

# THE FUTURE OF MITTELSTAND

TREND REPORT 2022





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**A Project of the Center for  
Digital Technology and Management (CDTM)**

The Center for Digital Technology and Management (CDTM) is a joint, interdisciplinary institution for education, research, and entrepreneurship of the Ludwig Maximilians-University (LMU) and the Technical University of Munich (TUM).

It offers the add-on study program "Technology Management" for students from various backgrounds, which provides students with tools and knowledge at the intersection of business and digital technologies.

The entire trend report was written by CDTM students under the close guidance of research assistants.

Visit [www.cdtm.de](http://www.cdtm.de) for more information.



# PREFACE OF THE EDITORS

“ **Everybody can learn from the past. Today it is important to learn from the future!** ”

Herman Kahn ”

As Herman Kahn, one of the founding fathers of modern scenario planning, nicely states, it is tremendously important for strategy and policymakers to get a deep understanding of possible future developments to be prepared for them.

The Center for Digital Technology and Management (CDTM) aims to connect, educate and empower the innovators of tomorrow. It is our mission to equip our students with the tools and knowledge they will need to become responsible leaders who actively shape their future environment rather than only react to changes.

This Trend Report is the result of the course Trend Seminar, which is part of the interdisciplinary add-on study program “Technology Management” at CDTM. About 26 selected students of various disciplines, such as Business Administration, Psychology, Medicine, Computer Science, Electrical Engineering, and others, work together on a relevant topic of our time. Over the course of seven intense weeks of full-time work during their semester break, the participating students dive deeply into the topic of the Trend Seminar. Working in several interdisciplinary sub-teams, students apply the knowledge of their main studies and learn new perspectives from their team members. They conduct trend research, develop scenarios of the future, generate ideas for innovative products or services, and detail them out into concrete business concepts.

We would like to take the chance to thank everyone who contributed and made this CDTM Trend Report possible:

We want to thank Bayern Innovativ for supporting this Trend Seminar. Particularly, we want to thank Dr. Tanja Jovanovic, Dr. Gunther Pabst, Dr. Matthias Konrad, and Dr. Rainer Sessner for their collaboration, valuable insights, and feedback throughout the whole project. We hope our findings support you in driving innovation in the context of The Future of Mittelstand!

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Carla Pregel Hoderlein and Felix Dörpmund  
Center for Digital Technology and Management (CDTM)

# PREFACE OF THE PROJECT PARTNER

Talking about economics these days, the impression might appear that it is all about disruptive entrepreneurs and mega-corporations. But looking closer at Germany's economic landscape, you will see it is the Mittelstand that is playing a major role. Its influence is not limited to the economical aspect but extends to German culture in general. The mere fact that there are approximately 2.5m small and medium enterprises with over 40,65m employees is demonstrating its impact.

We are proud to be part of this project discussing the future of the German Mittelstand, since it is the backbone of the German economy – and, therefore, the future of all of us. Due to our mission of supporting small and medium enterprises manifesting their ideas and products in innovations, we constantly network with SME representatives of all the major industries, including mobility, energy, health care, and many more.

What we get is the picture of a reliable and powerful community. Still, even the German Mittelstand is not being spared in a world that is battered by challenges from all directions, be it economic, environmental, or technological. Amid this turmoil, we are looking into what lies ahead for the sector. Will current technological developments fundamentally change how these companies are operating?

Do the economics of the future even allow for Mittelstand businesses to exist? How do environmental challenges and societal divides play into this?

What will the Mittelstand look like in the next 20 years? This is the main question the CDTM Trend Report is dealing with. Being the innovation incubator, network, and gateway between SMEs and universities of the Free State of Bavaria, it is an honor to us helping to define answers and solutions, thus enabling innovation. This is what we strive for, supporting the German Mittelstand for an innovative future. For the best for all of us.

We would like to thank everyone involved in the CDTM – we have experienced the CDTM as an outstanding initiative that creates a unique spirit thanks to an interdisciplinary and methodical approach. This makes the CDTM a great partner for the Bavarian innovation ecosystem!

The heart of the CDTM is its students. They have particularly impressed us for seven weeks – starting from the curious questions at the beginning of the seminar to the passionate final presentations. We have seen a lot of commitment, fun, and professionalism, and we are sure: these are the innovators of tomorrow! Dear students, thank you very much for your great work! Stay curious, passionate, and grow

“ **The future is Mittelstand!**

Bayern Innovativ GmbH ”

beyond yourself! We are happy if we were able to show you the power of Mittelstand.

And our sincerest thanks go to the supervisors, Carla Pregel Hoderlein and Felix Dörpmund, who were excellent supervisors for the students and great partners during this time.

The cooperation has shown us once again: growing together creates innovation, and paves the way to the future. That's what we aim for every single day.

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# METHODOLOGY

For a given topic that is highly impacted by digital technologies, the Trend Seminar pursues three main goals:

- Analyze the status quo and recent developments to identify important trends.
- Develop extreme but plausible scenarios of the future to be prepared for upcoming challenges.
- Develop future-proof product and service ideas and turn them into business concepts.

These goals are represented by the three main phases of the Trend Seminar: The Trends Phase, the Scenario Phase, and the Ideation Phase. The Kick-off Phase and the Communication Phase support the introduction into the Trend Seminar

journey and the communication of the results in a written and presentation format, respectively.

Twenty-six students, supervised by two doctoral candidates, pursue the Trend Seminar in seven weeks of intensive full-time work alongside their project partner. In each phase, interdisciplinary sub-teams are formed, including students from technology, business, and various other backgrounds, to combine versatile ways of thinking.

The Trends Phase yields a holistic overview of recent developments and trends in the environment of the overall topic. Based on the commonly used STEEP approach (Social, Technological, Economical, Environmental, and Political), the

status quo and trends in the fields of society & environment, technology, economics, politics & legal, as well as emerging business models are analyzed. Knowledge is gathered by literature research and expert interviews, preceded by a series of input presentations by experts on the topic. The class is split into five teams, each working on one of the thematic scopes. At the end of the Trends Phase, the teams present their key findings to each other for everyone to get a holistic view of the topic to build upon in the following phases.

The Scenario Phase builds upon the analyzed trends in order to create four scenarios of different futures in twenty years ahead. The driving forces behind the developments are identified and specified as drivers with bipolar outcomes. Once specified, all drivers are ranked according to their respective impact on the overall topic and the perceived degree of uncertainty regarding their outcome. Two key drivers that are independent of one another and have both a high impact and a high degree of uncertainty are chosen. Their bipolar outcomes are used to create a scenario matrix of four scenarios. A timeline for each of the scenarios is created, and the scenarios are sketched out using persona descriptions and visualizations. The Scenario Phase starts with a three-day workshop followed by group work in four teams. The teams are newly formed to include experts from each subtopic of the Trends Phase in each new Scenario Team.

In the third phase, the Ideation Phase, the goal is to develop innovative business concepts, which are then tested against the previously developed scenarios. Within a three-day workshop on structured ideation following the SIT approach (systematic inventive thinking) and unstructured ideation methodologies, a large number of business ideas are developed. Out of these, the most promising five ideas are selected and further developed into detailed business concepts. The sustainable business model canvas serves as the base structure. At the end of the seminar, the business model concepts are presented to the project partner and external guests.



# LIST OF ABBREVIATIONS

## AI

Artificial Intelligence

## API

Application Programming Interface

## AR

Augmented Reality

## B2B

Business to Business

## BDSG

German Privacy Act (Bundesdatenschutzgesetz)

## BVMW

Federal Association of Medium-Sized Businesses (Bundesverband Mittelständischer Wirtschaft)

## C-level

Chief Level

## CAD

Computer Assisted Design

## CAGR

Compound Annual Growth Rate

## CEO

Chief Executive Officer

## CNC

Computerized Numerical Control

## COVID-19

Coronavirus SARS-CoV-2

## CRM

Customer Relationship Management

## CSMA

Cybersecurity Mesh Architecture

## CSR

Corporate Social Responsibility

## CSRD

European Corporate Sustainability Reporting Directive

## DACH

Germany, Austria, Switzerland

## DEI

Diversity, Equity, Inclusion

## DT

Digital Twin

## ERP

Enterprise Resource Planning

## ESG

Environmental, Social, Governance

## EU

European Union

## EWE

Extreme weather events

## FTE

Full Time Equivalent

## GDP

Gross domestic product

## GDPR

General Data Protection Regulation

## HR

Human Resources

## ICE

Internal Combustion Engine

## IHK

Industrie und Handelskammer

## IIoT

Industrial Internet of Things

## IoT

Internet of Things

## LC

Low Code

## LGBTQ

Lesbian, Gay, Bisexual, and Transgender

## LiDAR

Light Detection and Ranging

## M&A

Merger and Acquisition

## FPGA

Field Programmable Gate Array

## MaaS

Manufacturing-as-a-Service

## MBA

Master Business Administration

## ML

Machine Learning

## MR

Mixed Reality

## NC

No Code

## NGO

Non Governmental Organization

## OEM

Original Equipment Manufacturer

## OLR

Outgoing Longwave Radiation

## R&D

Research and Development

## SME

Small and Medium-Sized Enterprises

## STEEP

Social-Technological-Economic-Ecological-Political

## TUM

Technical University of Munich

## LMU

Ludwig Maximilians University

## VC

Venture Capital

## VR

Virtual Reality

## VUCA

Volatility, Uncertainty, Complexity, Ambiguity

## VW

Volkswagen

## WEF

World Economic Forum

## WTO

World Trade Organization

## XR

Extended Reality



# TRENDS

The following chapter lists current trends that have a strong influence on the development and long-term strategic orientation of Mittelstand companies. In accordance with the Trends Phase methodology, trends and related driving forces are structured into five areas: technology trends, societal and environmental trends, legal and political trends, economic trends, and business model trends.

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# TECHNOLOGY TRENDS

ACCELERATING MITTELSTAND COMPANIES FROM  
ZERO TO ONE HUNDRED

Digital Maturity

Democratizing Software Development

Data-Leveraged Production

Next-Generation Assistive Technology

Holistic Cybersecurity

# TECHNOLOGY TRENDS

## Accelerating Mittelstand Companies From Zero to One Hundred

To assess which technology trends are most relevant, the section on digital maturity outlines the current state of digitalization within the Mittelstand. The following two trends are an analysis of technologies that can be implemented after a foundation has been laid and which many Mittelstand companies could incorporate at present to increase efficiency. Next-generation assistive technology explores technologies relevant for Mittelstand companies seeking an innovative approach in the next five years and beyond. Finally, the trend of holistic cybersecurity investigates cyber threat mitigation, which is crucial at all stages of technology implementation.

Many Mittelstand companies lack behind when it comes to basic digital infrastructure. This is problematic because foundational technologies are a precursor to innovation and market relevance in the digital era. Factors influencing the ability of Mittelstand companies to digitalize include the availability of reliable internet, financial capital, and skilled talent. However, the most critical factor is that management embraces

digitization and recognizes its utility in the future economy. Companies require a significant number of software developers to make the digitalization process and implementation of data-leveraging technologies faster and more efficient. However, IT talent acquisition is a challenging task for most Mittelstand companies. No-code and low-code tools reduce the entry barrier for building digital applications and automating workflows. Therefore, they will play a crucial role in getting the Mittelstand up to speed on the digital technology adoption and ensuring the ability to compete internationally.

Once the digital groundwork has been established, immense opportunities open for Mittelstand companies across all sectors to collect and utilize data harnessed from sensing capabilities along production processes. Rapid advances in data using technologies, supported by increasing computing capabilities, enable future processes to be simulated and virtually enhanced, thereby predicting inefficiencies and reducing risks along individual processes or entire supply chains.

Due to advances in Artificial Intelligence (AI), computer vision, robotics, sensing, Augmented Reality (AR), and collaborative robotics (cobotics) have gained more traction. These technologies will play an important role in leveraging new opportunities as data becomes increasingly available. By providing digital and physical assistance, AR and cobotics can help to reduce human error, make work more secure, increase efficiency, facilitate data access and employee education.

The technological advancements described above make Mittelstand companies more competitive in main and labor markets. However, this is accompanied by the rising threat of cyberattacks. Increased adoption of technologies like cloud services, mobile-based industrial applications, and Internet of Things (IoT) infrastructure expand companies' surface area for cyberattacks. To ensure a secure digitalization process and further operation, companies must undertake a holistic approach toward building decentralized cybersecurity architecture based on principles of modularity and scalability.

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# DIGITAL MATURITY

## Establishing a Baseline of Digital Infrastructure From the Ground Up

Digital maturity indicates Integrating digital technology in an enterprise to improve processes, services, or products [1], [2]. In 2022, Germany ranked 17th in Integrating digital technologies at an enterprise level [2]. An increasing discrepancy can be observed between the digital maturity of corporations and the Mittelstand, many of which lack basic digitalization measures [3]. For the Mittelstand to achieve digital maturity, upper-level management must prioritize digitalization initiatives, optimally creating new teams solely responsible for digital transformation. This includes facilitating awareness and education, allocating finances toward infrastructure, and thoroughly considering the strategic importance of digitalization. So far, less than one-fifth of the Mittelstand has a defined digitalization strategy, despite an uptick in initiatives necessitated by COVID-19 [1].

### Facts:

- 25% of the Mittelstand lack digitalization, even including digital communication with external parties [4]. An additional 6% decreased or halted digitalization since 2020 [1].
- 67% of large SMEs (greater than 50 employees) are undertaking digitalization projects, as opposed to only 30% of small SMEs (less than five employees) [1].
- Digital investment differs across sectors, with R&D-intensive manufacturing and knowledge-based services sectors investing the most and the construction sector investing the least [1].

### Key Drivers:

- In 2020, SMEs demonstrated an increase in completed digitalization projects (from 30% to 33%) and a 16% increase in digitalization spending. However, this was spurred by the onset of COVID-19 and not by an increased interest in digitalization, as evidenced by the rise in externally facing projects and not internally facing initiatives [1].

- Supra-regional competition motivates digitalization. 42% of SMEs operating internationally invest in digitalization versus only 26% of those operating regionally [1].
- Increasing rates of tertiary education in Germany are linked to digitalization [5]. 48% of SMEs employing graduates have completed digitalization projects, versus 28% of SMEs not employing graduates [1].

### Challenges:

- The top challenges listed by SMEs were data protection and data security requirements (39%), inadequate digital infrastructure (38%), and lack of IT skills (32%) [4].
- 36% of small SMEs and 47% of large SMEs listed poor internet connectivity as a digitalization barrier. This is not limited to rural areas; 32% of SMEs in large cities also listed this as a barrier [4].
- The initial capital required for digitalization often places stress on Mittelstand companies, especially in sectors like manufacturing, where expensive machine integration and retrofitting are needed rather than digitalization of administrative processes [1].

### Impact on the Mittelstand:

Digital maturity will establish the foundation that the Mittelstand requires to compete in innovative and international markets and leverage more advanced technologies. This is a crucial step toward ensuring that SMEs keep pace with corporations, suppliers, and Original Equipment Manufacturer (OEM); otherwise, they risk falling behind [3]. Innovative enterprises allocate significant funds toward digitalization which expands beyond laying the groundwork and investigates a range of topics [1]. If SMEs enter this sphere, it could decrease the economic, innovative, and collaborative discrepancies between differently sized Mittelstand companies, different sectors, and those with and without internal research and development (R&D) initiatives.

# DEMOCRATIZING SOFTWARE DEVELOPMENT

## Facilitating Application Development and Workflow Automation Through Low-Code and No-Code

No-code (NC) technologies enable users without prior coding experience to quickly build applications and products. Low-code (LC) tools allow users with limited development experience to undertake more complex projects. Low-code/no-code (LC/NC) technologies rely heavily on visual modeling tools, which lowers the barrier to entry for software development [1]. As SMEs face the challenge of attracting and educating the labor force with technological skills, LC/NC (low-code/no-code) solutions offer a smooth transition into software development, thereby enhancing the capabilities of the current workforce. Using LC/NC solutions results in faster time to market and higher agility. LC/NC tools can create value across diverse sectors of SMEs via the development of e-commerce platforms for retail, hospitality, and B2B (Business-to-Business) manufacturers, thereby boosting customer engagement. They also democratize the development of mobile apps, employee interfaces and even advanced internal tools aiding chemical production, construction, or agriculture.

### Facts:

- 70% of new enterprise applications are expected to use low-code and no-code by 2025 [6].
- The market for low-code development platforms is expected to grow to \$125.3bn USD by 2030 implying the further advancement of the technology [7].
- Companies with high organizational speed outperform slower competitors by 4.8 times when it comes to innovation and three times with regard to growth [8]. Using Low-Code tools can reduce development time by 50-90% [9].
- 72% of SMEs reported a lack of technically skilled workers to advance their digitalization efforts [10].

### Key Drivers:

- LC/NC solutions often need to interact with company-internal systems through Application Programming Interfaces (API). More than 90% of developers globally expect to use more APIs in 2022 compared to 2021 [11].
- Recent advances in AI-based language models allow generating source code based on simple prompts. This further reduces entry barriers to software development and increases employee productivity. The capabilities of such models are expected to improve significantly in the coming years [12].
- Overloaded IT departments at Mittelstand companies are unable to cope with employee requests. Therefore, employees outside of IT tackle challenges themselves and start building their own digital products and tools using no-code/low-code [13].

### Challenges:

- Due to the low entry barrier for developing software with LC/NC tools, the employees are able to create software without the approval or even awareness of the IT department. This poses security, data privacy, and financial risks to companies [14]. Therefore, LC/NC efforts demand further scrutiny and resources by IT departments.
- Currently, no-code platforms can only be used for simple use cases because they are limited by the capabilities of the visual interfaces. Low-Code development offers significantly more customization but might still require coding skills for more complex tasks.
- Companies report requiring extensive training for employees using low-code development tools.

### Impact on the Mittelstand:

LC/NC development tools address many of the Mittelstand companies' most pressing problems, particularly the lack of skilled IT employees and the struggle to keep up with digitalization. Companies embracing LC/NC will be able to make use of an empowered labor force while simultaneously staying true to their values of investing in current employees without major reeducation requirements. Mittelstand companies will be able to innovate faster and more flexibly, grow more quickly, and stay competitive in a global market. In the future, the capabilities of LC/NC tools will increase significantly as AI progresses, decreasing the barrier to entry even further.



# DATA-LEVERAGED PRODUCTION

## Future-Proofing Mittelstand Supply Chains and Production by Advanced Data Usage

The generation and management of data are expected to rise across industries [15], [16]. Consecutively, access to technologies capable of making sense of vast amounts of data (e.g., AI) is projected to increase [17]. This opens a wide range of opportunities for Mittelstand companies to enhance production operations. Due to recent advances in computing capabilities, sensor quality [18], and improved digital infrastructure, companies can accelerate and streamline processes on multiple scales [19], [20]. Data collection and aggregation enable the creation of digital representations of physical processes on a micro level via digital twins. Real-time performance monitoring and detailed simulations with ever-enhancing machine-learning models facilitate scenario prediction, which then can support decision-making and process implementation [21]. These can impact a multitude of sectors ranging from retail with the simulation of facility usage [22] to construction or agriculture with external condition scenarios projected on digital representations of physical infrastructures [23], [24]. On a macro level, data-leveraged processes can make entire supply chains more robust and resilient by decreasing reaction times and risks. Simulations of the whole supply chain can enhance production efficiency and equipment allocation, thereby further reducing costs [25], [26].

### Facts:

- Mittelstand companies are aware of the value created by digital process enhancement [27]. Boards increasingly facilitate data-leveraged production methods, thereby showing fundamental openness [28].
- Data-leveraged production tech can lead to a revenue increase of up to 10% and improve product quality by up to 25% [20].

- The market for digital twin technologies can reach ca. 48bn EUR worldwide and approximately 7bn EUR in Europe alone by 2025, with an annual growth rate of 30 to 45% [15], [20].

### Key Drivers:

- Entry barriers are decreasing with advancements in sensor fusion and machine learning. Companies can collect valuable data on small-scale applications from current equipment without having to invest in replacement [19], [29].
- Underlying technologies for data-driven production, such as AI, IoT, digital twins, or cloud/edge computing, gain recognition [17]. This improves accessibility, and its development is projected to advance even further [15].
- The COVID-19 pandemic plays a central role in the growth of data-driven processes as sectors recognize a need for robustness and digitization across supply chains [15].

### Challenges:

- Mittelstand companies must map and facilitate the harnessing of meaningful data across multiple process steps in structured ways to create the foundations for data-driven simulations and leverage them [19].
- Using data to enhance processes along production can require initial time and financial investments. As projects are constrained to specific processes, applications can be narrow and thereby have limited scaling potential [30].
- A lack of internal competencies can lead to dependency on scarce, external capabilities for the implementation of data-leveraged processes. In complex cases, this can lead to the tempering of the realization of such undertakings [30].

### Impact on the Mittelstand:

The meaningful harnessing of data is crucial for Mittelstand companies across all sectors to keep or establish a competitive advantage both against local as well as global competition. The facilitation of data leveraged processes will, however, not simply lead to the creation of enhanced, more resilient, and efficient future operations. With rapid advances in IoT, AI, and digital twin technologies, investment in data-leveraged production will also form a solid foundation for still obscured potential to be unfolded in the future [15].

# NEXT-GENERATION ASSISTIVE TECHNOLOGY

## Complementing Humans' Digital and Physical Capabilities With Augmented Reality and Cobots

Increasing digitalization and data-driven processes among Mittelstand companies require the use of new tools to access untapped potential. Furthermore, there is growing interest in employee security and fault reduction [31]. These needs can be digitally addressed via augmented reality (AR) and physically addressed via collaborative robots (cobots). AR integrates digital information within the physical environment, giving humans more direct access to data and control. The potential applications of AR are manifold, ranging from guidance systems (e.g., surgery, logistics, assembly, construction) to field data collection [32] to creating immersive retail experiences [33], [34]. Cobots collaborate with humans to accomplish complex physical tasks. Unlike industry robots, they work alongside humans, which poses new technological challenges. As separate technologies, AR and cobots are very promising, both reducing human error and making work more secure. When combined, they make human-robot interaction even more powerful and secure, for example, by using AR for cobot programming or to foresee cobot trajectories [35], [33], [36].

### Facts:

- In Germany, XR (AR, virtual reality, and mixed reality) generates revenue of approximately 400m euros and is predicted to have a CAGR (Compound Annual Growth Rate) of 26% to 57% from 2020 to 2024 [37], [38]. Worldwide, the XR market is expected to increase ninefold from 2021 to 2028 [39].
- The manufacturing and construction industries show most interest in XR technologies. 68% of German XR producers say their clients belong to these sectors, and 30% report these sectors as the most important for business [37].

- The global market for cobots is expected to increase at a CAGR of approximately 43% from 2022 to 2028 [40].

### Key Drivers:

- Hardware and software advances are improving usability while decreasing the cost of wearables such as smart glasses. [35], [40].
- Digitalization, data availability, and digital twinning will create an ecosystem that fosters the use of AR and cobots [36], [41].
- Developments in 5G network infrastructure, as well as edge computing, enable low latency interconnectivity, which in turn helps both mobile AR applications as well as cobotics [42].
- Increased availability of advanced software frameworks allows for the development of AR applications and cobotics [43].

### Challenges:

- Although there has been an uptick in media attention surrounding AR, it still lacks general popularity and requires detailed explanation. Therefore, training must be incorporated into the workforce to push the technology forward [37], [44].
- Situations may arise in which cobots are required to make safety-critical decisions, which urges further development of machine ethics [41].
- AR and cobotics rely on audio and visual data during operations. This data should be used to ensure safe operation while still protecting privacy [41], [42].

### Impact on the Mittelstand:

AR and cobots will have an impact on many industry sectors, predominantly manufacturing, logistics, healthcare, agriculture, and retail [36]. Cobots can significantly reduce human error and can perform delicate tasks [35], [41], [45]. However, they are underutilized in Mittelstand companies – although solutions are emerging, 96% of new workplaces do not incorporate robots [45]. Regarding AR, processes incorporating data-driven AR will most likely be a leading tool in information accessibility and control. In the meantime, AR will continue to gain traction in education and retail applications. [34], [35], [37].





# HOLISTIC CYBERSECURITY

## Implementing Modular and Scalable Architecture to Catch Up With Threats Advancements

Cybersecurity is an essential part of the digitalization process and will be one of the critical risk management priorities for the Mittelstand. Starting from basic protective technologies such as firewalls, password encryption, and antivirus software, companies will have to adapt to rapidly increasing advancements in malicious attacks [46]. With technological advancement, increasing adoption of social media, cloud services, mobile-based industrial applications, and IoT, the attackable surface area is expanding, making companies more vulnerable to cyberattacks [47]. One of the main trends in cybersecurity technologies is the implementation of AI algorithms for threat detection [48]. However, sophisticated algorithms are not enough – the next step is a holistic cybersecurity approach with decentralized operating architecture. One of the best practice principles is a Cyber Security Mesh Architecture (CSMA), which represents a comprehensive set of practices for expanding security control, even in the case of distributed assets such as multi-cloud architectures. Based on the zero-trust principle that, by default, none of the internal or external devices can be connected to the system without verification, CSMA allows for covering all system modules while keeping each in isolation in case of an attack [49].

### Facts:

- Around 70% of Mittelstand companies do not feel threatened by potential cyberattacks, and almost half don't see cybersecurity policy and implementation as a C-level priority [47].
- Companies are unprepared for cyberattacks – 57% have neither an emergency response plan nor additional, separately available means in case of an emergency [50].
- The lack of investments in cybersecurity measures leads to systems' inability to counteract cyber-attacks, on average causing financial damage to Mittelstand companies of around 200,000 EUR [51].

### Key Drivers:

- The number of potential entry points for malicious actors is increasing with the adoption of IoT and cloud technologies. The danger of such devices lies in their smaller storage and processing power, which makes it more difficult to install security applications on them when compared to laptops and smartphones [52].
- COVID-19 made businesses quickly switch to remote work without giving them a chance to address the vulnerabilities associated with private internet routers and smart devices [52], which results in an increasing number of cybercrimes.
- Ransomware is one of the successful attacks, becoming more sophisticated with machine learning and coordinated data sharing on the dark web [52].

