMENTATION ON PERFORMANCE IN GSA MANUFACTURING	77
4.4 RESEARCH QUESTION TWO: AGILE SUCCESS FACTORS IN GSA MANUFACTURING .	79

4.5 RESEARCH QUESTION THREE: IMPACT OF AGILE PRINCIPLES ON KPIs IN GSA MANUFACTURING	82
4.6 RESEARCH QUESTION FOUR: BEST PRACTICES	87
4.7 CRITICAL LIMITATIONS OF THE STUDY	94
4.8 SUMMARY OF FINDINGS	96
4.9 CONCLUSION.....	97
CHAPTER V:.....	99
DISCUSSION, SUMMARY, IMPLICATIONS AND RECOMMENDATION	99
5.1 DISCUSSION OF RESULTS.....	99
5.2 SUMMARY OF FINDINGS	99
5.3 DISCUSSION OF THE RESEARCH QUESTIONS.....	100
5.4 DISCUSSION OF RESULTS.....	102
5.5 TRANSLATING AGILITY INTO PRACTICE: STRATEGIC AND CULTURAL IMPLICATIONS FOR INDUSTRIAL ORGANISATIONS	103
5.6 GUIDING AGILE TRANSFORMATION: PRACTICAL RECOMMENDATIONS FOR INDUSTRIAL IMPLEMENTATION.....	105
5.7 RECOMMENDATIONS FOR FUTURE RESEARCH.....	113
5.8 CONCLUSION.....	117
APPENDIX A SURVEY COVER LETTER AND SURVEY QUESTIONS	120
APPENDIX B INFORMED CONSENT.....	129
REFERENCES.....	131

LIST OF TABLES

Table 2. 1 Comparison of different aspects during traditional transformation and agile transformation	17
Table 2. 2 Comparison of the GSA economy	24
Table 2. 3 Success factors and barriers of introducing agility	30
Table 2. 4 Comparison of Scrum Ceremonies and Scrum@Scale ceremonies	43
Table 5. 1 Implementation Plan Proposal	110
Table 5. 2 Short-term Implementation Plan.....	111
Table 5. 3 Possible Obstacles and Countermeasures	112

LIST OF FIGURES

Figure 1. 1 Structure of Doctoral Thesis.....	3
Figure 2. 1 The Scrum Framework (c) by Scrum.org.....	34
Figure 2. 2 Kanban Board.....	37
Figure 2.3 Typical Scrumban process adapted from Lunesu et al. (2018)	39
Figure 2.4 SAFe 6.0 Large Solution (c) by Scaled Agile, Inc.	41
Figure 2.5 The Scrum@Scale Process (c) by Scrum Inc; scrumatscale.com; agileeducation.org	44
Figure 4.1 Distribution of roles among study participants	63
Figure 4.2 Participants' years of experience of working with agile approaches	65
Figure 4.3 Age of study participants.....	67
Figure 4.4: Distribution of study participants by place of work	69
Figure 4.5 Distribution of study participants in subcategories of the manufacturing industry	71
Figure 4.6 Gender distribution of the study participants	73
Figure 4.7 The most effective agile principles for driving business success in manufacturing companies	79
Figure 4.8 Impact on time-to-market rate	83
Figure 4.9 Relationship quality of products and introduction of agile principles	84
Figure 4.10 Change in costs after introducing agile principles	85
Figure 4.11 Change in costs after introducing agile principles part 2	86

Figure 5. 1 Corporate Success Through Agility	108
---	-----

CHAPTER I: INTRODUCTION

1.1 Introduction

According to Kumar et al. (2020), the two main challenges facing manufacturing companies are the emerging advanced manufacturing philosophies and the changing nature of customers. Riesener et al. (2020) also state that customers want heterogeneity and shorter innovation cycles, especially in the development of physical products. These should be realised through agile principles.

As all market participants have to deal with this phenomenon, an answer is needed as to how companies must position themselves now or in the future in order to continue to be perceived as competitive market participants.

A complementary factor here is that in recent years, this trend has also become increasingly important in the manufacturing industry due to the introduction of agile principles in companies. Agile methods, which have their origins in software development (Schwaber, K. and Sutherland, J. 2020), no longer stop at challenges that lie in the non-software area. Anderson and Merna (2014) explain that agile methods have shown promising results in improving the adaptability, innovation and efficiency of organisations. However, the exact relationship between the implementation of agile principles and business success in the manufacturing sector is still under-researched, especially in the context of the GSA region (Germany, Switzerland, Austria).

The aim of this dissertation is to add value to science so that the findings can be used as a basis for further research. Building on current trends and challenges facing companies in the market, this thesis will conduct a study describing the introduction of

agile principles and their impact on business outcomes. It should be noted that this thesis deals exclusively with companies based in the manufacturing industry.

The GSA market is defined by various characteristics, which will be discussed in detail later in this paper. Traditionally, people in the GSA region tend to be sceptical about change and trends (Accenture *et al.*, 2019). So why should they change and even adopt a management approach that is not European?

The answer could, of course, lie partly in globalisation and global trade. It has long been known that market players in other regions and on other continents are also capable of manufacturing high-quality, reliable products and delivering them worldwide. The market has therefore grown, presenting new challenges for those involved. But what does this mean for companies based in Germany, Switzerland and Austria? They must face these challenges.

Corporate success is often used as a classic business management indicator to assess how efficient, how valuable, or in global terms, how healthy a company actually is. Later in the dissertation, a definition will be provided of how corporate success is viewed and what it means for market participants if they fail to adapt and continuously develop.

This research explores the concept of agility and its influence on corporate success. By combining insights from experts and industry representatives, with a mixed-methods approach, the study aims to deliver a scientifically sound and practically relevant contribution to the field.

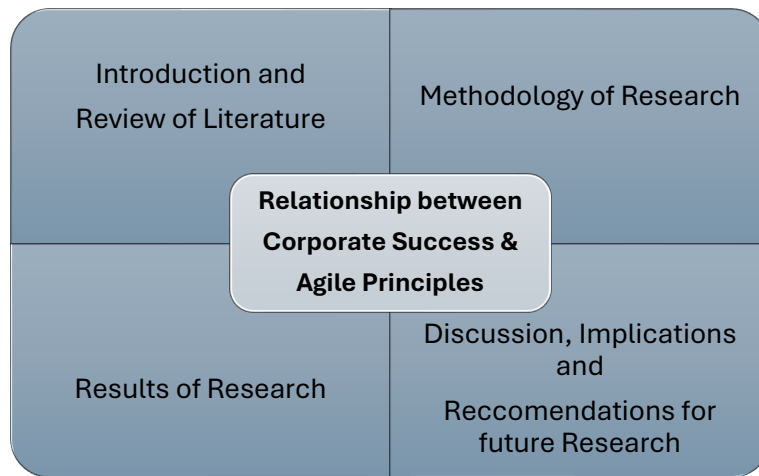


Figure 1. 1 Structure of Doctoral Thesis

1.2 Research Problem

Although the trend towards agility is no longer limited to the software industry, many companies are still not sure what to do with agility. In the past, classic project management methods were excellent for managing projects or a company, but today this seems to be called into question. Many media publications speak of agility as a saviour (Schäder 2018) or of agility as a bringer of misfortune (Prüfer, 2024) for every company. The fact is, however, that there is currently too little knowledge about agility in the German-speaking world (GSA region). If you then add the manufacturing industry factor to this, the limits of scientific research on the subject are quickly reached. But more knowledge about this is very important, especially in 2024, for manufacturing companies to meet their operational goals (Evans, 2024).

Further research is needed on the topic of how the introduction of agile principles affects a company's success. It shows that some past studies have mainly focussed on describing the spread of agile frameworks in companies and industries. Or the studies

refer to the contribution of managers and employees and their role and importance in the introduction of agility in an organisation (BearingPoint, 2022).

Manufacturing companies are being forced to address the issue of agility. It appears that the methodology and the topic are not just a passing trend that can be ignored (Sun *et al.*, 2022). If you look beyond your own backyard and compare your industry outside the GSA region with competitors, the automotive manufacturer Tesla, for example, which builds electric cars exclusively using agile methods, catches the eye (Vetter, 2019). Staying briefly with the automotive industry, the existence and success to date of Tesla is naturally an affront and a thorn in the eye of many German automotive managers, who are proud of the label “Made in Germany” - Motherland of the Automotive industry (Zwick, 2023).

This is just one example from the automotive industry. However, other manufacturing companies are also exposed to highly competitive pressure. Globally, major players from the United States, China and the Indo-Pacific region have long been active on the market. Action is therefore necessary. To further concretise the actual problem, it can be said that previous research efforts have not focused specifically on the German, Swiss and Austrian perspectives. Therefore, this thesis will deal with this aspect.

1.3 Purpose of Research

The long-term goal of the research is to build a better understanding of the relationship between agile principles and corporate success. The results should be prepared in a way that managers and company-leaders can use them as a guideline for leading their business operations. This research should also be an inspiration for other scientists to build on it in order to gain further insights.

Firstly, it is important to understand what it means to talk about agility. There are already differences here, so it will be necessary to take a global view and concretise it in the context of manufacturing industry. Furthermore, it is also necessary to consider what the term corporate success actually means, what characterises and distinguishes it. When discussing the introduction of agile principles, the topic of business transformation must also be considered. This is a further aspect of the research.

In other words, the intention is to identify factors that bring us closer to understanding agile principles and the success of the company. To be more accurate the following sub-objectives are intended to serve as a guide:

- Which agile principles are used most frequently?
- How has the company's success changed after agile principles were introduced?
- What has changed in the way of working after the introduction of agile principles?

Once sufficient data is available to answer the research questions and objectives, this research promises to make a contribution to the existing body of knowledge.

1.4 Significance of the Study

This study aims to contribute to expanding the existing field of research and identifying new ways in which future decision-makers could deal with challenges and obstacles. In addition, the research focuses on agility and its impact on corporate success. This is a relationship that has rarely been studied, particularly in the manufacturing industry in the GSA region (Germany, Switzerland, Austria). In past studies, agility was often analysed in the context of software development. For manufacturing companies, the question is to what extent agile principles can be transferred to a classic industrial

structure. This research starts right here and creates scientifically grounded findings that show whether and how agile principles can be used in a manufacturing environment and with what effects and what special features they have.

Academic Contribution:

This work provides scientific added value on several levels.

Focus on the GSA region: previous research has mostly examined international examples or focusses on other industries. This thesis is the first to take a centred look at the manufacturing industry in the German-speaking region.

Defining terms: the terms “agility” and “corporate success” are placed in a scientific context and given a practical definition. The aim is to create a common understanding of terms and facilitate further research in the field.

Empirical research: the mixed-method approach is used to collect both qualitative and quantitative data, which leads to more in-depth findings on the base of which further research can be conducted.

Impulse for further research: this work is intended to serve as a foundation for future research endeavours. Either specifically tailored to the manufacturing sector, or on the relationship between agility and corporate success.

Practical Implications:

This thesis offers the following relevant insights for practice:

Orientation for companies: this work shows which agile principles are used particularly frequently in practice and how these have a concrete impact on company’s success.

Best practices from the region: companies from the GSA region can use case studies to compare themselves and extract their own recommendations for action from successful approaches.

Awareness of challenges: when introducing agile methods, challenges will also arise.

This work also deals with these and shows how they can be overcome.

Support for strategic decisions: this work provides managers with a scientifically grounded basis for decision-making. They can see the added value of an agile organisation and apply it to their company. Important KPIs such as time-to-market and quality are also discussed.

1.5 Research Purpose and Questions

In order to understand how the introduction of agile principles affects a company's success, it is first necessary to understand what happens during such an introduction. How are agile principles introduced and who drives this process forward? Furthermore, it is important to examine the initial effects of this transformation on employees. After a certain period of time, are there already insights into the efficiency of the teams? The theory behind this question is that more efficient teams can generate higher output, which in turn increases company output and contributes to a higher production rate, leading to higher sales. Higher sales on the market then influence the profit generated by the company.

The formulation of research questions (RQ) is fundamental to this investigation. They serve as a basic framework for further work and guide the research process. Based on the above considerations, four dimensions have been defined, each of which addresses a specific research question. The dimensions are as follows: *implementation and success correlation, agile principles adoption, performance metrics and case studies and best practices*.

1. Implementation and Success Correlation

RQ1: What is the interrelation between the implementation and extent of agile principles and the overall performance metrics of manufacturing companies in the GSA region?

The RQ1 considers the implications and their relationship to a company's performance. It should be emphasised that these are manufacturing companies based in the GSA region.

The answer to this first RQ allows management to make initial considerations regarding the possible introduction of agility in their own company. This enables company executives and employee representatives to jointly analyse at an early stage whether the path to an agile way of working will be reflected in added value in terms of performance and what the effects might be.

2. Agile Principles Adoption

RQ2: Which agile principles are most effective in driving business success for manufacturing organisations in the GSA region and why?

It is essential to understand which agile principles have a particular impact on company's success. Based on the answer, company leaders can make further considerations and prioritise certain areas in the event of a possible upcoming transformation. If, for example, a particular area of agile principles demonstrates above-average added value for a company, this can serve as a decision-making aid for management.

3. Performance Metrics

RQ3: What is the impact on key performance indicators such as time-to-market, quality control and cost efficiency in the manufacturing sector in the GSA-region, through the introduction of agile principles?

Answering the RQ3 based on the impact on specific KPIs can be a crucial factor for a steering committee when deciding whether to experiment with agility or not. The manufacturing sector with its individual requirements in terms of production, the environment and technical challenges, expects a clear answer to this question. Especially with the unique geographical location in Central Europe.

4. Case Studies and Best Practices

RQ4: What exemplary approaches are there for the integration of agile principles in the manufacturing sector, based on the experience of companies in the GSA-region that have already successfully implemented them?

The question of optimal methodologies for agile transformations that have already been successfully implemented can serve as a guide. It could be possible for managers that conclusions may be drawn based on the experience and lessons learned of other companies. This allows mistakes to be avoided and priorities to be clearly defined from the beginning. In cases where there is a necessity for such action to be taken, the option for a network to be established between companies with a view to provide mutual support during a period of transformation exists. This could result in the creation of potential synergies.

CHAPTER II:

REVIEW OF LITERATURE

Rapidly changing market conditions and the need to orientate oneself to customer requirements while delivering high-quality products demand a solution. This solution is the use of agility (Goldman et al. 1995); (DeVor, Graves and Mills, 1997). There are two main approaches to agility, one is to react strategically and appropriately to changes and the other is to capitalise on these changes (Kidd, 1995); (Sharifi and Zhang, 2001).

Of course, this approach is radical and demands a break with already established work processes, as these are no longer considered up-to-date (Gunasekaran and Yusuf, 2002). Agility is the ability to constantly develop as an organisation and to remain competitive and survive in a dynamic market (Dowlathshahi and Cao, 2006).

2.1 Definition of Agile

It is challenging to define a term that seems to be on everyone's lips but appears to be interpreted differently by everyone (from team members to senior managers).

Bendel (2019) explained agility as the ability of a company or an individual to react flexible to unforeseeable changes. He goes on to explain that companies are traditionally characterised by many fixed defined processes. However, companies that work in an agile way can react more quickly to changing customer needs. This gives them the opportunity to react more dynamic to market requirements as a market participant.

Another definition was provided by Cockburn (2002), who calls for manoeuvrability and the use of a few rules for human-centred communication. Subramaniam and Hunt (2011) encourage feedback to strengthen collaboration and enable continuous improvements based on the input received. Larman (2004) on the other hand, defines agility as the ability to respond quickly and flexibly to change. Finally, Anderson (2004) is consulted, who sees the ability to accelerate processes in agility.

It can therefore be summarised, what Gren and Lenberg (2019) examined in various concepts and studies to arrive at a possible definition. Ultimately, they created a definition based on their experience from several agile transformations. They describe that the core goal of any agile transformation is the ability to adapt to change. The essential element here is the agile manifesto, which practitioners and scientists refer to.

Although the Agile Manifesto (Beck, K. *et al.*, 2001a) originally referred only to software development, it is now also used in non-software projects. Starting as an alternative to waterfall project management, agile methods are also present in projects and subject areas that are outlined with high complexity. It is used for example, in product development or strategic planning challenges (Müller, 2018).

2.2 Definition of Agile Principles

Agile Principles have their origins in the Agile Manifesto, which was written in 2001 (Beck, K. *et al.*, 2001a) by a group of 17 engineers. The aim of these men was to define better framework conditions for project management and product development.

But what exactly are agile principles? They are a set of different values and beliefs that describe the agile methodology. Specifically, the 12 agile principles are as follows:

1. “Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer’s competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity – the art of maximizing the amount of work not done – is essential.

11. The best architectures, requirements, and designs emerge from self-organizing teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.”, (Beck, K. *et al.*, 2001b).

2.3 Definition of Agile Manufacturing

Agile Manufacturing as a modern manufacturing paradigm that focused on organisations to enable them to respond immediate and efficient to changing market requirements. The main focus here is on innovation and flexibility, coupled with the highest quality standards and a fast-moving supply chain. This is intended to increase customer satisfaction and thus enable a greater ROI (Potdar *et al.*, 2017).

The most important elements of the approach include:

- Rapid response to change (both on the market and on the customer side)
- Integration of different resources (such as methods and technologies)
- Use of IT as a support tool for implementation
- Focus on core competencies and collaboration with customers and other involved players, such as producers and suppliers, in order to increase benefits.

Canda (2020) confirms the view that agile manufacturing, as a modern manufacturing paradigm aims to enable organisations to respond quickly and efficiently to changing market conditions.

The summary of the literature on this topic shows that agile manufacturing can be a strategic response that enables companies to maintain a certain degree of flexibility

reaction speed in a continuously changing market, influenced by a VUCA world. Jin-Hai *et al.*, (2003) describe the approach as evolutionary and revolutionary. Evolutionary because it builds on established management methods, and revolutionary because the holistic adoption of agile manufacturing represents a break with those old management methods.

To may give it another view and make a critical comment on agile manufacturing Amir (2011) recognises the need to change the culture of a company in order for agile production to emerge at all. Technical aids and machines alone will not help here. Furthermore, the concerns of managers who feel a loss of power due to the introduction of agility and the associated restructuring in self-organised teams must also be addressed. The same applies to the uncertainty of employees who feel overwhelmed by the new structures (Atzberger *et al.*, 2020).

2.4 Agility as a Factor for Success

In its study published in 2019, the management consultancy group the KPMG (2019) revealed that 68% of the companies surveyed cited agility as the most relevant factor for rapid product delivery and the best way to respond to changing customer needs at short notice. The companies go on to say that the ability to adapt to current change that they require can also be achieved through agility. These expectations are supported by Forbes Insights (2018), which argues that companies benefit from a high degree of agility in the organisation. For example, a shorter time-to-market rate of 60% with improved product quality is recognisable among the companies surveyed.

Agile transformations enjoy a certain popularity in many industries. Rigby, Sutherland and Takeuchi (2016) describe that the introduction of agility accelerates company growth. This in turn leads to a shift in the mindset of many managers. Two Examples are John Deere, who is developing new machines for agriculture, or the manufacturing company Saab that is building fighter jets. The popularity of agile transformations is underpinned by the expectation of German companies stating that they will introduce agility in selected areas of the business (22%), complemented by 33% aiming to become an agile organisation as a whole within the next three years (KPMG 2019). Taking a more global view, 69% of 274 companies surveyed stated that they are on the way to delving deeper into agility and its introduction (Business Agility Institute, 2019).

2.5 Agility as a Working model and cultural Element

Changing the culture and the different ways of working is probably the biggest challenge that needs to be overcome in order to successfully implement an agile transformation (Smet, Lurie and George, 2018). If this does not succeed, the scepticism and resistance of the workforce to an organisational transformation is enormous. The corporate culture in particular is strongly characterised by a company's employees. What is needed here is a clear management commitment from managers that argue in favour of agile working. It is assumed that the prevailing culture in the company will change significantly (Judt and Klausegger, 2022).

Ramesh and Devadasan (2007) describe the fact that agility as a concept is presented quite differently in the adaptation of companies. Companies try to find out their

own degree of agility with individual approaches. There is always an imbalance between the factors of speed, flexibility, costs, quality, innovation and proactivity, which are seen as positive characteristics of agility. A company cannot increase all factors equally (Ren, Yusuf and Burns, 2003).

Furthermore, Soepardi et al, (2018) describe that this individualised approach of companies to implementation means that there is an urgent need to research this trend and how agility and its characteristics affect the competitiveness of companies.

2.6 Definition of traditional Transformation and agile Transformation

Traditional transformation is characterised by a focus on large-scale, planned initiatives aimed at changing an entire organisation. It usually follows a predefined top-down approach. In order to improve organisational efficiency and thus competitiveness, traditional transformation often also aims to implement new business areas or technologies. This is described as a fundamental change in strategy. The reason (or the need) for the change is the reaction of a transforming company to adapt to new market conditions. A predefined (by management) outcome determines the transformation. These outcomes are usually to be achieved through standardised processes, a clear hierarchy and a complete focus on meeting these targets (Grebic *et al.*, 2025).

A traditional transformation is often sketched by:

- Centralised decision-making (Khalilov, 2023)
- Consecutive phases (planning, execution, monitoring), (Sarran et al.)
- Focus on predictable disruptions and risk minimisation (Levy and Merry, 1986)
- The transformation is managed by a transformation office or a governance committee (Saliunas, 2007).

Agile transformation describes an approach to fundamentally changing an entire organisation. Change takes place in the structure, processes and corporate culture. Agile principles and agile practices are introduced. Agile Transformation is constantly confronted with changing environmental factors. It therefore seeks answers that enable it to respond quickly to these influences. In addition, it attempts to manage the change that affects a company through greater collaboration and adaptability. Agile Transformation support continuous feedback, iterative development and, above all, decentralised decision-making.

An agile transformation is often sketched by:

- The focus is on flexibility, rapid adaptability and close cooperation with the customer
- Decentralised, self-organised teams that enjoy decision-making autonomy
- Iterative and incremental value creation
- Continuous learning and a willingness to be open to change.

Table 2.1 compares the different approaches:

Aspect	Traditional Transformation	Agile Transformation
Approach	Structured, top-down, planned	Iterative, adaptive, decentralised
Decision-making	Centralised	Decentralised, empowered teams
Change Management	Standardised processes, governance committee	Continuous feedback, learning, and evolution
Focus	Efficiency, risk management, predictability	Flexibility, responsiveness, customer value
Typical Drivers	Technology upgrades, market shifts	Need for speed, innovation, adaptability

Table 2. 1 Comparison of different aspects during traditional transformation and agile transformation

The “KI-AGIL” process model, which was developed especially for small and medium-sized enterprises (SMEs), serves as a supplement and outlines the further development of classic transformation approaches. In their research, Feld, Arens-Fischer and Schumacher (2024) describe how conventional models such as CRIPS-DM or CRISP-ML(Q) are too complex and too technically oriented for SMEs. “KI-AGIL” is an agile process model based on the vision of enabling low-threshold implementation of AI solutions through iterative sprints, feedback loops and minimum viable products (MVP).

2.7 Comparison of agility and conventional manufacturing approaches

Looking at the classic approach to manufacturing processes, accurate milestone planning should first be in place before the creation of a physical product can even be considered. The requirements for the later product must already be available at a stage before, the so-called Start of Production (SOP). The aim of this approach is to ensure that tools that accompany the manufacturing process or other aids can already be produced before the SOP (Reichwein *et al.*, 2020). However, a decisive disadvantage of this approach is that subsequent changes to the product can no longer be adopted, or only at considerable financial expense (Schröder, 2021). The situation is different with agile software development, which can also subsequently change products that have already been launched on the market with little effort; it even welcomes any change (Beck, K. *et al.*, 2001a). Agile manufacturing has the potential to solve this and other problems, such as long communication and coordination efforts within the company, or the disregard of specialised departments. However, it must be adapted to the individual production

situation of the company, taking into account that this is not software development, but hardware development (Atzberger *et al.*, 2020).

2.8 Understanding the GSA Region: Key Characteristics and their Impact on the Manufacturing Industry

The GSA (Germany, Switzerland and Austria; also known as DACH – Deutschland, Österreich, Schweiz) region is characterised not only by its geographical location in Central Europe, but also by its economic strength. It also offers a high quality of life and is characterised by a specific approach to entrepreneurship and talent development.

Economic and Business Environment

Germany

The German economy is recognised as the largest economy in Europe and a global export nation. At the end of the 1990s, Germany experienced a period of moderate growth with high unemployment. At the beginning of the 2000s, the economy developed into a true “superstar”, which can be described by the exports achieved in 2011, which amounted to 1.738 trillion US dollars. This amount represents about half of GDP and also corresponds to about 7.7% of global exports.

During the great recession crisis, the German economy proved to be robust and resilient. Compared to other European countries of the United States, Germany records only a slight increase in unemployment (Dustmann *et al.*, 2014)

Switzerland

Switzerland in particular is known for its internal security, stable political situation and reliable pension system. For multinational companies, the tax framework

and excellent infrastructure are further attractive features (Curioni, 2024). Another factor in the Swiss economy is its robustness and resilience during global challenges such as the COVID-19 pandemic. Government spending has remained low, which reflects the country's solid fiscal policy.

Furthermore, the economy is primarily characterised by its strong service sector (around 75% of GDP). Many small and medium-sized enterprises (SMEs) dominate the market (over 99%, with <250 employees). In addition, the Swiss labour market offers a large pool of highly skilled workers. Moreover, many multinational companies have already established themselves in Switzerland.

Spending on research and development will amount to approximately CHF 25 billion (USD 29.95 billion) in 2024, which corresponds to about 3.4% of GDP (Eidgenössisches Departement für auswärtige Angelegenheiten EDA, 2024).

Austria

The Austrian economy has been in a prolonged recession since end of 2022. As a result, negative or stagnating real GDP growth is expected for 2023 and 2024. The economy is expected to stabilise in 2025, but recovery effects are not predicted until 2026 (Fenz *et al.*, 2025). For 2026 a growth of about 1.2% is forecast (Federal Ministry Finance Republic of Austria, 2025).

Like Switzerland, Austria's economy has a dominant service sector, which for approximately 70% of gross value added, as well as the characteristics of over 99.7% small and medium-sized companies. (Gavac *et al.*, 2025).

Although the service sector is very prominent, manufacturing plays a significant role, accounting for approximately 27% of economic output. The most important sectors here are mechanical engineering and plant construction, as well as the automotive and automotive supply industry (Buchberger, 2017).

Interim Summary

The GSA region is economically strong. However, each country currently has its own challenges to overcome and sets individual priorities. The German economy is characterised as export-oriented, while the Swiss economy focusses on stability and innovation. Austria has a strong manufacturing industry in the secondary sector, which is on the way to ensuring stability for the economy.