### Challenges:

- Mittelstand employees often neglect core security principles due to a lack of basic security training, e.g., they often use weak passwords and connect to public Wi-Fi networks, which are one of the most significant sources of cyber threats in the workplace [46].
- It is difficult for the Mittelstand to acquire cybersecurity talents due to competitive salaries in other sectors and a lack of dedicated HR marketing strategies [53].
- Many companies deploy multiple-point security solutions to address specific risks. The resulting architecture is complex and difficult to monitor and manage [49].

### Impact on the Mittelstand:

Many Mittelstand companies significantly underestimate the potential threat of cyberattacks, paying insufficient attention to the needed prevention measures and frequently incorporating point solutions. By 2024, organizations that have implemented a holistic cybersecurity architecture that integrates defenses into a single ecosystem will reduce the financial impact of individual security incidents by an average of 90% [49].





# **SOCIETAL & ENVIRONMENTAL TRENDS**

**CONSIDERING CHANGING DEMANDS AND NEW WORK**

Rising Sustainability Awareness

Enhancing Extreme Weather Resilience

Corporate Social Responsibility

Changing Values Through Generational Shift

Shifting the Power Toward Employees

# SOCIETAL & ENVIRONMENTAL TRENDS

## Considering Changing Demands and New Work

Profound developments transform both our society and our environment. From urbanization and demographic change to the increasingly severe climate crisis and the weather disasters that come with it, the Mittelstand is facing one of the most challenging times in decades. Most of these challenges cannot be separated into the societal or environmental category – they are closely intertwined. To weather these difficult times, it is essential for the Mittelstand companies to understand the most critical trends thoroughly.

First, global movements such as “Fridays for Future” are turning the global gaze increasingly towards environmental aspects. People realize that the status quo must be challenged to align with the Sustainable Development Goals. This also manifests itself in supra-national initiatives such as the Paris Agreement. This results in significant changes and transformations needed in all industries.

Second, extreme weather events such as water floods and heat waves have risen in the past years but are also expected to become more common. With these events being unpredictable, uncertain, and complex, Mittelstand companies cannot avoid them but must develop a resilient strategy to recover from them.

Third, companies try to minimize their ecological and climate footprint to align with climate and environmental goals. All-encompassing sustainability strategies implementing aspects according to the CSR principle in Mittelstand companies are essential.

Fourth, Mittelstand leadership is on the brink of retirement, bringing considerable changes in the values of Mittelstand leadership through generational succession. While the new generation’s values will enhance the emphasis on specific

causes such as sustainability and diversity, it is to be determined if traditional values such as stability and regionality will supersede this generational shift.

Fifth, the values of employees are shifting. This leads to the new working environment requirements such as work-life balance, the priority of mental well-being, and remote work. Therefore, Mittelstand companies, in addition to the traditional values like stability, should be able to provide new value propositions for their personnel.

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# RISING SUSTAINABILITY AWARENESS

Increasing Awareness for the Sustainability of Consumers, Companies, Governments, and (Future) Employees

Traditional businesses and global systems for energy and materials unlock significant benefits and drive economic and social growth. However, they also heavily influence the environment. The resulting greenhouse gas emissions are the leading cause of climate change [54]. Global movements such as Fridays for Future, Non-Governmental Organizations (NGO), and consortiums of climate scientists, like the Club of Rome, publicly express the changes needed in global climate politics. Additionally, extreme weather caused by climate change already affects regions worldwide [55]. Broad parts of the population are environmentally aware. In 2020, the five most likely global risks, according to the World Economic Forum (WEF), all belonged to the environment category [56]. Since Germany has been responsible for 4.6% of total global greenhouse gas emissions since 1850, and manufacturing is responsible for 24.9% of German emissions, there is a significant lever to improve and an urgent need for action [57] [58]. Nevertheless, sustainability can also help to optimize business processes further considering rising resource- and energy costs, and it offers excellent opportunities for growth and employment [59].

## Facts:

- Anthropogenic climate change poses major challenges worldwide. To limit the impact of climate change, 196 parties agreed on regulating global warming to 1.5°C until 2050 [54], [60].
- Consumers of all societal structures and employees have a rising awareness of sustainability [61], [62].
- In 2020, around 12% of all Mittelstand companies invested a total of 22bn EUR in climate protection projects. Every tenth euro invested by Mittelstand companies in 2020 thus flowed into climate protection projects [63].

## Key Drivers:

- Global movements such as Fridays for Future are turning the economic, social, and political gaze towards sustainability [64].
- Extreme weather conditions such as heatwaves, droughts, or floods affect entire regions and businesses and are more likely to occur due to climate change. Immediate surroundings have the most substantial impact on the personal interest in sustainability [65], [66], [55].
- The public sector is incentivizing sustainability, for example, through ESG-linked bonds. Governments can price environmental impact with tools such as carbon taxation [67], [68].

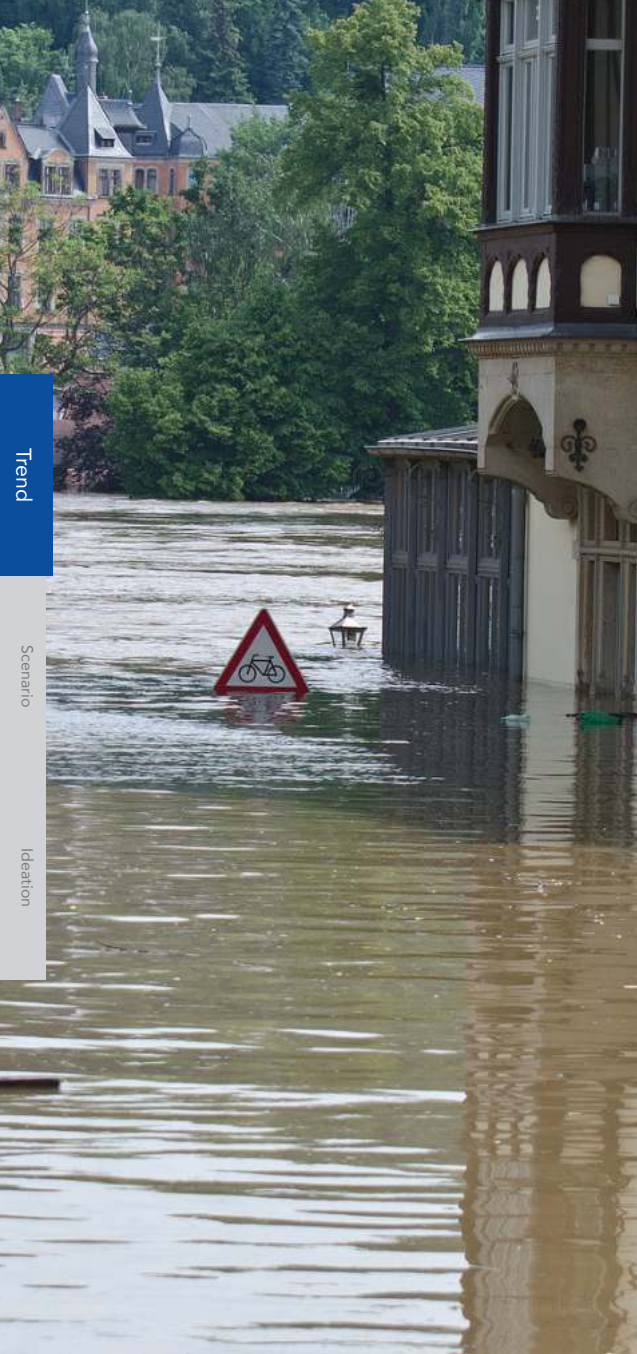
## Challenges:

- High capital requirements for investments in sustainable projects, especially for decarbonization. Investments could be deprioritized considering COVID-19, the energy crisis, or supply chain issues [69], [56], [59].
- 52% of 1,000 Mittelstand companies asked, mentioned that national solutions are a burden on international competitiveness [69].
- Consumers consider sustainability while shopping, but only 50% are willing to pay significantly more [70].
- It is challenging to quantify secondary effects, such as higher employee satisfaction, entrepreneurial, innovative strength, and improved public perception [71].

## Impact on the Mittelstand:

Sustainability awareness is and will be an all-encompassing trend. Thus, companies must adapt to this development to remain competitive [71], [59]. Mittelstand companies must consider this key trend in all future decisions and align their product portfolio, business model, and operational activities accordingly. Sustainability and climate protection shall no longer be seen as simple lip service but must be anchored as a strategic goal for the company. A transformation to a sustainability role model might also bring other positive secondary effects, such as improved public perception and higher employee satisfaction [71].





# ENHANCING EXTREME WEATHER RESILIENCE

## Mittelstand Companies Must Implement Adaptation Strategies Against Extreme Weather Events

While Mittelstand companies are the heart of the German economy, they are the most vulnerable to Extreme Weather Events (EWE) [72]. EWEs are categorized into three clusters: simple, complex, and unique extremes, where the two changing variables are the magnitude of the phenomenon and the number of variables at stake [73]. In the past few years, the number of EWEs has increased, and their intensity and frequency both in Germany and abroad [74]. Concerning the implications of such events on Mittelstand companies, there are contrarian views on the topic. The first perspective judges the Mittelstand as more affected by EWEs than corporations due to the lack of significant financial resources and limited access to skilled workers and technology. On the other hand, others suggest that Mittelstand companies are more prone to recover quickly from EWEs due to their relatively small size, less bureaucracy, strong internal communication, and fast decision-making [73]. Yet, in both cases, EWEs result in significant socio-economic losses. Therefore, it's up to Mittelstand companies to act against climate change as the primary driver of EWEs [75], but also to develop a resilience strategy to be better prepared for EWEs and maximize their positive consequences [76].

### Facts:

- 71% of extreme weather events that happened until 2022 were found to be made more likely or more severe by human-caused climate change, with 9% of events or trends made less likely or less severe by climate change, meaning 80% of all events experienced some human impact [75].

- Extreme heat, drought, and floods caused by climate change cost Germany at least 6.6bn EUR in damages annually on average in the past two decades [77].
- Economies with higher GDP tend to consume more raw materials and energy, occupy more productive land, and use it more intensively [78].

### Key Drivers:

- Human activity, being the main cause of climate change, contributes tremendously to EWEs. Specifically, burning fossil fuels for electricity, heat, and transportation causes CO<sub>2</sub> emissions that worsen global warming [79], [80].
- Oil continues to be one of the main energy sources in Germany, and oil and motor fuels account for 34% of primary energy consumption, with most of it being imported [81]. In parallel, construction, manufacturing, transport, and logistics that rely heavily on energy sources continue to be the main sectors of the Mittelstand [82].

### Challenges:

- Enhancing the resilience against EWEs in the case of Mittelstand companies can be challenging due to their current economic situation, along with the institutional regulations and the lack of external support and guidance [83]. This is even further exorbitated by the shortage in resources and the subjectivity in the perception and alleviation management in case of an unfortunate environmental event.
- Investments in EWEs adaptation strategies for Mittelstand companies are costly [84].

### Impact on the Mittelstand:

A continuous increase in EWEs constitutes adverse socio-economic effects on Mittelstand companies. As a matter of fact, manufacturing is the most affected sector. As a representation, flood events damage the company buildings, plants, and equipment of the company. In addition, damage to the transport infrastructure would hinder business operations. As a result, production would decrease, affecting all the company's operations. Taking the example of heat waves as another EWE, the immediate impact would be on the agriculture sector, which then impacts the pharmaceutical Mittelstand companies. Furthermore, energy production is usually restricted during heat waves, impacting the Mittelstand that relies on energy sources [84].

# CORPORATE SOCIAL RESPONSIBILITY

## Adoption of Measures to Incorporate Social and Environmental Concerns in Corporations

Throughout the last years, Corporate Social Responsibility (CSR) has established itself as a modern industry pillar. The reasons for this growth are both the increasing need for transparency in reporting the social and environmental expenses of corporations and a shift in market interest towards sustainable and ethical businesses. As a result, interest in CSR can be seen as the consequence of the increasing sustainability awareness expressed on the company side. According to the United Nations Industrial Development Organization, CSR is a "management concept whereby companies integrate social and environmental concerns in their business operations and interactions with their stakeholders" [85]. In fact, CSR is a broad subject of research involving various topics ranging from the responsible sourcing of materials to, e.g., the philanthropic and environmental investments of companies. The main motivations for the increasing adoption of CSR measures in corporate structures are not only motivated by the growing market demand for "ethical" products and corresponding consciousness on the corporate level but also by an increasingly strict regulation considering regional and international laws on the sourcing of materials.

### Facts:

- In a survey from 2021, 68% of German companies considered CSR and sustainability as "relevant" or "very relevant." However, around 25% of the total companies invested no money in this field, and another 40% invested less than 10,000 EUR per year [87].
- Studies on enterprises in China show that after CSR-oriented company restructuring, "the financial performance of firms was not significantly improved, but sales efficiency was increased" [88].

- In a worldwide landscape, Germany ranked 10th out of 180 countries in 2021's Global Sustainable Competitiveness Index, which considered factors such as social cohesion and natural capital [89].

### Key Drivers:

- The European Union has been enforcing CSR expense declarations. From 2025 on, companies above a certain size must provide annual information on "environmental, employee-related, and social issues, respect for human rights, and the fight against corruption" [90].
- Technology and social media as "opinion amplifiers," which means that corporations will need to take CSR measures seriously to avoid backfiring on the brand image and loyalty [91].

### Challenges:

- Falling into the greenwashing trap, or complying with standard CSR measures just on paper, for the sake of marketing. This can be highly detrimental to the brand image if it becomes known to the consumer public [92].
- CSR-oriented restructuring of Mittelstand companies may require rethinking parts of the business structure, models, and how a company decides to appear and represent itself on the market [88].
- Measurability of CSR impact on a company is not standardized or easy to communicate, and so potentially hard to convey in a company's marketing image [93].
- Taking compromises may be hard: balancing CSR with profitability is not trivial, and price increases due to CSR may lead to losing customers.

### Impact on the Mittelstand:

In a survey from 2017, several Mittelstand industries declared that they have difficulties to adapt to CSR requirements. Nevertheless, several are already implicitly implementing a large share of CSR measures with positive customer feedback [91]. Studies show that "CSR activities enhance a firm's reputation and increase employee satisfaction and employee loyalty" [94]. Additionally, the increasing competition with fair-trade brands in several niches requires the Mittelstand to incorporate CSR to stay competitive [91].



# CHANGING VALUES THROUGH GENERATIONAL SHIFT

## As Leaders Retire, the Mittelstand Is Shaped by a New Generation

As the vast majority of Mittelstand companies were founded decades ago, a change in leadership is inevitable in the near future. The new, younger leadership successors have grown up in a digital, internationally connected world, leading to different values and priorities in life. While more than half of successors come from within the family, some are long-time employees or externals via a management buy-in [95]. The new generation's education is more interdisciplinary and – specifically in the case of Mittelstand leadership successors – more often in business administration instead of engineering [95], [96]. These differences lead to significant changes in the way Mittelstand companies operate, both internally and externally [95]. Leadership successors need to demonstrate ambidexterity, meaning they must successfully manage the company's ongoing operations during a time of uncertainty and crises without missing out on long-term industry trends to ensure ongoing prosperity for employees and Germany as a whole. While the new generation's values enhance the emphasis put on certain causes, such as sustainability and diversity, it also decreases the emphasis put on others, such as projects and social support on a regional level.

### Facts:

- 60% of Mittelstand leadership successors come from within the family, and 79% are under the age of 45 [95].
- While previous Mittelstand leaderships often valued clear hierarchical management structures, successors are adopt-

ing a flatter, team-oriented management style instead [95].

- Many of the most highly regarded values among Mittelstand leadership are not as important to the new generation. For example, "Heimatverbundenheit," i.e., connection to the Mittelstand company's – and therefore also the family's – home region, is playing a much smaller role among the new generation [97].

### Key Drivers:

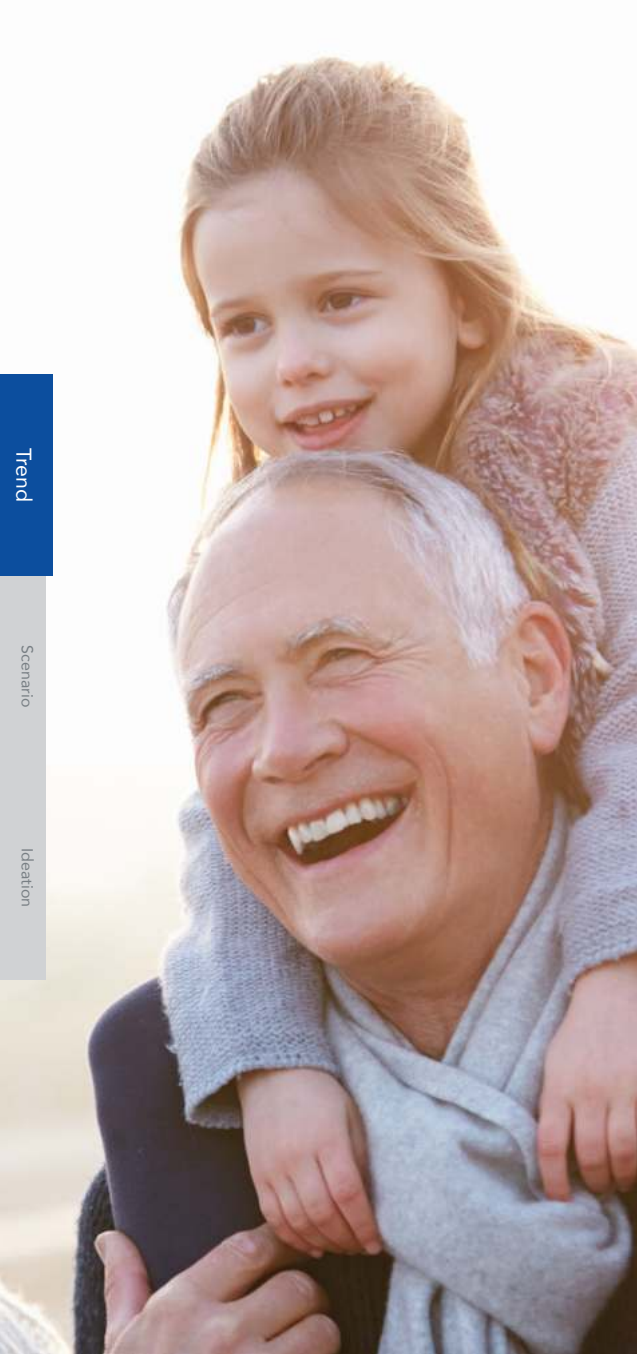
- The ratio of Mittelstand owners under the age of 45 has almost halved from 48% to 26% between 2002 and 2016, while the ratio of those over the age of 60 has almost doubled from 12% to 21%. This means that many corporate ownership/management transfers to the next generation are imminent [98].
- Young people are increasingly leaving their home villages and flocking to metropolitan areas in search of more and better opportunities, such as universities, and becoming "global citizens" instead of working all their lives in the same place where they were born [99].

### Challenges:

- The combination of most Mittelstand leaderships' desire for "a younger version of themselves" as successors and the fundamentally changing values of the next generation lead to a lack of suitable successors [97].
- This is particularly problematic for the 40% of Mittelstand companies without successors within the family who could have internalized the established values – like social responsibility towards employees and the region – while growing up [95].

### Impact on the Mittelstand:

The Mittelstand is already facing one of the most transformational eras, with the electrification of the mobility sector, Industry 4.0, etc. In addition to handling these challenges, the Mittelstand must successfully manage the transfer of leadership from one generation to another. This is associated with various challenges, from not finding a suitable successor to the principal-agent problem of not knowing an external successor's real intentions. At the same time, generational succession can also be an opportunity: new leaders are more familiar with upcoming technological and organizational trends and come with less entrenched mindsets.



# SHIFTING THE POWER TOWARD EMPLOYEES

## Social Sustainability Poses New Challenges for Mittelstand Companies

Social sustainability prioritizes the needs of individuals and society. Employees are placing new requirements on their working environment and want their individual life models to be considered [100]. Due to labor shortage, demographic change, and digitalization, their priorities shift from classic attractive features such as salary toward flexibility, mobile working, family friendliness, and corporate values [101]. Social sustainability will therefore play a significant role for the Mittelstand in attracting young employees [102]. However, these “new” values are not compromising the existing values of the Mittelstand: employees expect stability, flat hierarchies, trustful superior-employee relations, and a long-run mindset from their employer [103]. Supplementing the values already intrinsic to the Mittelstand is trending in these organizations. Finding the right balance between businesses’ needs to retain qualified workers and the inevitable economic decreases that a financial crisis brings is a challenge for Mittelstand companies.

### Facts:

- Employee satisfaction and retention were always significant concerns for the majority of the Mittelstand [104]. Setting employees’ needs higher than their own economic advantages, companies kept retaining their staff as long as possible, even in crisis times [105].
- Companies want to respond more to the desire for a work-life balance [106]. The majority of 30 surveyed firms started to prioritize frequent employee evaluations, work-life balance, and mental well-being [102].
- By 2025, the importance of flexibility and mobile working/

home office will increase [101]. Working from home and doing mobile work are becoming more common in the Mittelstand companies, but primarily when employees ask for that [100].

### Key Drivers:

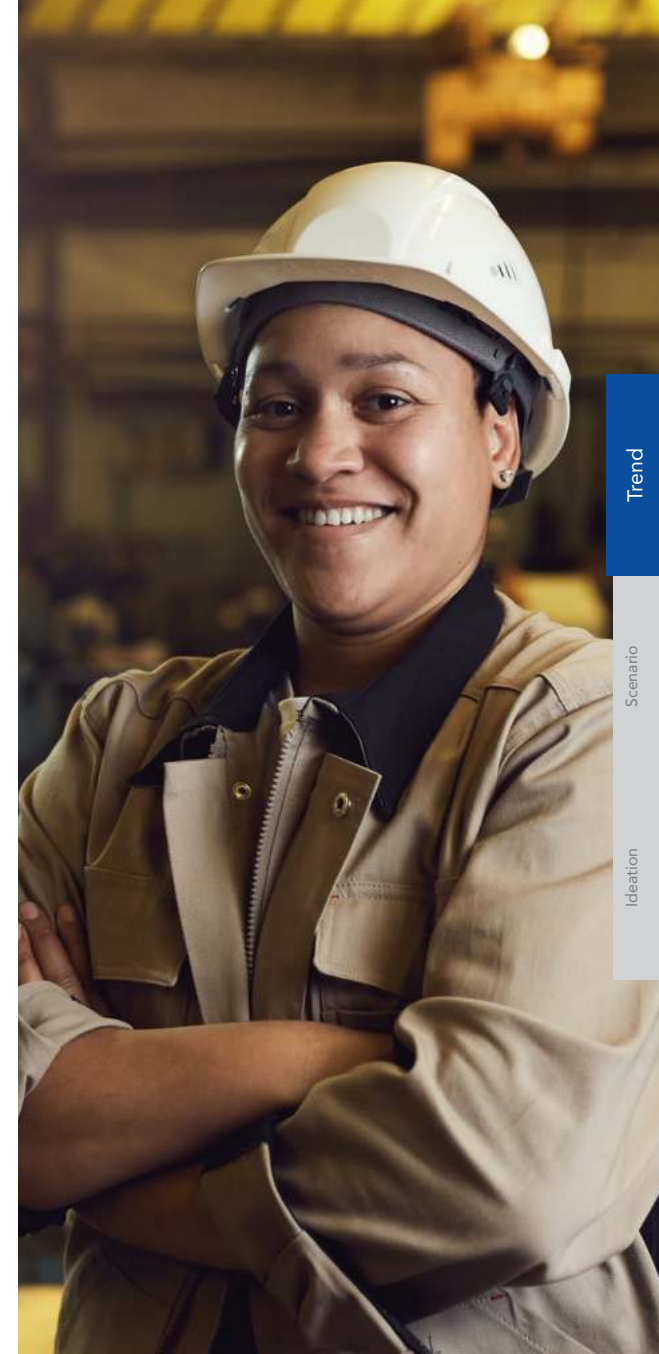
- Ongoing demographic change and labor shortage force the Mittelstand companies to shift power even more toward the employees’ side to retain skilled workers that are crucial for the company’s competitiveness [103], [59].
- Priorities of young people, whom the Mittelstand must attract, are reorienting away from conventional appeal criteria like money towards flexibility, remote work, work-life balance, and family friendliness [101], [102].
- The importance of image and reputation fosters employee-oriented behavior in family-owned companies [107], [108]. The age of transparency made possible by the internet, where any employee can post a review about an employer, reinforces this factor.

### Challenges:

- Although companies wish to accommodate employees’ demands for a work-life balance, full wage compensation might not be economically feasible [109].
- Due to the higher proportion of manual tasks, companies might struggle to implement remote working [110]. Businesses are not as well positioned as they might think when it comes to mobile working and home office [101].
- The current German regulatory framework does not oblige employers to offer remote working options anymore [111]. This might reduce the Mittelstand’s aspirations to provide desired working conditions.

### Impact on the Mittelstand:

Mittelstand companies are standing out with the long-term retention of personnel, which is achieved by corporate values such as flat hierarchies and a long-run mindset [103]. To attract and retain workers, the Mittelstand proposes new values such as remote work. Companies that offer mobile work and regulate them contractually are more successful than others [100]. Shifting power to employees will help the Mittelstand to mitigate the lack of human resources, contribute to long-term employee retention, and enable companies to maintain their high level of innovation successfully [103].





# LEGAL & POLITICAL TRENDS

REFLECTING ENVIRONMENTAL AWARENESS AND GLOBAL  
COMPETITION

Climate Neutral Companies

Transparency Obligation

Trade and Market Regulation

Data Governance Regulation

Diversity, Equity, and Inclusion




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Mete Polat 

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Lena Voß 

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# LEGAL & POLITICAL TRENDS

## Reflecting Environmental Awareness and Global Competition

Our globalized world is becoming increasingly volatile. The environment is constantly changing, driven by various factors such as technological trends, geopolitical conflicts, socio-economic factors, and climate change. Lawmakers on national and transnational levels must adapt their laws and policy frameworks to this changing environment. The creation and adaptation of regulations profoundly impact Mittelstand companies in Germany. This section presents five critical trends in policy and legislation which strongly influence Mittelstand companies.

Climate change induced by greenhouse gas emissions severely affects nature, society, and the economy. Increasing public awareness of the impacts of climate change has forced governments to act. The European Union (EU) aims to become the first climate-neutral continent by 2050. This leads to a robust regulatory push toward environmental sustainability on both German and European levels. Mittelstand companies are now confronted with countless new and updated obligations they must fulfill.

While environmental sustainability has been an object of public discourse for a long time, the consideration of social and governance aspects of sustainability has increasingly risen to prominence. A growing number of consumers and investors want to base their actions on extensive sustainability criteria, expanding their definition of compliance with human rights and ethical standards. Governmental frameworks and guidelines set the standards for how companies can create transparency about the sustainability of their products and processes. Adhering to these, Mittelstand companies need to disclose their business' environmental, social, and governance aspects.

The geoeconomic competition combined with the increasing number of conflicts worldwide have led to an unstable political climate. These conflicts have negative effects on businesses and sometimes even threaten their existence. European governments are reacting to the geopolitical situation by trying to protect their industries and weaponizing them to exert political pressure. As Mittelstand companies form

the backbone of the German economy, several regulations affecting their businesses have recently been adopted or are currently being discussed by policymakers.

Moreover, technical development has enabled a sharp increase in the amount of data that can be collected and processed. The increasing ubiquity and granularity of online data have led to rising awareness of the threat of data misuse in society. Policymakers are reacting to these concerns by introducing legislation defining requirements for data ownership, protection, and storage.

Lastly, there is increasing awareness of diversity, equity, and inclusion in society. Mittelstand companies therefore need to embrace diversity to attract young workers. Additionally, the integration of foreign workers provides an opportunity to fill the gap created by the lack of skilled workers. The German and European legislation have consequently adopted a legal baseline promoting diversity and easing the process for refugees and immigrants to come to the EU to work.



# CLIMATE NEUTRAL COMPANIES

## Reducing Greenhouse Gas Emissions

Climate change caused by greenhouse gas emissions impacts health, food availability, and productivity, leading to long-term economic harm. Recent studies confirm that it is cheaper to reduce greenhouse gas emissions than to deal with climate change's consequences [112]. Increased public awareness has brought climate action to the political agenda [113]. By adopting the Green Deal in December 2019, the EU has therefore set the ambitious goal to emit no more greenhouse gasses by 2050 and become the first climate-neutral continent [114]. As an intermediate step, the member states are obliged to reduce emissions by 55% until 2030 compared to the 1990 baseline [115]. To achieve this goal, the EU is currently working on the "Fit for 55" package. It adapts climate, energy, and traffic regulations to push the transformation toward a more environmentally sustainable future [115]. The wide range of changes comprising political interventions and financial measures has far-reaching implications for European businesses, including Mittelstand companies. Companies must understand and react to the new regulations.

### Facts:

- The European Green Deal Investment Plan will mobilize at least 1tn EUR in sustainable investments over the next decade [116].
- In 2021, the European Commission revised the EU Emissions Trading System, increasing the decline rate of the annual emission allowances from 1.7% to 2.2% [117].
- The new EU Energy Taxation Directive will remove outdated exceptions and incentives for fossil fuels while promoting green technologies [118]. The Energy Efficiency Directive will be revised, requiring member states to almost double their energy savings [119].
- The Circular Economy Action Plan adopted in 2020 includes initiatives along the entire lifecycle of products and aims at preventing waste and preserving resources [120].

- The European Carbon Border Adjustment Mechanism of 2021 shall prevent companies from moving their production abroad to exploit lower standards or prevent EU products from being undercut in price by less sustainably produced imports [121].

### Key Drivers:

- Climate change has tangible and observable impacts on the natural world, society, and businesses, such as floods, droughts, and wildfires [122].
- There is an increasing awareness of the long-term economic costs of climate change, which greatly outweigh the costs of preventing emissions in the present [112].
- 93% of Europeans believe that climate change is a serious problem and more than half of them think that national governments and the EU are responsible for tackling it [123].

### Challenges:

- Higher taxes on fossil fuels, combined with the energy crisis, could lead to exploding costs for companies with energy-intensive production [124].
- Companies exporting their products out of Europe might no longer be competitive since businesses in other countries might be able to produce at lower costs due to less stringent regulations [125].
- More than 72% of Mittelstand companies do not have sufficient resources to implement sustainable product innovations and policies [126].
- Many companies are unfamiliar with the implications of the EU Green Deal and how to act accordingly [127].

### Impact on the Mittelstand:

Mittelstand companies are forced to adapt to a rapidly changing regulatory environment. Regulation to diminish climate change is considerably challenging the business models of Mittelstand companies as aggravated carbon taxation and rising energy prices increase production costs. However, by utilizing subsidies and incorporating environmental sustainability into their products and processes, companies can gain a competitive advantage in the long run.

# TRANSPARENCY OBLIGATION

## Extending ESG Reporting Obligations and Compliance Systems

A value shift in society is leading to changes in consumer expectations and behavior [128]. While consumers have valued sustainability for a long time, a perceptibly more significant number of customers are willing to pay for safer, more environmentally and socially conscious products and services [129]. The changed expectations regarding environmental, social, and governance (ESG) topics require political and legislative adaptations. European and national policymakers aim to provide a legal framework within which companies must create transparency regarding ESG aspects to consumers and investors. To ensure compliance, companies are not only obliged to provide transparency but also to enable whistleblowing. Mittelstand companies are strongly affected by the changing regulatory landscape. While more prominent companies can build upon existing processes and systems, ESG requirements and operational implementation are new to Mittelstand companies.

### Facts:

- From 2024, the European Corporate Sustainability Reporting Directive (CSRD) obliges companies to publish yearly reports on their environmental and social impact activities. These must be certified by an accredited auditor or certifier [130].
- According to the German Supply Chain Act, companies must ensure compliance with human rights among their entire supply chain starting from 2023 [131], [132].
- To fight corruption, the German government will introduce the Corporate Sanctions Law and Whistleblower regulation which shall introduce internal channels to report infringements [133].
- The new European Sustainable Finance Disclosure Regulation of 2021 increases transparency around ESG claims made by financial market participants and prevents greenwashing [134].

### Key Drivers:

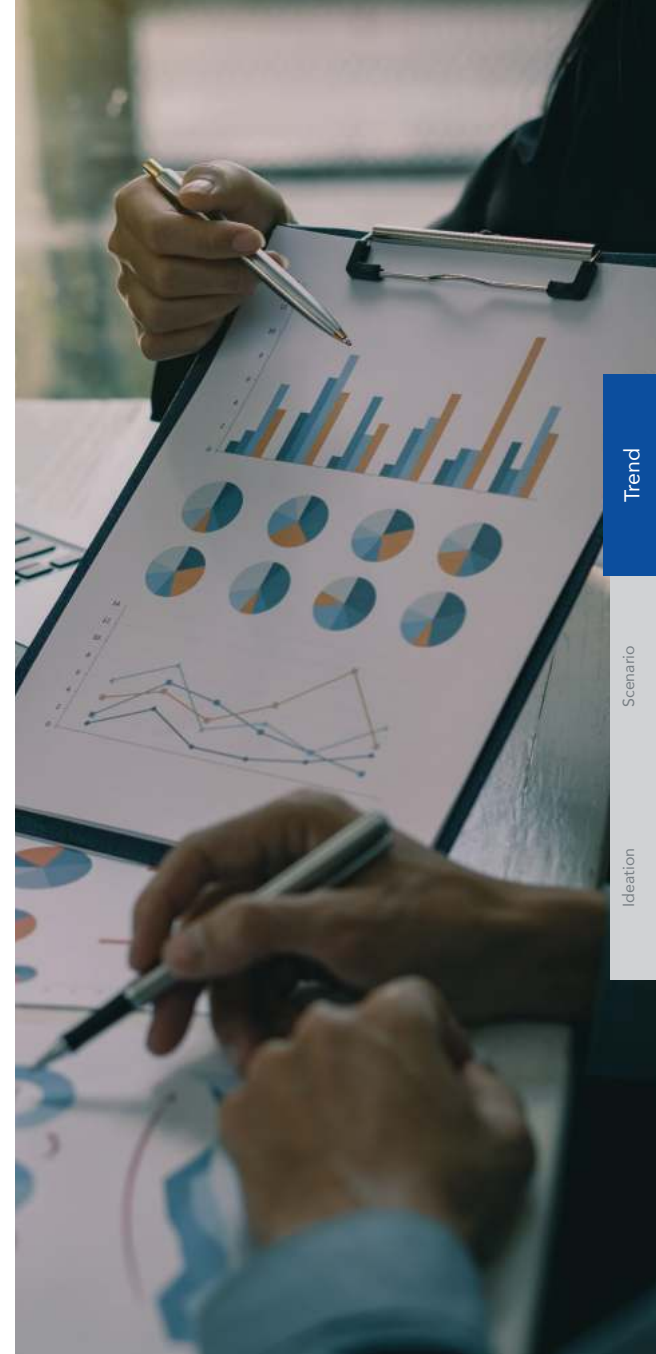
- ESG covers relevant factors guiding the investment decisions of 79% of investors [135]. 83% of consumers think companies should actively shape ESG best practices [129].
- To 79% of investors, ESG information must be independently assured, emphasizing the need for external auditing of sustainability reports [135].
- Transparency and compliance make companies less vulnerable to reputational and financial loss and thus leading to the lower volatility of cash flows and profitability [136]. In addition, this leads to business continuity strengthening long-term partnerships and customer relations.

### Challenges:

- Whereas 11,000 companies are subject to the existing reporting standards, nearly 50,000 companies will need to comply with the CSRD [137]. Thus, several companies cannot build on existing reporting standards but must establish transparency and compliance processes from scratch [138].
- Companies lack the human and financial resources to implement ESG reporting and compliance systems [139].
- Robust data is unavailable in all sectors. Therefore, fulfilling the requirements for data quality and scope might be difficult [140].
- Companies exporting to countries with less stringent regulations might lose competitiveness since ESG compliance is linked to additional costs.

### Impact on the Mittelstand:

New transparency regulations are forcing Mittelstand companies to incorporate new reporting systems. On the one hand, the new required resources and personnel will increase costs and result in a competitive disadvantage for companies exporting to countries with less stringent standards. The necessary transparency might reduce access to financing options and decrease revenues for less sustainable companies. On the other hand, increasing transparency and compliance can benefit Mittelstand companies that emphasize ESG criteria by strengthening customer loyalty and reducing costs in the long run due to risk minimization [141].



# TRADE AND MARKET REGULATION

## Geopolitical Tensions Reshape Economic Policies

Globalization has led to a tighter relationship between the German economy and the rest of the world. Driven by the increasing geoeconomic tensions, the COVID-19 pandemic, and armed conflicts, a negative trend has recently set in. The focus in Germany and the EU has now shifted away from further global integration toward protecting and strengthening the local economy. This is achieved by introducing several market-regulating instruments, ranging from prohibiting killer acquisitions to protecting critical infrastructure from getting acquired by international investors. While Mittelstand companies can benefit from this protectionist legislative trend, international conflicts can also disadvantage them. German exports are negatively affected by the EU imposing sanctions and implementing anti-coercion instruments, as well as foreign countries raising tariffs and imposing duties. This is especially relevant to Mittelstand companies as they generate 30% of their total turnover in foreign countries [142].

### Facts:

- In times of crisis, the proposed single market emergency instrument can be used by the EU as a last resort to force companies into producing and distributing critical goods [143].
- The German government has further restricted the scope of foreign direct investment, especially in critical infrastructure, and will prevent killer acquisitions [144], [145].
- The proposed anti-coercion instrument allows the EU to use economic policy to counteract pressures that countries are trying to coerce it [146].
- A new Dual-Use Reform recently entered into force in 2021 which expanded the scope of goods to which export controls apply, as they may serve both civilian and military purposes [147].

- The EU maintains now sanctions against 33 countries [148].

### Key Drivers:

- The economic and supply chain crises due to the COVID-19 pandemic revealed the fragility of decentralized and globalized economies and forced governments worldwide to rethink their global dependencies.
- Companies' infrastructure has become fragile due to recent geopolitical events such as the Russian War in Ukraine, leading to increased energy prices and economic instability.
- Big (tech) companies increasingly acquire European businesses to dampen innovation and restrain competition [149].
- Fossil resources are becoming scarce and the object of political coercion.

### Challenges:

- With stronger control on foreign direct investments and imposed sanctions on other countries, Mittelstand companies may have difficulties in accessing investment, exit options, and partnerships.
- Restrictions on foreign trade are reducing the number of exports [150].
- Mittelstand companies have less access to technology and know-how from abroad, such as 5G [151].
- Protectionism leads to less pressure for innovation and prices, harming companies dependent on sub-suppliers.
- Political uncertainty leads to a higher risk, hindering Mittelstand companies from investing.

### Impact on the Mittelstand:

The current geopolitical situation is characterized by increasing volatility as governments increasingly intervene in free trade to protect their local economies. This volatility heavily influences Mittelstand companies as they are strongly involved in foreign trade. On the one hand, Mittelstand companies can benefit from the current protectionist environment by being less exposed to foreign competition. Conversely, the international conflicts and the corresponding legislative and political changes negatively affect Mittelstand companies. This is because they inhibit exports, reduce revenues, and make investment decisions riskier.

# DATA GOVERNANCE REGULATION

## Advancing Regulation in Data Ownership, Protection, and Storage

Data has become one of the most valuable assets, as businesses and governments want to understand human behavior and generate commercial opportunities. However, organizations can misuse personal data and digitalization tools to predict and manipulate users' behavior. That was exemplified by the Facebook-Cambridge Analytica data scandal, where personal data was collected without consent for political use [152], [153]. The European General Data Protection Regulation (GDPR) and the German Privacy Act (Bundesdatenschutzgesetz – BDSG) were thus introduced to protect individuals from technological threats. These regulations define clear rules for the processes of data collection, data processing, data controlling, data storage, and data dissemination. For Mittelstand companies, data governance is an important instrument to protect the rights of both employees and customers, as it employs approximately 60% of the workforce in Germany [154]. However, understanding and adjusting to the rapidly changing data governance regulation poses a challenge for many companies.

### Facts:

- The European GDPR and BDSG were implemented in 2018 to regulate data processing, transfer, and storage [155], [156].
- The new German IT Security Act came into force in 2021 to regulate information security more strictly in critical industries [157].
- The EU Data Ethics Commission was established in 2018 to define ethical standards for protecting individuals' data in the digital era [158].
- The German government adopted the Open Data Strategy, which aims to increase quantity and quality of administrative data and make it accessible as open data [159].

### Legal & Political Trends

- In June 2022, the EU introduced the Data Governance Act to ease the exchange of confidential data between governments and companies on a European level [160].

### Key Drivers:

- Nearly 50% of global consumers fear losing control over their data. Lack of transparency in how data is stored and processed creates the threat that individual and corporate data may be leaked [161].
- Big data and the exploitation of individuals' data can potentially devastate society and undermine democracy if not adequately regulated [162].
- According to the German federal government, 90% of all data is not fully utilized, missing out on 425bn EUR of potential profits [163].

### Challenges:

- Mittelstand companies need to make adequate efforts in digitalization, such as new data management systems, to comply with regulatory changes. Difficulties in understanding those systems, training employees, and migrating from physical processes hinder a fast adaptation [164].
- Companies face rising upfront and operational costs to maintain legally compliant data systems and appropriate data protection personnel.
- Companies will face punishments for inappropriate data measures, increasing the financial burden for Mittelstand businesses [165].
- Some data guidelines, such as the ownership of workplace data between employees and employers, are still vague. This ambiguity leads to disputation in several legal cases [166].

### Impact on the Mittelstand:

Due to the GDPR, the EU has stricter privacy and data protection than other countries worldwide. Mittelstand companies must design data governance principles carefully, hire qualified data protection personnel, and implement and maintain legal data systems. Comprehensive regulation will benefit Mittelstand companies in the long run as they will have more resources to research innovation and build a sustainable, digital framework. However, companies will also face rising costs to support the transformation in the short run, which will be a challenge given the current economic situation.



Trend

Scenario

Ideation



# DIVERSITY, EQUITY, AND INCLUSION

## Promoting Diversity in the Workplace

The COVID-19 pandemic, digitalization, and demographic change have radically altered the workforce's expectations towards their prospective employers, demanding a more inclusive and diverse workplace. Diversity, equity, and inclusion (DEI) imply integrating employees into the workplace irrespective of gender, heritage, age, or physical condition. Studies have shown that a diverse workplace increases companies' productivity and profit margins [167]. EU and national regulations take on these benefits by enforcing DEI as stated in the EU's future of work vision [168]. Besides closing the gender gap and reducing discrimination, companies will also need to attract skilled foreign workers such as immigrants and refugees. This will lead to further demand for diversity because of demographic changes, such as a shortage of skilled labor and increased migration. Furthermore, integration of foreign workforce is facilitated by adapted legal frameworks.

### Facts:

- The European Pay Transparency Directive obliges companies with over 50 employees to report on the gender pay gap and to introduce a gender action plan [169], [170].
- The coalition agreement aims to enhance diversity management in Mittelstand companies to improve gender, LGBTQ, and best-ager diversity [170].
- The Skilled Immigration Act and the EU Blue Card enable qualified professionals from non-EU countries to work in Germany. Enhancing skilled immigration and further lowering the requirements for white- and blue-collar workers are planned [171].
- The EU Temporary Protection Directive was employed for the first time during the Russian war in Ukraine to integrate refugees into the labor force [172].

### Key Drivers:

- Due to the increasing shortage of skilled workers, companies increasingly need suitable personnel [173]. Urbanization will disadvantage rural companies in the labor market [174].
- Germany's population will become more diverse as it remains an immigration country with average annual immigration of 330,000 until 2030 – recent geopolitical events such as the war in Ukraine will increase these numbers [175].
- Diversity initiatives are essential determinants of employer attractiveness [176].
- Mittelstand companies experience the benefits of integrating foreign labor through mixed teams, cultural exchange, and changes in perspective [177].

### Challenges:

- Mittelstand companies lack the expertise to set up diversity strategies. More than 70% of companies do not have a person responsible for diversity and inclusion [177].
- A lack of intercultural competency and generational gaps can lead to communication barriers and prejudices that Mittelstand companies need to learn to deal with [178].
- Employers face uncertainty about how much to invest in foreign talent because workers are often uncertain about their right to stay, transcripts, degrees, and work permissions [179].
- Many refugees lack the vocational and technical training to perform skilled labor: 44% of refugees perform semi- and unskilled activities compared to 13% of native Germans [180].

### Impact on the Mittelstand:

Traditional and rigid corporate structures often characterize Mittelstand companies. Adjusting to the current trends and regulations in diversity management poses a serious challenge. Especially when it comes to integrating foreign workers, employers are forced to invest significant resources into employees while facing uncertainty about their right to stay. However, Mittelstand needs to adjust to this regulatory environment regarding DEI to remain attractive to the young, skilled workforce. Once employers embrace diversity, they can also benefit from increased productivity and profitability.



# ECONOMIC TRENDS

IN TIMES OF DEMOGRAPHIC CHANGE AND GLOBAL TENSIONS

Facing Unstable Supply Chains

Finding Skilled Workers

Increasing Transformation Pressure

Shifting to Circular Economy

Increasing Financial Burdens

Milana Gurbanova



Niclas Heun



Andrei Nazarov



Lisa Schmierer



Leopold Wieser



# ECONOMIC TRENDS

## In Times of Demographic Change and Global Tensions

With 6.1m companies, 40.6m employees, and 5.1tn EUR of turnover, the Mittelstand is the backbone of the German economy and the recipe for the success of the post-war period in Germany [181].

Mittelstand companies funded after the Second World War enabled the economic uprise and are crucial to today's living standards. But what has been a glorious story in past decades is causing German politicians and economists more and more headaches: international competition challenges the status of Mittelstand companies, a lack of skilled workers threatens their productivity, and digitalization falters in many cases. Companies that were once pioneers in their fields find it difficult to keep up with current progress.

In addition to the economic megatrends of recent years like digitalization, two major crises keep changing the financial landscape. COVID-19 has led to production reaching a standstill from one day to the next. Not only the international movement of people but also international trade was disrupt-

ed, and supply chains were disturbed. It was the beginning of the biggest economic downturn since the financial crisis in 2007/2008. Even before this crisis was over, Russia's attack on Ukraine shocked international relations and global markets. Since then, sanctions have worsened the economic mood, as rising costs dampen economic growth. Not only private households but also companies struggle with high prices for energy and raw materials, and some business areas even became unprofitable over the past months.

As much as energy prices determine the news in the short term, the long-term economic perspective is heavily influenced by climate change. Against the backdrop of an economy that needs to be decarbonized, Mittelstand companies will be striving to use resources more efficiently and to decarbonize their manufacturing processes. During this transition, they will have to overhaul whole product lines, as some products might even become obsolete. This holds true, especially in the car manufacturing industry, which needs to transition from conventional to electric-driven vehicles.

Innovation is one of the important keys to mastering this transition. The problem is: it becomes more and more difficult for companies to find skilled workers who can guide and determine this process. Although the labor shortage problem has been known for years, the implications for the Mittelstand are current. Within 15 years, most baby boomers will have retired, and the number of missing workers is expected to rise even further.

The developments mentioned above confront Mittelstand companies with challenges. However, they also provide the potential to discover new markets and explore future-proof paths to maintain and stabilize the backbone of the German economy.



# FACING UN-STABLE SUPPLY CHAINS

## Geopolitical Instability Revealed the Fragility of Supply Chains

In recent decades, companies optimized supply chains to minimize product costs. This meant relying on international markets and outsourcing production to low-cost countries. Long-term cooperation agreements further enabled cost minimization. By committing to long-lasting relationships with single suppliers, sellers could offer better prices due to larger purchase quantities over time. Another important factor in reducing costs concerned stocks: companies scheduled supplies to arrive just in time for production, reducing storage capacities and related costs [182]. However, in recent months, geopolitical instability disrupted international supply chains. Crises like COVID-19 revealed the fragility of supply chains. Especially due to just-in-time delivery, delays made whole chains collapse. Lockdowns and associated production downtime in foreign countries often led to a shortage in supply for European companies [183]. Affected companies needed to slow or partially shut down production, resulting in delayed deliveries and a significant increase in lead times for new orders or even the need to turn down orders [184].

### Facts:

- 73% of Mittelstand companies experienced supply chain issues during the pandemic, and over 40% are committed to modifying their supply chains [183].
- Up to 48% of Mittelstand companies faced a supply lack in 2021, especially in the manufacturing and construction sectors, where 78% of Mittelstand companies faced supply chain issues [185].
- Around 60% of German companies experienced additional supply chain issues through the Russia's war of aggression in Ukraine [186].
- 25% of Mittelstand companies increased prices due to supply shortages [185].

### Key Drivers:

- The pandemic caused global production lockdowns. Especially the Asian market, a critical supplier, faces ongoing lockdowns and strict quarantine regulations [187], [188].
- In the beginning, rapid changes in demand due to restrictions and lockdowns, followed by a wave of restocking and increased stockpiling of companies, amplified pressure on supply chains [189], [190].
- International relations are stressed by the ongoing war and accompanying sanctions.
- Instability is amplified by the decreased reliability of the global containerized logistics market, which, e.g., is manifested in a delay increase of up to six times since 2021 [190].

### Challenges:

- Large companies will be required to focus more on global multi-sourcing. However, special design and small quantities present significant burdens for the Mittelstand and hence introduce (too) high costs for Mittelstand companies to find new suppliers [184].
- Strengthening the supply chains with existing suppliers requires the Mittelstand to build up larger stocks and technology or process enhancement to be able to supervise the supply delays [184], [188]. Consequently, higher working capital and investments into new technologies and competencies are required.

### Impact on the Mittelstand:

Most Mittelstand companies have been facing ongoing supply shortages and an impairment of their production [184], [188]. As the near end of these geopolitical instabilities is not in sight, a strategic shift towards robustness-optimized supply chains is happening [185]. This includes increasing the visibility of delays through digitalization and mitigating the risk of complete supply breakdowns by using multiple suppliers for critical components. Furthermore, the lack of supply requires the Mittelstand to allocate more resources to procurement and incentivizes them to build up stocks [185]. In the long run, the Mittelstand needs to find a balance between the optimization of the costs and the robustness of the supply chains.





# FINDING SKILLED WORKERS

## The Lack of Skilled Workers Risks Future Development and Limits Growth

Many Mittelstand companies name labor shortage the biggest threat to future development [191]. Although COVID-19 initially mitigated the lack of skilled workers, the number of job vacancies is increasing again after lockdowns. Due to low birth rates in Germany, experts assume this trend to become even more critical throughout the next years. The number of young people entering the labor market will not be able to fill the gap baby boomers leave behind when retiring. Especially for positions in production and technical areas, Mittelstand companies struggle to find skilled workers [192]. Often employers must lower skill requirements, hire unqualified workers and provide further internal training, and require current employees to work overtime [193]. Still, many companies cannot fully utilize their production capacities because there is insufficient staff to operate machinery. Consequently, they must turn down orders, causing the German economy to miss billions of potential profits each year. Simultaneously, rising salaries increase costs for companies. Not only do the financial consequences of labor shortage threaten future competitiveness – since companies struggle to find workers with the required skill sets, but it also becomes increasingly difficult for them to drive innovation.

### Facts:

- 80% of Mittelstand companies had problems finding qualified staff as of January 2022. That is ten percentage points more than the previous year [194].
- By 2036, 12.9m people (the “baby boomer” generation) will have retired, which corresponds to nearly 30% of the active labor force in 2021 [195].
- The Mittelstand lost 64.1bn EUR of sales potential due to labor shortage as of 2018 [196].
- Two in three companies plan to increase their salary budget, most of them to attract new employees [197].

### Key Drivers:

- The birth rate in Germany rose to 1.49 children per woman in 2021. However, this is not enough to stop the aging of society. The retirement of baby boomers will tighten the labor market even further in the coming years.
- The share of pupils obtaining a degree that qualifies them for university studies steadily increased over the past years. At the same time, the number of unfilled apprenticeship positions is rising [198], [199].
- Furthermore, with 77.54% of the German population living in urban areas, Mittelstand companies in the countryside lack access to most of the workforce.

### Challenges:

- High salary expectations of skilled workers make it difficult for Mittelstand companies to compete to acquire new talent.
- Apart from financial aspects, many Mittelstand companies struggle to stay attractive to young people, who have less interest in much-needed apprenticeships but are driven to higher education [200].
- Digitalization requires different skill sets of employees to manage the digital transformation within the company and transition existing products to modern technological standards.