Characteristics of the Manufacturing Industry in the GSA region

The following sections examine the areas of structure, digitisation and Industry 4.0, sustainability and resource efficiency, competitiveness and innovation, as well as the labour market and skills shortages. A brief interim conclusion is then drawn.

Structure

The manufacturing industry is of fundamental importance for Germany. It is the backbone of the German economy. The materials and resource-based industry plays a particularly important role here. It accounts for around 20% total value added. This corresponds to a turnover of over 1.4 trillion euros. This secures around 6.5 million jobs. Germany is a leader in Europe and focusses on innovation, automation and digitalisation in the context of Industry 4.0 (Bundesministerium für Bildung und Forschung (BMBF). Referat Werkstoffinnovationen, 2025; Kagermann *et al.*, 2016).

In Austria and Switzerland, manufacturing is a key economic sector, but accounts for a smaller share of total value added than in neighbouring Germany. The manufacturing industry in both countries is characterised by a strong export orientation and high product quality. There is also a high degree of specialisation in niche markets.

Digitalisation and Industry 4.0

The manufacturing industry in the GSA region is in the middle of a digital transformation. Companies are increasingly relying on intelligent networking, with real-

time data analysis and automation. The aim is to optimise production processes and make them more flexible. In Germany in particular, there are numerous initiatives and competence centres for Industry 4.0. These are intended to promote knowledge transfer between research and industry.

A clear challenge in the field of digitalisation is the lack of expertise among SMEs when it comes to technologies and the integration of IT systems. However, this is seen as crucial to exploiting a company's full potential. (Gründel *et al.*, 2024; Kiczek, 2022; Schneider *et al.*, 2021)

Sustainability and Resource Efficiency

In its research “Zukunft der Industrie”, Stauf AG, (2023) found that two out of three industrial companies in the GSA region already aiming to achieve CO₂-neutral production within the next ten years. Sustainability is becoming increasingly important for economics success and competitiveness. In addition, overall raw material productivity is to increase. Environmental pollution is to be minimised, and resources used more efficiently (Mock *et al.*, 2022).

Competitiveness and Innovation

The GSA region is enhancing its focus on research and development, particularly in the areas of new materials, automation and AI. In addition, interdisciplinary cooperation between science and industry is driving the development of competitive products. The manufacturing industry is highly international and must adapt to constantly changing market conditions. In order to compete with international competitors, digitisation and agility must be implemented in a purposeful manner. SMEs must expand their skills through digitisation in order to secure competitive advantages (Peretz-Andersson *et al.*, 2024; Kewes, 2024).

Labour Market and Skills Shortage

As demographic change in the GSA region is leading to a shortage of skilled worker, Germany is aiming to increase the employment rate to 78% by 2030 (Mock, *et al.*, 2022). Companies are currently investing in further training for their employees to improve their performance (Gründel *et al.*, 2024).

Interim Summary

The manufacturing industry in the GSA region is influenced by strong innovative power, advancing digitalisation and the expansion of sustainable production processes. Germany plays a leading role not only within the GSA region, but also in Europe. Austria and Switzerland excel with specialisation and quality in their product portfolios. The challenges lie in the shortage of skilled workers, the integration of digital technology and the implementation of sustainability goals.

Dimension	Germany	Switzerland	Austria
General economic situation	Europe's largest economy, export-oriented, robust during the financial crisis	Stabel, secure, solid fiscal policy, high quality of life	In recession since the end of 2022, stabilisation expected from 2025
Economic structure	Strong industrial sector, export powerhouse	Dominance of the service sector (~75 % of GDP), many multinational companies	Service sector dominates (~70 % of GDP), strong industrial sector (~27 % of GDP)
SME share	Very high, backbone of the economy	Over 99 %, <250 employees	Over 99.7 %, <250 employees
Research and development expenditure	Focus on Industry 4.0 and material innovation	CHF 25 billion (~3.4 % of GDP) in R&D (2024)	Less data available, but strong sector in mechanical engineering and automotive
Production and industry	Leading in Europe, highly automated and digitised, high turnover (~€1.4 trillion)	Highly specialised, strong niche markets, high product quality	Important industrial sector specialising in mechanical engineering and automotive
Digitalisation/ Industry 4.0	Leading, many initiatives and centres of excellence	Progressive, but with a shortage of skilled workers in SMEs	In digital transformation, similar challenges to Switzerland
Sustainability/ Resource efficiency	Goal: CO ₂ -neutral production in 10 years, increased efficiency	Also, ambitious sustainability goals	Similar developments, but limited by the crisis
Innovative strength/ Competitiveness	High R&D investment, focus on automation, AI, agile processes	Strong innovative capacity, specialisation	Focus on efficiency and quality products in niche markets
Labour market	Demographic change, goal: 78% employment rate by 2023, continuing education initiatives	High level of qualifications, but also noticeable shortage of skilled workers	Skills shortage due to demographic change, investment in training
Interim conclusion	Innovation and export driver, pioneering role in Europe	Stable, qualified, innovative, highly attractive location	On the road to recovery, strong industrial base with potential

Table 2. 2 Comparison of the GSA economy

2.9 Corporate Success: Definition and Measurement

If the effect/ influence of agility is used as a measure of corporate success, there is a certain degree of uncertainty. An important factor here is that there are many definitions and approaches in the scientific literature and in practice that have an idea of corporate success. However, there is no universal understanding of the term. Wolfond (2018) explains that one of the reasons for this is that the approaches to the definition can depend primarily on the company's characteristics and strategy. In addition, company success can be measured using both monetary KPIs, such as profit or return on investment (ROI), and non-monetary indicators, such as customer satisfaction.

Murphy *et al.* (1996) take the strategic perspective, dealing with the problem of defining the term. They explain that the term success can be defined in various narrow and broad terms. As a multidimensional construct, success refers to the financial and operational levels of an organisation and its stakeholders. This underlying economic perspective is a central component of the explanatory approach of industrial economics. This is a specialist discipline of economics that deals with the relationships between success, industry characteristics and competitive behaviour (Homburg, 2015).

Performance controlling is part of organisational controlling and is used in particular to measure success. However, it is characterised by its complexity. On the one hand, there is the measurement of effectiveness ('doing the right things') and on the other hand, the measurement of efficiency ('doing things right'). Now, depending on the perspective, the objectives and the context in which the organisation finds itself, a globally valid measurement approach must be defined, but this is not possible. In

concrete terms, this means that there must be several dimensions that can contribute to measuring success. Business success cannot be reduced to one simple key performance indicator. It is always a question of perspective, objectives and the combination of effectiveness and efficiency (Mellewigt and Decker, 2007).

In their study on agile transformation of working environments published in 2020, Marrenbach and Korge (2020) conclude that corporate success is not primarily measured by traditional key figures such as turnover and profit. Instead, success is understood as a multidimensional construct consisting of adaptability to dynamic and changing markets, the ability to innovate and the company's organisation, which is influenced by a shared learning culture, as well as the measurement of employee satisfaction and motivation. In addition, the key figure of so-called cultural maturity in relation to agility is surveyed. Finally, the dimension of sustainable organisational development is also considered. However, the researchers also point out that, particularly in the GSA region, many companies are still strongly attached to classic KPIs and are trapped in their traditional hierarchies. Nevertheless, the transition to an agile organisation is seen as crucial for the future.

Another problem in research on corporate success and performance is the frequent use of success as a synonym for efficiency. The same applies to the equation of success with the achievement of traditional key figures without seriously considering the underlying organisational goals. Aguilera *et al.* (2024) criticise this situation in their paper. They argue that corporate success is much more than the degree to which goals are achieved. In their view, a well-founded analysis of success can only be carried out if the

actual corporate goals pursued have been taken into account beforehand, whether these are financial or non-financial goals.

In this context, the authors point out that different types of organisations, such as start-ups, family businesses and state-owned enterprises, sometimes have heterogeneous target systems. This makes a direct comparison of performance between them problematic. The authors' call for a rethink in management research is therefore a central focus of their research. They argue for a shift away from generalised evaluation based on traditional key figures towards a contextual understanding of success as goal-oriented performance.

2.10 Critical Success Factors and Barriers

Agility seems to be a universally relevant topic. Manufacturing companies in the GSA region would therefore be well advised to address this issue. This chapter takes a critical look at the debate and presents success factors and barriers.

The literature essentially describes six different success factors, that are important for the agile adaption: leadership commitment and vision, cultural readiness and change management, cross-functional collaboration, training and skill development, customer involvement and feedback loops and technology and digitalisation. In details it means: *Leadership commitment and vision*: Campanelli *et al.* (2017) explain that the support from top management is essential for a successful agile transformation: in fact, it is indispensable. Accordingly, leaders must have a clear vision of the transformation and actively drive the change process forward.

Cultural readiness and change: when considering this area Kuchel *et al.* (2022) analyses that an open corporate culture is needed that welcomes change, promotes collaboration and encourages continuous learning.

Cross-functional collaboration: in order to break down traditional knowledge silos that are often found in manufacturing, Weichbroth (2022) explains that agility relies on collaboration between direct departments, thereby creating added value in the production process.

Training and skill development: as in the area of cultural readiness and change, Kuchel *et al.* (2022) also add to this discussion in the area of training with their call for an organisation in which training and individual support are on the agenda. They explain that targeted training breaks down inhibitions towards agility and builds confidence.

Customer involvement and feedback loops: the integration of customer feedback into product development must also be ensured in the manufacturing process in order to be able to respond quickly to changes (Komandla, 2022).

Technology and digitalisation: the use of digital tools can increase transparency and data-driven decision-making (Korherr *et al.*, 2022).

Next, six barriers to the introduction of agility in the manufacturing industry are listed. The barriers are cultural resistance and organisational inertia, siloed structures and lack of communication, skills and knowledge gaps, technology constraints, inadequate measurement and success models and regulatory and compliance challenges.

Cultural resistance and organisational inertia: an agile transformation can be hindered by a corporate culture defined by deeply rooted norms, a strong pronounced hierarchy and established routines. In traditional manufacturing companies, resistance to change is often cited as the main obstacle (Strode *et al.*, 2009).

Siloed structures and lack of communication: functioning silos and boundaries hinder any kind of cross-functional collaboration (Carreno, 2024). Overcoming such silos requires active reorganisation.

Skills and knowledge gaps: companies outside the software industry still have limited experience in dealing with agile methods. This leads to uncertainty among employees who are expected to use these methods (Reunamäki and Fey, 2023).

Technology constrains technological limitations can be a major problem. If the digital infrastructure is inadequate for the application, for example due to a poor internet connection, high investment costs in technology can quickly arise. The implementation of agile tools to ensure real-time exchange of information is then an additional complication. High IT costs can be a real obstacle, especially for small and medium-sized enterprises (Omowole *et al.*, 2024; Kergroach, 2021).

Inadequate measurement and success: defining and subsequently measuring the success of agility in the manufacturing industry can lead to fading support among stakeholders. This is because traditional KPIs may not be compatible with agile values. New performance indicators are needed for this purpose (Balaban and Đurašković, 2021).

Regulatory and compliance challenges as describes in the agile values, agility thrives on a certain openness to agile experiments. However, these can be restricted by strict industry regulations and quality standards (Ali and Mahmood, 2024).

The table below shows a comparison of the success factors and barriers that can arise when introducing agility.

Success factors	Barriers to adoption
Leadership commitment and vision	Cultural resistance and inertia
Cultural readiness and change mgmt.	Siloed structures
Cross-functional collaboration	Skills and knowledge gaps
Training and skill development	Technology constraints
Customer involvement & feedback loops	Inadequate measurement models
Technology and digitalisation	Regulatory and compliance challenges

Table 2. 3 Success factors and barriers of introducing agility

In addition to the factors and barriers already described, there are now also approaches to making these dimensions measurable on the basis of data. Shafiabady *et al.* (2023) for example, show in their study that artificial intelligence (AI) can be enabled to predict future agility within an organisation on the basis of organisational characteristics and processes. Using machine learning algorithms, it was possible to predict with over 97% accuracy whether an organisation acts in an agile manner or is hindered by factors such as silo cultures, lack of leadership or sluggish decision-making processes. This approach underscores the fact that barriers and success factors can be not only described qualitatively, but also modelled quantitatively.

Introducing agile approaches in the manufacturing industry in Germany, Switzerland and Austria requires a solid plan and a balanced focus on the topics leadership, culture, collaboration, skills, customer involvement and technology. The crucial factor here is overcoming entrenched cultural and structural norms. Organisational knowledge silos must be broken down. Individual strategies for introducing agility can help remove obstacles. Furthermore, the strengths and specific

characteristics of the GSA region can be leveraged to enable a successful agile transformation.

The Agile@Porsche initiative is a recognised undertaking in the automotive industry in Germany for agile transformation. Porsche has focussed on the agile values (respect, focus commitment, courage and openness) in the agile transformation. Through self-organised teams, they have given their employees the necessary degree of freedom to make autonomous decisions so that they can generate speed on the one hand and feel valued on the other. Agile coaches have taught methods and played an important role in the change. The company-wide Agile@Porsche events ensured knowledge sharing so that no knowledge silos were created. There was also a strong focus on cross-functional and external partnerships. In addition, a customised framework was tailored to the personal needs of each participating team. The initiative addressed the topic of corporate culture at an early stage and actively committed itself to it (Roizman, 2020).

2.11 Theoretical Framework – Scrum

Scrum was originally introduced by Jeff Sutherland and Ken Schwaber in 1993 (Misra et al., 2010; Cervone, 2011). They originally invented the methodology as a project management method for software development. However, Scrum has since evolved and is now also used in other industries, such as manufacturing (Cardozo *et al.*, 2010; Hidalgo, 2019).

Scrum is primarily a framework for developing complex products (Vargas *et al.*, 2018). It is based on empiricism (learning from experience) and lean thinking (avoiding waste). The framework helps teams create value through incremental development, which takes place in iterations.

The cornerstones of Scrum are:

- Transparency: visibility of progress, quality and workload
- Inspection: regular review of work and processes
- Adaption: consistent improvement in the event of deviations or when new knowledge has been gained.

The collaboration between the employees involved is described by the five Scrum values: commitment, focus, openness, respect and courage.

- 1) Commitment: the Scrum team members personally commit to achieving the sprint goals
- 2) Focus: every team member focusses on their individual work and on the goal of the team
- 3) Openness: the Scrum team members and its stakeholders commit to be open about all the work and the challenges while executing the tasks
- 4) Respect: Scrum team members treat each other with respect as capable and independent individuals
- 5) Courage: everyone in the team has the courage to do the right work.

A Scrum team consist of three different roles. The Product Owner (PO) is responsible for the Return on Invest (ROI). He maintains and prioritises the so-called Product Backlog. The PO also makes decisions about the contents of the backlog and the order in which the work is to be completed. The Scrum Master (SM) coaches the team and the organisation. He is the guardian of the Scrum process and moderates the Scrum events. If obstacles arise in an iteration, the SM removes them. The team (formerly also called 'developers') gets the work done. It is responsible for the Sprint Backlog, quality

(describes in the 'Definition of Done') and the daily planning. The Scrum team is self-organised and cross-functional.

The Scrum events (also called ceremonies) are time-boxed. The sprint is the centrepiece of the process. It is defined as a fixed iteration of a maximum of four weeks. Sprint planning is used to plan the selection of work and the tasks to be implemented. The sprint goal is then agreed. The daily scrum is a 15-minute meeting attended by the team (developers). This is a transparent explanation of what was worked on yesterday, what is due for today and whether there are any obstacles. Each team member answers these three dimensions. The stakeholders are invited to the sprint review. A meeting at which the results of the last sprint are presented. Stakeholders can then provide feedback and express their wishes. In the retrospective, the focus is on the past sprint and improvements are discussed. At this stage, the team is again among themselves, without stakeholders.

Also worth mentioning are the three Scrum artefacts:

- The Product Backlog, a prioritised list of all requirements for the project or product. The commitment that needs to be made here is the Product Goal.
- The Sprint Backlog defines the tasks for the current sprint. The target is the Sprint Goal.
- An Increment is a functioning partial result. It is considered complete when it meets the Definition of Done (Schwaber and Sutherland, 2020).

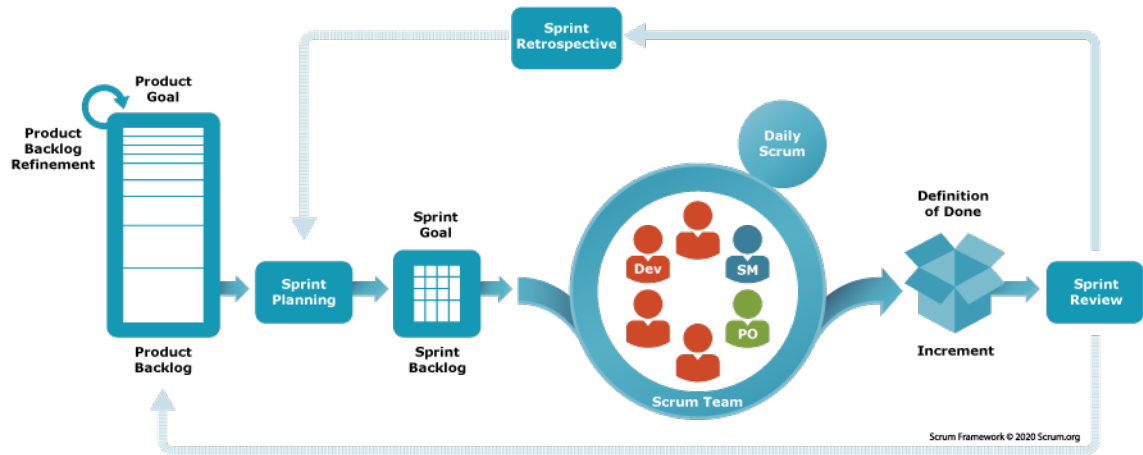


Figure 2. 1 The Scrum Framework (c) by Scrum.org

Figure 2.1 shows, that the Scrum process always begins with the creation of the product backlog. Once the team has defined its sprint goals, the development phase begins. Finally, an increment is delivered, and after the retrospective the process starts again. This is repeated until the product is complete.

2.12 Theoretical Framework – Kanban

Kanban was originally developed as a planning system for more efficient production at Toyota. The method is part of the Toyota Production System (TPS). Kanban is closely related to the just-in-time (JIT) production (Helmold, 2023). The Kanban method describes a continuous improvement of service delivery. This is achieved through constant optimisation and follows the goal of a loss-free workflow. Kanban has its origins in the lean manufacturing approach and is not actually considered an agile method. Unlike Scrum, for example, there are no predefined roles or processes in

Kanban. The main goal of the method is to visualise work and make continuous improvements.

What makes Kanban special is that it is intended as an alternative to agility and even considered a method for improving organisational agility (Measey *et al.*, 2015). The strength of the method includes the fact that it promotes team spirit, supports self-organisation within the team and increases transparency. Short-term successes are immediately visible. The implementation effort is relatively low and no additional personnel is required. However, Kanban is not suitable for larger projects. Furthermore, only the openness and willingness of the team members to change can guarantee the success of the method (Hassan *et al.*, 2022).

Kanban consists of three parts: the Kanban values, the Kanban principles and the Kanban practices. Implementing the method results from understanding the values and principles. These form the practices.

The Kanban values:

- Transparency: the belief that an open exchange of information can bring added value to business
- Balance: an understanding of different perspectives and abilities must be balanced in order to ensure performance
- Collaboration: Kanban is a method that forces its users to work together, this is the only way it can be successful
- Customer focus: Kanban focusses on customers and the value they receive
- Workflow: the recognition that work represents a flow of value, which can be viewed as permanent value or occasional value
- Leadership: this is the ability to move forward with courage. In Kanban, leadership is expected at all levels in order to deliver value

- Understanding: Self-awareness, because Kanban is a method that aims to achieve improvement. Therefore, the starting point and knowledge of this are important
- Agreement: Pursuing a common goal despite different approaches of point of view. This also requires dynamics within the team
- Respect: A fundamental value for Kanban is respect for each other among team members (Anderson and Carmichael, 2018).

The Kanban Principles:

Kanban defines six different principles, which are divided by two groups the Change Management Principles and the Service Delivery Principles.

- Change Management Principles: “Start with what you do now”, “Agree to pursue improvement through evolutionary change”, “Encourage act of leadership at every level”
- Service Delivery Principles: “Understand and focus on customer needs and expectations”, “Manage the work, let people self-organize around it”, “Evolve policies to improve customer and business outcomes” (Anderson and Carmichael, 2018).

The Kanban Practices:

The following six core practices are defined by using the Kanban method:

Visualise the workflow – each step must be visualised in the process. Typically, it is done on a Kanban Board. This gains transparency and contributes to information sharing.

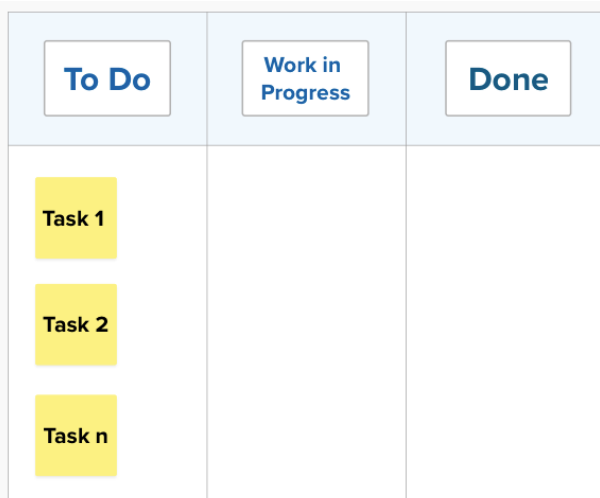
Limit work in progress (WIP) – to keep the work, which is in progress, to a minimum, is a goal to the team. This can improve the workflow and reduces coordination costs.

Manage flow – an illustration of the workflow is provided, by monitoring, analysing, measuring and looking for opportunities to improve.

Make process policies explicit – all policies that are relevant for the process need to be documented.

Implement feedback loops – to learn about the process and gain new knowledge, feedback loops are encouraged.

Improve collaboratively, evolve experimentally – it is important and part of the culture of Kanban, to continuously change and to look for improvements.



The minimal requirements of a Kanban Board are shown in Figure 2.2. The columns are “To Do”, “Work in Progress” and “Done”. However, there are also Kanban boards that are far more complex and customised to a team or a product.

Figure 2. 2 Kanban Board

2.13 Theoretical Framework – Scrumban

Scrumban is a project management method developed by Corey Ladas in 2008 that combines elements of the Scrum framework and the Kanban method. The aim of this combination is to utilise the structure of Scrum and combine it with the flexibility and flow orientation of Kanban. This hybrid was originally intended to serve as a tool to guide Scrum teams, step by step towards a pure Kanban system (Ladas, 2009).

The functioning of Scrumban:

Scrumban is based on five core elements. It is important to note that the introduction must be individualised for each project. In addition Majka (2024) points out that a departure from order can occur, as some Scrum elements are changed (such as 'no timeboxing') to ensure order. In detail, it looks as follows:

Visualisation of the work: In order to optimise bottlenecks and make tasks transparent, a Kanban board is to be introduced.

Continuous workflow: Unlike Scrum, tasks are not organised and executed in fixed sprints, but in a continuous flow.

Pull principle: Tasks are taken ('pulled') independently when a team member has the capacity to do so, in contrast to Scrum, where tasks be pushed.

Optimisation for throughput: Tasks should be carried out efficiently and continuously through the Scrumban system, rather than following sprint cycles.

Flexible meetings and roles: Roles from Scrum, such as the Product Owner, should be kept. However, the meetings (ceremonies) need to be reworked to make them more flexible.

To implement Scrumban, five different steps have to be executed.

Rethink sprint cycles: The focus is on continuous task completion. This does not happen in a fixed sprint cycle, but in an endless loop.

Integrate Kanban principles: Work in progress (WIP) must be limited. Pull mechanism has to be introduced.

Adapt retrospectives: Regular team reflections must take place, focusing on current challenges and the lessons to be learned from them.

Focus on throughput: Success is measured by completed tasks, not by meeting or achieving sprint goals.

Promote cultural change: Teams must be given autonomy and demonstrate a mindset that aims for continuous improvement.

Scrumban is an alternative to Scrum, especially in dynamic project contexts with greater flexibility, high transparency, and increased responsiveness, this hybrid combines structure and agility without being limited by time boxes (Alqudah and Razali, 2018).

Figure 2.3 shows a typical Scrumban process, adapted from Lunesu *et al.* (2018).

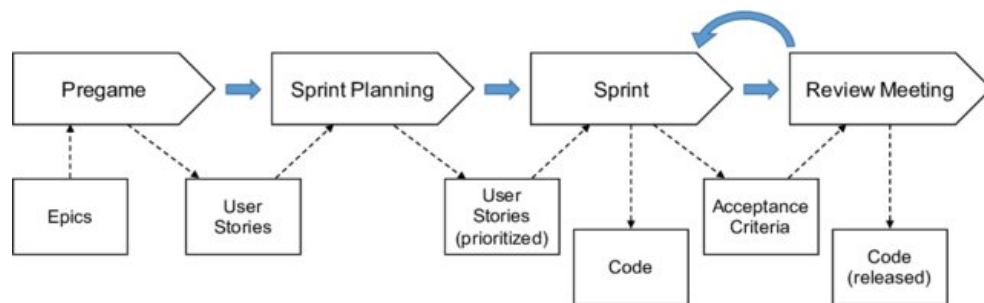


Figure 2.3 Typical Scrumban process adapted from Lunesu *et al.* (2018)

2.14 Theoretical Framework – Scaled Agile Framework (SAFe®)

SAFe (Scaled Agile Framework) is a framework for scaling agility that is applied to large organisations. SAFe was developed to transfer agile principles beyond the team level to the entire organisation, including the strategic and implementation levels. To put it even more specifically, SAFe is a comprehensive organisational model that helps companies deliver services and products in a customer-focused, fast and in high-quality manner. Figure 2.4 shows the so-called Large Solution of SAFe in the version 6.0.

SAFe consist of four central levels:

- Team-level: Scrum or Kanban teams deliver increments of working components in short iterations

- The program-level: here, several teams work together in a so-called Agile Release Train (ART)
- The large solution-level: here, several ARTs are coordinated simultaneously to develop very large products
- The portfolio-level: this is where strategic alignment takes place. It is controlled by Lean Portfolio Management, which is committed to business objectives.