### Impact on the Mittelstand:

Every second company faces losses from rejecting offers due to labor shortages [196]. Labor shortage threatens not only current success but also future development and competitiveness. Even if companies are willing to push ahead with digitalization, they often lack the skilled labor to implement digital transformation. To counteract this, Mittelstand companies must become more visible and attractive to skilled workers. This includes not only pay but also the provision of flexible and mobile workplaces [200]. Creating remote positions is also a chance for the Mittelstand to stand out, as potential employees do not have to relocate to rural areas.

# INCREASING TRANSFORMATION PRESSURE

## Technological Advancement and Societal Pressure Push the Mittelstand to Drive Innovation

Substantial parts of Mittelstand companies rely on the demand of a few big Original Equipment Manufacturers (OEM) [201]. By tailoring products to OEMs' needs, many mid-sized companies become champions in their field. This specialization leads to a narrow focus and dependency on a few specific buyers. These dependencies threaten the existence of Mittelstand companies when the needs of those few customers change due to entire sectors pivoting toward electrification and sustainability. A prominent example is the automotive industry, upon which many Mittelstand companies depend. With car manufacturers like Volkswagen (VW) and Audi shifting production away from vehicles powered by Internal Combustion Engines (ICE), suppliers for parts of ICE like fuel injectors will become obsolete [202], [203]. This transformation puts the respective suppliers under pressure to innovate. However, decades of success with products whose core technology hardly changed often leave company leadership alienated by rapid technological advancement. Additionally, the economic impact of COVID-19 and broken supply chains caused by war and political uncertainty made it crucial for the Mittelstand to adapt and innovate to survive.

### Facts:

- Many Mittelstand companies have a narrow product portfolio that relies on the demand of a few big OEMs [201], [204]. The most striking shifts are seen in the automotive industry, where some OEMs like VW will shift away from ICE by 2026 [202].
- With 90% of Mittelstand leaders coming from the manufacturing industry and 24% of Germany's gross industry

## Economic Trends

revenue being generated within the automotive industry, it is the German economy's backbone [205], [206].

- Margins of automotive suppliers dropped by 62% during the pandemic. This shows their little resilience in the face of crisis [207], [208].

### Key Drivers:

- In an interconnected world, digitalization is expected by partners and customers but also opens new product possibilities.
- With international industrial sectors closing the technological gap, competition forces Mittelstand companies to innovate.
- Rising energy prices caused by the Russian war in Ukraine require manufacturing companies to reshape their production lines towards better energy efficiency to stay profitable [209].
- Increased societal and environmental awareness shifts the automotive industry from ICE to electric mobility, increasing taxes on CO<sub>2</sub> emissions and environmental reporting guidelines.

### Challenges:

- With changing product strategies of their OEMs, Mittelstand companies will have to either diversify their products, adapt to new demand, or explore new markets.
- Keeping up with an increasingly digitized environment, companies must invest in the retraining of their aging workforce to stay relevant and connected.
- Facing a "stagflation" (high inflation rate, low economic growth) and insufficient access to institutional funding, Mittelstand companies will have to find investors and partnerships for transformation or strategic advice.

### Impact on the Mittelstand:

Heading towards an electrified, digitized, and interconnected world, Mittelstand companies need to adapt to changes in the underlying conditions. For many companies, it is crucial to transform towards future-proof technologies and products to stay competitive. Especially for suppliers of the automotive industry, this means rethinking existing products and value chains compared to vehicles powered by conventional combustion engines. This example, however, is only the tip of the iceberg, making way for transformations across several industries, such as steel and cement production.



# SHIFTING TO CIRCULAR ECONOMY

## Efficient (Re-) Use of Resources Provides the Potential for Further Value Creation

The “take, make, waste” approach of the linear economy has delivered significant economic growth over the past 200 years [210]. However, in times of growing scarcity of raw materials and increasing climate protection requirements, the alternative concept of the circular economy is gaining momentum [211]. The circular economy is an economic system focusing on the lowest possible use of raw materials and a product design based on durability, reparability, and recyclability [211]. As an internationally renowned manufacturing base, Germany benefits from circular economy practices, which help increase raw material productivity and create high-quality jobs [211]. For Mittelstand companies, shifting from linear to circular business models can be especially important to meet new consumer expectations and remain competitive. However, on the way to sustainable development, companies face several regulatory, financial, and collaborative challenges that all actors throughout the supply chain need to address.

### Facts:

- German industry is dependent on specific materials and natural resources. Companies import all the metal ore they need for production [212].
- By reducing dependencies on the import of raw materials, an additional gross value of 12bn EUR per year can be achieved [213].
- Collaborations between industries (e.g., textile and logistics, automotive and retail) help companies close material cycles, substitute resources, and increase material efficiency. However, of all possible cross-industry collaborations in Germany, only 43% are already established on a large scale [214].

### Key Drivers:

- Recovering raw materials that are disposed of in the linear “take, make, waste” system could boost Europe’s resource productivity by 3% by 2030, generating cost savings of 600bn EUR a year [215].
- Consumers are changing their preferences from owning to sharing and expect businesses to be environmentally conscious and socially responsible [216].
- Innovative technologies make it possible to extend the product lifecycle and keep materials in the loop longer [216].
- Increasingly scarce resources and unreliable supply chains increase prices for acquiring new raw materials, leading to an increasing value of waste streams [211].

### Challenges:

- The lack of a regulatory framework with clear goals and standards hinders businesses from executing circular economy strategies [217].
- The circular economy debate in Germany concentrates on waste management, giving too little attention to technical optimization measures that can expand economic and ecological potential [218].
- Actors along the value chain mainly concentrate on chain elements, which hinders the implementation of the circular economy [218].
- Implementing circular economy practices requires a significant upfront investment, which is exacerbated by limited funding for circular business models [219].

### Impact on the Mittelstand:

The transition to a circular economy is not only a step toward a sustainable future but also an opportunity for Mittelstand companies to secure competitive advantages, create new revenue streams, and increase their resilience to external influences like rising prices for raw materials. Enterprises must redesign their business models to deliver the value proposition in a circular way, which might mean rethinking processes and finding completely new approaches. In turn, policymakers need to establish transparency for actors in value networks, introduce economic incentives, and scientifically support technologies and knowledge building for Mittelstand companies [211].

# INCREASING FINANCIAL BURDENS

## Rising Costs for Energy and Commodities Threaten Profitability

Second to labor shortage, companies name increasing prices for energy and commodities as the highest risk for their future development and profitability [220]. One central cost driver is the ongoing COVID-19 pandemic: due to strict lockdowns, especially in Asian regions, productions still face shut-downs. Therefore, some deliveries are late or even get canceled, causing ripple effects through global supply chains. This supply scarcity has driven up costs along the entire value creation chain, including consumer end prices. Another important factor is the war in Ukraine, which has increased geopolitical tension and instability [221]. The combination of these effects complicated production and made international trade highly unpredictable for companies. The decision of the European Central Bank to increase prime rates failed to noticeably decrease inflation rates [222]. As a result, economic growth stagnates, and global inflation has risen sharply from its mid-2020 low.

### Facts:

- In June, inflation in the Eurozone rose to 8.6% compared to the same period last year. This is an all-time high since the common currency was introduced in 1999 [223].
- As a result of the imposed sanctions against the Russian Federation, the energy costs of Mittelstand rose by 54% from January to April 2022. This affected at least 2.1m Mittelstand in the EU alone [209], [224].
- 20% of companies needed to turn down orders since production costs were too high. 27% of companies turned down offers due to a material shortage [220].

### Key Drivers:

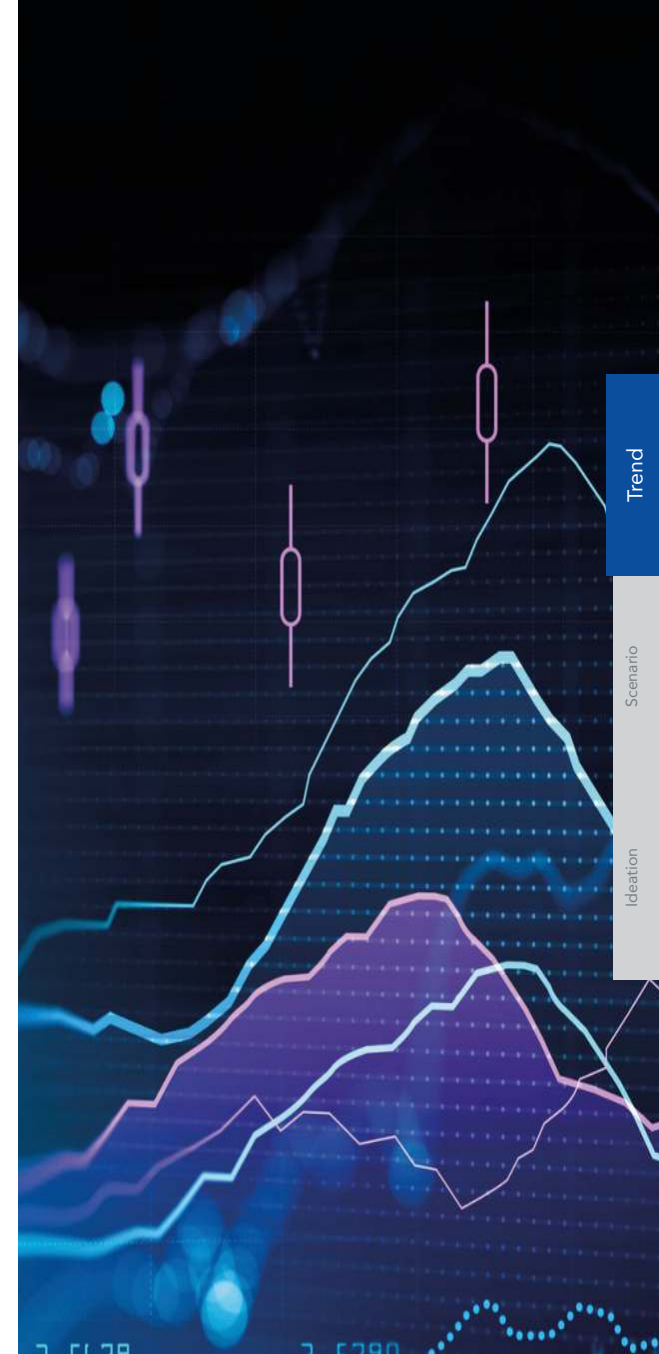
- As a reaction to the ongoing energy and fossil fuel scarcity, energy and raw materials prices have been consistently rising [225].
- Since international logistics have, in some parts, still not recovered from the effects of the pandemic, companies struggle to meet the demand, which drives up prices even further [190].
- Geopolitical tensions and regulations resulting from the Russian war in Ukraine have led to high uncertainty. For this reason, companies often shy away from investments needed for economic growth [226].

### Challenges:

- German companies fight to stay competitive in the face of rising costs for raw materials, labor, and energy [227]. This is especially relevant for Mittelstand, which are dependent on resources that cannot be domestically produced [228], [229].
- Mittelstand companies must deal with organizational and operational challenges in times of economic instability, partially caused by changing regulations and global crises [209].
- Major banks increasingly withdraw from the Mittelstand segment. As a result, it becomes more difficult for Mittelstand companies to get financing, and the fight for bank loans increases [230], [231].

### Impact on the Mittelstand:

In the next five years, the rising costs for Mittelstand companies will endanger the profitability of several business sectors, leaving Mittelstand companies in the construction and manufacturing sectors especially vulnerable due to a particularly strong dependence on fossil fuels and raw materials [232], [220]. At the same time, Mittelstand companies should find ways to reduce energy consumption and switch to renewable energy sources to reduce costs [233]. For a meaningful share of Mittelstand companies, this has already proven itself as an attainable goal to get liberated from fossil dependence [234]. The additional expansion of domestically produced energy is an opportunity to become more independent of foreign suppliers. This trend will be pushed more strongly in the future [233].





# **BUSINESS MODEL TRENDS**

**FOR A VOLATILE AND COMPLEX MARKET**

**Manufacturing-as-a-Service**

**Energy Prosumers and Sector Coupling**

**Digital Servitization**

**Merger and Acquisition Movements**

**Flexible Manufacturing**

**Joining Ecosystems**

Cyrine Chaabani



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# BUSINESS MODEL TRENDS

For a Volatile and Complex Market

The business model constitutes the cornerstone of any company's identity. It governs the product offers and defines the created value, and dictates mechanisms through which revenue is generated, and profit is achieved. Bearing in mind the sheer breadth and size of the Mittelstand, one can only begin to imagine the wide range of business models present across numerous sectors. Most of these firms have existed for generations and have had clearly defined procedures for running their business.

However, the recent geopolitical and environmental developments combined with the emergence of disruptive technologies at an unprecedented pace have made market conditions more volatile and complex than ever. This imposes several challenges on Mittelstand companies, thus increasing the need for action. The structural shift from combustion engines to electric vehicles worldwide is one such development already having tremendous implications on the Mittelstand. Another challenge worth mentioning in this context

is the ever-growing number of digitalized and software-driven competitors that are increasingly attractive to long-term Mittelstand customers. Furthermore, the entry of emerging players from different industries and geographies has notably increased the competition on a global scale. The resulting innovation pressure, paired with the high investments usually required to solve these issues, adds yet another layer of complexity to the problem. In addition to all the previously mentioned paradigm shifts, demands for sustainability and energy transition are equally on the rise. Undoubtedly, tackling these challenges would involve profound transformations in the concerned enterprises, which will eventually impact their business models.

This report dives into six business model trends identified and deemed particularly relevant: Energy Prosumers and Sector Coupling, Flexible Production, Digital Servitization, Manufacturing-as-a-Service, Joining Ecosystems, and Higher Merger and Acquisition (M&A) Rates. These trends are highly

intertwined and will play a key role in shaping the future of the Mittelstand. The following pages will further elaborate on these trends, thoroughly present key drivers and challenges that each of them engenders, and finally discuss their potential impact on the Mittelstand.



# MANUFACTURING-AS-A-SERVICE

## Provision of Physical Manufacturing Resources and Capabilities As-A-Service

The business model of Manufacturing-as-a-service (MaaS) aims to share distributed manufacturing capabilities and resources to enable a more efficient production process and streamlined customer relations. MaaS relies on a platform that intermediates between manufacturing providers, product development, and customers seeking manufacturing services. On these platforms, manufacturing providers can integrate their manufacturing capacity planning, thus adjusting their manufacturing services offering dynamically. As another advantage, it may soon even be possible for them to leverage collected data to estimate the utilization and available capacities, hence generating fine-grained statistics to optimize production processes [235]. To mention one relevant example, Xometry Europe is one of the leading European Manufacturing-as-a-Service Platforms. Xometry offers manufacturing services for Computerized Numerical Control (CNC) processing and 3D printing. Furthermore, it provides advanced services such as instant quoting Computer Assisted Design (CAD) modules, intelligent capacity management, and live status tracking to streamline the customer experience. This model was resilient to supply chain disruptions, thanks to its vast network of on-demand manufacturing capacities [236].

### Facts:

- The transition from mass production to personalized and customer-oriented manufacturing is a promising approach to improve and secure the future competitiveness of the European manufacturing industries [237].
- Outsourcing highly technical and demanding production parts leads to higher productivity and lower costs because companies do not need to spend a significant initial investment to buy heavy machinery and employ experts [238].

- The competitive advantage of companies today increasingly stems from enhancing product-service innovation [239].

### Key Drivers:

- Deep tech advances rapidly, making machinery increasingly expensive [240].
- Industry 4.0 and servitization are two trends that together are transforming the manufacturing industry [239].
- The simultaneous acceleration of Industry 4.0 and servitization in 2020 during the COVID-19 crisis has created an unprecedented opportunity for manufacturers to adapt to new business models [239].
- Technological innovations such as 3D printing, the internet of things, artificial intelligence, and big data improve the facilitation of MaaS [235].
- Market-related drivers such as shorter product life cycles, individualization, and global competition [235].

### Challenges:

- Small companies need advanced information technologies knowledge to establish technical platforms that use algorithmic match-making of available machinery capacities and the offered products to the customers [235].
- It is challenging to offer individualized products to a global market while being efficient when only producing product series on a smaller scale [235].
- Globalization and individualization lead to increasing specialization of companies and thus stronger international competition [235].
- Specialization will reinforce the pressure on the companies to be more efficient and thus transition rapidly to using intermediate platforms [241].

### Impact on the Mittelstand:

Due to rapid technological advancements [242], machinery is expected to become more capital-intensive [240]. MaaS offers a capital-light alternative to manufacturing and thus will become a major manufacturing model in the future. Especially for Mittelstand companies, outsourcing manufacturing processes via MaaS will be more attractive due to the high initial capital needed to acquire machinery. In addition, MaaS is a way to tap highly specialized engineering services, improving the overall product development process and offering options for potential cost reduction [238].



# ENERGY PROSUMERS AND SECTOR COUPLING

## Energy-Consuming Industries are Integrated Into the Energy Production Infrastructure

Rising energy prices and energy insecurity are causing Mittelstand companies to rethink their energy strategy [243]. More and more companies move away from being only a consumer of energy towards also producing renewable energy for meeting parts of their consumption, thus becoming “prosumers” [244]. The so-called sector coupling represents an essential step in reducing the curtailment in the energy transition, as industry, transport, and construction companies are integrated into the energy production and storage infrastructure [245]. These activities lead to greater integration of a company into local ecosystems and energy clusters [246]. This regionalization improves the harmonization of supply and demand imbalances on a local level and fosters growing energy independence from the rest of the grid [247]. With a growing portion of Mittelstand companies identifying the potential of photovoltaic deployment [248], there are first projects of geographically close companies partnering with external providers and developers to install integrated and connected energy systems and storage solutions [249].

### Facts:

- 81% of Mittelstand company managers identify energy cost as one of the three most important challenges [250].
- The CO<sub>2</sub> certificate mechanism has been expanded to the heating and transportation sector on a national level, with significant energy carriers to follow in 2022 and 2023 [251].
- As of 2022, drawing electricity from energy suppliers will be more expensive than self-sufficiency through combined photovoltaic and storage systems in Germany [244].

- Motivated by lagging regulation, potentials from sector coupling for the energy transition on a local level are currently still underutilized [252].

### Key Drivers:

- Rising energy prices are not a temporary issue based on geopolitical tensions, but prices are projected to stay at a high level over the next decades based on increasing costs for CO<sub>2</sub> certificates and the structural shift towards renewable energy sources [253].
- Increasing regulation from the EU and the German government, such as the Green New Deal, is enforcing the transition of most industrial sectors towards an electrified economy, significantly increasing electricity requirements compared to the current energy landscape [254].
- Progress in power-to-X technologies fueled by interest from the industry and the financial sector leads to a reduction in premiums and improved profitability [255].

### Challenges:

- Even when projects might be profitable, investment and compliance requirement might be too substantial for some Mittelstand companies who are already facing issues in securing financing for new investments [256].
- For the deployment of new energy systems and the expansion of the business model to become an energy provider, completely new capabilities are required, which are difficult to acquire as even established installers struggle with a lack of skilled labor [253].
- The individually most efficient sector-coupling technologies will vary by application, region, and market conditions, requiring effort for a tailored solution [257].

### Impact on the Mittelstand:

Due to rising energy prices, Mittelstand companies will become increasingly self-reliant in their energy supply. The intermittency of renewable energy sources will lead to increased integration into ecosystems to balance demand and supply gaps with geographically close peers. To achieve this integration, the energy infrastructure will not only be more decentralized, but also increasingly digital and connected in local hubs. To reap the benefits of sector coupling Mittelstand companies will rely strongly on external service providers to develop and manage energy systems on their premises.



# DIGITAL SERVICITIZATION

## Integration of Digital, Data-Driven Services with Physical Products in Manufacturing

The process of servitization refers to transitioning from a product-centric business model, essentially focused on selling products, to a service-oriented business model, which is rather oriented on providing services and solutions [258]. At the convergence of servitization and digital technologies, Digital Servitization leverages Industry 4.0 technologies to facilitate the provision of these services [259]. As an example, manufacturers may integrate digital sensors and wireless connectivity and leverage cloud computing to provide machinery that records its status via data streaming, e.g., to monitor processes constantly and to carry out corrections and repairs preemptively. In combination with artificial intelligence, systems become increasingly self-learning, thereby becoming capable of autonomous improvements [260]. Using this data, the Mittelstand can offer flexible monetization such as “pay-per-use” models, and enable digital service systems throughout the machine lifecycle, e.g., for the sake of remote usage monitoring and predictive maintenance [261]. As a consequence, on the one hand successful Digital Servitization improves manufacturers’ competitive advantage and creates new revenue sources, but on the other hand it also requires knowledge and capabilities in data-driven, digital technologies [262].

### Facts:

- 49% of SME CEOs declare Industry 4.0 as an important strategic direction for their company, and ever more increasing importance is expected [28].
- Customer requirements are changing towards customization and digital service offerings [263] and increasing demand to tap supplier competence, reduce operational risk, and improve cash flow management [264].
- TRUMPF, a manufacturing SME, offers laser cutting machinery in a pay-per-use model [265], and the company ISW-Technik provides digital condition monitoring as-a-service for their pneumatic pumps [266].

### Key Drivers:

- Lower barriers to implementing Industry 4.0 technologies are driven by lower hardware and software costs, improved broadband infrastructure, dissemination of technical standards, and broad political support, e.g., by the establishment of 27 competence centers in Germany [267], [268].
- Cross-industry competition is increasing due to new data-driven competitors (e.g., Google entering automotive) [267], [269].
- The need for a more resilient source of income, less dependent on economic cycles affecting investment activities and disruptions such as COVID-19 for manufacturers [270].

### Challenges:

- Increased data security risk due to bi-directional data transfer requires strong data security. Additionally, high levels of cloud infrastructure reliability are required [271].
- It will be challenging to maintain legal security in a changing regulatory environment with regard to General Data Protection Regulation within the European Union, as well as industrial espionage concerns [267].
- To achieve a successful go-to-market of digital services, a shift in the development process from product-centricity to customer-centricity is needed [272].

### Impact on the Mittelstand:

McKinsey expects a “seismic shift in value concentration within the digital technology stack from the hardware layer to hardware-software-services offers” [273]. For the Mittelstand, Digital Servitization offers a way to tap this emerging value pool. As-a-service IoT (e.g., predictive maintenance) and flexible monetization (e.g., pay-per-use) allow perpetual revenue streams instead of one-off asset sales. The customer value is evident: lower and less risky up-front investments in pay-per-use models, as well as a holistic integration of product and service [261]. Manufacturers integrating these offerings may opt for partnerships with research institutes, such as those of the Fraunhofer Society, and specialized software companies to build the required digital competencies [274].



# MERGER AND ACQUISITION MOVEMENTS

## Higher Market Pressure Drives M&A Activities

Mittelstand companies in Germany are facing significant challenges beyond the COVID-19 crisis. Skilled labor shortage, disruptive technologies, resource scarcity, saturated markets, and demographic change are just a few examples they are confronted with [275]. To remain competitive (and to grow), more companies are faced with the decision to buy from competitors or sell their business. Traditionally, organic growth was the most commonly used option to accelerate growth [276]. However, a lack of internal resources and competencies has made it impossible for some Mittelstand companies to position themselves more competitively for organic growth. On top of the lack of internal growth opportunities, acquisition and consolidation movements of competitors pressure companies to investigate inorganic growth options through the acquisition of a company or, as a last resort, the sale of their venture. From a business model perspective, being acquired is a way to change and evolve a company's business and support the acquirer's competitive advantage [277]. More specifically, a merger of two companies affects various aspects of the business model, including a more effective cost structure, new revenue streams, and – in some cases – a new customer value proposition from the acquired business model [278].

### Facts:

- 78% of all Mittelstand companies are planning an acquisition in the next five years [279].
- In 2021, M&A activity in Germany reached a new high at 2,165 transactions, with Mittelstand companies accounting for over 90% of those [279].
- 7% of all Mittelstand companies want to hand over the reins to a successor in the next two years [275].

## Business Model Trends

- Two-thirds of Mittelstand companies have already made an acquisition, and the majority of Mittelstand companies regard the sale of their company as a relevant topic [277], [279].

### Key Drivers:

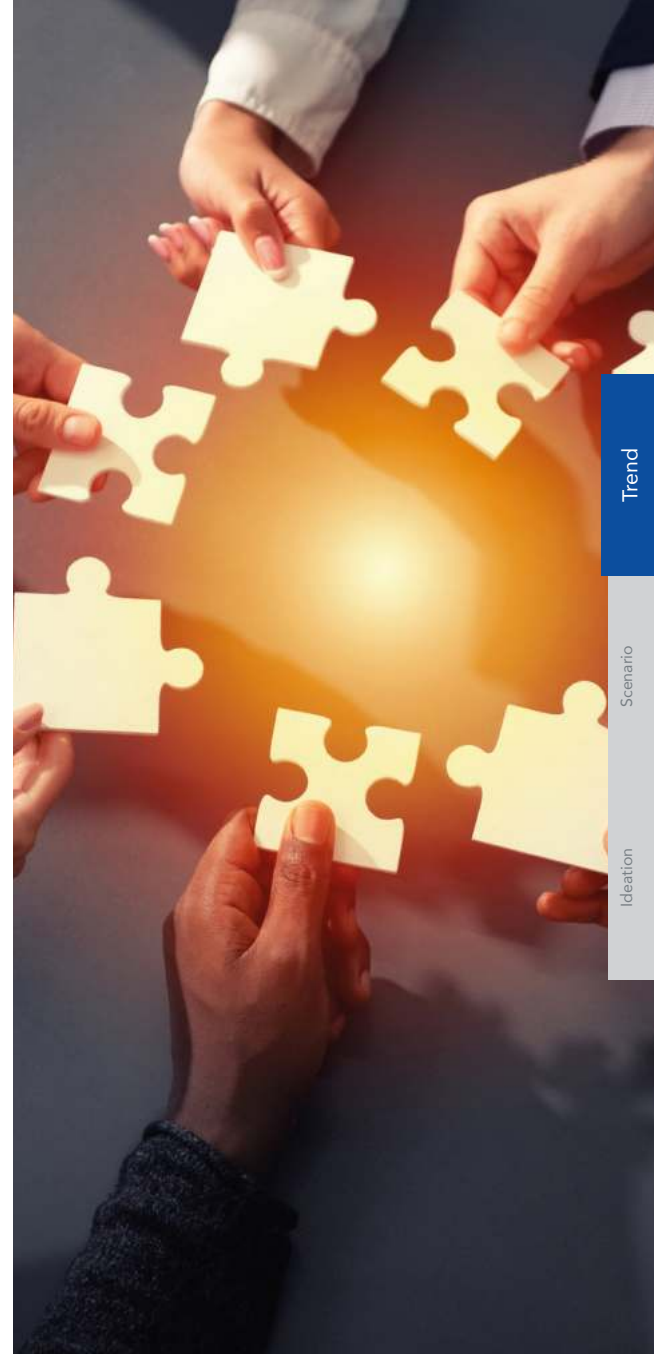
- Mittelstand companies face higher pressure due to uncertainties in the market, including the effects of the war in Ukraine, rising energy costs, and supply chain disruptions [277].
- Family-run businesses lack suitable successors due to demographic change or deviating life plans of planned successors [275].
- Many Mittelstand companies lack the capabilities and resources to accelerate growth within their company; especially after the COVID-19 pandemic, many could not keep up with the rapid digital progress and now have to either buy digital competencies or sell their company [280].