The advantages of SAFe include:

- Synchronisation of multiple teams via Programme Increment Planning (PI Planning)
 - Strategic alignment and prioritisation via Epics and Portfolio-Kanban
 - Focus on added value for the customer (The Customer Centricity and Design Thinking methodologies are particularly noteworthy here)
 - Continuous improvements through Inspect & Adapt-Workshops
 - Transparency and measurability with the help of OKRs (Objectives and Key Results) and other metrics.

According to the 17th State of Agile Report from 2023 (digital.ai, 2024), around 26% of companies surveyed worldwide use SAFe. Although this represents a decline compared to the previous year, SAFe is still one of the most widely used frameworks.

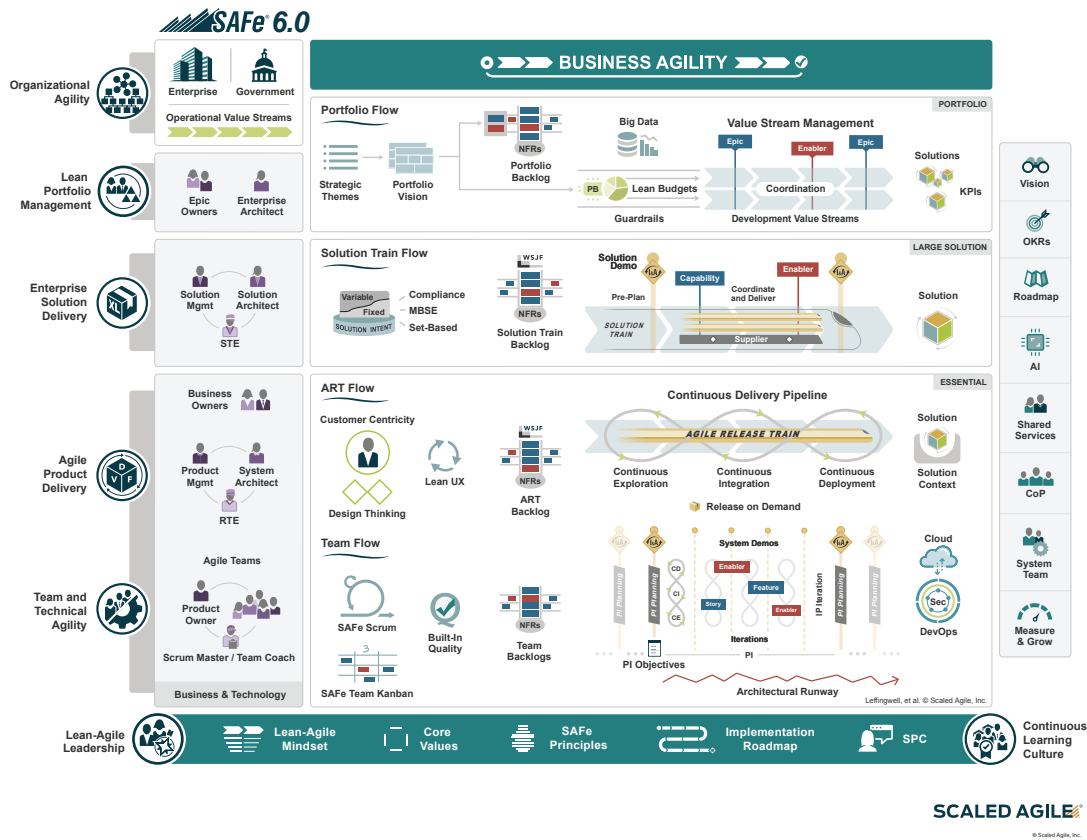


Figure 2.4 SAFe 6.0 Large Solution (c) by Scaled Agile, Inc.

However, according to Conboy and Carroll (2019), it is important to consider difficulties involved in introducing SAFe. Many companies blindly implement a framework only to discover that it is difficult to integrate into existing structures. In addition, SAFe requires clear leadership, which can also restrict the autonomy of teams. The recommendation here is to implement a tailor-made solution if a company want to introduce SAFe.

2.15 Theoretical Framework – Scrum at Scale (S@S)

Scrum at Scale (S@S) is a scaled agile framework developed by Jeff Sutherland, co-founder of Scrum. The aim of the method is to make organisations of any size more agile using the principle of Scrum. A key feature of S@S is its modular and adaptable structure, which can be customised to suit different business contexts (Sutherland, 2022).

Principles of Scrum@Scale:

Like many other agile frameworks, S@S is based on core principles. These are as follows:

Modularity: In order to adapt to the individual needs of an organisation, the framework is divided into modules that can be implemented independently of each other.

Minimal bureaucracy: To speed up decision-making and achieve greater efficiency, unnecessary hierarchy is avoided and processes are kept lean. The framework refers to this as ‘minimal viable bureaucracy’.

Scalability: The framework enables linear scaling. The aim here is to maintain the performance of the organisation regardless of its size.

Adaptability: S@S is designed to be adaptable to various organisational structures in different industries.

Structure and functionality:

The structure of Scrum at Scale describes two interconnected cycles (see Figure 2.5). The Scrum Master Cycle (How) coordinates processes and ensures continuous improvement. In the Product Owner Cycle (What), priorities and content of the vision are coordinated. Both cycles overlap at three points in the framework. The point of “Team Process” – where Scrum teams work, the “Feedback” point – where customer feedback is shared to identify improvements and the “Transparent Metrics” point – which form the basis for data-driven decisions.

Scaling teams:

Individual Scrum teams get together to form a Scrum of Scrums (SoS). This creates a network consisting of several teams. They work together and act as one large team. In very large organisations this is referred to as a Scrum of Scrum of Scrums (SoSoS) team. The aim of this merger is to avoid dependencies and enable work to be synchronised.

Roles at the scaling level:

The Scrum of Scrums Master (SoSM) is responsible for coordination the Scrum Masters. In addition, he resolves cross-team impediments and ensures that the processes are followed. The Chief Product Owner (CPO) is responsible for the strategic direction of the product and ensures that the entire backlog is prioritised consistently.

Scaled Ceremonies:

Ceremonies from Scrum are also available in the scaled version, Scrum@Scale. These events enable a level of transparency, synchronisation and adaptability to be maintained.

Scrum Ceremony	Scrum@Scale Ceremony
Daily Scrum	Scaled Daily Scrum (SDS)
Sprint Review	Scaled Sprint Review
Sprint Retrospective	Scaled Retrospective
Backlog Refinement	Scaled by the PO-Team
Sprint Planning	Scaled Planning with PO-Team and SM-Team

Table 2. 4 Comparison of Scrum Ceremonies and Scrum@Scale ceremonies

Management levels:

The Executive Action Team (EAT) coordinates the removal of impediments that affect the entire organisation. It is also responsible for the agile operation model. The Executive MetaScrum (EMS) is the platform on which strategic coordination of product decisions takes place with relevant stakeholders and responsible managers.

Scrum at Scale is an alternative to Scaled Agile Framework (SAFe) and offers a clearly structured framework for transferring agile practices to the entire organisation. By separating the “What” and “How” and using the roles SoSM and CPO, scaled events are made possible and a system emerges that is characterised by transparency and a high degree of adaptability. At the same time, it attempts to minimise bureaucracy.

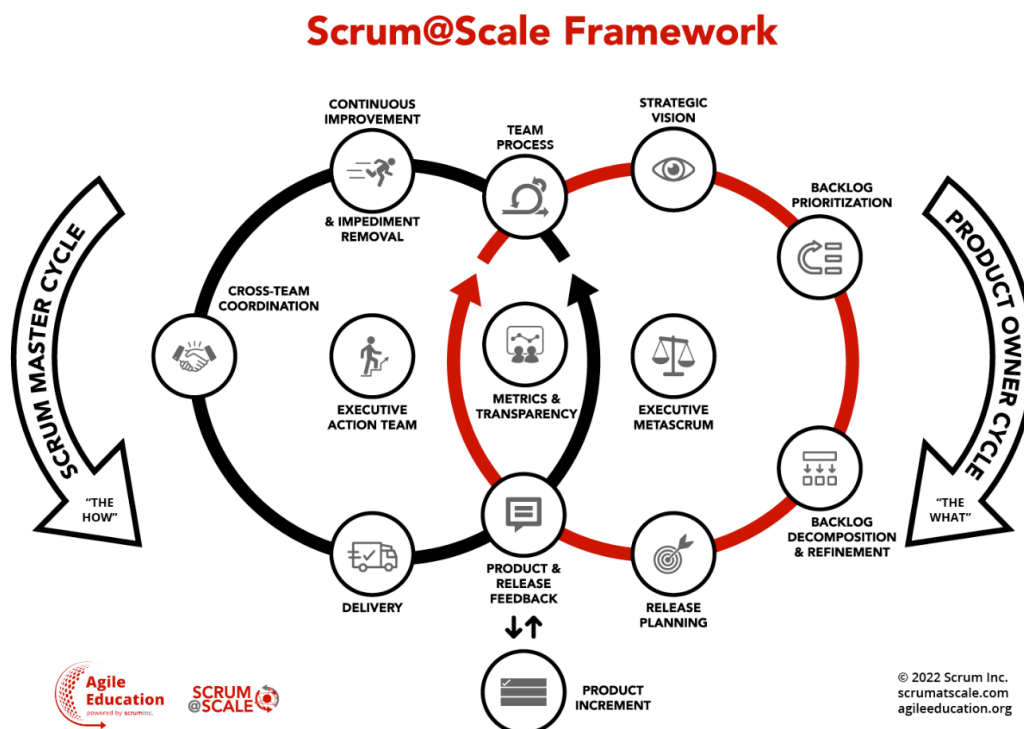


Figure 2.5 The Scrum@Scale Process (c) by Scrum Inc; scrumatscale.com; agileeducation.org

2.16 Theoretical Framework – Lean Agile

The Lean-Agile approach is a hybrid method of Lean Production and the Agile Manifesto approaches. It describes the basic strategy for improving development of services and products. The main objective of the approach is to maximise added value for customer while minimising waste. In addition, the adaptability of the method to current market conditions should be dynamic (Bastos, 2023). Lean-Agile is often characterised in software and project management issues, by self-organising team, the continuous improvement and a strong focus on customers' needs and on delivering added value through incremental work, that happens in iterative cycles (Oza *et al.*, 2013). The combination of waste reduction and adaptability, coupled with customer focus, is the essence of Lean and Agile.

Responsiveness to change: The ability to respond quickly to new information and changing priorities, as well as market changes, is embedded in agile principles. This is crucial in volatile environments (Gren and Lenberg, 2019; Milewska and Milewski, 2025a).

Reduction of waste: The focus on lean practices on resource and value creation has direct impact on the process. Unnecessary work and delays are identified, thus reducing costs (Hassani *et al.*, 2020).

Empowered teams: Cross-functional collaboration through self-organised teams helps decisions get made faster, leading to high-quality results.

Incremental delivery: Early detection of problems is facilitated by frequent deliveries of working increments. This approach allows for better implementation of regular feedback and new customer requirements (Рябоконь *et al.*, 2018).

Scalability: The lean-agile approach can be scaled to smaller teams and even large organisations. An individual model is necessary to include the complexity and size of an organisation (Uludag *et al.*, 2022; Dingsøyr, *et al.*, 2018).

Studies show that organisations that adopt the lean-agile approach are characterised by greater resilience and are able, to respond more quickly to environmental factors such as COVID-19. Lean-agile organisations can achieve sustainable efficiency gains even in such circumstances (Milewska and Milewski, 2025b).

2.17 Synthesis of the Literature and its Limitations

The literature shows that agility is not a trend but is increasingly understood as essential project management approach and even as an organisational principle. Agility has already grown beyond its pure application in the software industry and is now also gaining a foothold in the manufacturing industry.

Most studies agree that agility:

- Promotes flexibility and adaptability in a dynamic market
- Increases customer satisfaction through fast and better-quality deliveries
- Requires a cultural change at both management and employee level

Structured frameworks and methods already exist for introducing agile working methods (such as Scrum, SAFe and Scrumban), but these vary in terms of their complexity and scalability.

It should be noted that there are various limitations and gaps in research. The limited transferability to industrial products is due to the fact that much of the knowledge comes from software development and cannot be transferred 1:1 to physical products.

However, the manufacturing industry in particular requires agile concepts that can be adapted.

Companies approach the implementation of agility in very different ways, which makes comparison difficult. There is no uniform standard. Furthermore, there is a lack of long-term studies, as many results are based only on snapshots and the sustainability of an agile transformation has not been investigated.

When it comes to defining success, it should be noted that the term 'business success' is simply not clearly defined. This fact makes it difficult to measure the impact of agility in concrete terms. Methodologically, differences between monetary and non-monetary indicators remain under-examined.

With regard to the GSA region, it can be determined that despite the global success of agile methods, cultural differences have not yet been successfully differentiated. There is no evidence or relativisation of stereotypical phenomena such as unwillingness to change or a strong hierarchical mindset.

Ultimately, there is a lack of research that specifically addresses the GSA region. The influence of agile principles on companies in German-speaking countries and in the manufacturing industry has rarely been studied. This is where this thesis comes in.

CHAPTER III:

METHODOLOGY

3.1 Overview of the Research Problem

The underlying research problem is a complex issue that demands an answer in today's VUCA world. For long time, the GSA region and its companies, characterised by tradition, a strong hierarchical thinking and resistance to change, have shied away from this issue, but this is only possible up to a certain point. Perhaps that point has already passed. As companies that want to play a formative role in global competition, manufacturing companies must address the question of what introducing agility means for their own creative output.

At the time of writing this doctoral thesis, the GSA region finds itself caught between various different political approaches. The USA, with its previously liberal trade policy, is undergoing a dynamic change under the current administration, which is certainly allowing companies to shy away from investments (Armental, 2025; Cutter *et al.*, 2025). This could be seen as a chance for the GSA region. Quality "Made in Europe" is currently in vogue (Rink, 2025).

Call for action:

It is important to understand what actions a company's management can take to ultimately emerge as the winner. Agile methods are said to help companies respond more quickly to changing market conditions. A basic understanding of what this means and how it affects a company's success is therefore essential.

3.2 Operationalisation of Theoretical Constructs

This research is focusing on the relationship between corporate success and the introduction of agile principles. In addition, the research goes even further and centres its investigative focus on manufacturing companies in the GSA region. Therefore, several theoretical basics are relevant.

Corporate Success:

The term “corporate success” is interpreted and explained in various ways in the literature. However, there is no single, globally applicable definition. For this reason, the study that serves the basis for the data collection in this thesis is designed in such a way that it leaves the definition up to the participants.

Participants are asked what they consider to be corporate success. In the study, they can choose between the following answers: profitability, growth, customer loyalty, innovation, employee morale, sustainability. In addition, participants are asked to use their expertise to assess whether the introduction of agile principles has a significant impact on business success. Participants can provide a free-text answer for this.

Finally, a follow-up question is asked to determine whether the participating experts see a connection between business success and the introduction of agility. To ensure that classic KPIs are also surveyed, study participants are asked to provide their assessment of a possible change in the time-to-market rate, as well as the quality of the products and the possible change in other costs (HR costs, technology costs, quality control costs, administration costs, production costs, other – to be specified).

Agile Principles:

Agile Principles are rooted in the Agile Manifesto. They are a set of different values and beliefs that describe and characterise how teams work together.

GSA Region:

Germany, Switzerland and Austria build the GSA region. The GSA region is characterised by economic strength, both in Europe and globally. The economies of these countries are known for their outstanding performance in areas such as exports (Germany), stability (Switzerland) and innovation (Austria).

Manufacturing Industry:

The manufacturing industry in the GSA region is characterised by many successes achieved in the past. In the meantime, however, other market participants have caught up in terms of expertise and are now manufacturing high-quality products. GSA companies now have to compete with these “new” market participants.

3.3 Research Purpose and Questions

The main added value of this thesis is to provide an understanding of how corporate success and agile principles relate to each other. The four dimensions *implementation and success correlation*, *agile principles adoption*, *performance metrics* and *case studies and best practices* serve as a framework for building this understanding.

The first dimension aims to analyse the possible correlation between the introduction of agility and the performance of manufacturing companies in German-speaking countries. The findings from this research dimension are primarily intended to provide executives in corporate management with an empirically sound basis that can be consulted when determining the strategic direction of an organisation. This makes it possible to reliably evaluate key performance indicators and the added value of an agile transformation at an early stage of planning.

The agile principles adoption dimension deals with the question, which principles were introduced first and what impact this had. The insights that can be gained from this are highly relevant for decision-makers. They can use them to make strategic decisions and develop their company accordingly.

The aim of the performance metrics dimension is to explore how important KPIs are affected by the introduction of agility. How do the costs of manufacturing companies change as a result of agility? This needs to be investigated.

Finally, it is necessary to clarify what examples already exist, i.e. companies that have already undergone a successful agile transformation. So-called best practices can serve as a decision-making aid for executives when they ask themselves how to approach such a transformation initiative.

A holistic understanding of the introduction of agile principles and their relationship to corporate success of manufacturing companies in the GSA region is the ultimate purpose of this work.

Based on these consideration dimensions, this thesis is structured into four research questions:

Research Question 1: *What is the interrelation between the implementation and extent of agile principles and the overall performance metrics of manufacturing companies in the GSA region?*

Research Question 2: *Which agile principles are most effective in driving business success for manufacturing organisations in the GSA region and why?*

Research Question 3: *What is the impact on key performance indicators such as time-to-market, quality control and cost efficiency in the manufacturing sector in the GSA-region, through the introduction of agile principles?*

Research Question 4: *What exemplary approaches are there for the integration of agile principles in the manufacturing sector, based on the experience of companies in the GSA-region that have already successfully implemented them?*

3.4 Research Design

The research will adopt a mixed-methods approach. The quantitative phase will involve surveying manufacturing companies in the GSA region to gather data on the extent of agile principles implementation and various performance metrics. The survey will be designed based on established frameworks for assessing agile maturity and corporate performance. Additionally, qualitative data will be collected through interviews and focus group discussions with key stakeholders, including executives, managers, and frontline employees, to gain deeper insights into the challenges and benefits of agile adoption.

The mixed-methods approach combines qualitative and quantitative methods in research in order to achieve a more comprehensive gain in knowledge as a result. Further advantages of the approach are listed below:

1. Complexity of the research question

The mixed method approach enables more complex research questions to be addressed. These can contain both numerical and narrative data. This is an advantage for research that asks for quantitative data (the “what”) as well as qualitative data (the “why” or the “how”) (Tarka, 2017).

2. Synergy of both methods

While quantitative methods offer generalisability and static validity, qualitative methods provide a better understanding with deeper insights into the phenomena at hand. If these strengths of the two methods are utilised as a synergy, they compensate for their weaknesses (Gillespie, Glăveanu and de Saint Laurent, 2024).

3. Triangulation

By using several methods to investigate a specific research question, triangulation provides the validity and authenticity of the results. This increases the reliability of the research and strengthens trust (Jogulu and Pansiri, 2011).

4. More comprehensive database

A richer and more differentiated collection of data is necessary to enable research to cover a greater breadth and depth of a topic. This can be achieved through a combination of qualitative and quantitative data. (Teddlie and Tashakkori, 2003)

5. Increased acceptance

If research results are supported by the use of qualitative as well as quantitative data, a broader spectrum of interested parties can be addressed. This is particularly relevant in the context of interdisciplinary fields of research or when presenting results to decision-makers (Roelofs *et al.*, 2019).

The data for the analyses will be obtained by means of an expert survey. The survey will enquire about the agile principles in day-to-day work and emphasises the connection between these and employee productivity. The survey is based on the 12 agile principles. In addition, participants will be asked to provide certain company metrics.

Based on their experience, they should assess how costs and performance metrics have changed after the introduction of agility.

Consequently, the research design will follow the Grounded Theory approach. The aim of the Grounded Theory is to use collected data to develop new theoretical concepts and explanations. This distinguishes it from many other approaches that test a hypothesis.

The data is analysed in various steps and ultimately used to develop a theory about the relationship between corporate success and the introduction of agile principles in the manufacturing industry in the GSA region. Data analysis involves all available data from the survey and the interviews and will follow a three-stage process of open coding, axial coding and selective coding.

3.5 Population, Sample and Participant selection

The sample for this scientific study comprises professionals working in a manufacturing company who have already experience in working with agility. In addition, participants must be based in Germany, Switzerland or Austria.

Sample Size:

In order to achieve statistical significance, the sample size in the quantitative phase of the survey is expected to be at least 40 participants. In addition, two interviews are conducted with proven experts in the field of agility and corporate development.

Selection Criteria:

The participants are selected on basis of the following criteria:

Geographical Location:

Participants in the study must carry out their work in a country within the GSA region. It is not relevant in which country (Germany, Switzerland, Austria) they work.

Industry Focus:

Attendees must work in the manufacturing industry and have proven experience. The study distinguishes between the following specialisations: automotive, aviation, electrical engineering, technology, medical technology, mechanical engineering, glass and ceramics, tool manufacturer, optics construction supply and others.

Ethical Considerations:

The selection process of participants is carried out in accordance with ethical guidelines that ensure informed consent and confidentiality. Participants receive detailed information about the study, and it is emphasised that participation is voluntary. In addition, they are given the opportunity to contact the study administrator.

Limitations:

It should be noted that despite the care taken in conducting the study, the results do not claim to be complete or generalisable. Rather, they represent a foundation on which further research can be conducted. How corporate success relates to agility depends heavily on various environmental factors. Therefore, it is advisable to consider the overall situation on an individual basis.

Although it is possible to develop initial insights from the study, decision-makers should consider an analysis tailored to their company in each individual case. The fourth research question can provide an outlook on how other companies have already successfully tackled agile transformation.

3.6 Data Collection Procedures and Instrumentation

Data collection is the central element of this study. For this purpose, a study was conducted in which participants were asked about various aspects of business success and its relationship to agile principles. The study was conducted with a restricted group of participants, as it only considers companies in the manufacturing industry that are based in Germany, Switzerland or Austria.

Before participants begin the study, its purpose is explained to them. In addition, participants are informed about the confidentiality of the data collection, and it is emphasised that the data recorded is completely anonymous.

A second pillar of data collection are the semi-structured interviews with experts. In a technical discussion about the influence of agility on corporate success, the expert opinion is noted as additional insight, to extend the body of knowledge.

3.7 Data Analysis

Within the scope of this dissertation, Grounded Theory serves as a methodological guideline for analysing the qualitative (non-numerical) data collected. The aim here is to develop a theoretical model based on the experiences between agile principles and business success in the manufacturing industry in the GSA region. This chapter goes on to explain the strengths and the limitations of the Grounded Theory approach.

Grounded theory was developed by Glaser and Strauss in the 1960s (Glaser and Strauss, 1967). The primary goal is to develop new theories that can be closely linked to previously collected data. This distinguishes the theory from others, as it does not aim to test existing theoretical concepts. The theory develops during the research process and is not based on deductive assumptions, but rather on an inductive process. This approach is

particularly well suited when, for example, the implementation of agile principles in a manufacturing context is being investigated and only limited theoretical groundwork exists, or a new approach needs to be developed.

Data collection and Theoretical Sampling:

Data is typically collected using qualitative methods. In particular, semi-structured interviews, participant observation and document analysis are used. The central principle of Grounded Theory is theoretical sampling, in which further cases are selected on the basis of data that has already been analysed. The aim here is to continuously develop or review specific categories until theoretical saturation is reached and no new relevant findings can be gained.

Analysis Steps of Grounded Theory:

Open Coding:

At the start of the analysis all collected qualitative data will be systematically reviewed. In this phase of data analysis, terms or statements are divided into codes. The aim here is to develop relevant categories. This results in a large number of codes, which must be further clustered and differentiated as the analysis process progresses.

Axial Coding:

At this stage the process of analysing the relationship between the different codes and categories takes place. Categories are systematically linked to one another. The so-called coding paradigm is used, which includes contextual factors, causal conditions, action strategies and their consequences. The aim is to develop a deeper understanding of the internal structures of the various phenomena under investigation.

Selective Coding:

Aim of the selective coding is to develop a central category for further analysis. It will be the basis for a theory. The resulting theory describes a social or organisational

process. From the researchers' point of view, this process is relevant and causal-logically comprehensible.

Member Checking:

In this step, new data is compared with existing codes and categories. This allows the theory to be continuously reviewed and adjusted. The process step or procedure of member checking was added to ensure credibility of the Grounded Theory. This involves providing feedback to respective interview partners on initial coding, selected interview extracts and key categories. The aim is now to check whether and to what extent a researcher's interpretation corresponds to the subjective perception of the interviewees. This step allows misunderstandings to be identified and theoretical concepts to be clarified. Member checking is iterative and contributes significantly to increasing transparency and validity in theory development.

Strengths of Grounded Theory:

Grounded theory offers several significant advantages, particularly in an organisational context.

Generating theory from practice:

Instead of focusing on existing theories, new concepts are developed from empirical material. This is a major advantage in fields that are still relatively unexplored, such as the transformation of traditional industrial companies through agility.

Flexibility and Openness:

The iterative nature of the method allows for a high degree of adaptability, which is well suited to the dynamics of a research field.

Insights into complex social Processes:

The subjective interpretations of those involved are uncovered, and organisational realities are revealed from the perspective of the participants through the method.

Practical Relevance:

The proximity of those involved to the data increases the applicability of the results and provides in-depth insights for business practice and management.

Limitations of Grounded Theory:

Although the method offers some advantages, it also has methodological limitations and challenges, which will be discussed below.

High Resource Requirements:

The iterative approach to analysis is both time-consuming and labour-intensive and requires continuous reflection and critical consideration during documentation.

Methodological skills required:

In order to apply the method carefully and correctly, a deep understanding of qualitative research and a keen theoretical sensitivity are required.

Subjectivity:

The interpretation of data and theories can be strongly influenced by the perspective of the researchers, as they may have prior knowledge. Transparency (in the form of documentation) and reflection (through member checking) are therefore essential.

Limited Generalisability:

The transferability or even generalisability of the results is only possible to a limited extent, as the results are context-based. However, the aim of Grounded Theory is not static generalisability, but theoretical generalisability.

Summary:

Grounded theory provides a suitable methodological foundation for this thesis to describe a theory-based understanding of the impact of agile principles on business success. The method allows complex relationships to be condensed into a theoretical

model based on real experiences. At the same time, Grounded Theory requires a structured approach and the creation of transparency in order to guarantee the scientific validity of the research.

3.8 Research Design Limitations

Although this research is structured to provide valid insights describing the relationship between corporate success and the implementation of agile principles in the manufacturing industry in the GSA region, the following limitations regarding the chosen research design should be noted:

Generalisation:

The results of the research may not be generalisable. They follow a specific procedure and have a very focused research horizon with manufacturing industry in the GSA region. Applying research findings to a specific case can lead to discrepancies and therefore requires individual consideration.