### Challenges:

- In addition to the growth benefits, M&A bears the risk of declining efficiency due to the integration of an additional business, so companies face the challenge of balancing growth and efficiency goals [275], [281].
- Companies face critical challenges along the M&A process, particularly finding a target company, and the subsequent integration poses problems [275].
- Two-thirds of all Mittelstand companies do not feel well prepared for M&A because they lack the organizational structures to pursue M&A opportunities or resources to acquire suitable targets [275].

### Impact on the Mittelstand:

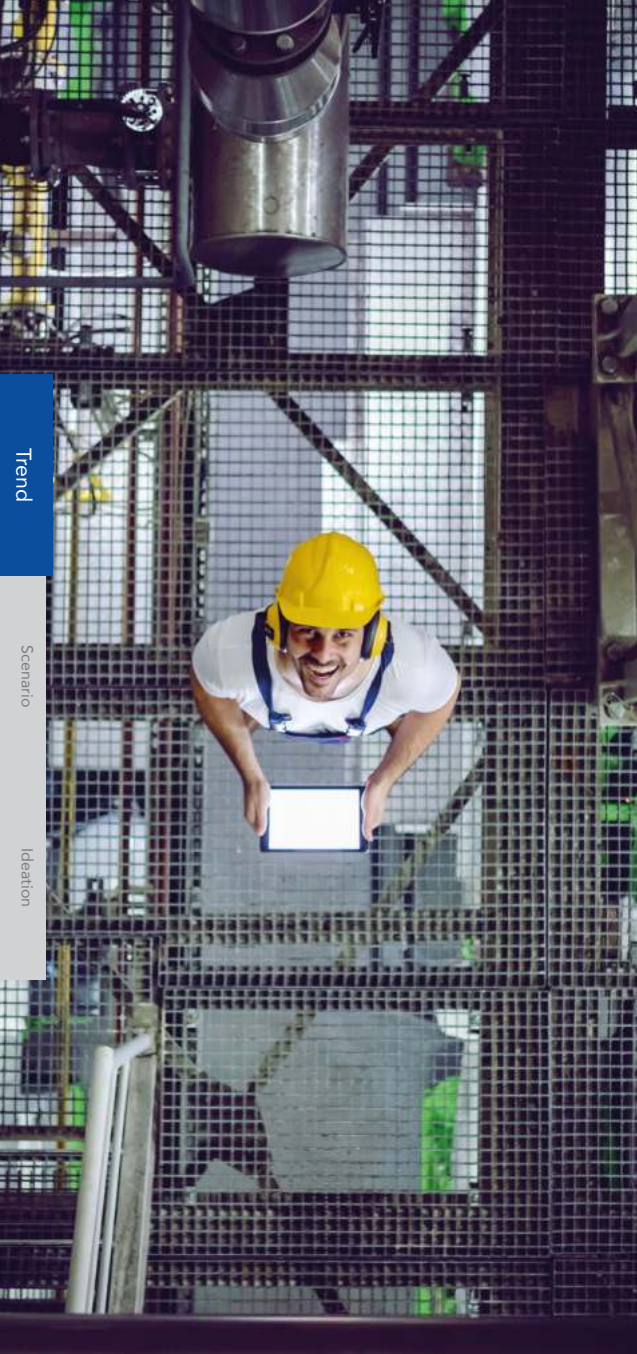
In addition to their internal problems, such as a lack of digital skills or financial resources to pursue external growth, Mittelstand companies also feel increasing pressure from market developments and crises, further driving up M&A activity. This has the potential to change market structures fundamentally. New players emerge, competitors vanish, and new threats and opportunities arise. M&A is an option for growth, as well as a means to form deep strategic partnerships. Specifically, the growing influx of private equity companies offers new avenues to access capital.



Trend

Scenario

Ideation



# FLEXIBLE MANUFACTURING

## An Increase in Market Volatility and Complexity Requires Companies to Change Their Manufacturing Paradigms

Rapid technological advancements push manufacturers continuously to enact design updates to their production lines and venture into new markets with better prospects. This endeavor has proven to be difficult and time-consuming due to the fixed nature of the assets within facilities. Furthermore, a major hurdle is the ever-growing customer demand for faster delivery and more customization [282]. One approach that tackles these significant challenges efficiently is building agile factory floors, thus allowing manufacturers to swiftly react to these increasingly relevant challenges with little incremental cost to their existing production base. One particular enabler of manufacturing flexibility is the modular design of production and assembly [283]. This paradigm shortens both the product life cycle and the time to market, which is linked to a maximization of production capacity, reduction in costs, and improved overall efficiency. This industrial transformation is proven to help companies integrate market demands, develop competitive technologies and further enhance existing products which has led to its increase in popularity, hence turning it into a trend.

### Facts:

- An agile production reduces the planning and management needed to fulfill customer demands and saves costs by up 30% [282].
- Using flexible manufacturing, manufacturers can boost their productivity by as much as 30% [261].
- The ability to respond rapidly to new orders or consumption habits is crucial for survival, particularly due to the increase in volatility and complexity of markets [261].
- Several businesses face the threat of becoming obsolete; having an adaptive production chain can help readjust the entire pipeline to a new market [284].

### Key Drivers:

- Technological progress in robotics and IT, along with increasing data availability for better customization and automation, have made the switch to flexible manufacturing more accessible and attractive for businesses [283].
- Due to the emergence of disruptive technologies that affect B2B businesses, the Mittelstand needs to adapt its production to keep up with the pace and retain its customers [284].
- Interest in customized products versus one-size-fits-all is increasing internationally [283].
- The entry of new data-driven competitors from outside the traditional industry, e.g., Google, Amazon, and Apple, requires flexibility and technological enhancement in the Mittelstand product portfolio to remain relevant [261].

### Challenges:

- Finding suitable markets to migrate to and acquiring new customers [284].
- Implementing a flexible manufacturing paradigm requires a significant financial investment upfront [283].
- Tremendous changes in the organizations and the mindsets of managers and employees are required as well as cross-department collaborations and retraining of the workforce [261].

### Impact on the Mittelstand:

Flexible manufacturing is expected to play a crucial role in alleviating significant challenges the Mittelstand is currently facing. It is projected to not only adapt products to different markets and customer customization easier but also to equip Mittelstand companies with the right tools to improve their response time to crisis and fluctuating demands, which opens a wide range of novel opportunities to the enterprise for business partners and customer base expansion [282]. In fact, its primary value offering stems from its capacity to pave the way for hybrid products and services. Finally, the agile factory facilitates the introduction of pay-per-use and platform-based business models for the Mittelstand [261].

Trend  
Scenario  
Ideation

# JOINING ECOSYSTEMS

## Mittelstand Companies Integrate Deeper Into Ecosystems to Develop and Expand Their Business Models

In the face of rising uncertainty related to regulatory scrutiny regarding environmental impact and the structural shift of the German economy away from the combustion engine, Mittelstand companies are forced to increasingly seek cooperation with universities, startups, and businesses [285]. The goal of such cooperation is to find new ways to deliver the value proposition of existing customers as well as to find new applications for existing competencies that allow tapping into new customer groups and revenue streams [286]. To foster and engage in such cooperation, companies are engaging with ecosystem players to facilitate matchmaking with complementary companies [287] and proactively encourage closer connections with universities to be part of a lively exchange with research and take advantage of new developments in scientific research for their domain of competence. Family offices of Mittelstand companies actively foster innovations in indirectly or unrelated fields by providing financing to startups and spin-offs, with those companies often acting as pilot customers for novel products [288]. The locality of the Mittelstand and interaction with universities results in hubs of related academic experts and companies [289].

### Facts:

- Creating and successfully managing a strong ecosystem is beneficial to a firm [290].
- Patents, publications, and citations from the natural sciences (research output) lead to an increase in the density of companies surrounding technical universities in Germany [291].
- Co-located scientific fields related to technology platforms that institutional entrepreneurs actively shape will be necessary to keep up with global innovation [292].
- Network infrastructure has become more integral than ever to urban competitiveness, business models, and the location decisions of firms [293].

### Key Drivers:

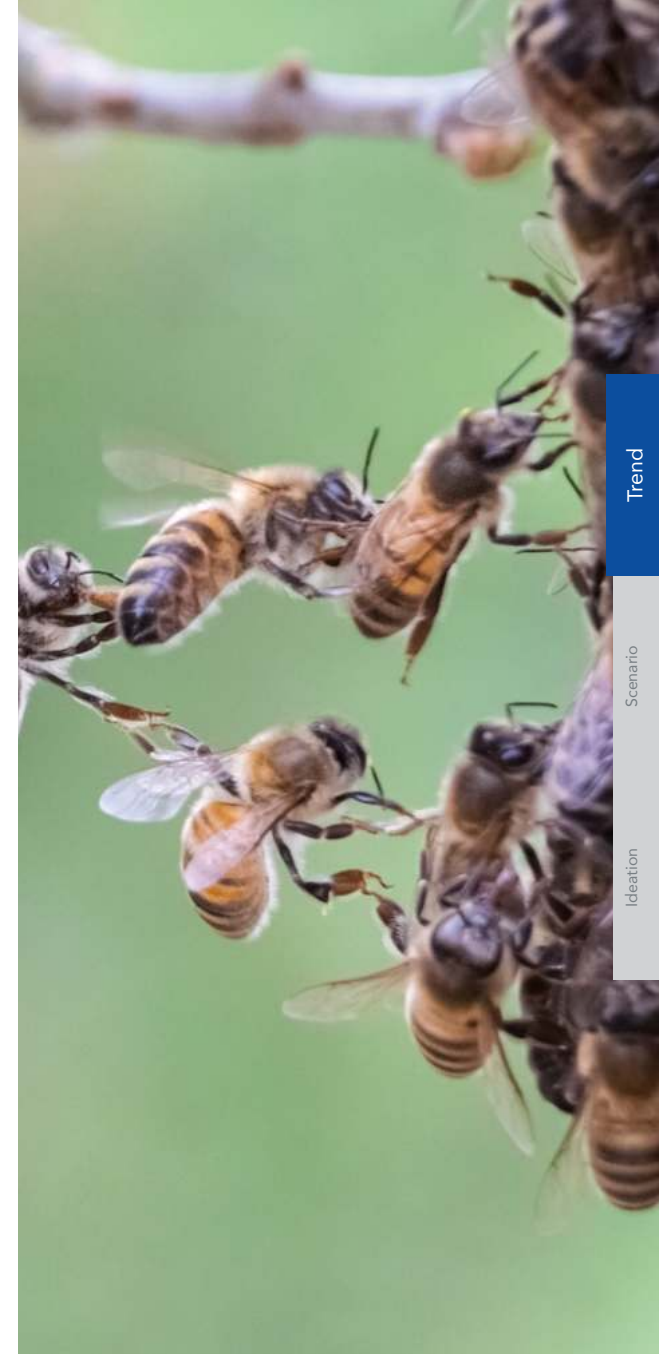
- Progress has accelerated in recent years and will continue to do so in the future, making it crucial for companies to be close with leading scientists in their field [294].
- The shift away from the combustion engine has significant implications for the future viability of many Mittelstand companies' business models [295].
- The German government is committed to funding elite universities to keep pace with rapid technology development worldwide [294], [241].
- Increasing visibility within ecosystems through innovation platforms improves access to partners [296].

### Challenges:

- Due to a reinforcement effect of local hubs, land prices in such areas are becoming increasingly expensive, making it increasingly difficult to locate parts of the business in geographical proximity [291].
- Keeping pace with global innovation, Mittelstand companies and universities must keep up with the world's leading technology companies and institutions [294]. At the same time, highly qualified scientists are poached by large companies with significant budgets, thus making it harder to hire talent [297].
- Reliance on a partner can lead to the hazard of singular dependence [285].

### Impact on the Mittelstand:

Mittelstand companies will increasingly initiate innovation projects with an array of previously unexpected partners to identify opportunities to develop their business models. A stronger focus will be placed on cooperation with leading local universities, with companies becoming more active in the local ecosystems and hubs to gain preferred access to talent and technological advances in their domain. This more open innovation of companies is enabled and accelerated due to their ability to make leaner and quicker decisions compared to corporates, considering their ownership structure.



# SCENARIOS

The following chapter describes four scenarios of different futures. The scenarios are plausible, relevant, challenging, consistent, and recognizable from the present and near future signals. All of the scenarios are equally plausible and derived from two identified key drivers. They present far-reaching visions of what the future of Mittelstand companies could look like in 2042. Personal narratives tell stories of ordinary days in 2042 to allow an in-depth look into the future. Finally, identified signposts indicate the progress towards each scenario. They emphasize possible paths from the present to each of the four scenarios.

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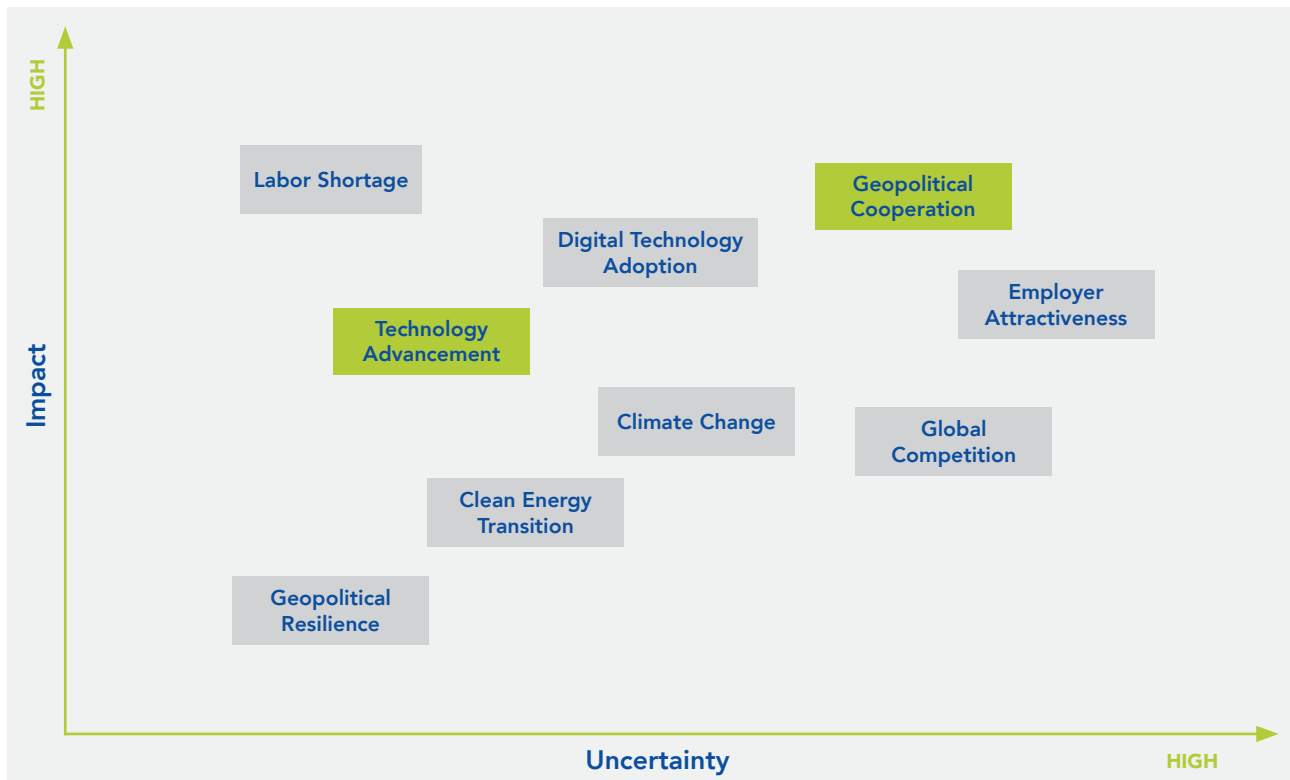
SCENARIO 4  
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# DRIVER MATRIX

The scenario phase follows a structured approach to imagine what life could look like in 2042. Based on the research conducted in the first phase, current drivers with high uncertainty and high impact on the Mittelstand were identified. The drivers, which are forces shaping the future of the Mittelstand, are modeled with plausible yet extreme outcomes. The cor-

responding matrix ranks the identified drivers according to two factors – the magnitude of the potential impact on Mittelstand companies and the degree of outcome uncertainty. Based on these dimensions, technological advancement and geopolitical cooperation were chosen as key drivers, marked in green. Along with other highly impactful and uncertain

drivers, they will be described in further detail in the key drivers' chapter. Using the two selected key drivers, a scenario matrix was constructed, which outlines four possible scenarios for the future of the Mittelstand.



# KEY DRIVERS

## Protectionism

Protectionism is a set of governmental policies that favor the development of domestic companies and impede international trade. Introducing such regulations causes import substitution, production, and distribution localization. In this extreme outcome, the exacerbation of trade tensions will lead to trade tariffs and embargo policies. As such, access to foreign markets will be restricted by sanctions, eventually leading to trade wars and the dissolution of international alliances and associations such as the European Union and the World Trade Organization. In this case, the government will provide subsidies to support weakened Mittelstand industries, which will lose their main markets and struggle to maintain jobs.

## Geopolitical Cooperation

Geopolitical cooperation refers to international actions by governments to jointly address global issues, such as cross-border migration and the accompanying economy-specific impacts. The degree of this driver is measured on a scale ranging from excessive protectionism, which reduces nations' interdependence and forces decoupling, to extensive globalization, in which all countries routinely trade goods and exchange value. In this regard, the extent of future geopolitical cooperation depends on technology, trade parity, and the coherence of national policies on issues such as climate change. Uneven distribution in the global supply chain could push countries to take measures such as trade restrictions to move the offshore business back. In addition, differences in climate change policies across countries can lead to trade imbalances, such as unfair price competition due to carbon pricing, further reinforcing domestic market protection.

## Globalization

Since the end of World War II, globalization has been a strong driver for many global developments, meaning the world has become increasingly interconnected in areas such as the economy, culture, and the environment. In this outcome, the current trends regarding deglobalization, including war and the pandemic, will be successfully overcome. Globalization will experience a revival. The Mittelstand will face new challenges, such as increased global competition from foreign companies entering the German market. At the same time, globalization will bring new opportunities for Mittelstand, enabling the expansion to new markets and thereby significantly increasing the potential market size.

## No Innovation

Mittelstand companies will fail to generate innovative products or to implement internal process innovation due to a lack of research and development (R&D) or misguided R&D, e.g., application of technologies that do not successfully contribute to business needs. Consequently, these companies will lose relevance, reflected by dissolutions, bankruptcies, and acquisitions. Mittelstand companies will struggle to retain ownership in the face of cross-industry and international competition. Value creation will be transferred to Big Tech, corporate entities, and startups, which will play an increasingly pivotal role in developing key technologies.

## Technological Advancement

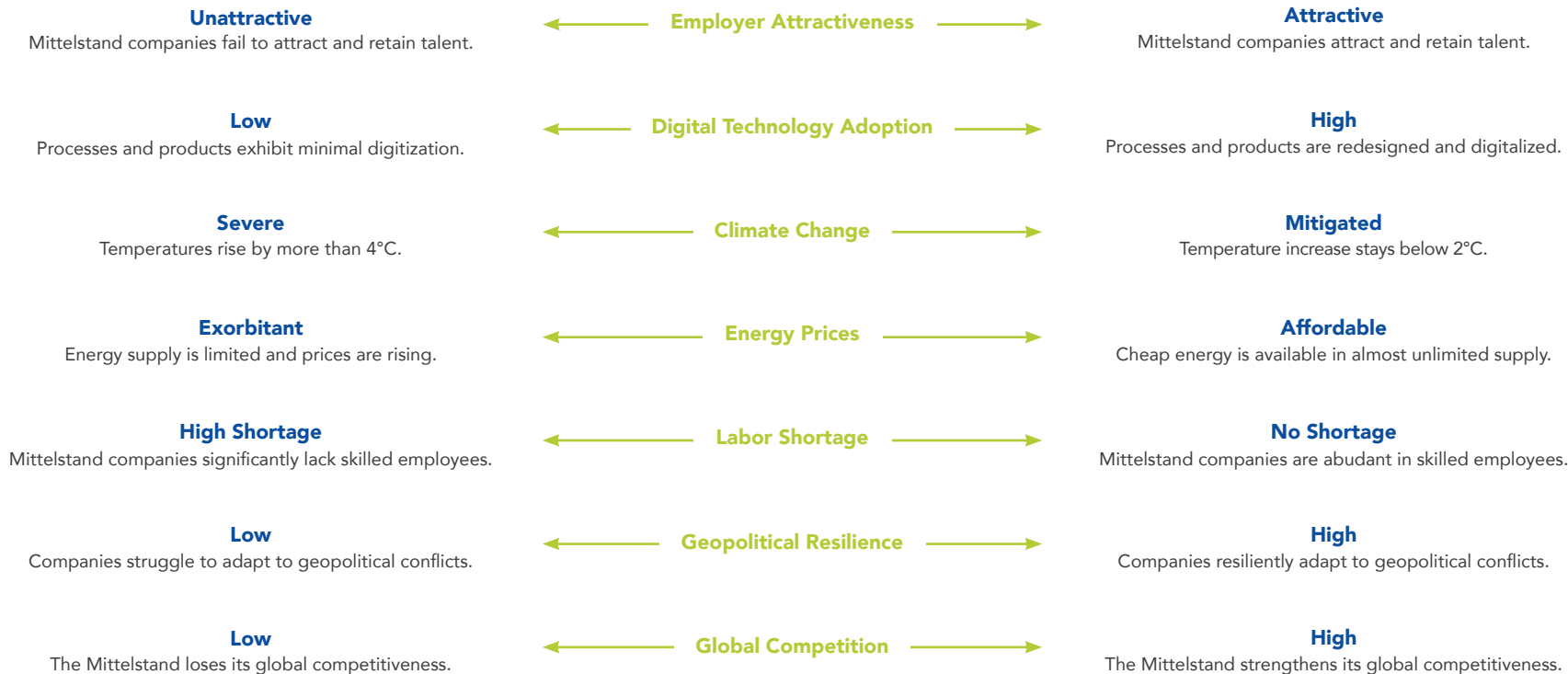
In the past, the degree of technological advancement significantly contributed to the success and competitiveness of Mittelstand companies, enabling them to gain significant market share in their respective, often niche, domains and build a strong global brand. Technological advancement encompasses the identification of innovative processes to improve the efficiency and quality of products, as well as the flexible development of novel products which address dynamic customer needs. If companies succeed in implementing frontier technologies, they can generate a progressive and differentiated product portfolio, stay competitive internationally, and drive the development of key technologies and processes.

## Innovation-Driven

Mittelstand companies will be at the forefront of developing and applying relevant key technologies in their product development, enabling them to deliver superior quality and efficiency or provide new, complementing value propositions. Companies will introduce the latest R&D tools and practices improving their agility to respond to customer requirements and challenges quickly. This flexibility will also enable them to thrive in the face of more pivotal business model challenges, ensuring they will become a driving force in addressing and adapting to the climate crisis. By relying on leading scientific knowledge in their domains, the products of Mittelstand companies will represent the pinnacle of engineering ingenuity, building a strong international brand, which, in turn, will lead to an improved and defensible market position.



# OTHER IMPORTANT DRIVERS



# SCENARIO MATRIX

The two key drivers and their outcomes create a scenario matrix. Each axis represents one key driver, with bipolar outcomes on both ends. All four scenarios are based on the extreme outcomes of the two key drivers. Other important drivers are also considered, with plausible and consistent outcomes in each scenario.

**Global Pioneers:**

This scenario describes a future in which Mittelstand companies can operate globally without restriction, becoming leading developers and adopters of the latest key technologies while maintaining a leading market position.

**Competitive Paralysis:**

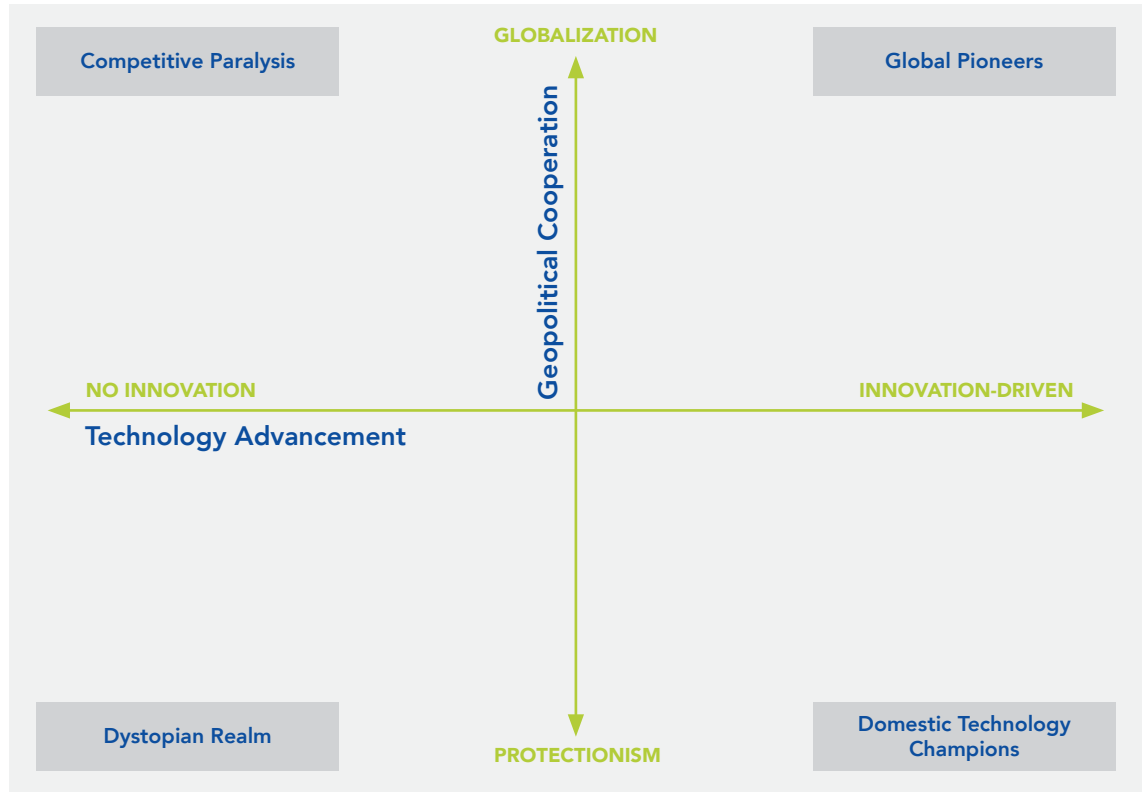
This outcome is characterized by global competition, new markets, and cross-industry competitors. It portrays a future in which the Mittelstand no longer drives innovation, lags technologically, and disappears into insignificance.

**Dystopian Realm:**

This scenario illustrates a future in which geopolitical tensions lead to a regression in technological development and a greater interest in military ventures, reinforced by the rise of a protectionist state. Thereby, the Mittelstand is more tied to governmental policies than ever.

**Domestic Technology Champions:**

In this outcome, regulations preventing global competition led to decoupling and protectionism. Therefore, Mittelstand companies focus on domestic business. However, even without international relationships, the Mittelstand is at the forefront of innovation.



Trend  
Scenario  
Ideation

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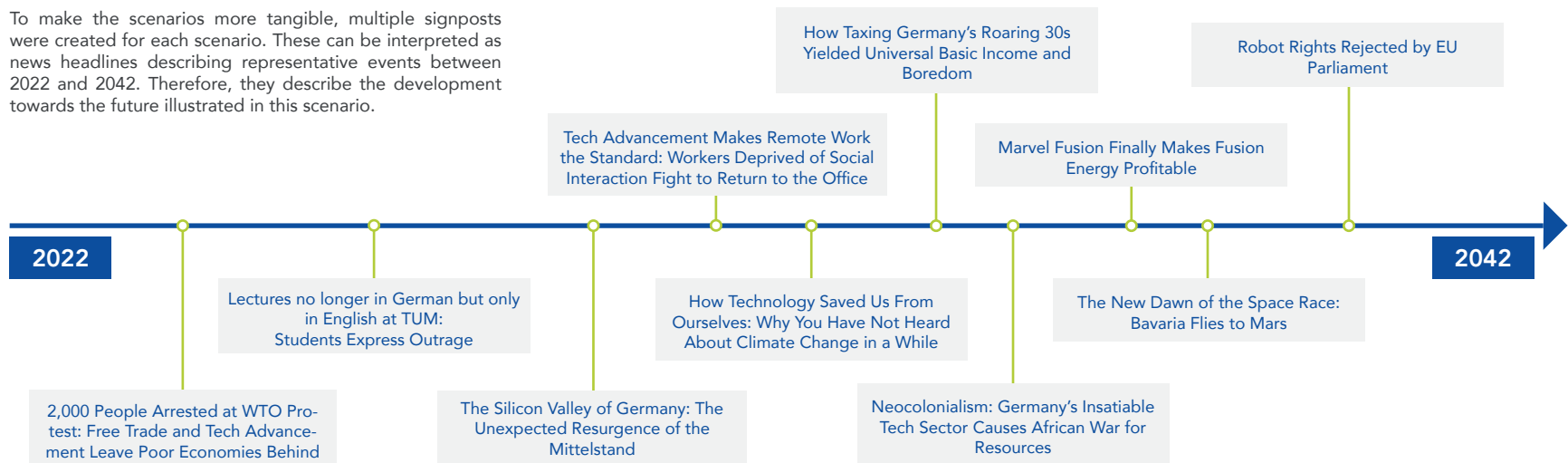
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# GLOBAL PIONEERS

## The Mittelstand at the Technological Forefront in a Fully Globalized World

To make the scenarios more tangible, multiple signposts were created for each scenario. These can be interpreted as news headlines describing representative events between 2022 and 2042. Therefore, they describe the development towards the future illustrated in this scenario.



Trend

Scenario

Ideation

## A Day in 2042

"Wakey-wakey, the sun is rising, Max." Max feels reminded of his mother waking him up for school and turns around. The voice stays relentless: "Max, wake up. Your next meeting is in 45 minutes". Max suddenly feels catapulted back into reality. Andrea, his AI assistant, has been trying to wake him up for the past five minutes. Still sleepy, he opens the curtains and realizes with excitement that it is the first day of his training.

He proudly reminisces about the process he has to go through to get here: "Of course it is hard, I mean, who does not want to work for one of the trendy Mittelstand companies these days," he thinks. Only ten more minutes until his first meeting, and he still has no clue what to wear. Sifting through the mess in his room, he finally finds his VR lens. He enters the virtual meeting room and quickly dresses his avatar. Max shops for some digital vintage and vegan shoes from the 20s, which have recently come back into fashion. "God bless Meta," he sighs as his new supervisor, Avantika, enters the room. Avantika has a stunning physique, and for a moment, Max drifts away, thinking about how he could one day afford premium bodily features like this for his avatar. But company slides pop up and take him back to reality - or rather virtual reality. Avantika starts by introducing herself. She is one of the many climate refugees who came to Germany as her home country Kuwait became uninhabitable. Max notices that she is emotionally touched as she describes how her migration to Germany would not have been possible without the massive wave of globalization and openness that accompanied the past 20 years. "Now," she says, "it may seem completely normal to you that more than half of our workforce comes from all over the world, but back then, there were heavy restrictions on migration as people were afraid of cultural decay. But anyways, let's get back to the history of Futura, whose story took a fairly similar turn as mine." She shifts to the next slide. The transition to autonomous driving has led former car suppliers to become part of the robotics industry. While initially producing industrial lasers, Futura started producing laser visual sensors called Light Detection and Ranging (LiDAR) for autonomous driving and later robots. The company has now become the technology leader in its field, but this was not always the case. Avantika contemplated the 20s when everyone told them it would be impossible to catch up with the pace of digitalization, "but here we are today, like a phoenix rising from the ashes," she smirks mockingly. "Welcome to the future of manufacturing"



is stated on the last slide. While Avantika's virtual background slowly disappears, rows and rows of gigantic robots start to appear in the background.

"Let me show you around," Avantika says cheerfully, "only this time in person! See you in 10 minutes." Max knew that the day would come when he would need to go to the office in person – but now? He does not feel like socializing with colleagues today. After all, he has chosen Futura because it allows him to work remotely with a workforce completely distributed across the world. Nevertheless, he recognizes that while the world has never been more connected, his gener-

ation feels as lonely as no generation has ever felt before. In his age group, suicide is one of the most frequent causes of death. But before he can finish his thoughts, Avantika already confirms the arrival of an air taxi that will take Max to the company's headquarters. "To combat mental health issues, Futura has introduced a mandatory in-person social events series. And while you are already here, why not do a quick factory tour too. Quickly putting on some clothes, Max steps outside and observes how the air taxi lands quietly in front of his door. As he flies past the greenery surrounding his home in the suburbs of Munich, he remembers the days when his biggest dream was to contribute to mitigating the climate

crisis. “Times are changing,” he hums. The climate crisis may have been resolved, but there is still so much in the world that needs to change – “What to do about the global inequality...maybe machines do deserve rights and ...? At that moment, the flight assistants chirping voice informs him of his arrival.

Stepping out of the air taxi, Max is impressed with the sheer size of the Futura factory. “It did not look that big from the sky,” he thinks and steps into the dome. It almost seems archaic with all its solar panels. With fusion energy being commercialized nearly ten years ago and now providing 80% of Germany’s energy, solar panels are rarely used nowadays. He notices how deceiving the outside appearance can be, as the inside is a marvel of engineering in which automata and humans interact in separate realms. Segregation is the newest trend in architecture, making it easier for humans to stay among each other without being constantly reminded of their silent servants. The more similar androids got to humanity, the harder humans tried to create distance between “us and them,” as the philosopher Anselm Krauss once said. Max is now wondering how puzzling it was that all those robotic mega corporations did not manage to solve this problem yet. He steps towards the reception and is greeted by a smiling lady, “probably a human,” he assumes. Stating his name, the receptionist lets him step into a facial 3D scanner. “This will allow you to pass through biometric security doors,” she explains.

Avantika is already waiting on the other side of the security door. She seems exhausted as a huge order for a former automotive Original Equipment Manufacturer (OEM) needs to be shipped today. Striding through the entrance hall, Avantika shows Max through the door separating the human from the machine area. The hum of dozens of robots loading packages is overwhelming for Max. These days, manual labor is a thing of the past, as robots have taken over everything that is physically demanding. After initially being outraged about losing jobs to automation, people quickly got accustomed to perfectly served food and clean streets and accepted the presence of their electronic companions. Robots had to be developed, maintained, and directed, so while some jobs were lost, others were created.

But this is the past, and prospects of new technological advancements amaze him. The precise robotic arms around him, which are implanting LiDAR sensors into robotic androids of all sorts and sizes, inspire Max. The machines that

receive their visual sensors come from all over the world. Futura is the world leader in this technology. Big corporations buy their sensors at Futura, and small businesses send their robots for repair to the company. Maintenance, powered by full automation, has made Futura successful all over the world. The company is at the forefront of innovation while being a well reputable global player.

Furiously gesticulating, Avantika directs a fleet of bulky cargo bots carrying crates filled to the brim with the newest international tech. If things must go faster than usual, a bit of human intervention and creativity is needed to cut time and corners. As the last crate is loaded into one of the giant delivery trucks used to transport goods over long distances, Max starts feeling a slight unease. These recently introduced electric behemoths are completely autonomous and just wait for Avantika’s signal to start their delivery.

As their shift comes to an end, Max and Avantika are approaching the so-called “Social Lab,” which is the location of today’s social event. Avantika is telling Max that this place, with all its vibrant colors, round tables, and fun game areas,

reminds her of a “We Work” – a space she used to work at when she started her first job. Max and Avantika approach one of the more crowded tables and sit down. Max joins the table of eye-blinking co-workers and activates his own HoloLens. The names of all the people surrounding him pop up in his social feed. He quickly realizes that his co-workers come from all over the world. Most of them also seem to speak English. If not, they are probably using live translation apps. More interesting than his surroundings, however, is the ongoing international soccer league, which he quickly enlarges in his field of view. Max notices that Avantika seems increasingly irritated. Trying to be attentive, Max asks her whether she has any issues with her HoloLens. Slightly at unease, she responds to Max: “This new world is simply different.” “Different how?” Max asks.

“Back when I started my first job 20 years ago, our superiors complained about us being on our smartphones, and we disregarded them as laggards. Now I see you interacting in this world full of all these technological advancements, and I am really just not sure anymore if this is any good. But maybe I am just lagging behind and getting old,” she ponders.



Julia Balowski



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# COMPETITIVE PARALYSIS

## Mittelstand Companies Fail to Innovate and Are No Longer Globally Competitive

To make the scenarios more tangible, multiple signposts were created for each scenario. These can be interpreted as news headlines describing representative events between 2022 and 2042. Therefore, they describe the development towards the future illustrated in this scenario.



Trend  
Scenario  
Ideation



## A Day in 2042

Impatiently tapping his fingers on the table, Timo stares at the coffee dripping into his mug. He loves the classic, vintage coffee machine with its noisy, mechanical nature. He inherited it from his grandparents and still uses it despite its energy efficiency lagging way behind current standards.

While he waits to finally intake his much-needed caffeine dose, Timo takes a look at the smart screen covering most of the kitchen wall. "Lagos, Nigeria surpasses Silicon Valley as largest startup hub in the world," the headline states. Not so long ago, he thinks, parts of Germany used to be technological development centers, as Lagos is today. He wonders how it would have been to have lived and worked in such a

thriving environment. After rapidly downing the coffee, he prepares to head to work.

The autonomous vehicle, which Timo leases, arrives directly at his front door, pre-heated and with taxi mode already launched. As he watches the car independently maneuver out of the driveway, he rests his hand on the soft, comfortable seat. The premium seats are among the last components in this car to be developed and manufactured by a German supplier. Timo feels proud to own the company that produces them, leading more than two thousand employees.

While propulsion technology has been strongly advancing in recent years, all planes, buses, trains, and cars still need seats. Therefore, his company has been less affected by

ongoing technological changes, especially compared to his colleagues who manufacture parts for combustion engines, many of whom already went out of business 15 years ago. Timo remembers when he inherited the company from his father. That was over 20 years ago. He finds it ironic that struggling with the disadvantages of being a very young CEO was one of his biggest problems when appearing credible to investors. Times have changed, and things have become increasingly difficult for Mittelstand companies in Germany.

Newspapers and experts keep blaming increased globalization for this crisis. Less protectionist regulations and a growing amount of free trade agreements with countries worldwide have led to increased competition regarding prices, technological advancement, and quality. For instance, companies in China adapt to swiftly changing requirements, which puts pressure on other businesses. Furthermore, companies in Germany are not as protected from the killer acquisition as they used to be. Still, Timo tries to remind himself that there is also a good thing about strong international cooperation. It has significantly reduced the number of political conflicts worldwide, positively affecting resource availability and supply chain stability.

On his way to work, he passes several vacant houses. What used to be a proud suburban town surrounded by beautiful nature has turned into a half-abandoned ghost town. Of course, Timo knows the reasons for this unfortunate development. Since more and more Mittelstand companies went bankrupt, the unemployment rate in rural areas like this has heavily increased. Looking for work in corporations or hoping to found a startup, a large number of people have moved into the big cities.

Arriving at work, Timo heads straight into his office. The day's first meeting is about the latest revision of the global environmental standards. "I really don't understand why they've tightened regulations again. The last update was only four months ago," one employee groans angrily. "You know how important it is to stop climate change and find global agreements," Timo diplomatically replies. The rising temperatures, in combination with increased natural disasters like floods, wildfires, and droughts around the world, have made climate change tangible and observable to everybody within the last 20 years. This has slowly increased the public pressure on politics globally, resulting in legislative measures. Since key players around the world have agreed to fight climate change together, managing the climate crisis has become re-

## Competitive Paralysis

alistic. The downside is that formulating global environmental standards has led to a tight net of constantly changing regulations that companies must fulfill. Like many Mittelstand companies, Timo's business has been struggling with updating its processes to meet steadily stricter standards.

Hoping that the impact of the new regulation will not be as extensive as last time, he addresses the head of environmental compliance. "What do we need to comply with –" his smart pad pings loudly, stopping him mid-sentence. Since this tone is reserved for critical notifications, he immediately checks the incoming message. His face freezes as he reads the lines. "I'm sorry, but we need to postpone the meeting," he says, hurriedly leaving the room.

The moment Timo has been dreading is finally coming true. A corporation that produces transportation seats that com-

pete with his company's products has patented a new generation of seats that adapt to the occupant's weight. Timo is well aware that his research and development department is currently not in the best position. Despite every effort, he cannot attract qualified workers due to the public perception that innovation is only driven by startups or large corporations. Furthermore, attracting external investors and sourcing innovation funds is more difficult for an established, stable company than for a newly founded startup.

Still, it hits him hard that his product will be outdated within a short time. His family patented the designs, yet nearly identical and cheaper copies have been developed. Additionally, over recent years he'd encountered patent blocking when a competitor patented a slightly tweaked version of his company's design. Having no legal recourse, Timo's product was unable to evolve, remaining essentially unaltered.

What now? Timo tries to calm down and evaluate his possibilities. If he does nothing, they will undoubtedly face insolvency within a few months, as many of his peers already have. Thinking about the potential impact on his employees and their families, he has good reason to be worried. One possible solution would be to give up control, either selling his company to an international investor or accepting one corporation's acquisition offer, which has been lying on his desk for weeks. He thinks of a friend's headlight production company, which a major corporate car manufacturer acquired ten years ago. Most of the workforce could keep their jobs, although the workers had to relocate to the city. Additionally, all decisions and development processes are now steered by the corporate.

However, his family owned his company for five generations, and selling it now would feel like admitting failure. Another option would be to continue production and sell the seats for a decreased price to countries that do not require the latest technology. The increasing globalization of the past years has allowed many developing countries to emerge and gain access to advanced technology. However, costs still play an important role in these countries; therefore, they are the optimal customers for slightly outdated yet cheap seating. Production costs could be reduced by drastically decreasing the quality of seats, allowing Timo's company to penetrate these markets.

Still, the thought of turning the family business into a low-quality mass production industry makes him feel sick. His grandfather would likely be disgusted, having always valued quality and progress. Further lowering prices would require major compromises, turning nearly hand-made products into commodities. Is preservation worth sacrificing the underlying spirit of his company?

Overwhelmed with digital bureaucracy, Timo tries to keep on working on his tasks, but all day he is distracted by the decision of how to proceed. When he finally arrives home in the evening, he collapses onto the couch and asks his smart assistant to turn on his nootropic diffuser. But despite the profoundly relaxing effect, he cannot help but continue thinking about the future of his business. Tomorrow, important decisions will have to be made.





Cyrine Chaabani 

Daria Ekimova 

Milana Gurbanova 

Marvin von Hagen 

Anselm Krauss 

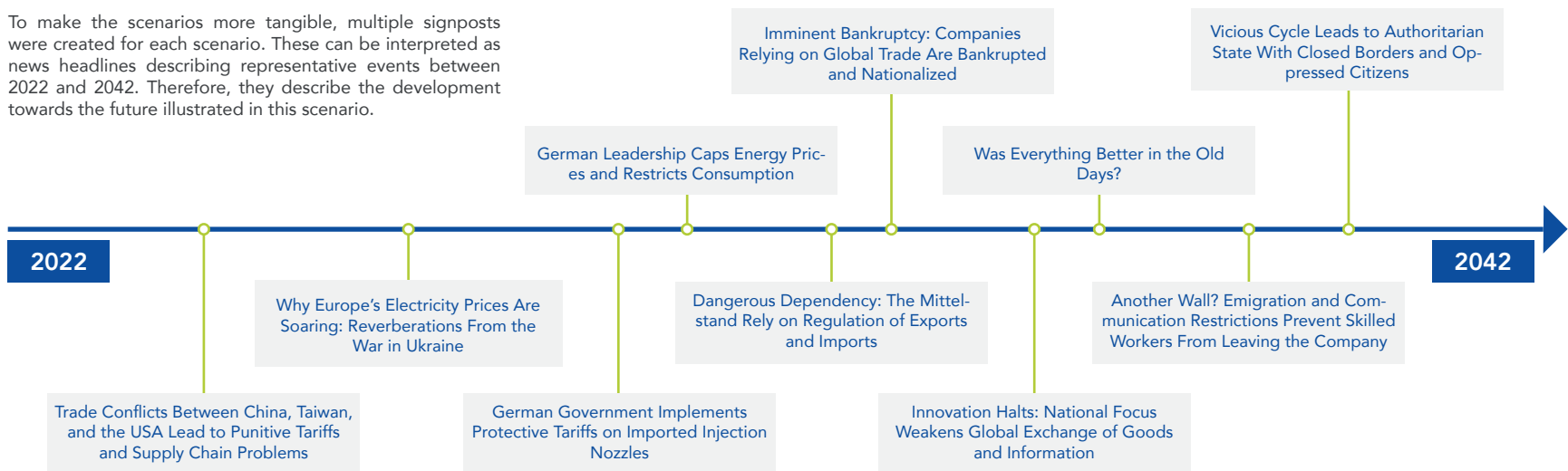
Simon Wittner 

Ruby Zhang 

# DYSTOPIAN REALM

## Innovation Stagnates and Mittelstand Companies are Heavily Reliant on the Government

To make the scenarios more tangible, multiple signposts were created for each scenario. These can be interpreted as news headlines describing representative events between 2022 and 2042. Therefore, they describe the development towards the future illustrated in this scenario.



Trend

Scenario

Ideation

## A Day in 2042

The bell rings, signaling break time. Every four hours, all workers have ten minutes for themselves, which they can use however they please. Most smoke a cigarette outside and engage in small talk. One employee – Karla Dörpmunt – has recently noticed a shift in the topics being discussed. Her colleagues express concern regarding the run-down factory equipment and how nothing changes despite reporting it to management. Others discuss their suspicions that the government is hiding a shortage of raw materials to avoid causing general turmoil. “It will be a rough winter,” she overhears as she walks past a group of employees huddled near the entrance.

Karla usually spends her break smoking as well, but she prefers to be alone. For over 20 years, she worked at the prestigious Mittelstand company Helmutdruck until the energy crisis caused them to nationalize and turn into Helmutwaffen. Production swiftly shifted to combustion engines for military planes, which authorities saw more fitting for national priorities.

After last week’s accident, tensions among employees have risen. One assembly line machine’s internal ventilation system overheated, causing it to break down. No one noticed, and it went undetected by the sensors. Rumors spread that all the sensors were out of order, despite the administration’s official quality report stating otherwise. Instead, the blame was shifted to the machine operator and his alleged lack of expertise. No one has heard from him since the accident, but some people saw him being transported to the hospital after sustaining severe burns. Although Karla’s colleagues are convinced that urgent machine maintenance is required, they are too scared to notify management. Showing signs of resistance to the general order is problematic.

As Karla smokes, she is surprised by how sunny this winter day is – only two days ago, snow blocked most of the roads, completely isolating entire regions. Scientists frequently express concern that humanity has already lost the war against climate change, which grows worse daily. Planning to call her sister, Karla goes back inside to quickly charge her iPhone 12 using a mechanical power bank. The phone’s battery died five years ago, but having a smartphone at all is a luxury. Semiconductors are a rare treasure to which most commoners don’t have access.

Heading back outside, she sees military aircrafts passing over the factory, likely heading to the recent border conflict over water resources. Karla sighs and reminisces about the past, wondering how society ended up here. If she had to pinpoint it, she thinks the war in Ukraine and the resulting trade conflicts were pivotal. She remembers the first winter after the war – energy prices soared, inflation skyrocketed, and basic amenities could no longer be taken for granted. The government quickly stepped in with regulations, introducing household energy budgets which gradually shrunk to the bare minimum. It was a vain attempt to rescue the Mittelstand, which desperately needed power to sustain production. Confronted with this complex situation, governmental economists called for regulations on cross-border trading, insisting that that was the only way domestic companies stood a chance. And so a tremendous wave of nationalization was established, particularly among Mittelstand firms. Regardless, many went bankrupt, leading to an even more merciless

wave: unemployment. Countless families fled the country in search of better prospects.

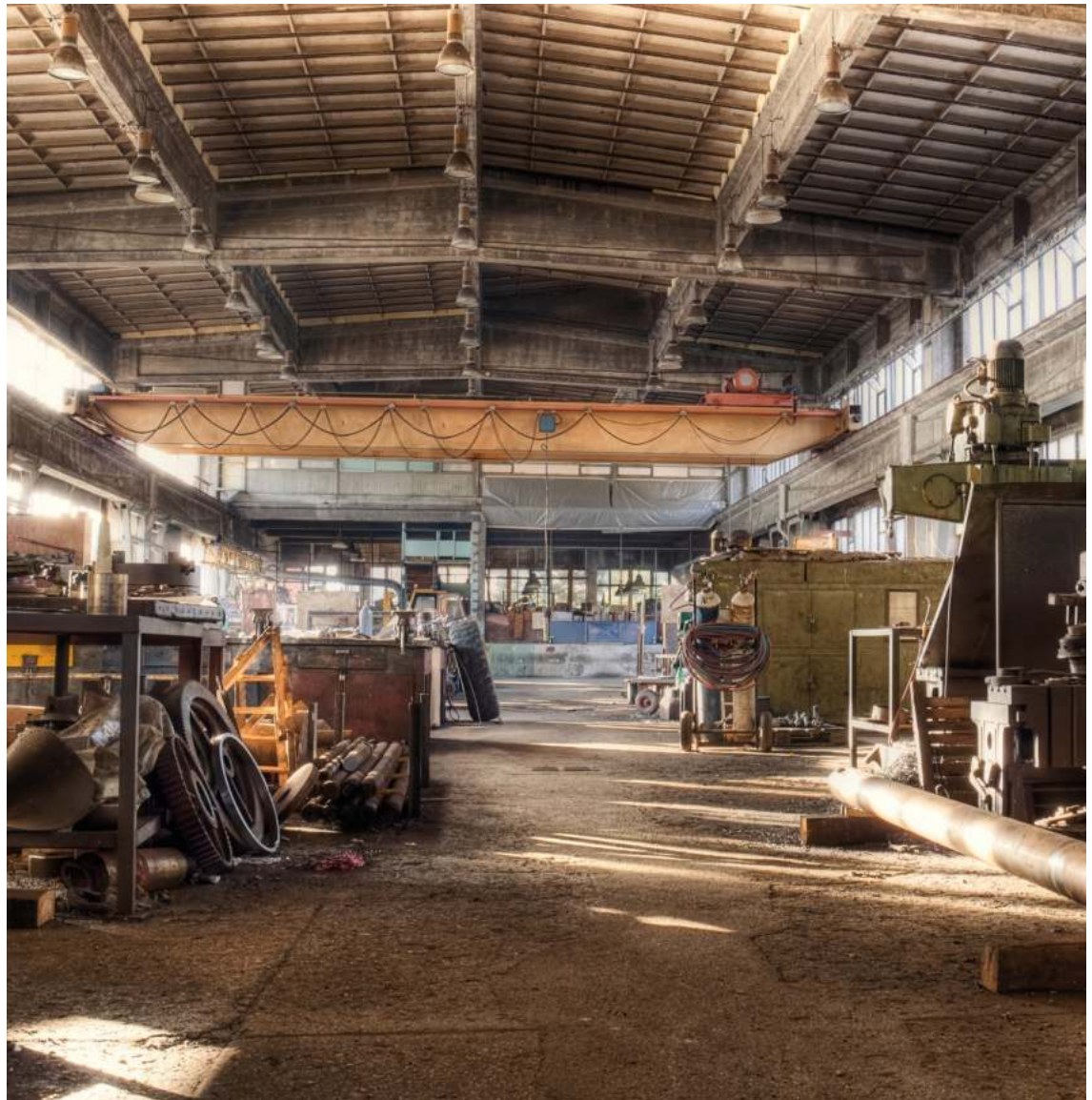
Karla’s aunt managed to move her family to France, and Karla’s parents planned to follow suit. However, they waited too long and were stopped by regulations restricting permanent emigration. Karla would love to visit her aunt in France but is aware of the bleak reality – due to the ongoing war, all border crossings have been halted. She has not seen her aunt for nearly two years, and there is nothing to suggest the regulations will be lifted.