Self-Report Bias:

Both the qualitative and quantitative phases of this research are based on data that includes self-reported information. This carries the risk of potential bias if participants express their own wishes rather than answering questions truthfully. Another factor is that the study has been conducted anonymously, and it is impossible to determine whether the responses are truthful or whether someone wanted to steer the results in a certain direction.

Snapshot of the Study:

Since the study was conducted under specific environmental conditions and market requirements for companies are constantly changing, this study can only reflect a

snapshot of the relationship between corporate success and agility. Further research requires a study that spans several years and pursues a specific research topic.

Selection Bias:

The study participants were selected based on certain restrictions and do not represent the entire working population in the GSA region. This can lead to bias in external validity.

Despite these limitations, the study is still scientifically and practically relevant. The research design was carefully chosen to get the most insights possible. However, this study also acknowledges its limitations and aims to motivate practitioners and scientists to conduct further experiments and research.

3.9 Conclusion

The methodology used to conduct this research provides a comprehensive construct for investigating the relationship between corporate success and the introduction of agile principles. By choosing a mixed-methods approach, a more differentiated understanding of the topics investigated was achieved. A survey enabled to collect data on a larger scale. The data collected allowed for statistical analysis and the identification of trends. In addition, open questions in the survey offer participants the opportunity to express further knowledge in their own words, which produces another way of collecting quantitative data. Adding to this, interviews with subject matter experts provided further insights and enabled a deep dive into specific topics.

Despite the care taken in conducting the study and selecting appropriate methods, the limitations of the research must also be considered. The very specific focus of the study makes it difficult to generalise the findings. Beyond that, errors due to self-report

bias are possible. Influenced by the VUCA world, it must also be taken into account that the study only provides a snapshot of the relationship between business success and agility in manufacturing companies in the GSA region.

In summary, the methodological approach and consideration of the limitations of the study aim to provide a comprehensive answer to the defined research questions and gain new insights to the body of knowledge.

CHAPTER IV:

RESULTS

4.1 Conceptual Findings

This thesis, focused on the relationship between corporate success and the introduction of agile principles in the manufacturing industry in the GSA region, is based on a mixed-method approach. In order to ensure reliable data collection, a study was conducted to survey professionals, who work in an agile environment and are employed by manufacturing companies in the GSA region. Parallel to the study, two semi-structured expert interviews were conducted with recognised specialists.

After the data collected from the study were cleaned up, 44 high-quality responses had been identified.

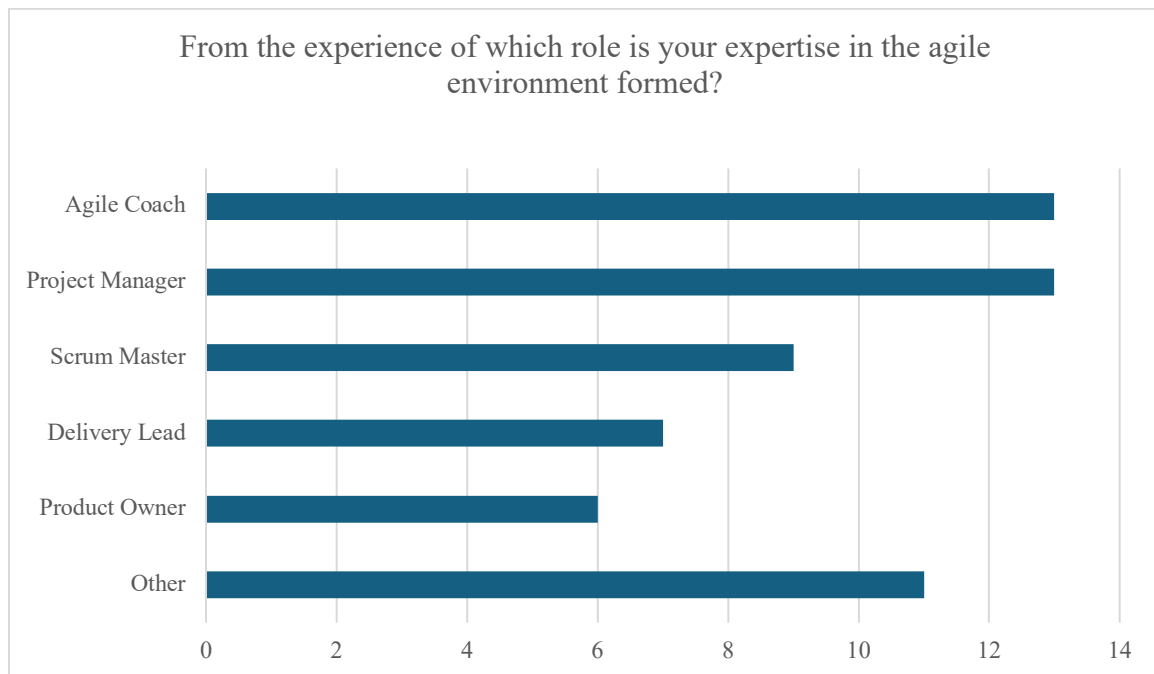


Figure 4.1 Distribution of roles among study participants

Figure 4.1 shows the professional roles in which the study participants gained their experience with agile working methods. The most frequently mentioned roles are Agile Coach (13 mentions) and Project Manager (13 mentions), followed by Scrum Master with nine mentions and the Delivery Lead with seven mentions. Product Owner is mentioned six times. Other roles were grouped under “Other” (eleven mentions).

The distribution shows that the respondents come from different areas, which means that a high degree of different perspectives is available for the investigation. The large group of agile coaches and project managers shows that respondents are closely involved in the operational and strategic management of agile transformation.

[Agile Coaches and Project Managers as Architects of Transformation:](#)

The high number of agile coaches can be explained by the increasing importance of cultural change, leadership and coaching in organisations. According to Stettina and Hörz, (2014) agile coaches play a key role in communicating agile values, empowering teams and overcoming organisational resistance. Their inclusion in the study contributes to a high level of reflection on cultural prerequisites for corporate success in an agile context. Project managers are also well represented. They often have experience in traditional control models and are increasingly often finding themselves in hybrid roles or working models (Schröder, Steinhorst and Winter, 2019). This is important in the context of industrial production, combined with the structures and processes that are currently being standardised in the GSA region in the manufacturing sector.

[Scrum Master, Delivery Leads and Product Owner – Frontline of the Transformation:](#)

Scrum Masters and Delivery Leads bring their proximity and experience from their daily work to the table. They can provide a practical insight into topics such as self-organisation, team dynamics and agile delivery cycles. Product Owners play a major role in stakeholder communication and customer centricity. Their perspective on how agile

principles contribute to the success of the company is highly relevant ((Grocholski, 2022).

Relevance of Variety of Roles:

The role Other (n=11) may be an indication that roles outside agile models in the manufacturing industry also come into contact with agile principles. This supports Produção *et al.* (2022) findings that agility is increasingly appearing across industries and no longer exclusively serves the IT or service sector.

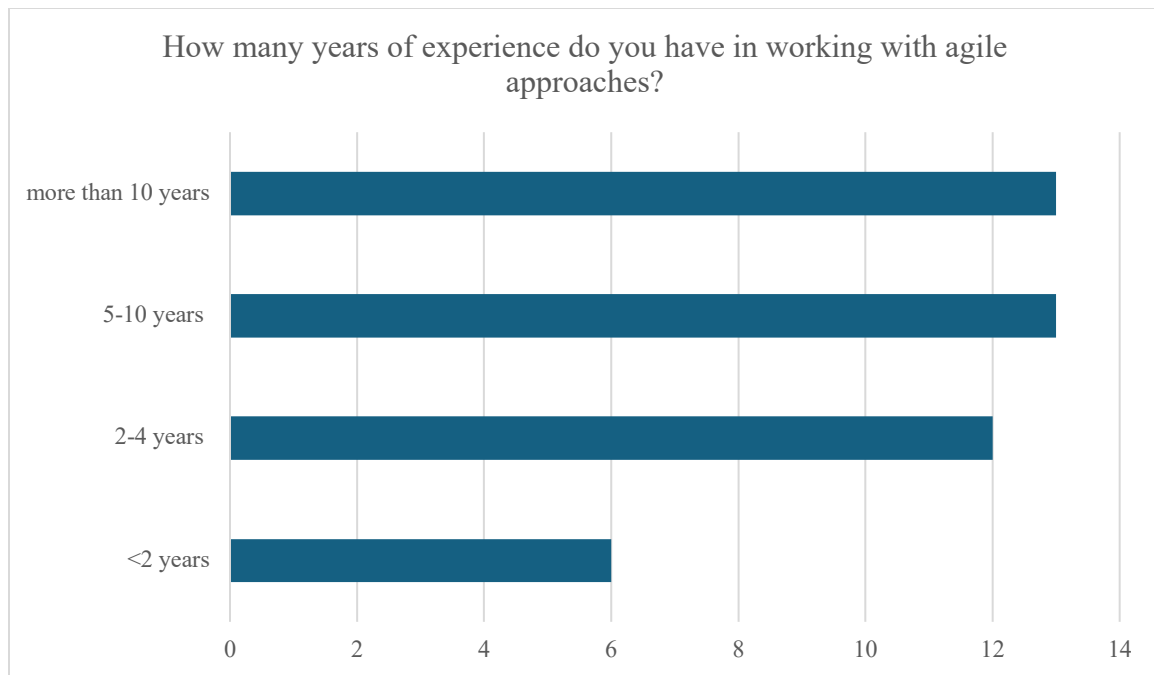


Figure 4.2 Participants' years of experience of working with agile approaches

Figure 4.2 shows the distribution of participants according to their professional experience with agile approaches. Thirteen of the respondents have more than ten years of experience in working with agility, and another thirteen have between five and ten years of experience. In addition, twelve people say they have two to four years of

experience, while six participants report less than two years of experience. The distribution thus shows a high level of overall experience among the study participants. This indicates the depth and validity of the qualitative statements about agile transformation processes in the manufacturing industry. Of particular note is the proportion of people with more than five years of experience (26 out of 44), which shows that agility is not a short-term trend but has established itself as a long-term change process.

According to Dikert, *et al.* (2016) experienced players in agile transformations are crucial to the success of such an initiative. Large-scale transformations are more likely to succeed if they are driven by employees who already embody the fundamental values and principles of agility. This in turn, can have a positive effect on an organisation's ability to change. In addition, agile practitioner are better equipped to develop hybrid models, as they understand both agility and the existing structures in the manufacturing industry, as well as the structures within their own companies. These employees are particularly relevant, as agile working methods are often tailored to the service or IT sector. This requires adjustments (Hobbs and Petit, 2017).

The group of participants with less than two years of experience (n=6) may indicate that agility is becoming more widespread, but that some companies are still sceptical and prefer to set up a pilot project first to gain experience.

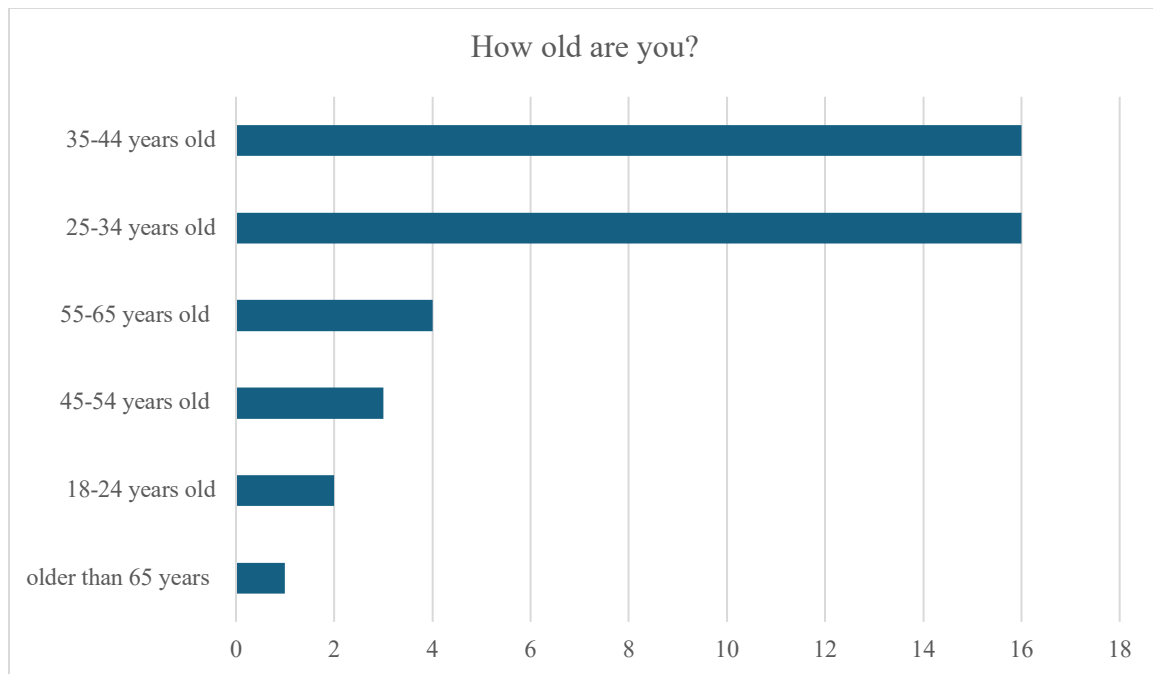


Figure 4.3 Age of study participants

Figure 4.3 shows the age distribution of the participants surveyed in the study. Most of the participants are in the age categories 35 – 44 years and 25 – 34 years. 16 people are assigned to each age group. These two categories therefore make up the majority of respondents. This may suggest that specialists and managers in the early to mid-career phase in particular play a decisive role in the introduction and implementation of agile principles in the manufacturing industry.

Accordingly, the age groups 55 – 65 years (4 people), 45 – 54 years (3 people), 18 – 24 years (2 people) and older than 65 (1 person) are significantly less represented. The low number of older participants could be due to several factors: it is feasible that agile approaches in the manufacturing industry primarily attract and are supported by a younger generation of employees who are more socialised with agile principles and agile work. Another factor could be that older managers tend to participate less frequently in such studies or are less likely to play a proactive role in an agile transformation.

From a scientific perspective, the age distribution is a very relevant factor when it comes to interpreting the qualitative results. The age distribution could have an influence on the attitude towards agile principles. It could also have an influence on the willingness to change and the perception of the impact on the company's success. As Ng and Feldman (2010), describe in their meta-analysis, younger employees are more likely to have a positive attitude towards organisational change and are more willing to adapt to new ways of working. Younger participants bring in more innovative and technology-affine perspectives that help them to benefit from or be more convinced of agile approaches.

In this context, Kanfer and Ackerman's (2004) argumentation is also interesting, as they believe that the level of cognitive flexibility and learning ability in middle adulthood is comparatively high. This would be of particular importance for 25 – 44-year-olds, as this group is often in positions of increasing responsibility and adaptability. This is beneficial when it comes to implementing agile principles into traditional structures.

On the other hand, there are older employees who may be more critical of organisational changes. In an investigating study on the introduction of new technologies, Zwick (2006) identifies that older employees more frequently report barriers in the application of new forms of work. This factor can also have an impact on the introduction of new working approaches such as agile methodologies. These are oft accompanied by changes in work roles and team dynamics, as well as changes in decision-making processes.

Looking at the manufacturing industry, it should be noted that younger generations have already being trained more in collaborative and flexible environments. Older managers, on the other hand have often been strongly socialised in standardised,

hierarchically influenced organisational models. Social conditioning can therefore influence access to and attitudes towards agility (Buasuwan, 2023).

The over-representation of the middle age group may suggest that the discussion about agile principles takes place and is anchored more in this generation.

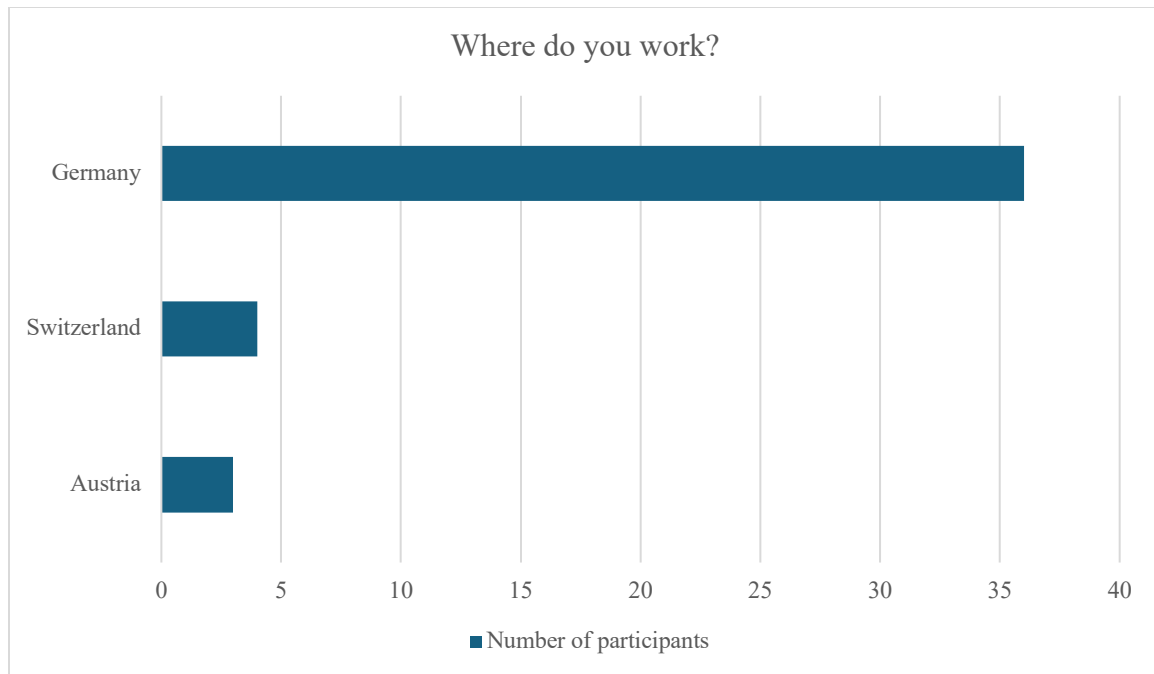


Figure 4.4: Distribution of study participants by place of work

The origin of the study participants according to their place of work is shown in Figure 4.4. With 37 out of 44 respondents, Germany is by far the largest group. Four employees come from Switzerland and one participant from Austria.

A direct implication for the interpretation of the qualitative results, regarding regional differences in the implementation of agility and their effect on the success of the company, is the strong dominance of German participants. The economic structure of the GSA region is also reflected here- Germany is the largest industrial base with the highest density of potential participants from the manufacturing sector (Bundesministerium für Wirtschaft und Energie (BMWi), 2020).

In addition, several studies indicate that national and organisational cultures can have a significant influence on the design and acceptance of agility. Denison *et al.* (2014) for example, argues that uncertainty avoidance, distance of power and individual versus collective orientation are cultural factors that influence the success of change processes. In this context, Germany is culturally close to Switzerland and Austria, but there are still different characteristics in terms of hierarchy and innovation leadership, which can have an impact on transformation processes (Hofstede Insights, 2025).

Furthermore, the argument by Birkinshaw *et al.* (2008) is taken into account, which states that the implementation of agile principles is closely linked to the institutional embedding in national economic systems. Germany is a typical example of a coordinated market model in an international comparison. Influenced by a strong co-determination of companies and industry standards, the framework condition in Germany are both a hurdle and a chance for the establishment of agile ideas.

The uneven regional distribution of participants in the study must be considered in the subsequent depth of the discussion of results. However, the qualitative depth of the survey is independent of the representation of the individual GSA states. Nevertheless, it can provide insights and correlations that allow a context-specific view and can categorise regional differences.

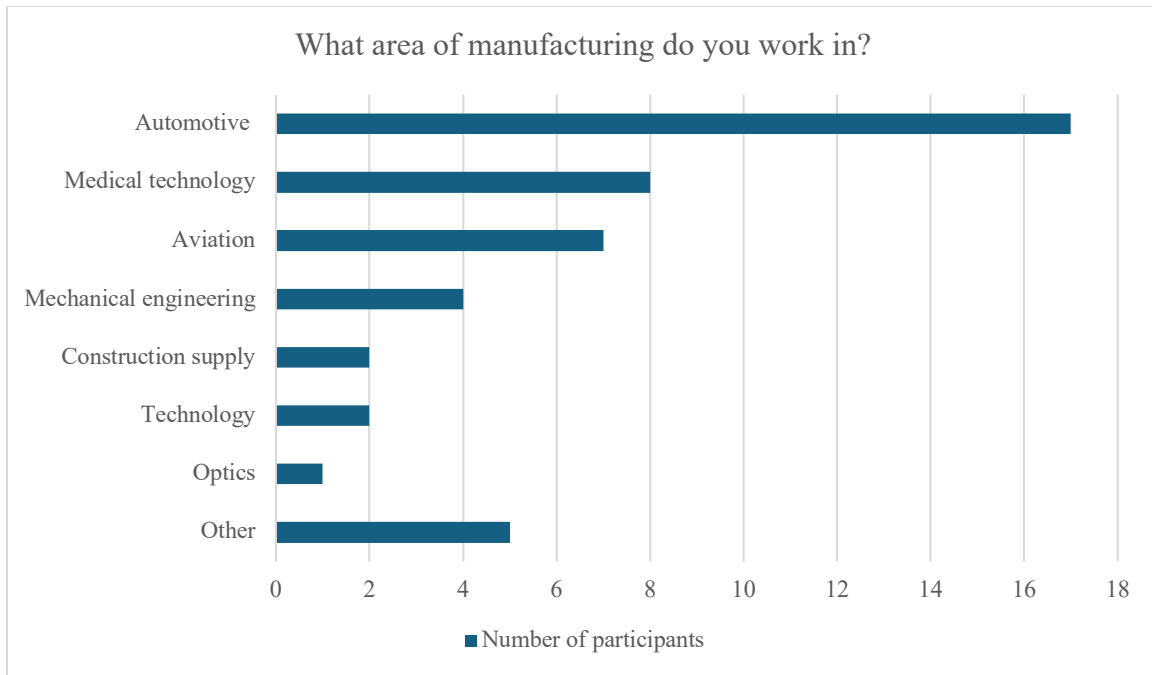


Figure 4.5 Distribution of study participants in subcategories of the manufacturing industry

Figure 4.5 shows the distribution on subcategories of the manufacturing industry and allows to recognize that the majority, 17 participants, come from the automotive industry. This group is followed by the medical technology sector with 8 representatives, the aviation industry with 7 employees and mechanical engineering with 5 participants. Other sectors such as construction supply, technology, optics and a non-specific “other” are each represented by one to four participants.

This distribution allows to see that the introduction of agile procedures is a major topic of discussion, especially in complex and dynamic industries such as the automotive and medical technology sectors. The sectors are under pressure to innovate, which can be attributed to global market players. The high degree of technical complexity and short product life cycles are adding pressure to the industries. However, it is precisely these environmental factors, that are considered favourable for agile approaches, as they promote flexibility, enable rapid reactivity and require cross-functional collaboration (Rigby *et al.*, 2016).

The automotive industry has undergone profound structural change in recent years due to the shift towards mobility services, electrification and digitalization. According to Schumacher *et al.* (2016) the demand for transformation to Industry 4.0 is for new management paradigms in which agility plays a central role. It can also be seen that the high representation of the subcategory is not only of economic importance but can also play a central role as a driver of agility in transformations that are focussed on the manufacturing industry.

Medical technology is also characterised by a high level of innovation, even if it is more heavily regulated. A selective adaption of agile methods, mostly limited to the R&D sector, is demonstrated by Moeuf *et al.* (2017). If the next group, the aviation sector is then considered, there is also a noticeable pressure to innovation, but this goes hand in hand with high safety requirements. This combination requires a hybrid organisational model in which agile methods can be used to complement existing traditional project management methods (Conforto *et al.*, 2014).

As highly standardised and linear production environments have higher structural barriers to transformation (Vogelsang *et al.*, 2019), the lower representation of the mechanical engineering, construction supply and optics sector is not surprising. They indicate that the pace of adaptation is slower in these sectors.

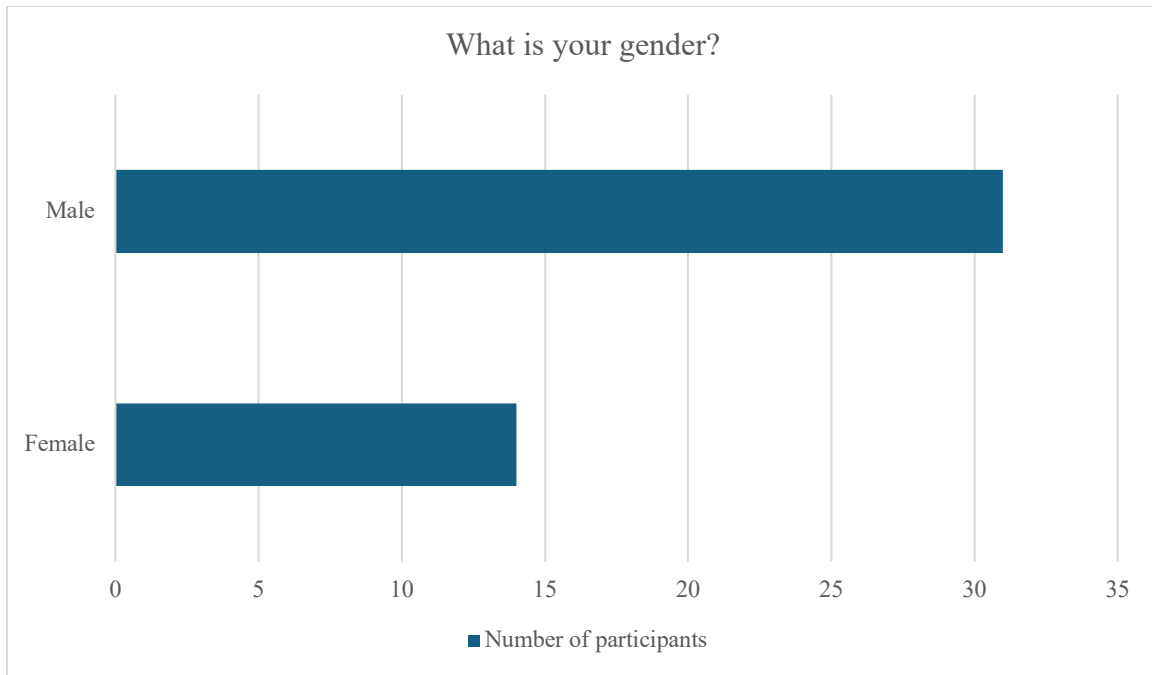


Figure 4.6 Gender distribution of the study participants

The gender distribution of the study participants shows that the sample is clearly male dominated, with 32 male and 13 female participants. In Germany, Switzerland and Austria, the technology-related industries are traditionally strongly characterised by men, which reflects the distribution of the gender-specific structure (Eurostat, 2022).