The factory bell rings, signaling the end of the break. Karla heaves an exasperated sigh at the thought of the remaining four hours of her shift. She is convinced another assembly line accident will soon occur and wonders who will be the next victim.



In the evening, Karla stretches the walk home for as long as possible – it's always the highlight of her day, although she dreads being home. The loneliness and silence make her realize that everything she once cared about has already been taken from her. She resents calling this place home – her parents passed away in the small room at the end of the corridor, and she has kept it locked ever since. The doctors failed to identify the virus, and as her parents' fevers hit a record high, emergency services responded too slowly. Karla represses thoughts of her parents' illness, although she hears rumors of older neighbors dying from a mysterious disease. Experts on national TV attempt to calm the population by stating that the government is making headway on their research of the novel virus. However, Karla knows the painful truth is that investments are being pumped into warfare, not research. She snaps back to reality as she passes a man chanting the national anthem. Beggars often exhibit national pride in an attempt to gain sympathy. Karla is passing through the homeless ghetto, occupied by people who lost their jobs during the crisis. To escape the cold, they spend their nights in the neighboring underground shelters. Today, Karla is surprised to discover the erection of new refugee camps. She heard on the news about floods in the southwest part of the country which destroyed many neighborhoods, forcing residents into shelters. Apparently, many have been relocated to this city. Karla wonders whether this is a sign that experts expect another natural disaster.

These days, the media tries to only broadcast positive news. The national motto reads, "A united tomorrow is a better day." Although it's not explicitly defined, Karla suspects she would be framed as a traitor and imprisoned for posting anything negative online about shelter living conditions. As she exits the ghetto, Karla finally spots a grocery store. Despite her hunger, she hasn't eaten all day since money is running low at the end of the month. She relishes walking through the aisles and inspecting the products on the shelves, although there is never anything new. Ever since food companies were nationalized, prices have risen and variety has decreased. Karla checks out with her Leberkässemel, a traditional Bavarian snack, and continues on her way home. She would rather have something else for dinner, but her options are limited. Would Karla's life be better if she had more choices?



Salma El Ghayate



Niclas Heun



Lukas Ketzer



Mete Polat



Lena Voßs



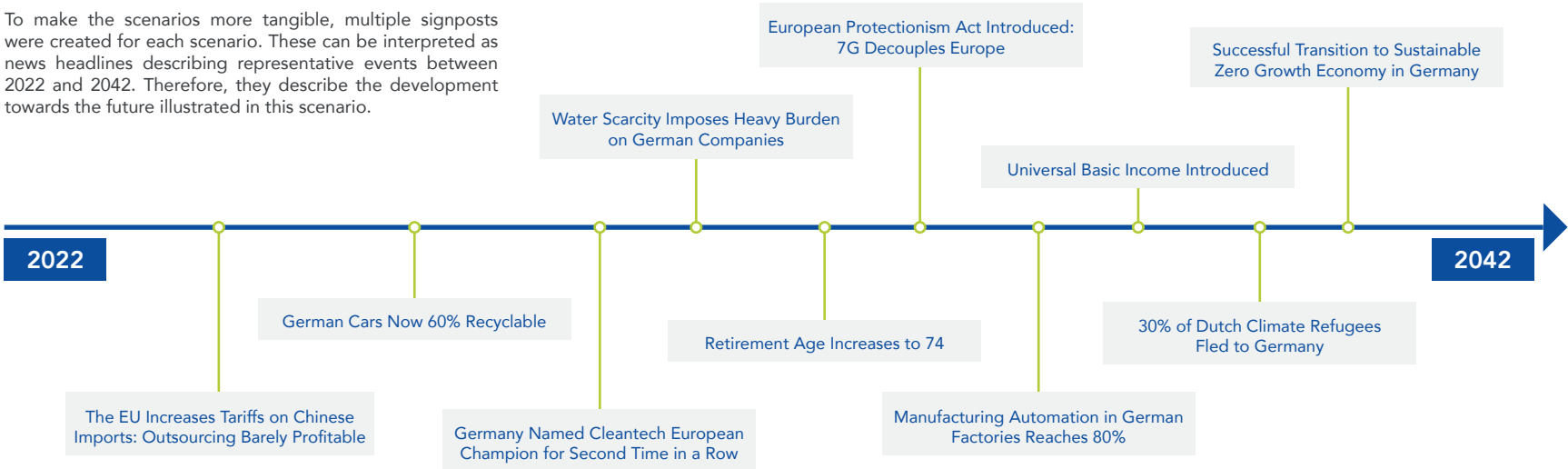
Christian Wallenwein



# DOMESTIC TECHNOLOGY CHAMPIONS

## The Mittelstand Drives Innovation in Protectionist European Union

To make the scenarios more tangible, multiple signposts were created for each scenario. These can be interpreted as news headlines describing representative events between 2022 and 2042. Therefore, they describe the development towards the future illustrated in this scenario.



Trend

Scenario

Ideation

## A Day in 2042

A blaring noise cuts through the silence – it is 6:30 a.m., and Isabell’s alarm is ringing. Excited for the day, she jumps into the bathroom and gets herself ready. As her coffee machine starts to heat up, she unlocks her tablet and opens the Tagesschau news app: “German economy expected to stagnate, yet 11.4% carbon reduction year over year achieved.” She is impressed with the progress. She continues scrolling, “New tariffs imposed – trade conflict between the EU and foreign blocks heating up.” She saves the news article and thinks, “I will need that later today.”

It is a new chapter in Isabell’s life. In her late fifties, she has never thought about changing jobs. Living in Saxony, she is glad she found a new position as a legal and operations manager in the emerging semiconductor industry. Today, her onboarding starts. Her new employer, CO2mpressor GmbH, is a typical Mittelstand company. A few years ago, they successfully transitioned from producing compressors for combustion engines to compression machinery required for carbon capture in semiconductor fabs. They are supplying the local semiconductor industry that had to relocate to Europe because of the ongoing trade wars. CO2mpressor is one of many Mittelstand technology champions that focuses on providing machinery for the European market.

Isabell unplugs her electric car and roams onto the local streets. Her virtual assistant warns her: “47°C expected today, staying inside recommended. Have a safe ride.” She complains, “Just another day in the heatwave.” While she enters the highway, her excitement arouses again: “I am looking forward to creating a more sustainable environment. I can really have an impact.” The last months were tumultuous. Her former employer, another Mittelstand company, had to shut down. Hit by the unavailability of cerium – a rare earth mineral primarily sourced in China – and the simultaneous collapse of their primary market due to higher punitive tariffs, they failed to survive. Many Mittelstand companies faced the same fate over the last years as the green transformation and regionalization of supply chains shook up the German industry. Nonetheless, the majority of companies adapted. Isabell is proud to support a local business, the backbone of the German industry.

As she spots the company logo, she turns into the final street and onto the parking lot. After getting out of the car, she



starts charging her electric vehicle again. A pop-up appears on her phone – “Free charging today due to surplus photovoltaic energy. 100% produced on-site.” “That is a nice touch – considering my insanely expensive electricity contract at home,” she notes. Isabell makes her way towards the main entrance as she spots a few familiar faces. It is José and Max. She met them at her Mittelstand bootcamp – an education center that offers an upskilling program for people searching for a new job in the local Mittelstand. It’s financed by the federal state and an alliance of local Mittelstand companies. José, himself in his late fifties, came to Germany a few years ago as the severe heat and drought in Andalusia made his job as a farmer impossible. Max, a funny Dutch guy, found his new place in Saxony as his hometown fell victim to the increasing amount of space required to secure the Netherlands from rising sea levels.

“You must be Isabell!” a friendly voice greets her. “Welcome to CO2mpressor. I’m Werner. I will be your supervisor for today’s onboarding.” Isabell greets back and joins the crowd of people around him. “Such a diverse group. Some of them must be in their early twenties. Others are for sure ten years older than me!” she thinks. Werner continues, “Great that you are all here, and welcome to your onboarding. You will be an essential part of creating the innovation we all need.” He stops and waves with a welcoming gesture to three men standing in the back. “Also, welcome our visitors from the Egyptian Industry Conglomerate. They will join our tour to learn about German cleantech innovations and are important partners in the search for new markets, considering the international trade difficulties.” Then he turns around and points toward a production hall. “Let’s get started!” he yells.

The group enters the building. “We will start with the shop-floor,” Werner explains. “In this part, we produce our compressors. Everything is certified after the latest European quality standards. In the next five years, we plan to introduce the first pilot Industry 5.0 systems.” Isabell observes the highly automated production lines. There are almost no humans around. Mobile robots are transporting materials autonomously to a machine whose purpose she cannot fully identify. “What is this machine doing?” she asks. The supervisor replies, “In the last 20 years, our company was forced to relocate production and process steps back to Germany due to resource scarcity and protectionist regulations of the government. While we used to import the materials and parts for our combustion engines from China, we established more local supply chains. In the last couple of years, we developed

this industry-leading machine that helped us to recycle old compressors locally and sell them to companies in the semiconductor industry. I will introduce you to the production line in a second.” Isabell remembers that CO2mpressor is a significant pioneer in the Mittelstand-dominated cleantech field.

“Let’s move to our most recent addition to the production line: The re- and upcycling area,” Werner directs the crowd. He wanders into a wide-open hall with multiple workbenches. Workers and robotic arms are decomposing heavy machinery synchronously. “These workers are remanufacturing our old compressors. As the state introduced the mandatory recycling quota for all products, we had to come up with a solution. We are recycling the most precious parts of these machines. It is still a manual process, and we invest a lot in it.

Yet, we are glad that we have established these capabilities ahead of the cerium shortage – otherwise, our whole production would have stopped.”

The next tour stop is the Innovation Lab, in which founding teams of several startups are accommodated. Since the European Cleantech Fund was established five years ago, the Mittelstand has had new means to collaborate and experiment with new startups, technology, and business models. “Our Innovation Lab has released hundreds of patents in cleantech and circular economy. The German university landscape helps us figure out ways to deal with climate change”, Werner adds. Since trade wars and geopolitical tensions get more severe every day, the EU increased its efforts to keep the pioneering role of Mittelstand companies by fostering open innovation and enforcing actions against patent infringement.

The site tour ends in the company’s cantina, where local food is served. After the first half of the day, Isabell gets to know her team in the legal and operations department. Her new team is already waiting for her in a meeting room. “Will Veronika not join today?” she asks as she recognizes that her boss is not present. Isabell met her for the first time during her Mittelstand bootcamp, where Veronika recruited her. “No, she will join virtually today,” one of her new colleagues replies. At that exact moment, a hologram of Veronika appears and greets Isabell. After a team introduction, Isabell receives an onboarding in the latest state-of-the-art compliance software, which she already gets to know during her upskilling boot camp. It is one of the most intelligent solutions on the market. Her job will be to keep track of all the existing and upcoming trade regulations. These days, import tariffs, border law controls, and trade agreements change frequently. The top priority of every Mittelstand company today is to retain carbon neutrality and resilient supply chains.

After a day of new impressions, Isabell starts her electric car and heads home. Full of joy, she recaps the day. While she was devastated about the shutdown of her old company a few months ago, she finally has hope again. The temperature scale still shows 45°C when she arrives at home. “The Mittelstand bootcamp definitely paid off,” she thinks. “Now I am at the forefront of innovation at a company tackling today’s challenges.”



# IDEATION

The following chapter describes five novel business models that are of great relevance for Mittelstand companies, especially in view of the identified future trends. Each of the business models is described using the Osterwalder Business Model Canvas.

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# PRIMS

## Program for Rotational Internships within the Mittelstand (PRIMS)

PRIMS, short for “Program for Rotational Internships within the Mittelstand,” helps Mittelstand companies attract more ambitious, curious, and open-minded students and allows them to experience an exciting year that will shape them for decades to come. PRIMS is not only building up relationships between companies and for a mere collection of internships but is offering a full-fledged gap year program, mainly targeted at students who just graduated from a bachelor’s program, with everything included.

Before the start of the program, students can choose their respective track among the dimensions of industry (e.g., automotive) and disciplines (e.g., engineering). Students entering the program will then be matched into cohorts of 10–20 students who will all attend kick-off and wrap-up weeks as well as internships at the same four different companies in

the same four locations together. Three will be in Mittelstand companies across Germany, and one will be in a big corporation abroad.

During all these four internships, students will receive a 15m<sup>2</sup> room less than 20 minutes biking distance from the respective workplace as well as a rental bike. Other benefits include free lunch on all working days, transportation between the internship locations, and a monthly financial stipend of 1,000 EUR. In addition, PRIMS is organizing an intensive seminar and coaching program for the students to strengthen their hard and soft skills.

After the successful program, students may be interested in joining these companies, which would also benefit the Mittelstand. Even if they are not integrated into the workforce,

young talents can use the practical experience gained in Mittelstand companies to start their businesses and solve some Mittelstand problems. Before the program begins, PRIMS takes care of recruitment, and even after the program, companies and former students stay in touch through the alumni network.

Our vision for PRIMS is to become a well-known brand within the Mittelstand and among ambitious young students and build long-lasting relationships with Mittelstand companies, with new students entering each company regularly.

Jakob Ehlert



Andrei Nazarov



Konstantin Neureither



Marvin von Hagen



Lena Voß





## Business Model

### Key Partners

- Associations
- German Chamber of Commerce and Industry
  - Leading associations in the Mittelstand
- Public Institutions
- Federal Ministry of Education and Research
  - Universities
  - Local municipalities
- Companies
- Mittelstand companies
  - Corporates

### Key Activities

- Companies and student recruitment
- Design of different internship tracks
- Matching candidates and companies
- Organization of events, student housing, transport

### Key Resources

- Network of project partners
- Talent scouting
- Local communities
- Brand recognition and awareness
- Web and social media presence

### Value Proposition

- For Mittelstand
- Connect the Mittelstand with talents
  - Talent integration into the workforce
  - Increase students' understanding of Mittelstand problems
  - Recruiting done by PRIMS

- For Students
- Get an overview of different fields
  - Support with job orientation
  - Establish contact with Mittelstand companies
  - Mentoring by experienced professionals
  - Innovate on real-life problems

### Customer Relationships

- Tracks and events together with other companies
- Mentorship and coaching for students
- On-/Offboarding week
- PRIMS student and alumni community

### Channels

- Companies
- Direct selling
  - External events
- Students
- Career fairs, hackathons, and our own career events
  - Online marketing

### Customer Segments

- Mittelstand companies of all industries
- Corporates such as BMW
- Motivated and open-minded bachelor students

### Cost Structure

- Fixed Costs
- Salaries of PRIMS employees
  - Office rent & other operations

- Variable Costs
- Marketing costs
- Student Benefits
- Accommodation costs
  - Mobility costs
  - Food costs

### Revenue Streams

- PRIMS will charge an annual fee of approximately 40,000 EUR per student
- This fee will be spread across four different companies

### Eco-Social Costs

- Uneven access to students with less financial resources
- Program requires students to move in Germany and go abroad
- Entry to full-time workforce might be delayed
- Implications on retirement funding, tax, and social security payments

### Eco-Social Benefits

- Getting to know different employers
- Personal development before making a career choice
- De-urbanization
- Building of networks and communities in rural areas
- Tackling Labor Shortage
- Education on Mittelstand companies and their issues

 Value Proposition

**For the Mittelstand:** PRIMS aims to connect Mittelstand companies with young talents from the university during their studies. While absolving the individual internships at the companies, the students bring in their own perspective, open-mindedness, and background from their studies. Mittelstand companies can challenge students with real-world problems and benefit from the innovative ideas and new perspectives the students bring to the companies. After completing the program, graduates might be interested in joining these companies constituting a source for recruiting. If not integrated into the workforce, young talents might still use the real-world experience they gained in Mittelstand companies to create their own business and solve some Mittelstand problems. Before the program starts, PRIMS handles the recruiting, and after the program, companies and students stay connected via the alumni network.

**For Students:** Many students are undecided about which path to take after their (bachelor's) studies. Participating in PRIMS allows them to work in four different companies according to their broad interest (orientation track). If they already know what specific field they are interested in, students can also choose the expert track to explore a particular area from four perspectives. Alongside the internships, they are supported by mentors who are professionals in the fields. Also, PRIMS includes an intensive seminar and coaching program. During the program, they meet like-minded people and get to live at three different locations in Germany and one abroad. Students get challenged with an overarching focus topic, such as process automation, talent acquisition or robotics, into which they can dig more profound during the accompanying PRIMS activities. After the successful program, students have a better idea of what they are interested in and are well connected to potential employers. Furthermore, during the year, they were exposed to real-life problems of Mittelstand companies. This experience can lead to students founding initiatives or startups that tackle these problems from the outside, which in turn increases Mittelstand-related innovation in the market.

 Customer Segments

**Mittelstand Companies:** Our primary focus is on Mittelstand companies struggling to find a skilled workforce. They are located in both urban and rural areas and have probably almost exhausted the labor resources nearby. This makes PRIMS attractive to them as a new way to attract motivated and skilled interns. The program has no limitations on company industries, as it benefits from a diverse pool of partners that will be attractive to prospective interns with diverse backgrounds. The only initial requirement for companies is the ability to accommodate a group of approximately ten interns which will allow the program to optimize accommodation and other costs.

**Corporates:** Another segment is German corporations, which also benefit from the new channel of attracting qualified labor. Since PRIMS focuses on Mittelstand companies for which the problem of labor shortages is more critical, the program requires only a few big brands in the portfolio. Those corporates will be anchor companies attracting both the Mittelstand and potential interns to the program.

**Students:** As for prospective interns, our main group is motivated, curious, and open-minded students who want to gain practical experience relevant to their studies. We focus on students in their bachelor's studies' fourth and above semesters. On the one hand, these students want to explore new career opportunities, learn how to solve real-life problems, and become part of a professional community. On the other hand, they already have basic applied skills and will be able to provide value to the companies during their internship. However, in the future, the PRIMS program will also consider accepting motivated master's students, university graduates, and high school graduates.

 Customer Relationships

PRIMS mainly has a two-sided customer field: The company partners and the students.

**Companies:** PRIMS collaborates with company partners that would like to offer internships to a cohort of students. Together with these companies, the different tracks are designed. To create the accompanying seminar and coaching program, PRIMS works closely together with the partners to

fine-tune the content, find focus topics, and provide a framework that helps the students to drive innovation inside the Mittelstand companies. In addition, PRIMS reaches out to its partners to collaboratively organize (marketing) events. Beyond the internship, PRIMS maintains partnerships with companies, i.e., by organizing alumni events. Partners have access to a growing alumni network of students and other partner companies.

**Students:** The relationship with the students starts in the interview process, which PRIMS and its recruiting team entirely handle. After a successful admission, the year begins and ends with a kick-off/wrap-up week organized by the PRIMS team. During the year, the PRIMS team supports the students by offering personal assistance for study-, job- or program-related questions. As one-on-one mentoring is an integral part of the program, PRIMS assigns every student a professional from one of the partners and provides a supporting structure for these mentorships through events and guiding material. After the internships, PRIMS continually organizes alumni events and keeps everyone connected in the alumni community, providing students with access to great potential future employees.

 Channels

**Mittelstand Companies and Corporates:** B2B sales often require a personalized approach to communicate the value to a potential client. Therefore, to attract Mittelstand companies and corporations, our program focuses on two main channels - direct sales and partnerships with business associations. Direct sales, including cold calling and emailing, allow us to carefully select a pool of diverse companies that will be of interest to students and tailor the offer to each client's needs. In turn, partnerships with business associations such as Bayern Innovativ and IHK ensure a stream of quality leads for our sales representatives. For this purpose, we participate in meetups, workshops, and other industry events and place our labor-related content in partner channels.

**Students:** To attract motivated and talented potential interns to the program, we ensure our presence in places where future and current students congregate. Events such as career fairs, hackathons, university competitions, and our own career events allow us to reach hot leads, i.e., ambitious and curious talents interested in internship offers. We also partner with universities to spread the word about career opportu-

nities through their own channels, such as websites, social media, and on-campus print materials. In addition, we use online marketing tools to target our customer group. We build communities on LinkedIn and Instagram, use paid online advertising, and optimize PRIMS' website to increase our search engine rankings and help students find us. We also have a blog on our website to post educational content about career planning.

### Key Activities

**Acquisition and Recruiting:** The PRIMS gap year program is based on an ongoing acquisition and talent scouting process. PRIMS constantly acquires new project partners such as Mittelstand companies and corporates to diversify and expand the gap year offering. Besides the company acquisition, the management of existing partnerships builds the program's foundation. PRIMS coordinates the application process by evaluating documents, matching them with company profiles, and preselecting candidates. PRIMS takes care of

the bureaucratic processes throughout the interview and hiring process. After successful matching and interviews, PRIMS introduces the talents to the companies and project partners.

**Organization of Rotational Internships:** PRIMS tailors the gap year program to the needs and preferences of the talents and companies to offer a modular experience with different tracks. Talents can choose if they want to follow an orientation track to explore their opportunities after university or specialize in a specific field of interest. PRIMS organizes events such as on- and offboarding weeks, workshops, and a mentoring program for the different cohorts. Furthermore, PRIMS offers paid accommodation for the participants during the internship stays, establishes local mobility offers, and supports the talents throughout the year regarding bureaucratic concerns.

**Talent Retention and Community Building:** PRIMS builds and manages a community of companies and students that are part of the gap year program. The program enables different participants, such as companies, talents, and educa-

tional institutions, to get in touch with each other. After successfully completing the gap year, PRIMS offers companies a talent retention program to stay in contact with students who successfully completed the gap year program. By organizing events and establishing newsletters, PRIMS ensure that companies do not lose touch with their former interns.

### Key Resources

**Partnerships:** An essential part of the success of PRIMS is the customer and user base. The more extensive the network of project partners, the more students consider participating in the program. To ensure constant application demand, PRIMS has talent scouts who attract new university students and discover new channels to reach them. Partnership managers take care of the existing network of industry partners and local communities and acquire additional contacts. Another valuable asset will be the established community of alumni. By building strong relationships with alumni, PRIMS can profit from the expertise of graduate students after they start their professional career in a (Mittelstand) company or research.

**Brand and Image:** A trusted and recognized brand is vital to building a customer and user base in industry and academia. Many of the Mittelstand companies are Hidden Champions. This means that their brand can be unknown to most students. PRIMS needs to have an attractive presence that compensates for students' unfamiliarity with the Mittelstand to engage them to work in companies and regions they do not know yet. For this, PRIMS needs to establish a strong web and social media presence. PRIMS brand should also be able to address Mittelstand companies and their needs.

### Key Partners

**Public Institutions:** PRIMS benefits from close collaboration with public institutions by accessing networks and financial support while solving problems such as labor shortage and increasing the attractiveness of the Mittelstand. The Federal Ministry of Education and Research is a critical partner in connecting PRIMS with Mittelstand companies in technology fields and increasing awareness of the program among stakeholders in education. Other partners, such as universities, increase awareness about the Mittelstand and connect PRIMS with young talents for the gap year program. In return, PRIMS gives universities access to a network of specialized



and innovative Mittelstand companies for potential research projects. In cooperation with local municipalities, PRIMs can grant their students benefits with regard to housing, local transport, etc.

**Associations:** The German Chamber of Commerce and Industry is a set of local associations which disposes of one of the most extensive company networks in Germany and Europe. PRIMs uses the network to acquire Mittelstand companies and corporates in the same local areas to build its

network of project partners. Associations mainly dedicated to the Mittelstand, such as the Bundesverband Mittelständischer Wirtschaft (BVMW), Unternehmensverband Mittelstand, or Bayern Innovativ, are sparring partners to introduce and promote the gap year program.

**Companies:** The Mittelstand and corporates are not only customers of the gap year program but also key partners in realizing and developing it further. These companies co-create the program through their wishes, ideas, and input. PRIMs

can develop different specialist tracks in the gap year program by collaborating intensively with a broad network of industry partners. With this, young talents can specialize in a specific domain while discovering different companies. By increasing the network of project partners, PRIMs offers the Mittelstand possibility to interact with other companies outside their region or field of expertise.

### Revenue Streams

PRIMs will charge companies the total gross cost of benefits per student plus additional fees to cover operating expenses such as employee salaries and office rent, as well as to generate a corporate profit. For year 1, we estimate to host ten cohorts with 10 students each (100 total), and the respective annual break-even amount per student is around 37,500 EUR, so we would apply a 6.5% margin and charge 40,000 EUR. Because the operating expenses increase at a lower rate than the revenue with an increasing number of students, we estimate to be able to achieve a profit of 38m EUR in year ten without increasing the amount we charge, just by scaling up the number of students from 100 to 5,000. By charging 50,000 EUR instead of 40,000 EUR, we can already make an increased profit of 88m EUR. The final pricing is subject to validation in the pilot phase and acts as a critical mechanism to match the demand on both sides of the matching. The higher the salary, the more attractive to students, but in turn, less attractive to the Mittelstand.

Apart from the standard packages described above, we could charge additional fees for various preferred treatments, such as being part of a track with another prestigious employer. Another example could be preferred logo placement on the PRIMs website and other marketing materials. However, these additional revenue streams might not be well received by all companies, and we should carefully evaluate them before pursuing them.

### Cost Structure

PRIMs offers an all-inclusive package to its participants. All students are accommodated in a ~15m<sup>2</sup> room with a private kitchenette, bathroom, and free high-speed internet connection. These rooms are always less than 20 minutes of biking away from the respective workplace and less than 10 minutes walking distance to the rooms of the other cohort members.