The underrepresented group of female experts in the sample can open up relevant perspectives for the interpretation of the study results. Eagly and Carli (2003) show that women in leadership roles tend to pursue more collaborative, participative and transformation-oriented approaches. These are characteristics that go well with agile principles such as team accountability, transparency and self-organisation.

Nielsen and Huse (2010) argue that there tends to be a greater capacity for innovation and more differentiated approach to problem-solving with greater gender diversity. Looking at this, it might seem obvious that a higher proportion of women in an agile transformation not only strengthens social dimensions but is also more sustainable and contributes to a better company result.

In terms of qualitative methodology and the limited number of participants, however, the gender distribution should not be understood as a demining factor, but rather as a contextualised framework to influence. The gender distribution can contribute to investigating different approaches.

4.2 Comparison and Synthesis of Grounded Theory Analyses

Below, two independent analyses are compared:

- The qualitative evaluation of expert interviews with Expert 1 and Expert 2
- The analysis of the open survey responses from the qualitative study.

The aim is to formulate a comprehensive Grounded Theory that integrates consistent patterns and central categories. In addition, new theoretical insights into the relationship between corporate success and the introduction of agile principles in the manufacturing industry in the GSA region are to be gained.

GT 1: Interview with Expert 1:

Central category: *“Agile principles promote business success – when cultural and structural change happen in sync.”* This theory emphasises that agility is only effective when both leadership and culture are transformed. Particular factors that influence effectiveness are focus, personal responsibility and tolerance of mistakes – combined with a long-term perspective.

GT 2: Interview with Expert 2:

Central category: *“Agile principles only have an impact in culturally and structurally mature organisations.”* This theory emphasises that agility enhances existing organisational maturity. Culture, competent implementation and supportive leadership are prerequisites for positive effects to unfold.

Synthesis of Theories:

The two theories presented show clear similarities in terms of content. Neither describes the effect of agile principles in the methodology itself. They see the integration in an organisational, cultural and leadership-related context. The similarities between the theories are as follows:

- Agility does not work automatically – context is crucial
- Cultural openness (on the part of the company and its employees) and maturity are essential prerequisites
- Leadership must be transformed, not just improved
- Support from external sources can be effective and helpful, or it can be a hindrance
- Long-term corporate success is reflected in motivation, quality and innovative strength.

New central Category:

“Agility generates business success through cultural connectivity, systemic implementation and sustainable leadership change.”

New Grounded Theory:

Three levels must work in sync for agility to become a success factor in the manufacturing industry in the GSA region:

1. **The cultural level** – influenced by values such as openness, responsibility and willingness to learn
2. **The structural level** – requires space for self-organisation, cross-functionality and iterative work
3. **The leadership level** – requires trust, empowerment and true transfer of power.

Is one of these levels missing, the result is merely “symbolic agility” or worse, resistance. However, when agility is embedded in the system, it can act as a catalyst for efficiency, quality, time-to-market and employee loyalty

Summary of the Grounded Theory Analysis:

As described in chapters 3.4 and 3.7, Grounded Theory has its origins in interpretive social research (Glaser and Strauss, 1967) and is anchored in the qualitative paradigm. Within the framework of this dissertation, a mixed-method approach was used to enable a differentiated understanding of the research question. Care was taken to ensure that the development of theoretical categories and explanatory approaches was developed exclusively from the qualitative data.

The quantitative results from the survey were not integrated into the coding process of the Grounded Theory, as their structured collection method did not comply with the methodological principles of the approach. As quantitative findings, they served as supplementary contextualisation and basis for the triangulation in order to better classify perspectives and reveal initial correlations between agile principles and selected success factors.

According to Corbin and Strauss (2015) and Bryant and Charmaz (2010), this approach is consistent with the further development of Grounded Theory within the framework of a pragmatic mixed-method approach. The researchers empathise that theory-generating research can certainly benefit from quantitative contextual information, provided that this is clearly delineated and not integrated into the coding process.

According to these points it finally results in the combination of the two analyses show that agility is not understood as a method. Rather, it must be understood as a holistic system. Business success is not achieved simply by introducing agile principles, but only by embedding them in a connected and mature organisation with a learning-

oriented (and open to learning) management. The new theory provides a consolidated perspective for agile transformation in manufacturing companies.

4.3 Research Question One: Impact of Agile Implementation on Performance in GSA Manufacturing

What is the interrelation between the implementation and extent of agile principles and the overall performance metrics of manufacturing companies in the GSA region?

Empirical Findings:

The thesis presents a mixed-method study involving 44 professionals and two experts from the manufacturing sector in the GSA region, with a strong representation from Germany. The participants showed a wide range of different roles, ensuring a broad perspective on agile transformation processes. Three key findings have been identified:

Experience with agility:

A significant proportion of respondents have more than five years of agile experience, suggesting that agile transformation is not a trend but a sustained change in the manufacturing industry.

Sectoral distribution:

The automotive and medical technology sector are most represented. They reflect industries that are under high pressure of innovation and characterised by complexity, factors favourable for agility.

Core agile principles:

The most effective principles identified are continuous improvement, customer satisfaction and self-organised teams. These principles are seen as directly contribution to improved innovation, adaptability, and employee empowerment.

Interrelation between Agile Implementation and Performance Metrics:

The relationship between the extent of agile principles implementation and organisational performance is multidimensional.

Continuous improvement:

Companies that have embedded continuous improvement cycles in their system demonstrate a greater innovation and greater growth rates. This is consistent with Bibby and Dehe's (2018) findings that iterative learning and feedback loops are central to sustainable performance improvements.

Customer satisfaction:

Agile companies are characterised by an outstanding ability to respond to volatile markets and changing customer needs. This leads to higher customer loyalty and a larger market share.

Self-organised teams:

Empowerment and decentralisation promote faster decision-making. This increases motivation and leads to better results, as confirmed by Gujar and Shafighi (2023).

Conclusion of Research Question One:

The interrelation between the implementation and extent of agile principles and the overall performance metrics of manufacturing companies in the GSA region is clear: when agility is holistically embedded (cultural, structural, and leadership dimensions), it acts as a catalyst for business success. This is highlighted by the Grounded Theory synthesis in this thesis. Isolated adoption of agile methods without the supporting changes results in “symbolic agility” with limited impact on performance.

4.4 Research Question Two: Agile Success Factors in GSA Manufacturing

Which agile principles are most effective in driving business success for manufacturing organisations in the GSA region and why?

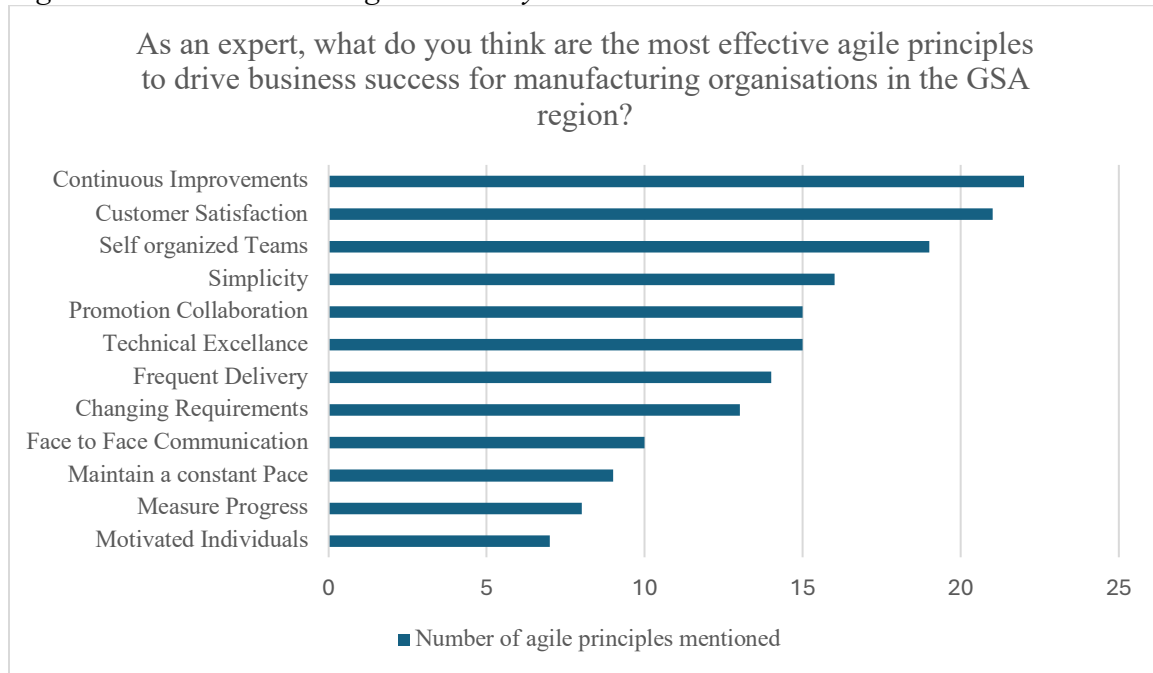


Figure 4.7 The most effective agile principles for driving business success in manufacturing companies

Figure 4.7. describes which agile principles the experts surveyed consider to be particularly effective for manufacturing companies in the GSA region. The results are based on an open survey and show the frequency with which the individual principles were mentioned.

The principles most frequent mentioned were “continuous improvement” (23 mentions), follows by “customer satisfaction” with 22 mentions and “self-organised teams” (19 mentions). These findings show a clear focus on principles that relate to both structural and cultural aspects of transformation within an organisation.

Continuous Improvement:

The central importance of iterative learning processes in an industry that has historically focused on efficiency and process stability is matched by the high relevance of continuous improvement. Studies on Industry 4.0 show that organisations that have implemented agile principles in their manufacturing processes are particularly capable of sustainably improving their innovation capacity through continuous feedback loops. This is confirmed by Bibby and Dehe (2018) who with their maturity model for Industry 4.0, highlight the importance of continuous adaption and learning ability as key elements for higher growth rates and the further development of an organisation.

Customer Satisfaction:

The second most important dimension is the customer satisfaction. They underline the increasing market- and user orientation in manufacturing. The globalised industry and high competitive pressure can only be overcome by the ability to meet individual customer requirements flexibly and with high quality. This is also shown by Chukwunweike and Aro (2024) in their investigation, explaining that agile companies can react better to volatile markets and strengthen customer loyalty through the constant adaption to new user needs.

Self-organised Teams:

The high value placed on self-organised teams highlights the importance of empowerment and decentralised decision-making in the context of agile transformation. Gujar and Shafighi (2023) confirm this in their analysis of project management in the manufacturing industry, which shows a shift away from centralised control mechanisms towards team-centred and agile working methods. Cultural change is needed here.

Other Principles:

Principles such as simplicity, technical excellence and promotion of collaboration are also often mentioned. A reference to the need to establish robust and collaborative

solution approaches in industrial systems. The fact that principles such as motivated individuals or face-to-face communication were mentioned less frequently may be due to the fact that, in contrast to the IT sector, manufacturing is primarily concerned with technical and process-oriented dimensions.

Why these Principles drive Business Success:

The success of these agile principles in the GSA manufacturing sector is rooted in several factors:

Alignment with market requirements:

Continuous improvements and customer satisfaction ensure that companies remain competitive. They must be able to respond to market changes and adapt to constantly changing customer requirements.

Empowerment and commitment:

Self-organised teams and a culture of curiosity boost employee motivation and commitment. This creates greater loyalty among employees to their company, which in turn contributes to a higher productivity and innovation.

Operational flexibility:

Iterative development and operational flexibility enable manufacturer to respond to uncertainties, reduce lead times and thus ensure optimised resource utilisation.

Cultural and organisational change:

The successful introduction to agile principles and agility in general depends on a company's cultural openness, leadership transformation and the overall maturity of the organisation. Without these factors, the impact of agile methods remains superficial and limited to "symbolic agility".

Conclusion of Research Question Two:

The most effective agile principles for the business success of manufacturing companies in the GSA region are continuous improvement, customer satisfaction and self-organised teams. These principles directly address the challenges associated with innovation pressure, market volatility and the complexity of manufacturing processes. Their impact is magnified when supported by a corporate culture of openness to learning and cross-functional collaboration, coupled with a leadership culture of personal accountability.

For leaders planning an agile transformation, this prioritisation offers a clear path to greater performance, adaptability and, ultimately, long-term success.

4.5 Research Question Three: Impact of Agile Principles on KPIs in GSA

Manufacturing

What is the impact on key performance indicators such as time-to-market, quality control and cost efficiency in the manufacturing sector in the GSA-region, through the introduction of agile principles?

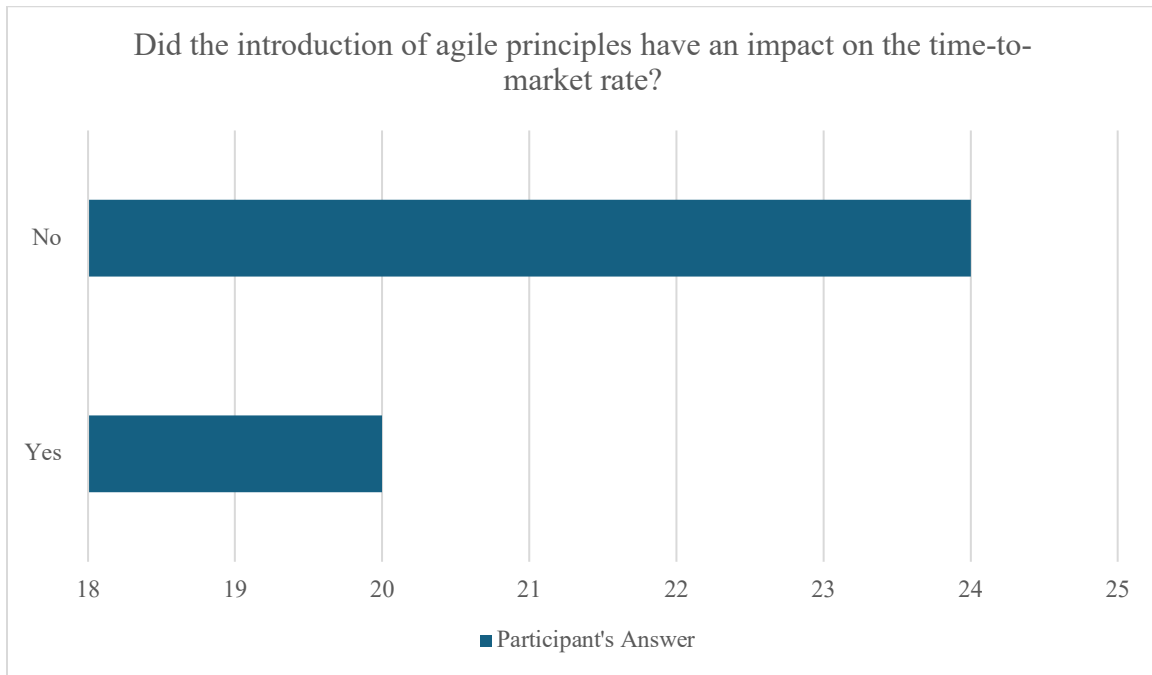


Figure 4.8 Impact on time-to-market rate

The Influence of Agile Principles on the Time-to-Market Rate:

The survey shows that 20 out of 44 participants (45%) state that the introduction of agile principles had led to an improvement in time-to-market rates. However, 55% of participants did not see any significant impact. The expected acceleration effect often attributed to agile working environment and frequently regarded as an advantage in software-related areas cannot be seen in the results for the manufacturing industry in the GSA region. While incremental work, following agile principles, can lead to shorter development cycles in software development Rigby *et al.* (2016), physical production processes seem to limit time flexibility due to potentially longer planning and validation phases as well as technical dependencies.

It should also be mentioned here that Ahmad *et al.* (2018) argues that agile principles can only be effective in this context in the early stage of industrial product development (such as prototyping). However, these effects are neutralized in later stage by structural complexity.

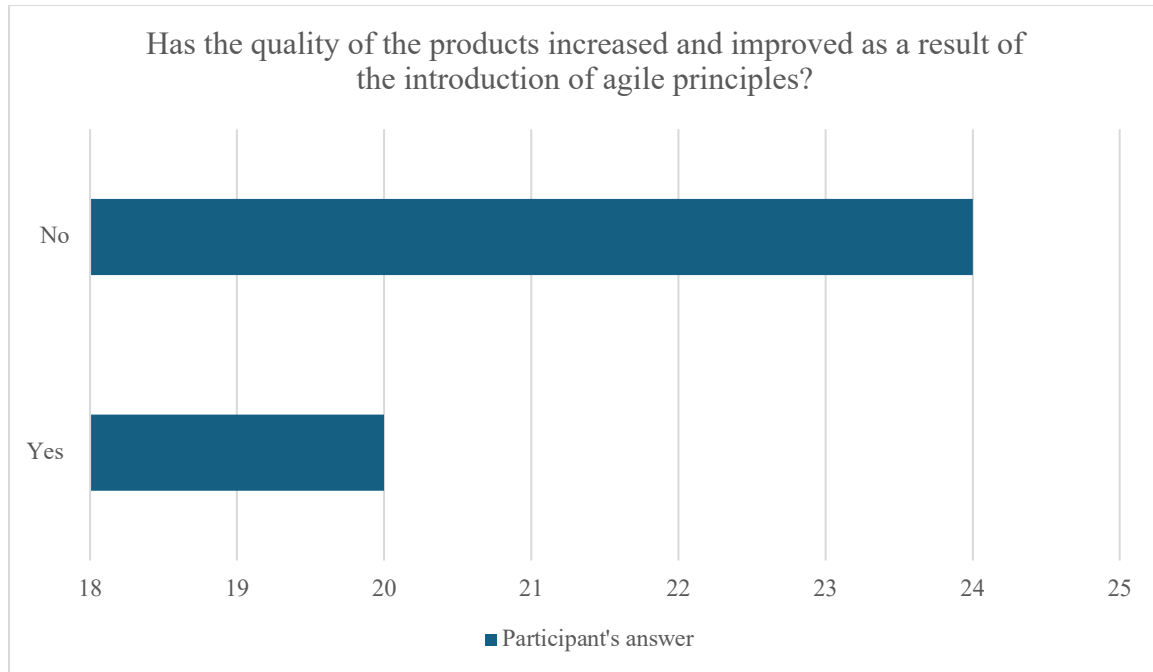


Figure 4.9 Relationship quality of products and introduction of agile principles

The Impact of Agile Principles on Product Quality:

The area of product quality shows a similar picture. Here, too, only 20 out of 44 participants (45%) stated that they had noticed an improvement in product quality through agile principles. In contrast, 24 participants (55%) reported no improvement in quality. This analysis contradicts the widespread assumption that agile methods lead to higher product quality through continuous customer feedback, close collaboration in interdisciplinary teams and incremental improvements (Dikert *et al.*, 2016). One explanation could be that in the manufacturing industry, product quality is determined more by standardized testing processes, certifications and long-term stability than by

iterative learning. It may also be the case that highly regulated areas such as medical technology or aviation, extensive documentation and validation are required. That limits the integration of agile practices (Produção *et al.*, 2022).

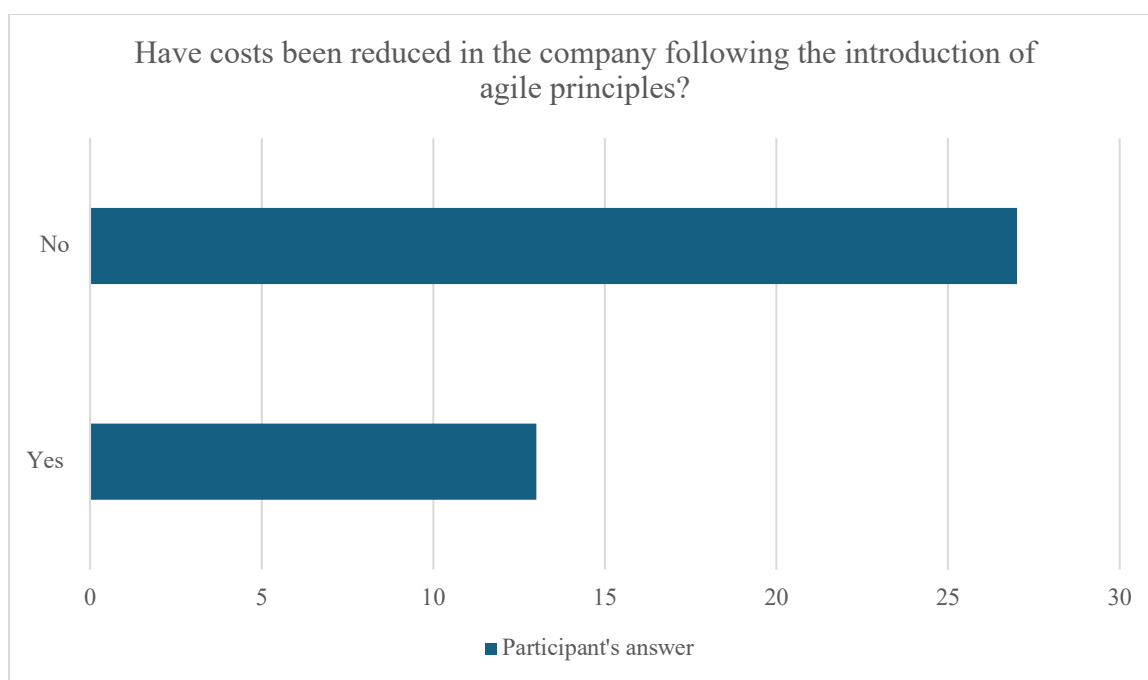


Figure 4.10 Change in costs after introducing agile principles

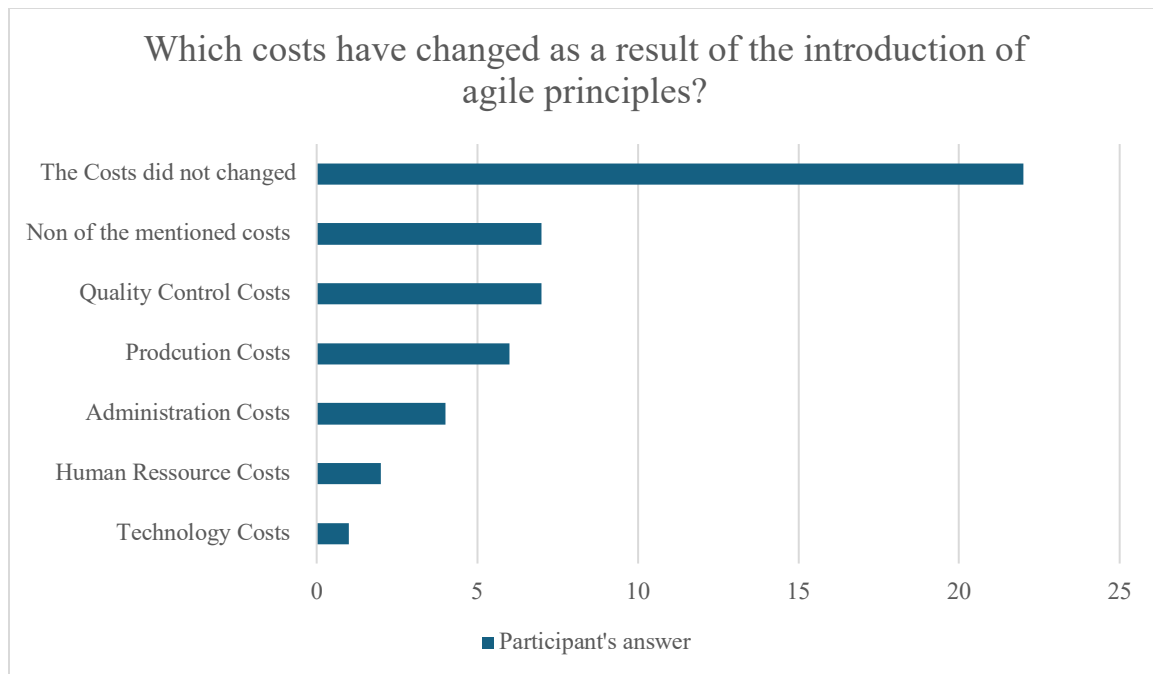


Figure 4.11 Change in costs after introducing agile principles part 2

Impact on Cost Efficiency:

According to the survey, the introduction of agile principles also had no clear effect on the cost situation in companies. In figure 4.10, 28 out of 44 people (63.6%) stated that there had been no cost reduction. Only 16 participants (36.4%) reported cost savings. A closer look at the changed cost types (Fig. 4.11) shows that 23 participants (52%) explicitly state that there have been no changes in the cost structure. Further details are distributed as follows: production costs (7 mentions), quality costs (6 mentions), administrative costs (4 mentions), HR costs (2 mentions) and technology costs (1 mention).

These data suggest that agile principles have not yet led to substantial savings or structural cost changes in the manufacturing industry in the GSA region. This may be due to the initial investments in training, change management, restructuring and tool introduction, which offset efficiency gains in the short term. In their investigation about

hybrid project management methods, Schröder *et al.* (2019) found out that agile transformation processes can even lead to additional expenditure in the medium term. Particularly in traditional industries, if the existing system and responsibilities are not synchronised.

Conclusion of Research Question Three:

The empirical evaluation shows that the introduction of agile principles in the manufacturing industry in the GSA region had no clear positive effects on key performance indicators (KPIs) such as time-to-market, product quality or cost efficiency. A majority of the experts surveyed reported that these indicators were not significantly influenced.

These results suggest that the benefits of agile principles are not automatically transferable to industrial production contexts. Structural characteristics such as technical complexity, regulatory frameworks and high standardisation require differentiated and context-specific implementations of agile approaches.

4.6 Research Question Four: Best Practices

What exemplary approaches are there for the integration of agile principles in the manufacturing sector, based on the experience of companies in the GSA-region that have already successfully implemented them?

Example 1: Use of Digital Twins at Airbus to promote agile Principles in Manufacturing

Aircraft manufacturer Airbus is a great example of how agile principles can be successfully implemented in manufacturing through the extensive use of digital twin technology. As part of a company-wide digital transformation, Airbus is relying on so-

called digital twins. These are virtual, data-supported twins of physical products, processes or systems. They serve to optimise various value creation phases, from design and production to operational activities.

The technology enables a significant reduction in development and production cycles by allowing simulation-based iterations in the design phase, largely physical prototypes and promotion data-driven decisions in real time. Another key component of agile manufacturing is that the use of digital twin promotes adaptive and learning production systems. The use of this technology is particularly noteworthy in production control and maintenance management. Digital twins are used in several Airbus plants, such as Hamburg and Toulouse, to help monitor production progress in real time, identify quality deviations at an early stage and plan maintenance measure predictively. This leads to greater efficiency and flexibility in production and also to greater operational reliability and availability of products in the production system. Through uniform data management and cross-departmental collaboration, Airbus is able to respond quickly to changing requirements, which is also key factor in an agile organisation.

In summary, the use of digital twins allows Airbus to achieve a high degree of agility, transparency and efficiency in its manufacturing process. The combination of digital technology with a process-oriented and iterative approach thus represents a practical implementation of agile principles in a highly complex manufacturing context (Airbus, 2025).

Example 2: Agile Product Development at MAN Truck & Bus

The case study of MAN Truck & Bus provides another prime example of the successful introduction of agile principles in the manufacturing industry. In 2016, the company was faced with the challenge of developing a new TÜV-approved commercial vehicle with innovative unique selling points within 18 months. Under normal

circumstances, this project would have required a development cycle of five years or more. To meet this challenge, MAN decided to set up an agile pilot project based on the Scrum framework. An interdisciplinary team with a 100% focus on the project was established within a short period of time. The project team was supported by external agile coaches. The agile coaches provided intensive training in the methods and got the project team up and running within a week.

The key success factors were the full availability of the team members, co-location and close daily collaboration with other departments such as assembly and purchasing. Stakeholder management was implemented to speed up the decision-making process. This enables feedback and change requests to be incorporated into regular review meetings. The consistent application of agile principles is particularly noteworthy as it was also applied in upstream processes such as the selection and integration of external development service providers. For example, the use of lean approaches reduces the procurement process from six months to six weeks. Agile tools such as Kanban were established in assembly to promote transparency and enable rapid problem solving. The pilot project was successfully completed within the specified time frame. The finished vehicle was presented at the IAA Commercial Vehicles 2018. The knock-on effect of the successful pilot is evident in the deep cultural anchoring of agility within the company. The success and high motivation of the Scrum team led to company-wide acceptance of agile working methods, thus laying the foundation for a sustainable transformation towards an agile organisation.

The MAN case study clearly shows that agile methods, when applied correctly and embedded in the organisation, can generate significant added value in terms of efficiency aims and innovation potential, not in software development but also in

industrial product development. The implementation of agile manufacturing in an established company in the GSA region (Salimi, 2018).

Example 3: Learning Organisation LEGO

Although Research Question four deals primarily with best cases from the GSA region, it is also relevant to look beyond this geographical restriction in order to consider meaningful concepts (see chapter 5.7). Looking beyond the GSA horizon to the LEGO company, it is striking that the Danes have already successfully implemented an agile transformation.

LEGO's transformation has been a strategic, planned and step-by-step process. The use of lean practices was deliberately chosen. As a result, LEOG has developed into a learning and ultimately an agile organisation. The starting point for the transformation was the realisation that the company should not only focus on short-term efficiency gains, but rather work towards a long-term, adaptable organisation that is capable of learning. This is, among other things, a current market requirement, as the environment in which LEGO operates is dynamic, with many competitors and challenges.

To gain initial experience in this area of transformation, LEGO decided to start with a non-productive support department of approximately 100 employees. The introduction of lean practices that are not primarily designed for classic production optimisation was initially the focus of the change. The aim was to establish systematic problem-solving skills and a sustainable learning culture. Practices such as A3 thinking (Agilists would compare it with the agile principles *Continuous Improvements*, *Technical Excellence* and *Simplicity*), Gemba walks (corresponds to the agile principles *Promoting collaboration*, *Face to face communication*, and *Self-organizing teams*), improvement kata (corresponds here roughly to *Continuous reflection*, *Measure Progress* and *Customer satisfaction*) and visual performance management (corresponds to the agile

principles *Face to face communication* and *Frequent delivery*) were of crucial importance here. It is important to mention in this context that the focus was not on the introduction of fixed frameworks such as Kanban, but rather on internalising the ways of thinking and behaving that enable continuous learning.

At LEGO, another key element was the role of managers and how this changed in the new organisation. Managers acted as learning facilitators and coaches, supporting their teams and departments through targeted coaching to find and implement solutions themselves. Due to this major change in execution and the self-image that some managers had developed, this change initially proved to be a challenge. Typical criticism included a perceived devaluation of skills and the new methodology of coaching and supporting teams, which was considered too time-consuming. In this relationship, some employees were initially sceptical about the change and the breaking of familiar decision-making processes. Increasing experience and visible successes then strengthened acceptance of the new approach.

LEGO introduced lean principles in three phases. First, managers were trained and introduced to the new management approach. In the subsequent phase, employees were integrated into the learning process. They were given specific problems to identify in their everyday work and then solve using lean methods. To generate transparency and progress, visual performance management systems were introduced in the third phase. Based on this approach, several successes were achieved. Despite an increasing order situation, costs fell by 13%. On-time delivery improved from 56% to 94%. The proportion of rework also declined. Another result was a fundamental change in the way the teams worked together. Problems were now systematically analysed and solved together. Through appreciation and proactive contribution from employees, continuous improvement in work was achieved. Furthermore, mistakes were no longer seen as

failures, but as learning opportunities. The development of a learning-oriented structure subsequently laid the foundation for LEGO to achieve greater efficiency and product quality and also marked the beginning of its subsequent agile transformation. Lean practices in particular, such as coaching and iterative approaches, as well as thinking in problem-solving cycles, form the bridge to the agile working world for LEGO. In 2018 the company officially introduced agility as its central working method.

In summary, it can be said that the transformation was not purely an efficiency project for LEGO, but rather a profound cultural change. With the conscious decision to introduce lean methods as a social and learning-oriented system, the company has achieved both short-term performance optimisations and the long-term prerequisites for introducing agility in a sustainable manner and thus remaining competitive. This example shows that such a transformation requires time, consistency and willingness to make a lasting behavioural change (Kristensen *et al.*, 2022).

Conclusion of Research Question Four:

The case studies from Airbus and MAN Truck & Bus show practical, successful approaches to integrating agile principles in the manufacturing industry in the GSA region.

Airbus demonstrates how digital technology can act as a driver of agility. Agile elements that are also found in the 12 Agile Principles, such as flexibility (in manufacturing), the pursuit of continuous improvement and the minimisation of waste, are omnipresent at Airbus. In addition, a high degree of agility has been established through the support of iterative and adaptive processes and the promotion of cross-functional collaboration. The digital transformation at Airbus demonstrates how technological innovation can contribute to the implementation of agile principles in a highly complex environment.

The MAN Truck & Bus case study illustrates the organisational and cultural dimension of agile transformation. As already described in chapter 4.3, transformation can only be successful through a holistic approach. In the specific case of MAN, the consistent use of the Scrum framework was the driving force behind achieving a successful final result within 18 months, even given the complexity of a vehicle project. Cultural factors, in particular, such as “embracing something new”, the willingness to change and the curiosity of the project team members, were decisive for success. This, coupled with management that supported agility, ultimately led to a successful pilot.

As already mentioned in *Example 3*, the focus of RQ4 is on the GSA region, but it is still useful to look at the LEGO case study. The Danish company has undergone a step-by-step agile transformation. Initially, lean practices were introduced in a non-productive support department. The aim was to establish problem-solving skills and promote a learning culture. An important factor in the success was the further development of managers, who had to learn a new understanding of leadership and helped shape the change as coaches and learning facilitators. The company established its transformation project in three phases. This also led to several efficiency gains and new cooperation between departments through the involvement of employees. The mindset of openness of the workforce to continuous improvement is exemplary for the success of the transformation. In the long term, agility was established as the company’s central working method by 2018.

In summary, it can be seen that there is no universal approach to the introduction of agility in the manufacturing industry. A holistic approach, both technologically and structurally, and above all culturally, is crucial here. Companies that integrate agile principles into their organisation in a context-appropriate manner and remain consistent in doing so can achieve significant advantages in terms of efficiency, innovation strength

and responsiveness to market changes. As the LEGO case study shows, sustainable agile transformation is not just about methods or performance, but rather about the cultural development of the organisation.

4.7 Critical Limitations of the Study

Although the study was planned and conducted with the utmost care, it is subject to several limitations that must be taken into account when interpreting the results.

Limited Generalisability:

The study focusses exclusively on the manufacturing industry in the GSA region. The findings are therefore highly context specific. They cannot be readily transferred to other industries or geographical areas. Practitioners and organisations that fall outside this framework should therefore exercise caution when considering possible recommendations for action.

Self-Report Bias:

In both, the qualitative and quantitative phases, the results are based on self-reported information. These are subjective and may be potentially biased by social desirability, individual perceptions or deliberately strategic responses. Validation by objective performance data would be necessary to compensate for these potential errors.

Snapshot instead of long-term Analysis:

This paper is a snapshot. It captures the status quo in a specific economic and political constellation. In a dynamic environment such as the VUCA world, conditions can change quickly. Long-term developments and effects of an agile transformation are therefore not taken into account.

Imbalance in Geographical Distribution:

Since the majority of respondents are from Germany (37 out of 44 participants), the Swiss and Austrian perspectives are underrepresented. This limits comparability within the GSA region. Any cultural or structural differences are therefore not considered. A comparison of the three GSA countries can be found in chapter 2.8.

No Differentiation based on Company Size:

The study does not distinguish between the size of the companies in which the participants work. However, there is a presumption that the impact and implementation of agile principles varies greatly depending on the size of the company and the complexity of its organisational structure.

Limited sample size:

With a total of 44 valid questionnaire responses and two expert interviews, the study is solid but limited in scope. A larger sample would have been necessary to make a reliable differentiation between subgroups (e.g. between the GSA countries).

Restricted Transferability:

As mentioned above, the results of the study refer to the manufacturing industry in the GSA region. Transferring the results to other sectors, such as healthcare, may lead to false expectations. This is because other sectors may have different structural or cultural conditions. Therefore, transferability is not guaranteed.

The same applies to adaptation to other regions outside the GSA region. This is also limited, as political, regulatory and socio-economic conditions can influence the introduction and effectiveness of agile principles.

The study results should therefore be interpreted with great caution when applied beyond the context investigated.

4.8 Summary of Findings

This doctoral thesis examines the relationship between corporate success and the introduction of agile principles in the manufacturing industry in the GSA region. A mixed-method approach was used to ensure an in-depth analysis at both the quantitative and qualitative levels. The key findings can be summarised at several levels:

Agility as a cultural, structural and leadership-related System:

In order to enable the full benefits and added value of agile principles, they must not be introduced in isolation as a collection of methods but require systemic integration. To ensure measurable business success, a simultaneous transformation at the cultural, structural and management levels is essential. Without this coherent anchoring, agility misses its target and remains purely symbolic.

Success Factors in an industrial Context:

The agile principles *Continuous Improvement*, *Customer Satisfaction* and *Self-organized teams* were identified as particularly effective. They enable adaptability, innovation and employee retention when introduced in a mature organisation that supports agility.

Short-term Impact on hard Performance Indicators:

The investigation shows that agile principles have only a short and limited, context-dependent effect on traditional KPIs such as time-to-market, quality and cost efficiency. Although improvements can be observed in some pilot areas or in teams, the effects generally remain isolated. This is because they are influenced by the maturity and readiness of the existing system. This highlights the need to carefully differentiate agile methods for the manufacturing context rather than adopting them directly from the software development environment.

Long-term Strategic Effects:

Despite the limited short-term improvements in traditional KPIs, the study emphasises the significant long-term benefits of agile principles. Once agility is implemented holistically, as a cultural, structural and leadership approach, it becomes a catalyst for sustainable innovation, organisational adaptability and employee retention. Although these dimensions are less measurable, they contribute significantly to long-term competitiveness in complex and regulated industrial environments.

Practical Examples as Blueprints:

The case studies discussed show that a successful agile transformation can only be achieved through a holistic approach. It must be technology-driven (Airbus), culturally embedded (MAN), or learning-oriented (LEGO).

4.9 Conclusion

The conclusion of chapter 4 answers the central research question of whether and how agile principles influence corporate success in the manufacturing industry in the GSA region based in the available results as follows. Agile principles contribute to a company's success when they are not seen as operational tools but are lived as part of a systemic change. In order to prevent agility from withering away as a symbolic action with little effect, there needs to be a combination of cultural openness, structural adaptability and transformational leadership. The simple introduction of agile principles is no guarantee of economic success per se. Rather; the organisation as a whole must be developed into a learning and adaptable unit. The present investigation shows that the manufacturing industry, which has traditionally been strongly influenced by hierarchical and process-oriented structures, faces particular challenges. At the same time, however, it demonstrates that the context-sensitive and integrative approach of agility can also act

as a catalyst for efficiency, innovation and employee retention in complex and regulated environments.

This dissertation contributes to the scientific discussion and initiates the contextualisation of agile principles outside the IT or service industry. It shows that transformation success depends not on methods, but rather on the maturity of an organisation and its cultural fit. For companies in the GSA region, this means that if they understand this difference, they can use agility as sustainable management model and expect it to have an impact on their long-term competitiveness and adaptability.

In summary, agility does not automatically lead to quick wins in terms of efficiency or cost savings. Its real strengths lie in long-term effects: driving innovation, strengthening cultural adaptability and increasing employee commitment. These aspects are key to staying competitive in volatile environments – and should therefore be given clear priority when shaping transformation strategies.

CHAPTER V:

DISCUSSION, SUMMARY, IMPLICATIONS AND RECOMMENDATION

5.1 Discussion of Results

Chapter 5 discusses the results of the study and grabs a well-founded conclusion that refers to the research questions defined in chapter 1. From this, practical implications are formulated. Recommendations for implementation in business practice are then presented, and suggestions for future research are proposed. The general aim of this chapter is to place the findings in a broader context and to highlight their significance for science and practice.

The structure of the chapter is based on a tried-and-tested-approach. The introductory overview is followed by a brief summary of the key findings of the study. The individual research questions are then addressed in an in-depth discussion and recommendations for action are provided. Chapter 5.7 then presents suggestions for future and further research. Finally, a summary conclusion is drawn.

5.2 Summary of Findings

The dissertation investigates the relationship between the introduction of agile principles and corporate success in the manufacturing industry in the GSA region. The basis for this is an investigation using a mixed-method-approach consisting of a quantitative study (n=44) and two qualitative expert interviews. Looking at the most important findings, they can be summarised as follows:

- Agility only has a demonstrable effect on a company's success if it is understood and practised as a systemic change. An isolated methodological approach does not add value to the company. This can also be seen in the research by Kumar *et al.* (2019).
- The agile principles considered most effective for positive change in business success are: “*Continuous Improvement, Customer Satisfaction and Self-organized teams*”.
- Traditional or classic KPIs, such as time-to-market rate, product quality of cost efficiency, tend to be rather cautious or inconsistent in their response to agile transformation processes, as described by Banáš and Hrablík (2023)
- Best practices from the field (Airbus, MAN, LEGO) illustrate that technological, structural and cultural factors must be given equal consideration (Oliveira-Dias, *et al.*, 2022).

5.3 Discussion of the Research Questions

While the above summary of the results highlights the most important empirical findings, the following chapter provides a more in-depth analysis. Each research question is examined individually in the basis of the collected data and findings that have been evaluated.

RQ1: What is the interrelation between the implementation and extent of agile principles and the overall performance metrics of manufacturing companies in the GSA region?

The results clearly show that a direct relationship can only be identified if agile principles are introduced as part of a comprehensive transformation. Companies that

merely use agile methods without making parallel cultural or structural changes will see only limited effects. As management consultant, I have often encountered executives who underestimate the importance of agility, reject it outright or respond with comments such as “Agility? Hans takes care of that for us...” But they themselves seem unaffected by what they see as a “trend towards agility”. Other researchers, such as Kumar, Singh and Jain (2020) in their research published in 2020, also see these findings.

RQ2: Which agile principles are most effective in driving business success for manufacturing organisations in the GSA region and why?

The agile principles “*Continuous Improvement, Customer Satisfaction and Self-organized teams*” were mentioned particularly frequently by the experts surveyed. These principles have a direct impact on innovation, flexibility and employee loyalty, and thus on key success factors for industrial companies.

RQ3: What is the impact on key performance indicators such as time-to-market, quality control and cost efficiency in the manufacturing sector in the GSA-region, through the introduction of agile principles?

According to the survey, the impact of agile principles on hard metrics such as time-to-market, product quality and costs is ambiguous. No clear evidence of a significant improvement in these indicators could be found. Agility reaches its structural limits in regulated industries with rigid validation processes (Ali and Wasim, 2022).

RQ4: What exemplary approaches are there for the integration of agile principles in the manufacturing sector, based on the experience of companies in the GSA-region that have already successfully implemented them?

The case studies examined in the thesis show that a successful agile transformation must always be conceived and implemented holistically. Airbus shows how technology (digital twin) serves as an enabler. MAN, on the other hand, impresses with its focused pilot project and cultural anchoring. LEGO impressively illustrates how a learning organisation can gradually become an agile organisation. The common denominator in these examples is consistent management commitment and a deeply rooted willingness to learn and change (Oliveira-Dias *et al.*, 2022).

After presenting the individual research questions and their findings in this chapter, the following section discusses these results.

5.4 Discussion of Results

The results of this work are consistent with numerous studies that emphasise that agility is more than just the application of methods and frameworks. Rather, agility is an understanding of principle and values that must permeate the entire company (see also Neumann *et al.*, 2024). In a professional discussion I had a few weeks ago during an exchange between agility experts, a colleague thanked me for making him think. My thesis was that when looking at the SAFe framework, the configuration level (Big Picture, Essential, Large Solution, Portfolio, Full) is irrelevant if you don't take into account the core values of "*Lean-Agile Mindset, Core Value and SAFe Principles*". Strictly following the implementation roadmap is useless if the organisation is not ready to start with the fundamentals. Everything that follows, such as the various scaling levels, is unstable without a solid foundation.

In particular, the realisation that classic KPIs are not necessarily improved by agility calls for a rethink. The success of agile transformations lies less in short-term

efficiency gains and much more in the long-term strengthening of innovation, adaptability and employee loyalty (Banáš and Hrablík, 2023).

However, from my professional point of view, one of the common opinions in German-speaking management is the promise that was probably made with a wink by Jeff Sutherland in 2015 in the form of his book title “Scrum: The Art of Doing Twice the Work in Half the Time”. This clearly formulates the expectation – if the team does Scrum, then they only need half the time for everything. So, the conclusion is: “Let’s to Scrum”, but the organisation remains unchanged.

This also shows that so-called “symbolic agility”, the formal introduction of agile methods (according to the motto “Department XY is doing agility”), has little effect without cultural or structural transformation. Three levels are considered essential for change to take place: culture, structure and leadership (Hasan and Sarkis, 2007).

5.5 Translating Agility into Practice: Strategic and Cultural Implications for Industrial Organisations

The findings of this work have far-reaching implications for practice and are aimed in particular at decision-makers and designers of change processes in industrial value creation. As the investigation makes clear, agility should not be understood as a universal solution, especially in the manufacturing industry. Rather, it is a context-sensitive management approach. This is particularly true in an industry that is influenced by process stability, high quality requirements and technical complexity. A reflective and critical approach to agile principles is essential here.

In practice, this means that agility is not understood as a method or a project. Rather, it is a long-term change that encompasses various levels. Managers focus on

redesigning operational processes, questioning cultural patterns and attitudes, and reviewing them for the long term. Successful transformation requires existing power and decision-making structures to be analysed and reviewed. It is then possible to initiate change. A key component of this is a management style at eye level, which is influenced by trust, empowerment and transparency.

The results also underscore the need for a clear strategic direction. Introducing agility solely as a short-term response to market pressure or technological trends will not promise long-term success. Rather, agility must be understood as an overarching corporate goal. Companies should therefore examine whether their strategic orientation already provides the necessary scope for agility or whether a realignment is required.

The study also shows that a company's employees play a central role in the change process. Through their active participation, they contribute to a successful transformation. For this purpose, a company must create psychological security and, if necessary, revise its learning and failure culture. In addition, managers must contribute to cultural development in addition to methodological competence and should invest in management coaching.

Ultimately, agility can also be a response to key challenges such as the growing shortage of skilled workers and the demands of a new generation of employees. The aspects of self-organisation, purpose orientation and continuous learning are increasingly considered attractive when exemplified by a company. Firms that exemplify these aspects thus gain a certain strategic advantage, both in terms of employee retention and in their innovation and responsiveness to the market.

A change can be initiated based on four points:

1. [Agility should be understood as a system](#). Values, structures and leadership concepts must be aligned with one another for agility to be effective. Individual measures rarely lead to lasting success.
2. [Check cultural requirements](#). Companies must analyse and understand how open their employees are to personal responsibility, transparency and iterative learning processes.
3. [Positioning management as an enabler](#). The role of manager must change. Away from classic decision-maker, towards a coach, moderator and companion for self-organisation. For this purpose, managers must, of course, actively confront their fear of losing power and come to terms with their new role.
4. [Utilizing pilot projects as a learning method](#). Pilot projects that are rolled out step by step and gather important insights into agile transformation are a good way to gain initial experience. It is important that these projects do not remain isolated.

5.6 Guiding Agile Transformation: Practical Recommendations for Industrial Implementation

The results presented here can be translated into concrete recommendations for action that will help and support companies in the manufacturing industry in the GSA region to successfully shape an agile transformation. However, it should be noted that the individual maturity level of the organisation, the structural framework conditions and the cultural starting point of a company influence the form in which agile principles take effect. Right at the start, it is advisable to carry out a concrete, systematic analysis (e.g.

using the SAFe framework, which offers such analyses) of the agile maturity of the organisation. Once it is clear how far the company has already developed in terms of agile thinking and working methods, suitable actions can be defined. As already describe in the previous chapter, the introduction of agile principles should not be seen as an isolated project somewhere in the organisation, but rather as a starting point for establishing a comprehensive change process on several levels simultaneously. Namely, at the level of leadership, structures and corporate culture. In this relationship, it is important that agile methods are not adopted without reflection but are adapted in a meaningful and context-sensitive manner. With industry-specific adaptation of frameworks such as Scrum or Kanban, the organisation has a good orientation as to what further steps may look like in order to build an individual agile transformation construct.

In order to anchor knowledge broadly within the company, reduce rework and make it sustainable, the establishment of so-called multiplier has proven to be a success factor in practice. By training internal agile coaches and transformation consultants, the specialist knowledge is equally well established throughout the company. In parallel with the steps described above, the role of managers as enablers, supporters and cultural shapers should be defined and implemented. The key lever here is the shift from a classic top-down logic to a supportive and servant leadership style.

Pilot projects are important to enable the organisation to gain experience with the new way of working. These should be clearly defined and staffed with interdisciplinary teams.

However, pilot projects are not the end point of the transformation, instead they should even be seen as a starting point with the aim of gradually scaling agile principles across the rest of the company.

Finally, it is advisable to review an organisation's feedback and learning culture. A major advantage of agility is that it thrives on the ability to self-reflect and adapt. However, this must be learned. Methods such as retrospectives, reviews and other feedback formats enable teams to exchange experiences and learn from them. This can be even become institutionalised at the organisational level. Companies that see themselves as learning organisation thus lay the foundation for a successful and sustainable agile transformation.

As the topic AI is constantly evolving and companies are increasingly relying on AI technology, I would like to especially refer to SMEs to the INTERREG project, which has developed the "KI-AGIL" process model. It shows how companies with limited resources can be introduced to the development and implementation of AI solutions through agile approaches. Field tests have shown that this enables SMEs to successfully implement their first AI solutions (Feld, Arens-Fischer and Schumacher, 2024). In practice, this means that agility is not just a simple transformation goal but can also be a pragmatic way to embed technological innovation in industry.

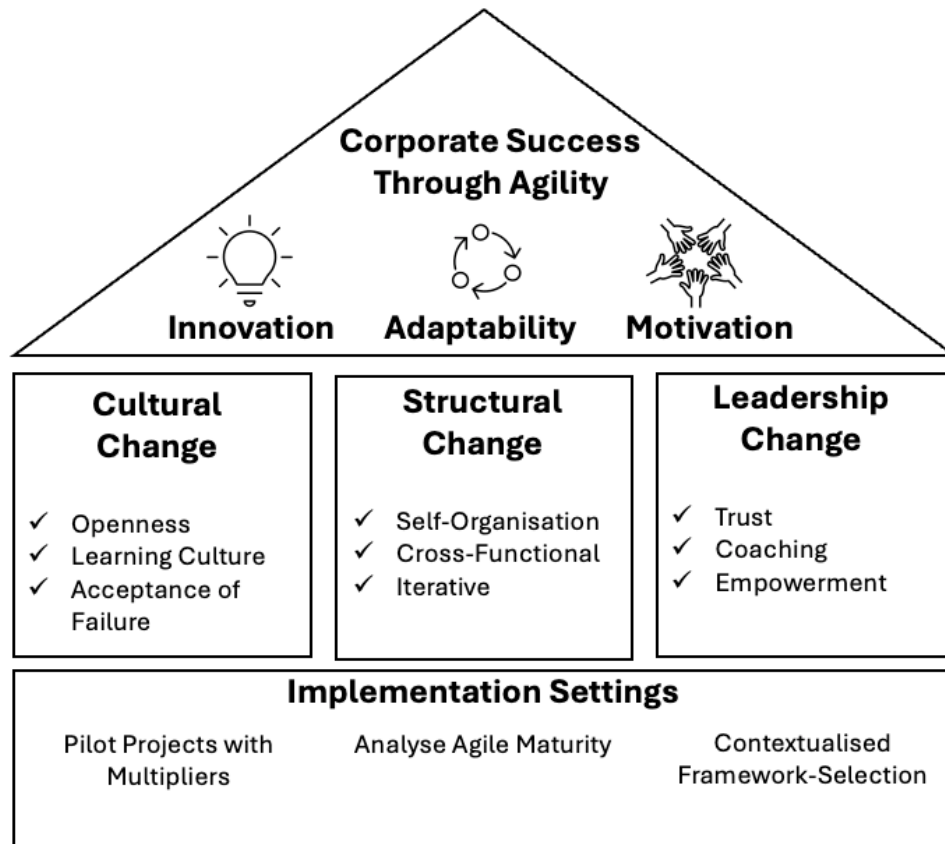


Figure 5. 1 Corporate Success Through Agility

The pyramid-shaped structure in Figure 5.1 shows the key findings of the research presented in chapter 5, for the manufacturing industry in the GSA Region. At the centre is the goal of “*Corporate Success Through Agility*”. This is divided into three key result dimensions: innovation, adaptability and motivation. These characteristics represent the areas of impact in which agility contributes to corporate success when introduced successfully (see chapter 4.3). This target vision represented in the diagram by three central areas of change, which must be in balance with each other in accordance with the Grounded Theory developed in chapter 4.2. The reason for this is the effectiveness of agility within the company and its anchoring.

Agility first requires a cultural shift characterised by openness, a culture of learning and an accepted culture of failure. The second point is the dimension of structural change. This is achieved through self-organisation and cross-functional and cross-departmental cooperation, which functions in an iterative manner. Thirdly, as already described above, a change in leadership is necessary. Trust, coaching and empowerment are the essential skills on which the new role of managers is based (see also chapter 4.4 and 4.5). The foundation of the pyramid is formed by the implementation settings. This is where specific recommendations for starting a transformation are mapped out. These include carrying out pilot projects, analysing the agile maturing of the organisation and selection suitable frameworks based in the context (see chapter 5.6).

The figure thus underlines the central finding of this dissertation: Agility only contributes to corporate success if it is introduced holistically and not as an isolated methodological construct standing on its own. Holistic change requires cultural, structural and leadership related change within the organisation.

These recommendations are intended to serve as starting point for practitioners when designing an agile transformation. The study also identifies several points of departure for future research, particularly with regard to overcome its own limitations and further developing the conceptual framework of the research.

Maturity	Recommendations	Timeline
Initial (Low Maturity)	Execute Agile Maturity Assessment (e.g. SAFe Diagnostics)	1st Quarter
	Culture: Values, Transparency, Fail-safe-culture, Openness	1st Quarter
	Start Pilot Project in selected Areas	1st Quarter
	Train Multipliers: e.g. Agile Coaches, internal Change Agents	1st-2nd Quarter
Advanced (Intermediate Maturity)	Establish cross-divisional, cross-functional teams	2nd Quarter
	Management coaching for role change (coach instead of decision-maker)	2nd-3rd Quarter
	Institutionalise feedback and learning formats (retros, reviews, etc.)	2nd-3rd Quarter
	Adapt frameworks (Scrum, Kanban) to suit the industry	2nd-3rd Quarter
Transformed (High Maturity)	Scaling agile principles to other areas of the company	from 3rd-4th Quarter
	Strategy alignment: Anchoring agility as an explicit corporate goal	from 3rd Quarter
	Shaping our self-image as a learning organisation	ongoing from 3rd Quarter

Table 5.1 Implementation Plan Proposal

Short-term Implementation Plan	
Quarter	Focus
1st Quarter	Agile Maturity Level Analysis; Initiate Cultural Work (Workshops on Values, Learning, Failure-culture); Set up initial Pilot Projects
2nd Quarter	Establish cross-divisional Teams; Train Agile Coaches; Start Leadership Coaching
3rd Quarter	Establish Feedback Formats; Adapt Frameworks to specific Contexts; Prepare Scaling
4th Quarter	Strategic Anchoring of Agility; Roll-out to other Units; Institutionalise Learning

Table 5. 2 Short-term Implementation Plan

Tabel 5.1 and Table 5.2 outline two proposals for an implementation plan. These can serve as an aid for managers and organisational change agents to help them manage the initial planning considerations for their own organisational transformation.

Adding to the tables shown above, Table 5.3 supplements them by explaining the typical obstacles for each level of maturity within the organisation and presenting the corresponding actions.

Maturity	Typical Obstacles	Consequences	Possible Countermeasure
Low	• Resistance of employees • Fear of losing control • Lack of understanding of agility • Strong hierarchies	• Symbolic agility • Obstacles in pilot projects	• Change workshops • Deploy agile coaches • Launch initial pilot project
Medium	• Silo structures • Lack of cross-departmental collaboration • Unclear roles (e.g. Product Owner) • Limited experience with frameworks	• Stagnation in isolated projects • Friction between teams	• Form cross-functional teams • Train internal multipliers • Develop managers into enablers
High	• Technology and tool limitations • Lack of KPI adaption (classical vs. agile) • Regulatory requirements • Risk of “agile theatre” without substance	• Limited impact on hard KPIs • Relapse into old patterns	• Adapt KPIs (e.g. learning and innovation metrics) • Scale beyond pilot areas • Secure long-term cultural anchoring

Table 5. 3 Possible Obstacles and Countermeasures

5.7 Recommendations for Future Research

The limitations identified in chapter 4.7 form the basis for further promising research approaches for future scientific work. Below are some recommendations in this context.

Cross-sectional Analysis:

In order to reliably map the long-term impact of agile principles on a company's success, research and studies are needed that observe such potential changes over several years. For example, this research could examine specific KPIs over a period of three to five years for a particular company. Based on this, developments can be identified that might be recognised as relevant in the context of an agile transformation.

These investigations could then be enriched by the factor of company size. In Germany, for example, the focus could be on large corporations, while in Switzerland and Austria, the SME sector could be examined more closely.

Comparative Studies between Industries and Regions:

It is possible that the influence of agile principles on corporate success may be quite different in other industrial sectors or in an international context. Comparative studies looking at the manufacturing industry and, for example, the service sector could provide new insights. These comparative studies could then be enriched by focusing on a comparison between regions, for example between the GSA region and other European regions (see also chapter 4.6). These comparisons could contribute to gaining insights into cultural and structural influencing factors.

In-depth Analysis of influencing Factors:

Using quantitative methods, for future research could investigate how strongly individual agile principles (such as self-organisation or continuous improvement) affect different dimensions of success. This could then be differentiated according to areas such as product development, production or customer service.

Integration of objective Company Metrics:

In the context of the difficulty of defining corporate success and the evaluation of KPIs discussed in scientific literature (see chapter 2.9), which are intended to enable companies to be compared, it makes sense to collect evaluation indicators from annual reports and employee surveys. Annual reports would provide an objective basis of economic significance (such as EBIT, liquidity ratio), while employee surveys could provide information about a company's motivation, commitment and social responsibility. With the help of a points system, for example, future investigations could produce a more neutral assessment.

Differentiation according to Company Size and Maturity:

As already mentioned in the subchapter *Cross-sectional Analysis*, future research should focus on differences between small, medium-size and large companies. This grouping can then be subdivided according to the agile maturity of the organisations. Various analysis models can be used to determine the agile maturity. One goal of the research could then be to develop context-dependent recommendations for action.

Social Dimensions and Plurality:

The quantitative analysis indicates that age, gender and role within the organisation can influence the perception and implementation of agile principles. A more detailed examination of these socio-demographic factors would be interesting in order to gain further insights that could in turn be used as a basis for designing successful corporate transformations.

Regression Analysis Approach:

Chapter 4.7 already pointed out that the study conducted in this thesis has some limitations. Therefore, it is suggested that further research on agility in the manufacturing industry, also with reference to the GSA region, should include a regression analysis. The aim here is to investigate the influence of specific agile principles on corporate success in quantitative terms and thus to be able to statistically model causal relationships that go beyond simple correlation. A useful methodological extension of the present research would be to conduct a multiple linear regression analysis. This would allow quantification of which individual agile principle influence corporate success. The investigation to date has been based on an exploratory mixed-methods approach, regression analysis could help further research to statistically demonstrate causal relationships.

Multiple linear regression can be used to analyse the effect of several independent variables on a dependent variable. The basic assumption here is that there is a linear relationship between these variables. Accordingly, the regression equation is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \varepsilon$$

In this case:

Y denotes the dependent variable (e.g. perceived company success)

$X_1 \dots X_n$ denotes the independent variables (e.g. degree of implementation of the 12 agile principles)

β_0 denotes the intercept

β_i denotes the regression coefficient

and ε denotes the error term.

In the context of this dissertation and further research, the dependent variable could consist of an aggregated index for assessing business success. This index could be developed from the factors of growth, innovation, customer satisfaction or employee loyalty. The independent variables then represent the characteristics of individual agile principles (e.g. *Customer Satisfaction*, *Self-organized teams*, *Continuous Improvement*). These are rated on a scale or determined as multiple mentions, as they were in the survey. However, certain statistical assumptions must be checked before such an analysis can be performed:

- Linearity of the relationship between predictors and target variable
- No multicollinearity between the independent variables
- Consistent variance of errors
- Independent observations

The calculation makes it possible to determine which agile principles have the greatest influence on perceived corporate success. The regression coefficient β_i indicates the strength and direction of the influence, while R^2 value indicates the proportion of the variance in the dependent variable that is explained by the model.

In future research, the regression analysis method can make a solid contribution to clarifying whether certain agile principles are particularly effective in specific industry segments (e.g. automotive vs. aviation) or company sizes (SME vs. large corporations). Even greater significance could be achieved by incorporating objective performance indicators, for example from annual financial statements.

Artificial Intelligence and Agility:

Future scientific research would also be appropriate to the field of AI-supported forecasting models. A key question here could be how such AI forecasting models can support agile transformations. Shafiabady *et al.* (2023) *et al.* have already shown that AI can not only efficiently support operational processes but also serve as a measuring instrument for organisational agility that can even deliver forecasts. This approach opens up the possibility of identifying critical success factors and barriers at the beginning of a transformation and initiating appropriate actions. For the GSA area, this presents opportunities and the potential to combine classic qualitative investigating with data-driven forecasting methods.

Due to these methodological extensions and the thematic deepening, future empirical work can use this thesis as a basis and gain further insights that will strengthen its generalizability. In the final chapter, an overall conclusion of the research presented so far is drawn.

5.8 Conclusion

This dissertation investigated the relationship between corporate success and the introduction of agile principles in the manufacturing industry in the GSA region. Using a mixed-method approach, the results provide both differentiated and clear evidence that agile principles, when holistically embedded in a company, can act as a catalyst for innovation, adaptability and organisational resilience.

The study explains that agility should be understood as a systemic, context-sensitive transformation strategy rather than a fixed or rigid methodology. Successful

implementation therefore requires coordination across several dimension and levels. Namely, corporate culture, structural adaptability and change in leadership (cultural change, how leadership is exercised, not necessarily the replacement of individual managers). Without these three factors, the impact of agility is limited and there is a risk that agility will remain merely symbolic.

Traditional KPIs such as time-to-market rate or cost efficiency cannot be improved in short term through agility, as the results suggest. However, the true added value of agility lies in long-term cultural adaptability and improved learning ability of cross-functional teams. Furthermore, case studies show that companies that have already undergone successful agile transformations have integrated agility into their core operational and strategic logic. This put them in a better position to respond to complexity and dynamics in the market.

By studying this dissertation, managers gain a scientifically grounded and practical understanding of how agile principles work in the manufacturing industry and which factors determine success or failure. Consequently, managers can develop specific recommendations for action to establish agility in a targeted and context-sensitive manner as a long-term effective construct within their own company.

This thesis contributes to academic literature by systematically investigating the impact of agile principles on the manufacturing industry in the GSA region for the first time, thereby shedding light on a field of application that has been largely underexplored to date. It closes the research gap that has existed until now, where previous studies have either focused on software development or only examined international examples. A concrete reference to the GSA region, with its specific cultural and structural characteristics has been neglected until now.

In summary, this dissertation makes a fundamental contribution to the academic and practical understanding of agility in the manufacturing industry. The need to go beyond superficial implementations is particularly emphasised by this work for decision-makers and practitioners in the GSA region. Agility must be understood as a strategic necessity so that, when contextualised correctly, its potential for long-term competitiveness and employee engagement as source of sustainable success can be fully exploited.

APPENDIX A

SURVEY COVER LETTER AND SURVEY QUESTIONS

Cover Letter

Dear Agile Expert,

I am researching for my Doctorate in Business Administration on the relationship between corporate success and the implementation of agile principles in the manufacturing industry in the GSA (Germany, Switzerland, Austria) region. Your input, based on your expertise, can make an important contribution to understanding the relationship between agile principles and corporate success.

The findings of this doctoral thesis can contribute to gaining further insights into this topic both in practice and in science and help decision-makers with future challenges.

The survey will take about 10 to 15 minutes of your time. If you have any questions about the survey of the research, you can contact me via LinkedIn DM. The survey is anonymous and does not collect email addresses.

Thank you in advance for your time and effort!

Christian Gronau

Survey Questions

Question 1 – Please read the “Informed Consent” document.

Question 2

From the experience of which role is your expertise in the agile environment formed?

- ☐ Scrum Master
- ☐ Product Owner
- ☐ Agile Coach
- ☐ Delivery Lead
- ☐ Project Manager
- ☐ Other (please specify)

Question 3

How many years of experience do you have in working with agile approaches?

- ☐ <2 years
- ☐ 2-4 years
- ☐ 5-10 years
- ☐ More than 10 years

Question 4

Do you have any agile related certifications?

- ☐ Scrum Master Certification (PSM I, PSM II, CSM, or equivalent)
- ☐ Product Owner Certification (PSPO I, CSPO, or equivalent)
- ☐ Agile Coach Certifications (ICP-ACC, SPC, or equivalent)
- ☐ Agile Leadership Certification (CAL 1, Leading SAFe, or equivalent)
- ☐ No agile Certification
- ☐ Other (please specify)

Question 5

What area of manufacturing do you work in?

- ☐ Automotive
- ☐ Aviation
- ☐ Electrical engineering
- ☐ Technology
- ☐ Medical technology
- ☐ Mechanical engineering
- ☐ Glass and ceramics
- ☐ Tool manufacturer
- ☐ Optics
- ☐ Construction supply
- ☐ Other (please specify)

Question 6

What is or was your role during the time of implementing agile principles? Please mark only one.

- ☐ Team Member
- ☐ Team Leader
- ☐ Scrum Master
- ☐ Agile Coach
- ☐ Enterprise Agile Coach
- ☐ Project Manager
- ☐ Leadership (e.g. Managing Director, VP, or equivalent)
- ☐ Other

Question 7

Which agile principles did your organisation introduce first?

- ☐ Customer Satisfaction
- ☐ Changing Requirement
- ☐ Frequent Delivery
- ☐ Promoting Collaboration
- ☐ Motivated Individuals
- ☐ Face to Face Communication
- ☐ Maintain a Constant pace
- ☐ Measure Progress
- ☐ Technical Excellence
- ☐ Simplicity
- ☐ Self-organized Teams
- ☐ Continuous Improvements

Question 8

Which agile principles have added value to the team efficiency? You can mark multiple.

- ☐ Customer Satisfaction
- ☐ Changing Requirement
- ☐ Frequent Delivery
- ☐ Promoting Collaboration
- ☐ Motivated Individuals
- ☐ Face to Face Communication
- ☐ Maintain a Constant pace
- ☐ Measure Progress
- ☐ Technical Excellence
- ☐ Simplicity
- ☐ Self-organized Teams

- Continuous Improvements

Question 9

As an expert, what do you think are the most effective agile principles to drive business success for manufacturing organisations in the GSA (Germany, Switzerland, Austria) region?

- Customer Satisfaction
- Changing Requirement
- Frequent Delivery
- Promoting Collaboration
- Motivated Individuals
- Face to Face Communication
- Maintain a Constant pace
- Measure Progress
- Technical Excellence
- Simplicity
- Self-organized Teams
- Continuous Improvements

Question 10

Did the introduction of agile principles have an impact on employee satisfaction?

- Yes
- No
- Partially

Question 10.1

What impact did the introduction of agile principles have on employee satisfaction?

- Free text

Question 11

Did the introduction of agile principles have an impact on the time-to-market rate?

- ☐ Yes
- ☐ No

Question 11.1

If Question 11 was answered with “Yes”, please give an estimation of how many percent the time-to-market rate changed.

- ☐ Free text

Question 12

Has the quality of the products increased and improved as a result of the introduction of agile principles?

- ☐ Yes
- ☐ No

Question 12.1

What impact did the introduction of agile principles have on the quality of the products

- ☐ Free text

Question 13

What impact did the introduction of agile principles have on the company costs?

- ☐ Free text

Question 13.1

Have costs been reduced in the company following the introduction of agile principles?

- ☐ Yes
- ☐ No

Question 13.2

If Question 13.1 was answered with “Yes”, please mark which costs.

- ☐ Human Resources Costs
- ☐ Technology Costs
- ☐ Quality Control Costs
- ☐ Administration Costs
- ☐ Production Costs
- ☐ Other (please specify)

Question 14

Where do you work?

- ☐ Germany
- ☐ Switzerland
- ☐ Austria

Question 15

Which agile methodology do you use in your daily business?

- ☐ Scrum
- ☐ Kanban
- ☐ Scrumban
- ☐ Scaled Agile Framework (SAFe)
- ☐ Disciplined Agile
- ☐ Scrum at Scale (S@S)
- ☐ Lean Agile
- ☐ Other (please specify)

Question 16

Did you have the impression that the company management had a clear concept for the introduction of agile principles?

- ☐ Yes
- ☐ No

Question 17

Did the management hire a consulting firm or an external coach to help by driving agility through the company?

- ☐ Yes
- ☐ No

Question 18

In your position as an expert, what do you think is the influence of agile principles towards corporate success?

- ☐ Free text

Question 19

What is corporate success for you?

- ☐ Profitability
- ☐ Growth
- ☐ Customer loyalty
- ☐ Innovation
- ☐ Employee morale
- ☐ Sustainability

Question 20

In your opinion, is there a connection between the company's success and the introduction of agile principles? Please provide examples.

- ☐ Free text

Question 21

How old are you?

- ☐ 18-24 years old
- ☐ 25-34 years old
- ☐ 35-44 years old
- ☐ 45-54 years old
- ☐ 55-64 years old
- ☐ 65 years or older

Question 22

What is your gender? Mark only one.

- ☐ Male
- ☐ Female

Question 23

What is your educational level? Mark only the highest.

- ☐ High school diploma or equivalent
- ☐ Diploma
- ☐ Magister
- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ Doctoral degree
- ☐ Other (please specify)

APPENDIX B

INFORMED CONSENT

Informed consent form

Consent for the Research Study on the “Relationship between corporate success and the implementation of agile principles in the manufacturing industry in the GSA region”.

Dear Participant,

You are being invited to participate in the research study titled “*An empirical investigation of the relationship between corporate success and the implementation of agile principles in the manufacturing industry in the GSA region*”.

Purpose of the study: The study expects to provide empirical evidence on the relationship between the implementation of agile principles and corporate success in the manufacturing industry in the GSA region. The findings will contribute to the existing body of knowledge. Furthermore, the identification of challenges and barriers will enable stakeholders to develop strategies to overcome implementation hurdles effectively.

Procedures: when you give your consent to the study, you will be asked for the following information:

1. General data, such as gender, age, the state you live within the GSA (Germany, Switzerland, Austria) region.
2. Several specific subject-related questions to the above topic.
3. Relevant experiences that may be relevant to the study.

Risks and Benefits: The risks of this study are kept to a minimum. Essentially, the aim is to collect a large amount of data in order to have a scientifically sound group of participants from which findings can be derived, and research questions can be answered.

As the data is anonymised, it is almost impossible to draw conclusions about the identity of the participants.

Confidentiality: Your data will be treated as strictly confidential and will only be used for the above-mentioned study. All data in this study will be processed as anonymised data sets so that no conclusions can be drawn about the identity of the participants. Your data will not be passed on to third parties but will only be used to gain the knowledge that this study aims to obtain.

Voluntary Participation: Participation in this study is completely voluntary. You can cancel the study at any time if you feel uncomfortable with some of the questions or do not wish to answer them. Withdrawal from this study will have no consequences for you.

Contact Information: If you have any question, or would like additional information about the study, feel free to reach out to me via e-mail at [studieagile \(at\) gmail \(dot\) com](mailto:studieagile@gmail.com).

REFERENCES

- Accenture *et al.* (2019) 'Aus Innovationen Werte schaffen'. Available at: <https://www.accenture.com/content/dam/accenture/final/a-com-migration/r3-3/pdf/pdf-98/accenture-aus-innovationen-werte-schaffen-1-pdf.pdf>.
- Aguilera, R.V. *et al.* (2024) 'Organizational Goals, Outcomes, and the Assessment of Performance: Reconceptualizing Success in Management Studies', *Journal of Management Studies*, 61(1), pp. 1–36. Available at: <https://doi.org/10.1111/joms.12994>.
- Ahmad, T. *et al.* (2018) 'Hybrid Project Management: Combining Agile and Traditional Approaches'.
- Airbus (2025) *Digital Twins: Accelerating aerospace innovation from design to operations* | Airbus. Available at: <https://www.airbus.com/en/newsroom/stories/2025-04-digital-twins-accelerating-aerospace-innovation-from-design-to-operations> (Accessed: 19 June 2025).
- Ali, A. and Wasim, A. (2022) 'Innovative Framework for Assessing the Impact of Agile Manufacturing in Small and Medium Enterprises (SMEs)', *Sustainability*, 14, p. 11503. Available at: <https://doi.org/10.3390/su141811503>.
- Ali, A.A. and Mahmood, A. (2024) 'Developing a causal framework of internet of things adoption barriers for agile manufacturing in post COVID-19', *International Journal of Engineering Business Management*, 16, p. 18479790231223623. Available at: <https://doi.org/10.1177/18479790231223623>.
- Alqudah, M. and Razali, R. (2018) 'An Empirical Study of Scrumban Formation based on the Selection of Scrum and Kanban Practices', 8. Available at: <https://doi.org/10.18517/ijaseit.8.6.6566>.
- Amir, F. (2011) 'Significance of Lean, Agile and Leagile Decoupling Point in Supply Chain Management', *Journal of Economics and Behavioral Studies*, 3(5), pp. 287–295. Available at: <https://doi.org/10.22610/jebis.v3i5.282>.
- Anderson, D.J. (2004) *Agile management for software engineering : applying the theory of constraints for business results* / David J. Anderson ; foreword by Eli Schragenheim. Upper Saddle River, N.J.: Prentice Hall Professional Technical Reference (The Coad series).
- Anderson, D.J. and Carmichael, A. (2018) *Die Essenz von Kanban kompakt*. 1. Auflage. Translated by M. Leber. Heidelberg: dpunkt.verlag.

Armental, M. (2025) 'Private Equity Leaders Look Abroad as U.S. Policy Roils Market', *Wall Street Journal*, 15 May. Available at: <https://www.wsj.com/articles/private-equity-leaders-look-abroad-as-u-s-policy-roils-market-a666dec3> (Accessed: 21 May 2025).

Atzberger, A. *et al.* (2020) 'Agile Entwicklung physischer Produkte: Eine Studie zum aktuellen Stand in der industriellen Praxis'. Available at: https://doi.org/10.18726/2020_5.

Balaban, S. and Đurašković, J. (2021) 'Agile Project Management as an Answer to Changing Environment', *European Project Management Journal*, 11, pp. 12–19. Available at: <https://doi.org/10.18485/epmj.2021.11.1.2>.

Banáš, D. and Hrablík, H. (2023) 'Agile Manufacturing vs. Lean Manufacturing', *Research Papers Faculty of Materials Science and Technology Slovak University of Technology*, 31, pp. 58–67. Available at: <https://doi.org/10.2478/rput-2023-0007>.

Bastos, A. (2023) 'Como aplicar a metodologia Lean Agile com sucesso?', 6 June. Available at: <https://abre.ai/jNSj>.

Beck, K. *et al.* (2001a) *Manifesto for Agile Software Development*. Available at: <http://agilemanifesto.org/>.

Beck, K. *et al.* (2001b) *Principles behind the Agile Manifesto*. Available at: <https://agilemanifesto.org/principles.html>.

Bendel, P.D.O. (2019) *Definition: Agilität*, <https://wirtschaftslexikon.gabler.de/definition/agilitaet-99882>. Springer Fachmedien

Wiesbaden GmbH. Available at: <https://wirtschaftslexikon.gabler.de/definition/agilitaet-99882> (Accessed: 15 May 2025).

Bibby, L. and Dehe, B. (2018) 'Defining and assessing industry 4.0 maturity levels – case of the defence sector', *Production Planning & Control*, 29, pp. 1–14. Available at: <https://doi.org/10.1080/09537287.2018.1503355>.

Birkinshaw, J., Hamel, G. and Mol, M. (2008) 'Management innovation. Acad Manage Rev', *The Academy of Management Review*, 33. Available at: <https://doi.org/10.5465/AMR.2008.34421969>.

Bryant, A. and Charmaz, K. (2010) *The SAGE handbook of grounded theory*. Available at: <https://doi.org/10.4135/9781848607941>.

Buasuwana, N. (2023) *Managing the multigenerational workforce and the future workplace*.

Buchberger, N. (2017) *Sektoren der Wirtschaft*. Available at: <https://www.oesterreich.com/de/wirtschaft/branchen-und-industriezweige/sektoren-der-wirtschaft> (Accessed: 16 May 2025).

Bundesministerium für Bildung und Forschung (BMBF). Referat Werkstoffinnovationen (2025) 'Materialinnovationen für die -Transformation von Wirtschaft und Gesellschaft (Mat2Twin)'. BMBF.

Bundesministerium für Wirtschaft und Energie (BMWi) (2020) 'Jahreswirtschaftsbericht 2020: Wachstum Wettbewerbsfähigkeit und Produktivität stärken - in Deutschland und Europa'.

Campanelli, A., Neto, F. and Silva Parreiras, F. (2017) 'Assessing Agile Transformation Success Factors'. Available at: <https://doi.org/10.48550/arXiv.1711.04188>.

Canda, A. (2020) 'Taking the Leap to Agile Manufacturing: From Intention to a Successful Paradigm Shift', *Scientific Bulletin of the Politehnica University of Timișoara Transactions on Engineering and Management*, 1. Available at: <https://doi.org/10.59168/LQTG1416>.

Cardozo, E.S.F. *et al.* (2010) 'SCRUM and Productivity in Software Projects: A Systematic Literature Review', in: *14th International Conference on Evaluation and Assessment in Software Engineering (EASE)*. Available at: <https://doi.org/10.14236/ewic/EASE2010.16>.

Carreno, A. (2024) 'Breaking Down Silos: Strategies to Overcome the Collaboration Trap and Drive Innovation'. Available at: <https://doi.org/10.5281/zenodo.14294357>.

Cervone, H. (2011) 'Understanding agile project management methods using Scrum', *OCLC Systems & Services*, 27, pp. 18–22. Available at: <https://doi.org/10.1108/10650751111106528>.

Chukwunweike, J. and Aro, O. (2024) 'Implementing agile management practices in the era of digital transformation', *World Journal of Advanced Research and Reviews*, 24, pp. 2223–2242. Available at: <https://doi.org/10.30574/wjarr.2024.24.1.3253>.

Cockburn, A. (2002) *Agile Software Development*, p. 201.

Conboy, K. and Carroll, N. (2019) 'Implementing Large-Scale Agile Frameworks: Challenges and Recommendations', *IEEE Software*, 36(2), pp. 44–50. Available at: <https://doi.org/10.1109/MS.2018.2884865>.

Conforto, E. *et al.* (2014) 'Can Agile Project Management Be Adopted by Industries

Other than Software Development?', *Project Management Journal*, 45. Available at: <https://doi.org/10.1002/pmj.21410>.

Corbin, J.M. and Strauss, A.L. (2015) *Basics of Qualitative Research Techniques and Procedures for Developing Grounded Theory*. 4th edn. Thousand Oaks: Sage Publications.

Curioni, A. (2024) *What's the secret to Switzerland's status as a global talent hub?*, *World Economic Forum*. Available at: <https://www.weforum.org/stories/2024/03/whats-the-secret-to-switzerlands-status-as-a-global-talent-hub/> (Accessed: 16 May 2025).

Cutter, C., Tita, B. and Wilmot, S. (2025) *Trade-War Uncertainty Prompts Wave of Companies to Yank Forecasts*, *WSJ*. Available at: <https://www.wsj.com/business/earnings/earnings-trade-war-uncertainty-88edd369> (Accessed: 21 May 2025).

Denison, D., Nieminen, L. and Kotrba, L. (2014) 'Diagnosing organizational cultures: A conceptual and empirical review of culture effectiveness surveys', *European Journal of Work and Organizational Psychology*, 23(1), pp. 145–161. Available at: <https://doi.org/10.1080/1359432X.2012.713173>.

DeVOR, R., GRAVES, R. and MILLS, J.J. (1997) 'Agile manufacturing research: accomplishments and opportunities', *IIE Transactions*, 29(10), pp. 813–823. Available at: <https://doi.org/10.1023/A:1018575613893>.

digital.ai (2024) '17th State of Agile Report'. Available at: <https://digital.ai/resource-center/analyst-reports/state-of-agile-report/>.

Dikert, K., Paasivaara, M. and Lassenius, C. (2016) 'Challenges and Success Factors for Large-Scale Agile Transformations: A Systematic Literature Review', *Journal of Systems and Software*, 119, pp. 87–108. Available at: <https://doi.org/10.1016/j.jss.2016.06.013>.

Dingsøyr, T., Moe, N. and Olsson, H. (2018) *Towards an Understanding of Scaling Frameworks and Business Agility: A Summary of the 6th International Workshop at XP2018*. Available at: <https://doi.org/10.48550/arXiv.1812.10280>.

Dowlatshahi, S. and Cao, Q. (2006) 'The relationships among virtual enterprise, information technology, and business performance in agile manufacturing: An industry perspective', *European Journal of Operational Research*, 174(2), pp. 835–860. Available at: <https://doi.org/10.1016/j.ejor.2005.02.074>.

Dustmann, C. *et al.* (2014) 'From Sick Man of Europe to Economic Superstar: Germany's Resurgent Economy †', *Journal of Economic Perspectives*, 28, pp. 167–188. Available at: <https://doi.org/10.1257/jep.28.1.167>.

Eagly, A.H. and Carli, L.L. (2003) 'The female leadership advantage: An evaluation of the evidence', *The Leadership Quarterly*, 14(6), pp. 807–834. Available at: <https://doi.org/10.1016/j.leaqua.2003.09.004>.

Eidgenössisches Departement für auswärtige Angelegenheiten EDA (2024) *Schweizer Wirtschaft – Überblick*. Available at: <https://www.aboutswitzerland.eda.admin.ch/de/schweizer-wirtschaft-ueberblick>.

Eurostat (2022) 'Employment by sex, age and economic activity (from 2008 onwards, NACE Rev. 2) - 1 000'. Eurostat. Available at: https://doi.org/10.2908/LFSA_EGAN2.

Evans, D. (2024) 'Manufacturing Industry Trends 2024: The Economy, AI, And Supply Chain', *Forbes*, 11 June. Available at: <https://www.forbes.com/sites/daveevans/2024/06/11/manufacturing-industry-trends-2024-the-economy-ai-and-supply-chain/> (Accessed: 12 September 2024).

Federal Ministry Finance Republic of Austria (2025) *Current Economic Data - Austria*. Available at: <https://bmf.gv.at/en/topics/budget-economic-policy/economic-policy-austria/current-economic-data-austria.html> (Accessed: 16 May 2025).

Feld, M., Arens-Fischer, W. and Schumacher, M. (2024) 'Chapter 2 "KI-AGIL" – An Agile Process Model to Make AI Development Accessible to SMEs', in I. Lausberg and M. Vogelsang (eds) *AI in Business and Economics*. De Gruyter, pp. 19–30. Available at: <https://doi.org/10.1515/9783110790320-002>.

Fenz, G. *et al.* (2025) *OeNB Report 2025/5: Austrian economy to stabilize in 2025 - Oesterreichische Nationalbank (OeNB)*. Available at: <https://www.oenb.at/en/Publications/Economics/reports/2025/report-2025-5-economic-outlook/html-version.html> (Accessed: 16 May 2025).

Gavac, K. *et al.* (2025) *KMU-Daten*. Wien. Available at: <https://www.bmwet.gv.at/Themen/Wirtschaftsstandort-Oesterreich/KMU/KMU-im-Fokus-2024.html> (Accessed: 16 May 2025).

Glaser, B.G. and Strauss, A.L. (1967) *The discovery of grounded theory: strategies for qualitative research*. Chicago: Aldine.

Grebic, B. *et al.* (2025) *FROM FRAGILE TO AGILE: BUILDING ORGANISATIONAL RESILIENCE THROUGH AGILE TRANSFORMATION*, p. 108. Available at: <https://doi.org/10.24867/FUTURE-BME-2024-012>.

Gren, L. and Lenberg, P. (2019) *Agility is responsiveness to change: An essential definition*. Available at: <https://doi.org/10.48550/arXiv.1909.10082>.

Grocholski, E. (2022) 'The Relevance of Agile Change Management in a Dynamic Business Environment', *European Journal of Marketing and Economics*, 5(1), p. 17. Available at: <https://doi.org/10.26417/230dnr26>.

Gründel, L. *et al.* (2024) *Künstliche Intelligenz in der Produktion*. Available at: <https://doi.org/10.2314/KXP:1914453646>.

Gujar, S. and Shafighi, N. (2023) 'Project Management in the Manufacturing Sector', *Archives of Business Research*, 11, pp. 257–270. Available at: <https://doi.org/10.14738/abr.118.15160>.

Gunasekaran, A. and Yusuf, Y.Y. (2002) 'Agile manufacturing: A taxonomy of strategic and technological imperatives', *International Journal of Production Research*, 40(6), pp. 1357–1385. Available at: <https://doi.org/10.1080/00207540110118370>.

Hasan, M. and Sarkis, J. (2007) 'A Study of Barriers to Agile Manufacturing', *International Journal of Agile Systems and Management*, 2, pp. 1–22. Available at: <https://doi.org/10.1504/IJASM.2007.015679>.

Hassan, M. ghazali *et al.* (2022) 'A framework for implementing a Supplier Kanban System through an action research methodology', 30, pp. 1562–1587. Available at: <https://doi.org/10.1108/BIJ-12-2020-0656>.

Hassani, Y., Ceașu, I. and Iordache, A. (2020) 'Lean and Agile model implementation for managing the supply chain', *Proceedings of the International Conference on Business Excellence*, 14, pp. 847–858. Available at: <https://doi.org/10.2478/picbe-2020-0081>.

Helmold, M. (2023) *Wettbewerbsvorteile entlang der Supply Chain sichern*. Springer. Available at: <https://EconPapers.repec.org/RePEc:spr:sprbok:978-3-658-40609-7>.

Hidalgo, E.S. (2019) 'Adapting the scrum framework for agile project management in science: case study of a distributed research initiative', *Heliyon*, 5(3), p. e01447. Available at: <https://doi.org/10.1016/j.heliyon.2019.e01447>.

Hobbs, B. and Petit, Y. (2017) 'Agile Methods on Large Projects in Large Organizations', *Project Management Journal*, 48, pp. 3–19. Available at: <https://doi.org/10.1177/875697281704800301>.

Hofstede Insights (2025) *Country comparison tool*. Available at: <https://www.theculturefactor.com/country-comparison-tool> (Accessed: 23 May 2025).

Homburg, C. (2015) *Marketingmanagement : Strategie - Instrumente - Umsetzung - Unternehmensführung*. Wiesbaden: Springer Gabler. Available at: <https://madoc.bib.uni->

mannheim.de/39244/ (Accessed: 13 July 2024).

Jin-Hai, L., Anderson, A. and Harrison, R. (2003) 'The evolution of agile manufacturing', *Business Process Management Journal*, 9, pp. 170–189. Available at: <https://doi.org/10.1108/14637150310468380>.

Kagermann, H. *et al.* (2016) 'Industrie 4.0 im globalen Kontext: Strategien der Zusammenarbeit mit internationalen Partnern (acatech STUDIE)'. Herbert Utz Verlag.

Kanfer, R. and ACKERMAN, P. (2004) 'Aging, Adult Development, and Work Motivation', *Academy of Management Review*, 29. Available at: <https://doi.org/10.5465/AMR.2004.13670969>.

Kergroach, S. (2021) "'SMEs Going Digital: Policy challenges and recommendations", Going Digital Toolkit Note, No. 15'.

Kewes, T. (2024) *Agenda 2035: Der Zukunftsplan von McKinsey, Boston Consulting und Roland Berger*. Available at: <https://www.handelsblatt.com/unternehmen/dienstleister/agenda-2035-der-zukunftsplan-von-mckinsey-boston-consulting-und-roland-berger-01/100064057.html> (Accessed: 18 June 2025).

Khalilov, E. (2023) *to Understand the Complexities of Centralized and Decentralized Approaches in Managing Organizational Change and Innovation*. Available at: <https://doi.org/10.13140/RG.2.2.17776.02565>.

Kiczek, A. (2022) 'Herausforderungen der Industrie 4.0 für KMU Entwicklung eines reifegradbasierten Referenzmodells zur Verbesserung der IT-Prozesse'.

Komandla, V. (2022) 'Enhancing Product Development through Continuous Feedback Integration', *ESP Journal of Engineering & Technology Advancements*, 2, pp. 105–115. Available at: <https://doi.org/10.56472/25832646/JETA-V2I4P118>.

Korherr, P. *et al.* (2022) 'From intuitive to data-driven decision-making in digital transformation: A framework of prevalent managerial archetypes', *Digital Business*, 2, p. 100045. Available at: <https://doi.org/10.1016/j.digbus.2022.100045>.

Kristensen, T.B., Saabye, H. and Edmondson, A. (2022) 'Becoming a learning organization while enhancing performance: the case of LEGO', *International Journal of Operations & Production Management*, 42(13), pp. 438–481. Available at: <https://doi.org/10.1108/IJOPM-10-2021-0676>.

Kuchel, T. *et al.* (2022) *Key Challenges with Agile Culture -- A Survey among Practitioners*. Available at: <https://doi.org/10.48550/arXiv.2212.07218>.

Kumar, R., Singh, K. and Jain, S. (2019) 'Agile manufacturing: a literature review and Pareto analysis', *International Journal of Quality & Reliability Management*, ahead-of-print. Available at: <https://doi.org/10.1108/IJQRM-12-2018-0349>.

Kumar, R., Singh, K. and Jain, S.K. (2020) 'An empirical investigation and prioritization of barriers toward implementation of agile manufacturing in the manufacturing industry', *The TQM Journal*, 33(1), pp. 183–203. Available at: <https://doi.org/10.1108/TQM-04-2020-0073>.

Ladas, C. (2009) 'Scrumban - Essays on Kanban Systems for Lean Software Development'.

Larman, C. (2004) *Agile and Iterative Development: A Manager's Guide*.

Levy, A. and Merry, U. (1986) *Organizational Transformation: Approaches, Strategies, Theories*. New York: Praeger.

Lunesu, M.I. *et al.* (2018) 'Using Simulation for Understanding and Reproducing Distributed Software Development Processes in the Cloud', *Information and Software Technology*, 103, pp. 226–238. Available at: <https://doi.org/10.1016/j.infsof.2018.07.004>.

Majka, M. (2024) 'Challenges of Using Scrum in Research Projects and the Advantages of Scrumban', January.

Marrenbach, D. and Korge, A. (2020) 'Partizipative Transformation von Arbeitswelten: Die industrielle Revolution Schritt für Schritt meistern. Zukunftsprojekt Arbeitswelt 4.0 Baden-Württemberg. Bd. 15.' Fraunhofer IAO, Stuttgart. Available at: https://wm.baden-wuerttemberg.de/fileadmin/redaktion/m-wm/intern/Dateien_Downloads/Arbeit/15_Agile_Transformation.pdf (Accessed: 9 June 2025).

Measey, P. *et al.* (2015) *Agile Foundations: Principles, Practices and Frameworks*. BCS Learning & Development Limited (EBL-Schweitzer). Available at: <https://books.google.de/books?id=AUwcDQEACAAJ>.

Mellewigt, T. and Decker, C. (2007) 'Ansätze zur Messung des Organisationserfolgs', *Controlling*, 19(8–9), pp. 433–440. Available at: <https://doi.org/10.15358/0935-0381-2007-8-9-433>.

Milewska, B. and Milewski, D. (2025a) 'Lean, Agile, and Six Sigma: Efficiency and the Challenges of Today's World: Is It Time for a Change?', *Sustainability*, 17(8), p. 3617. Available at: <https://doi.org/10.3390/su17083617>.

Milewska, B. and Milewski, D. (2025b) 'Lean, Agile, and Six Sigma: Efficiency and the Challenges of Today's World: Is It Time for a Change?', *Sustainability*, 17, p. 3617.

Available at: <https://doi.org/10.3390/su17083617>.

Misra, S., Kumar, V. and Kumar, U. (2010) 'Identifying some critical changes required in adopting agile practices in traditional software development projects', *International Journal of Quality & Reliability Management*, 27, pp. 451–474. Available at: <https://doi.org/10.1108/02656711011035147>.

Mock, J., Richter, S. and Wischmann, S. (2022) 'Nachhaltigkeit durch den Einsatz von KI – Orientierungshilfe für anwendende Unternehmen'.

Moeuf, A. *et al.* (2017) 'The industrial management of SMEs in the era of Industry 4.0', *International Journal of Production Research*, 56, pp. 1–19. Available at: <https://doi.org/10.1080/00207543.2017.1372647>.

Müller, H.-E. (2018) 'Agile Managementmethoden'. Springer Gabler. Available at: <https://wirtschaftslexikon.gabler.de/definition/agile-managementmethoden-54468/version-277497>.

Murphy, G.B., Trailer, J.W. and Hill, R.C. (1996) 'Measuring performance in entrepreneurship research', *Entrepreneurship and New Firm Development*, 36(1), pp. 15–23. Available at: [https://doi.org/10.1016/0148-2963\(95\)00159-X](https://doi.org/10.1016/0148-2963(95)00159-X).

Ng, T. and Feldman, D. (2010) 'The relationships of age with job attitudes: A meta-analysis', *Personnel Psychology*, 63, pp. 677–718. Available at: <https://doi.org/10.1111/j.1744-6570.2010.01184.x>.

Nielsen, S. and Huse, M. (2010) 'The Contribution of Women on Boards of Directors: Going Beyond the Surface', *European Finance eJournal*, 18. Available at: <https://doi.org/10.1111/j.1467-8683.2010.00784.x>.

Oliveira-Dias, D., Moyano-Fuentes, J. and Maqueira-Marín, J.M. (2022) 'Understanding the relationships between information technology and lean and agile supply chain strategies: a systematic literature review', *Annals of Operations Research*, 312(2), pp. 973–1005. Available at: <https://doi.org/10.1007/s10479-022-04520-x>.

Omowole, B. *et al.* (2024) 'Barriers and drivers of digital transformation in SMEs: A conceptual analysis', *International Journal of Scholarly Research in Science and Technology*, 5, pp. 019–036. Available at: <https://doi.org/10.56781/ijrst.2024.5.2.0037>.

Oza, V. *et al.* (2013) 'Attaining High-performing Software Teams with Agile and Lean Practices: An Empirical Case Study'.

P. T. Kidd (1995) 'Agile manufacturing: a strategy for the 21st century', in *IEE Colloquium on Agile Manufacturing (Digest No. 1995/179)*. *IEE Colloquium on Agile Manufacturing (Digest No. 1995/179)*, p. 1/1-1/6. Available at:

<https://doi.org/10.1049/ic:19960497>.

Peretz-Andersson, E. *et al.* (2024) ‘Artificial intelligence implementation in manufacturing SMEs: A resource orchestration approach’, *International Journal of Information Management*, 77, p. 102781. Available at: <https://doi.org/10.1016/j.ijinfomgt.2024.102781>.

Potdar, P., Routroy, S. and Behera, A. (2017) ‘Agile Manufacturing: A Systematic Review of Literature and Implications for Future Research’, *Benchmarking: An International Journal*, 24, pp. 00–00. Available at: <https://doi.org/10.1108/BIJ-06-2016-0100>.

Produção, G., Ferreira, L. and Nobre, F. (2022) ‘Agile project management under the perspective of dynamic capabilities’, *Gestão & Produção*, 29. Available at: <https://doi.org/10.1590/1806-9649-2022v29e3122>.

Prüfer, T. (2024) ‘Agil vorbeigesprintet’, *Handelsblatt*, 6 September. Available at: <https://www.handelsblatt.com/meinung/kolumnen/pruefers-kolumne-agil-vorbeigesprintet/100066418.html>.

Reichwein, J. *et al.* (2020) ‘On the Applicability of Agile Development Methods to Design for Additive Manufacturing’, *Procedia CIRP*, 91, pp. 653–658. Available at: <https://doi.org/10.1016/j.procir.2020.03.112>.

Reunamäki, R. and Fey, C.F. (2023) ‘Remote agile: Problems, solutions, and pitfalls to avoid’, *Business Horizons*, 66(4), pp. 505–516. Available at: <https://doi.org/10.1016/j.bushor.2022.10.003>.

Riesener, M. *et al.* (2020) ‘Agile Transformation in produzierenden Unternehmen’, *Zeitschrift für wirtschaftlichen Fabrikbetrieb*, 115(6), pp. 367–370. Available at: <https://doi.org/10.3139/104.112350>.

Rigby, D., Sutherland, J. and Takeuchi, H. (2016) ‘Embracing Agile’, *Harvard Business Review*, 1 May. Available at: <https://hbr.org/2016/05/embracing-agile> (Accessed: 13 July 2024).

Rink, L. (2025) *Made in Europe*. Available at: <https://www.ipg-journal.de/aus-dem-netz/artikel/made-in-europe-2-8201/> (Accessed: 21 May 2025).

Roizman, A. (2020) ‘How we foster innovation through agile values’, 13 August. Available at: <https://newsroom.porsche.com/en/2020/digital/porsche-anna-roizman-how-we-foster-innovation-through-agile-values-21767.html> (Accessed: 19 May 2025).

Salimi, S. (2018) *Case Study: Success Story MAN.*, *Agile Academy*. Available at: <https://www.agile-academy.com/en/organizational-development/case-study-man/>

(Accessed: 19 June 2025).

Saliunas, J. (2007) 'Transformation Program Management - Critical Factors', in. *PMI® Global Congress 2007—North America, Atlanta, GA*, Newton Square, PA: Project Management Institute. Available at: https://www.pmi.org/learning/library/transformation-program-management-7203/?utm_source=chatgpt.com (Accessed: 21 May 2025).

Sarran, P., Clark, D. and Mendonca, K. (no date) 'Change Management Toolkit - Tips, tools, and techniques for leading a successful change initiative'. Berkeley University of California. Available at: https://hr.berkeley.edu/sites/default/files/change_management_toolkit.pdf (Accessed: 21 May 2025).

Schneider, H. *et al.* (2021) 'Metrik zur Erfassung des Digitalisierungsgrades in produzierenden Unternehmen'.

Schröder, A. (2021) *Agile Produktentwicklung: Schneller zur Innovation – erfolgreicher am Markt*. Carl Hanser Verlag GmbH & Company KG. Available at: <https://books.google.de/books?id=u5Y2EAAQBAJ>.

Schröder, M., Steinhorst, U. and Winter, M. (2019) 'Hybrides Projektmanagement – Einbindung agiler Arbeitsweisen im Rahmen der fortschreitenden Digitalisierung', in, pp. 829–844. Available at: https://doi.org/10.1007/978-3-658-25412-4_40.

Schumacher, A., Erol, S. and Sihni, W. (2016) 'A Maturity Model for Assessing Industry 4.0 Readiness and Maturity of Manufacturing Enterprises', *Procedia CIRP*, 52, pp. 161–166. Available at: <https://doi.org/10.1016/j.procir.2016.07.040>.

Schwaber, K. and Sutherland, J. (2020) *The Scrum Guide - The Definitive Guide to Scrum: The Rules of the Game*.

Shafiabady, N. *et al.* (2023) 'Using Artificial Intelligence (AI) to predict organizational agility', *PLOS ONE*. Edited by S. V. E., 18(5), p. e0283066. Available at: <https://doi.org/10.1371/journal.pone.0283066>.

Sharifi, H. and Zhang, Z. (2001) 'Agile manufacturing in practice - Application of a methodology', *International Journal of Operations & Production Management*, 21(5/6), pp. 772–794. Available at: <https://doi.org/10.1108/01443570110390462>.

Staufen AG (2023) 'Zukunftsindustrie - Die vierte Dimension der Wettbewerbsfähigkeit 2023'. Available at: <https://www.staufen.ag/insights/studien-whitepaper/studie-zukunft-industrie/studie-zukunft-industrie-2023-dankesseite/>.

Stettina, C. and Hörz, J. (2014) 'Agile portfolio management: An empirical perspective

on the practice in use', *International Journal of Project Management*, 33. Available at: <https://doi.org/10.1016/j.ijproman.2014.03.008>.

Strode, D., Huff, S. and Tretiakov, A. (2009) *The Impact of Organizational Culture on Agile Method Use, Proceedings of the 42nd Hawaii International Conference on System Sciences*, p. 9. Available at: <https://doi.org/10.1109/HICSS.2009.436>.

Subramaniam, V. and Hunt, A. (2011) *Practices of an Agile Developer. Working in the Real World*. Pragmatic Bookshelf.

Sun, J. *et al.* (2022) 'Organizational Agility and Sustainable Manufacturing Practices in the Context of Emerging Economy: A Mediated Moderation Model', *Processes*, 10, p. 2567. Available at: <https://doi.org/10.3390/pr10122567>.

Sutherland, J. (2022) *The Scrum@Scale® Guide The Definitive Guide to Scrum@Scale: Scale that Works*. 2.1.

Uludag, Ö. *et al.* (2022) 'Revealing the state of the art of large-scale agile development research: A systematic mapping study', *Journal of Systems and Software*, 194, p. 111473. Available at: <https://doi.org/10.1016/j.jss.2022.111473>.

Vargas, D.A.D. *et al.* (2018) 'Implementing SCRUM to develop a connected robot'. Available at: <https://doi.org/10.48550/ARXIV.1807.01662>.

Vetter, P. (2019) *IAA: Wolfgang Porsche schließt VW-Einstieg bei Tesla nicht aus - WELT, DIE WELT*. Available at: <https://www.welt.de/wirtschaft/article199994794/IAA-Wolfgang-Porsche-schliesst-VW-Einstieg-bei-Tesla-nicht-aus.html> (Accessed: 14 May 2025).

Vogelsang, K. *et al.* (2019) *Barriers to Digital Transformation in Manufacturing: Development of a Research Agenda*. Available at: <https://doi.org/10.24251/HICSS.2019.594>.

Weichbroth, P. (2022) 'A Case Study on Implementing Agile Techniques and Practices: Rationale, Benefits, Barriers and Business Implications for Hardware Development', *Applied Sciences*, 12, p. 8457. Available at: <https://doi.org/10.3390/app12178457>.

Wolfond, E. (2018) *Einflussfaktoren und Wirkungen der Unternehmenskommunikation auf den Unternehmenserfolg im Anlagen- und Systemgeschäft*. Wiesbaden: Springer Fachmedien Wiesbaden. Available at: <https://doi.org/10.1007/978-3-658-23216-0>.

Zwick, D. (2023) *Tesla bestimmt jetzt das Tempo in Wolfsburg - VW hat ein Kostenproblem - WELT, DIE WELT*. Available at: <https://www.welt.de/wirtschaft/plus245860138/Tesla-bestimmt-jetzt-das-Tempo-in->

Wolfsburg-VW-hat-ein-Kostenproblem.html (Accessed: 14 May 2025).

Zwick, T. (2006) 'The Impact of Training Intensity on Establishment Productivity', *Industrial Relations: A Journal of Economy and Society*, 45, pp. 26–46. Available at: <https://doi.org/10.1111/j.1468-232X.2006.00412.x>.

Рябоконь, Н., Рябоконь, Б. and Рябоконь, А. (2018) 'AGILE METHODOLOGY: VALUE-ORIENTED APPROACH', *Proceedings of Scientific Works of Cherkasy State Technological University. Series: Economic Sciences* [Preprint]. Available at: <https://doi.org/10.24025/2306-4420.0.49.2018.136152>.

Declaration of Authorship

"I, Christian Gronau hereby declare,

- that I have written this thesis independently,
- that I have written the thesis using only the aids specified in the thesis guide;
- that all parts of the thesis produced with the help of aids have been precisely declared;
- that I have mentioned all sources used and cited them correctly according to established academic citation rules;
- that I have acquired all immaterial rights to any materials I may have used, such as images or graphics, or that these materials were created by me;
- that the topic, the thesis or parts of it have not already been the object of any work or examination of another course, unless this has been expressly agreed with the faculty member in advance and is stated as such in the thesis;
- that I am aware of the legal provisions regarding the publication and dissemination of parts or the entire thesis and that I comply with them accordingly;
- that I am aware that my thesis can be electronically checked for plagiarism and for third-party authorship of human or technical origin and that I hereby grant the Swiss School of Business and Management Geneva the copyright according to the Examination Regulations as far as it is necessary for the administrative actions;
- that I am aware that the institution will prosecute a violation of this Declaration of Authorship and that disciplinary as well as criminal consequences may result, which may lead to expulsion from the institution or to the withdrawal of my title."

By submitting this thesis, I confirm through my conclusive action that I am submitting the Declaration of Authorship, that I have read and understood it, and that it is true.

02.09.2025, 

Date and student signature