Students don't need to worry about buying and selling a bike at each internship location, thanks to a free bike rental. In addition to mobility within each internship location, PRIMS organizes transportation between the internship locations by train or, if needed, by plane. To entirely focus on the internship itself, food is provided for free on all working days, either via the company's canteen or via cooperations/vouchers at local restaurants. During the kick-off and wrap-up weeks, the program fully funds all expenses. In addition, all students receive a monthly financial stipend of 1,000 EUR to cover remaining living expenses. The total costs add up to roughly 23,500 EUR for a 12-month-long PRIMS program. In addition to these variable costs, we have operating expenses of approximately 700,000 EUR annually (based on ten cohorts with 10 students each). This is estimated based on eight full-time salaries: three founders, two software developers, and three employees for administrative and support tasks.

### 💰 Eco-Social Costs

**Social Cost:** Access to the program might be unevenly distributed and reinforce social inequalities in society. Because the program requires students to pause their education for a year before continuing with a potential master's program, students with different backgrounds might show different levels of readiness to do so. The delay in entering the workforce might inhibit students from choosing this program from backgrounds with limited financial means. Economic benefits such as scholarships or student loans would not apply as this program would be absolved while not matriculated at a university or other educational institution. This imbalance could reinforce social inequalities. Another cost factor is the increased requirement for mobility and travel in Germany. As students rotate through different companies in different parts of Germany and abroad, higher costs arise to travel to and from these places. This can put further strain on students from lower-income backgrounds.

**Delayed Workforce Entry:** While the program enables students to make more informed decisions and have a broader horizon, participation also means dedicating a whole year to this program. Considering the existing labor gap and the generational shift upon the baby boomer generation's retirement, this affects the workforce's size, contributing to retirement funding and social security.



### 🌱 Eco-Social Benefits

**Empowerment of Workers:** PRIMS enables students to know different employers and work cultures before making a career decision. This broadens their horizon and helps them build a more rational mindset. This personal development supports an informed and more targeted career choice. The program further allows students to pick the proper study focus for their following academic trajectory, as the different rotations highlight different job profiles building on differing study paths. In addition, there is a benefit of having insights into different companies and connecting with other students in the batch, as students are empowered in future negoti-

ations from the insights they gained and shared with other students. In particular, for women, this can support them in closing the gender pay gap, as they have more insights into what peers earn.

**De-Urbanization:** As the gap year program focuses on Mittelstand companies, the students will be located in their respective areas. Considering that a large portion of Mittelstand companies is found not in cities but in suburban or rural areas, students will experience life outside the city in a new way. By organizing activities and building communities, rural areas are gaining attractiveness. This is beneficial, as congestion in cities is reduced. In addition, the higher mobility be-

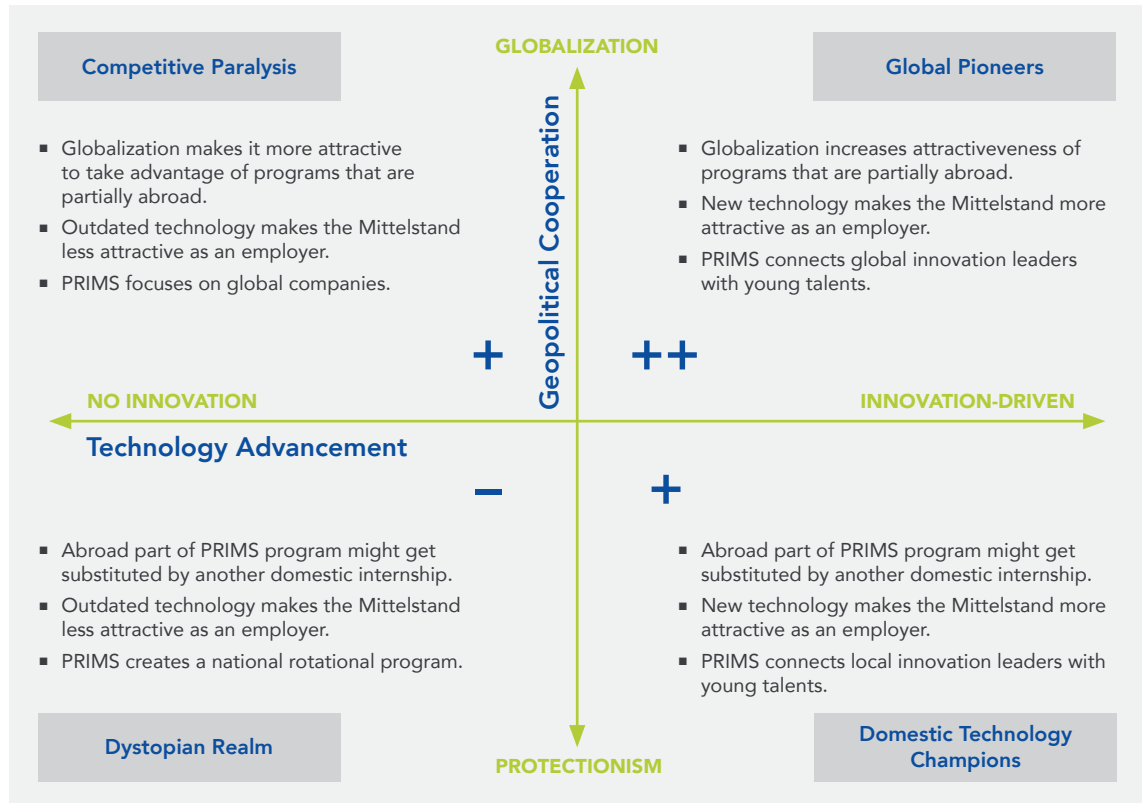
tween cities and rural regions can tackle the societal divide and improve transport infrastructure.

**Tackling Labor Shortage:** With PRIMS, more students and young innovators are learning about Mittelstand companies, what they are and what issues they face daily regarding the labor shortage. With the improved understanding and the overarching innovation project, PRIMS fosters targeted innovation to solve the issue of labor shortage based on first-hand experience. As the issue is very complex and individual to specific industries and locations, students learning about the issue directly supports knowledge exchange and tailored problem-solving.

**Scenario Fit:**

**Global Pioneers:** In this scenario, Mittelstand companies are technology leaders adapting cutting-edge innovations and developing their own ones. In a highly globalized world, they can operate without any restrictions and have a leading position in the market. This scenario is ideal for the PRIMS program for several reasons. Firstly, Mittelstand companies are attractive employers due to their high level of innovation and agility, which means that students, excited by promising career opportunities, will look for ways to get into the Mittelstand. This will allow us to reduce the cost of attracting interns. Secondly, globalization makes overseas internships more accessible. Gaining applied international experience makes our program even more attractive to prospective interns. In general PRIMS is an intermediary between the innovative Mittelstand and young gifted talents, which provides the most convenient and beneficial way to interact with minimal risks for all parties.

**Competitive Paralysis:** Globalization, new markets, and cross-industrial competition exacerbate the situation for the Mittelstand, which has failed to innovate. International giants are buying up Mittelstand companies. Many of those left in the market cannot compete and eventually go bankrupt. Mittelstand companies are in dire need of a skilled and innovative workforce but have nothing to offer the labor market. Students do not consider working in such companies prestigious and prefer global corporations. Despite this, the PRIMS program will be able to benefit from this scenario. To do this, PRIMS will have to drop the "MS" in the name (which stands for "Mittelstand") and shift the focus of the program to rotational internships in global companies. This will meet the demand of corporations for a skilled workforce and enable



students to get a turnkey cross-industrial and international experience.

**Dystopian Realm:** In this scenario, rising geopolitical tensions are forcing Germany to become a protectionist state and shift its focus to military ventures. Mittelstand companies are often nationalized and reformatted to meet the needs of the state. This leads to a regression of technological development, and the Mittelstand loses its attractiveness as an employer. The drain of skilled talents exacerbates this problem. For the PRIMS program, this leads to several challenges. First, non-nationalized and non-bankrupt Mittelstand companies are struggling for their existence. Therefore, they are in

great need of low-skilled personnel and are not very interested in rotational internship programs for future innovators. In addition, students are less interested in working for companies that can neither offer competitive salaries nor positions that fit their university degrees. To address these issues, PRIMS could shift the focus from university students to high school students. The program could also work closely with the state and jointly create a national rotational program, upon the completion of which the state will send students to work in a company of its choice.

**Domestic Technology Champions:** Mittelstand companies are focusing on the domestic market due to the end of glob-

Trend Scenario Ideation

al competition, decoupling, and government protectionism. At the same time, they are at the forefront of innovation and are technological leaders. To drive innovation even further, companies compete for a highly skilled workforce. Young talents are happy to work in such companies, as they provide excellent working conditions and the opportunity to contribute to developing new technologies. This scenario is well suited to the PRIMS program and does not require significant changes in the business model. Due to protectionism, PRIMS will have to give up non-European internships, which will not be a considerable challenge since Germany and Europe will stay attractive places to work. The program will be in demand as it will provide students with an enjoyable and diverse internship experience and facilitate recruitment for Mittelstand companies.

### Challenges

- PRIMS needs to achieve reputation in the Mittelstand as well as in student circles. Both parties must be convinced about how to profit from the gap year program.

- An internship in a small town or rural area can be less appealing for young, motivated talents.
- The supply and demand imbalance can endanger the program. PRIMS can only offer as many places in the program as open positions at Mittelstand companies.
- Offering different tracks and gap year specializations mean PRIMS needs to diversify its project partner portfolio.
- After successful completion of the gap year program, talents can decide how they want to proceed in their career. This does not necessarily mean that all the talents return to the Mittelstand for their first full-time position.

### Outlook

While the initial focus of PRIMS lies on domestic Mittelstand companies with sufficient size to accommodate a group of eight to ten students, the offering will expand continuously as the program size grows. Relying on a strong and increasingly international network, PRIMS will establish itself as Europe's leading gap year internship program. The highly modular nature of the rotations and the ability to dive deep into

technical ecosystems attract not only German graduates but also international students. Expanding the network across European organizations, the program becomes increasingly global, and tracks can be tailored to individual preferences and specializations. The strong brand and network build trust from Mittelstand companies to participate, further increasing the attractiveness of PRIMS. To address new target groups, a second offering will be introduced. This product is tailored toward high school graduates to assist in the decision between university and apprenticeship. With the growing size and more significant number of batches per year, community management will gain importance in order to facilitate connections and organize events.





# LAGERMEISTER

Exchange Platform for Commercial Warehouse Space

The VUCA (volatility, uncertainty, complexity, and ambiguity) world created by wars and changes in global supply chains leads to an increasing need for flexibility and adaptability. Adapting to an ever-changing world puts enormous stress on small and midsize companies. As a result, warehousing has become a problem. Reacting to changes in demand requires complex logistical decisions. For companies that own warehouses, vacant space is untapped revenue. For other companies, the same unoccupied space solves their warehousing demand.

To tackle seasonal and VUCA-induced changes in demand, we do create a network of warehouse space suppliers and warehouse space seekers. LAGERMEISTER brings simplicity into the complex world of warehousing logistics. Our solu-

tion, empowered by the latest machine learning (ML) algorithms, matches companies needing warehouse space with companies with unused warehouse space to generate extra revenue.

LAGERMEISTER delivers value to two different customer segments: warehouse tenants and owners. The first customer group is companies in need of warehouse space. To satisfy their demand, we are offering a seamless experience that includes finding a suitable warehouse space (taking into consideration the size needed, most optimal location, and distance from their customers) and optimized warehouse management using the latest digital technologies to ensure that the facility is operating efficiently and meeting its objectives. Furthermore, LAGERMEISTER cooperates with logis-

tics companies to take care of the products' picking, packing, and shipping.

The second customer segment is warehouse owners with empty warehouse space available due to seasonal or decreasing production, geographical change in production hubs, or unexpected external events. Regardless of their warehouse size and capabilities, these companies can register on LAGERMEISTER and specify the warehouse space they want to rent. After the onboarding process, our company is responsible for adjusting the warehouse facilities according to the needs of the potential users (e.g., adding shelves, cooling spaces, etc.).

Dmitry Burlakov



Salma El Ghayate



Anna-Lena Sahler



Christian Wallenwein



Leopold Wieser



Ruby Zhang





## Business Model

 Key Partners

- Established logistics companies
- Warehouse owners
- Warehouse management tech companies

 Key Activities

- Advertising to attract potential customers
- Digitalizing the warehousing management
- Providing tracking and security monitoring services
- Data analytics to optimize warehouse processes

 Key Resources

- Employees and expertise
- Warehouse database
- Partnerships
- Software

 Value Proposition

- Pay per use instead of building warehouses or long-term rent
- Adapt to rapid demand changes and unexpected events (e.g., seasonal products)
- Virtual warehouse management (Plug&Play warehouse)
- Additional revenue streams by renting out warehouse space
- Digitalize and upgrade existing warehouses and platform integration (through third-party logistics companies)

 Customer Relationships

- Warehouse owners get long-term support and further optimization
- Warehouse tenants get service for product support and ongoing product improvements through demand analytics

 Customer Segments

- Warehouse owners as companies that have access to free space in warehouses
- Warehouse tenants as companies and event organizers in need of warehouse space

 Channels

- Targeted advertisements on B2B platforms, Google, etc.
- Offline advertisements on conferences, through associations, newsletters and magazines

 Cost Structure

## Initial Investments

- Mobile and web software developments
- Establishing partnerships with logistics providers and tech partners

## Fixed Costs

- IT equipment
- Maintenance of application
- Salaries, office rent, utilities

## Variable Costs

- Marketing costs
- Customer service
- Employee training
- Third-party logistics supplier onboarding
- Software subscriptions

 Revenue Streams

## From Warehouse Owners

- Subscription fee
- Setup charge on digital hardware and software

## From Warehouse Tenants

- Monthly dynamic service fee
- Add-on priority support fee

 Eco-Social Costs

- Reduced employment opportunities for warehouse workers
- Counter-innovation, if LAGERMEISTER starts to be perceived as a more accessible revenue stream
- Quicker shipping infrastructure contributes to more carbon emissions

 Eco-Social Benefits

- Reduced energy use
- Less CO<sub>2</sub> emissions
- Reduced burden for residents
- Closer collaboration between Mittelstand companies
- Higher tax revenues from the logistics sector
- Reduced entry barriers for new companies

 Value Proposition

**Warehouse Owners:** Warehouse management requires a lot of planning and demand estimation, and owners can, therefore, not fully utilize their warehouse space. They deliberately leave space to be able to adapt to times of high demand, seasonal fluctuations, etc. LAGERMEISTER allows warehouse owners to bring them closer to perfect utilization. They can generate additional revenue streams by offering their leftover warehouse space to companies in need. Using LAGERMEISTER will increase revenue streams even if only used for short periods without significant extra effort. LAGERMEISTER also offers digitalization of warehouses on request for warehouse owners that want to use their full potential. LAGERMEISTER can digitalize warehouses using state-of-the-art in-warehouse logistics technology and integrates the owner's logistic platform with leading third-party logistics companies.

**Warehouse Seekers:** Building warehouses has become unfeasible for many Mittelstand companies as they require high upfront investments. Prices for warehouse space are growing because warehouse space is limited, while demand is expected to grow by 4m<sup>2</sup> until 2025. Rising energy prices and material shortages reduce profit margins. Instead of building or buying warehouses, companies only pay for the warehouse space they need when using LAGERMEISTER. A second problem is a growing number of German municipalities that prohibit building new warehouses. Instead of possibly unsuccessful, time-consuming, and expensive negotiations, customers of LAGERMEISTER receive quick access to warehouse space throughout Germany. LAGERMEISTER also enables its customers to quickly adapt to unforeseeable events by ordering warehouse space on demand. Furthermore, switching to LAGERMEISTER warehouses is effortless because all logistical hurdles, like picking, packing, and shipping are handled by third-party logistics providers over the platform. Finally, speedy delivery is provided to end customers. When a warehouse tenant orders a particular product, our third-party logistics partners quickly ship the goods.

 Customer Segments

LAGERMEISTER is a two-sided platform, which means that two different customer groups benefit from the solution. These customer groups pursue opposite goals, namely renting or leasing, and can be individuals or companies.

**Warehouse Owners:** One customer group of LAGERMEISTER is represented by the owners of the warehouses. This customer group owns storage space they do not need and would like monetization. The owners can either be companies that own commercial storage space or individuals. The biggest problem of this client group is finding a suitable tenant for the storage space and taking care of the whole leasing process. This is where LAGERMEISTER comes in, finds suitable tenants, and takes care of the process anonymously. The landlords pay a handling fee to LAGERMEISTER but have the advantage of not constantly looking for new landlords who only want to rent for a short time due to seasonal demand.

**Warehouse Tenants:** Contrary to the first group, the second group of customers needs additional storage space. This group includes individuals or event organizers, but most commercial companies. The reasons for extra storage space range from a permanent solution due to increased production capacity to short-term storage space due to seasonal demand. As storage capacity is scarce, especially in Germany, this customer group is willing to pay a margin to LAGERMEISTER. Another benefit for this group is the complete transport of the stored goods from the old warehouse to the new one and eventually even to the end customer.

 Customer Relationships

Attracting new customers and building a loyal user base are crucial for LAGERMEISTER. Additionally, LAGERMEISTER being a multi-sided platform, implies the interdependent relationship between the two customer groups. Our platform is only attractive to warehouse owners if there are enough tenants and vice versa. Hence, there is a strong emphasis on building strong customer relationships with the two customer segments.

**Warehouse Owners:** Unused warehouse space and rising costs are the warehouse owners' main worries. LAGERMEISTER will develop a collaboration with warehouse owners and a customer relationship. LAGERMEISTER will assist warehouse owners in making the most of their space by cooperation. The warehouse owner only has to provide basic warehouse information. LAGERMEISTER will search for an appropriate warehouse tenant and handle all procedures, including transportation, warehouse onboarding, and monitoring, without the warehouse owner undertaking any additional activities. For the customer relationship, LAGERMEISTER

will support warehouse owners in modernizing their facilities and providing various services such as freight analytics and optimization. These services effectively support traditional Mittelstand's digital transformation. LAGERMEISTER will also manage critical accounts for warehouse owners.

**Warehouse Tenants:** By opting for LAGERMEISTER, the tenants expect a seamless warehouse and logistics management of their products. That implies initial personal customer service and onboarding to guarantee a suitable warehouse allocation. Furthermore, LAGERMEISTER offers an analytics tool to better understand the market demand according to the season and industry. The latter point enables warehouse tenants to improve their offerings through accurate data. The specificities of this relationship make it one that should be based on personal assistance (the customer should be able to communicate with an actual customer representative to get help at any point of the sales process) and aimed to be long-term.

 Channels

**Online:** In a digitalized world, online channels are essential for addressing customers and partners. LAGERMEISTER has recognized this, sees targeted advertising on Google, and selected business-to-business (B2B) platforms as critical marketing channels. In addition, LAGERMEISTER invests in search engine optimization to be displayed as the first entry in the search results of popular search engines for search queries related to warehousing solutions. As content marketing increases in relevance for B2B companies, LAGERMEISTER cooperates with warehousing podcasts, blogs, and newsletters by creating informational content, appearing on podcasts, and running ads. Furthermore, LAGERMEISTER utilizes the potential of professional platforms by regularly posting content, running ads, and actively participating in warehousing and logistics-related groups.

**Offline:** While the world is becoming increasingly digital, many Mittelstand companies still prefer offline sales channels. As one of LAGERMEISTER's largest customer groups, they make using these channels essential. LAGERMEISTER addresses potential customers and partners at conferences and trade fairs related to small and medium-sized enterprises (SME) or warehouse solutions. LAGERMEISTER works closely with nationwide and local industry and trade associations to gain access to large corporate networks. The representation

in the magazines and newsletters of these associations enlarges the circle of potential customers of LAGERMEISTER. The focus on superior customer support increases retention and customer satisfaction, resulting in word-of-mouth marketing by encouraging existing customers to endorse LAGERMEISTER to their business network. Recognizing that personal referrals have a very high conversion rate, LAGERMEISTER is introducing a unique referral system that encourages customers and partners to invite new participants to the platform in exchange for financial benefits.

### Key Activities

**Advertising to Attract and Build a Relationship With Potential Customers:** To create a network of warehousing partners, advertisement and relationship building are crucial. For this, LAGERMEISTER is constantly exploring new possibilities of reaching out to warehouse owners and potential customers needing space to store their products. To achieve this, we are present at Mittelstand fairs and networking events. From this networking activity, LAGERMEISTER is curating a database with potential customers ranked by estimated conversion possibility, location, and storage capacity.

**Setting up Digital Tools at Warehouses:** With the help of external hardware and equipment providers, LAGERMEISTER offers warehouse owners to upgrade and digitize their existing warehouse facilities to make them more efficient. Setting up hardware for digital tracking and storage management also allows for more transparency to LAGERMEISTER's customers and boosts the potential revenue for warehouse owners.

**Providing Tracking and Security Monitoring Services to Warehouse Tenants:** In cooperation with external logistics companies, LAGERMEISTER aims to provide transparency and security for all goods handled through its platform and partners. When stored at one of our partnering facilities, this is enabled by the digitalized and monitored infrastructure that LAGERMEISTER imposes during warehouse onboarding processes. We collaborate with external logistics providers during delivery and transport to ensure our direct customers can reliably track products. They can, in turn, forward this data to their end customers.

**Data Analytics to Optimize Warehouse Utilization:** LAGERMEISTER utilizes the data collected from our logistics and



warehousing partners to give insights into warehouse optimization. This includes demand forecasting based on locations and seasonal demands. LAGERMEISTER achieves this by utilizing state-of-the-art time-series analysis algorithms and machine learning models.

### Key Resources

**Employees:** LAGERMEISTER's most important resource is its employees. Backend and frontend developers are essential for developing an easy-to-use platform. In addition, LAGERMEISTER employs machine learning engineers, data engineers, and logistics experts to develop optimization and forecasting algorithms. Electrical engineers are responsible for Internet of Things (IoT) device integration and automated picking tools. A sales team specializing in the Mittelstand is LAGERMEISTER's greatest asset in acquiring new customers and building a network of warehouse owners. Onboarding staff ensures that warehouse owners have better usability for using the LAGERMEISTER platform, and quality control employees ensure that standards are maintained throughout the network. These standards are a prerequisite for smooth col-

laboration between our partners. This is especially important for warehouses that store products at certain temperatures or under increased security conditions.

**Data:** Connecting warehouse owners and customers, LAGERMEISTER has access to a database of available warehouse locations and vacancies. The most valuable data, however, is information about demand, seasonality, and density that can be used for predictive product allocations and location-based matching.

**Partnerships:** LAGERMEISTER curates a network which consists of two customer segments – warehouse seekers and warehouse owners – and also cultivates partnerships with logistics and warehouse infrastructure providers.

**Software:** LAGERMEISTER guarantees customers a smooth interaction by investing in a user-friendly web interface for ordering and managing warehouse space. In the backend, powerful optimization algorithms match customer demands to the warehouse based on usage frequency and location. For warehouse owners, LAGERMEISTER provides a mobile app that allows scanning and managing packages, providing customers transparency and tracking options. Furthermore,

LAGERMEISTER integrates with key partners such as logistics providers and warehouse management software companies. This allows customers to handle all logistics interactions over the LAGERMEISTER interface without reaching out through external channels.

### Key Partners

There are three key partners LAGERMEISTER cooperates with. The most important partner is the owners of warehouses with free space. Second, logistics providers are needed to provide transportation to and from the integrated warehous-

es. Thirdly, companies are required to supply the technical equipment to integrate warehouses into our system.

**Warehouse Owners:** The most important partners for LAGERMEISTER are the owners of the existing warehouse infrastructure. Many warehouse owners cannot utilize their warehouse space entirely because of rapid demand changes and a declining economy LAGERMEISTER offers these players additional revenue streams for their vacant warehouse space.

**Established Logistics Companies:** To ensure a smooth process for customers, LAGERMEISTER works with external logistics providers. These partners are necessary to pick up

products from our direct customers and deliver them to the network of warehouses working with LAGERMEISTER. These logistics companies are also responsible for picking, packing, and delivering the products from the warehouses to the end customer.

**Technical Companies for Warehouse Management:** We work with warehouse technology providers to enable easy integration of warehouse operators into our platform. LAGERMEISTER offers a tier system for its warehouse suppliers based on technology integration and level of standardization with the platform. A higher tier corresponds to a higher level of compatibility with the platform, which also means that LAGERMEISTER takes lower margins, as better integration enables more efficient processes. To achieve this integration, warehouse management technology suppliers provide the necessary hardware to organize, scan, and track our customers' products in the warehouses of our collaborative network. This hardware includes forklifts, warehouse racks, and scanning equipment. If necessary, these partners also install and maintain the warehouse equipment.

### Revenue Streams

**Subscription Fee from Warehouse Owners:** When warehouse owners have extra space to rent, they can join the LAGERMEISTER network and access its holistic services for a one-time onboarding fee and monthly fees for accessing the platform. This subscription includes 24/7 customer service, a guarantee that a suitable tenant is found within a specific period, and warehouse optimization analytics.

**Tiered Setup Charge for Warehouse Owners:** LAGERMEISTER provides warehouse owners with a mandated tiered standard, digital upgrading services to assist them in adjusting to the digital age, and improved services to warehouse tenants. The cost is scaled based on the state of the warehouse infrastructure. When the warehouse infrastructure is already digitally managed, LAGERMEISTER only standardizes the warehouse space and integrates LAGERMEISTER equipment for a basic tiered charge. When the warehouse space is not digitized, LAGERMEISTER deploys intelligent setup solutions, including storage, monitoring, and digital analysis tools, for a fee corresponding to a higher tier.

**Monthly Dynamic Service Fee From Warehouse Tenants:** LAGERMEISTER charges flexible monthly fees from ware-



house seekers based on geographical location, cargo size, the density of local warehouses, and time. This fee is the only required for warehouse tenants and covers all-inclusive services such as customer support, transportation, packaging, and tracking.

**Add-on Priority Support Fee:** LAGERMEISTER will change how Mittelstand companies handle warehousing needs. Shifting to a shared warehousing solution such as LAGERMEISTER will require additional support for some warehouse tenants. For an additional fee, they will receive priority support and detailed explanations for all upcoming questions.

### Cost Structure

**Initial Investments:** LAGERMEISTER must build algorithms that connect warehouse owners and tenants depending on geographic location, cargo size, logistical conditions, and other factors. As a website- and app-based platform, LAGERMEISTER must also finalize the design of product features and contact appropriate logistics partners such as DHL and warehouse tech partners to set up the entire process in the pre-launch phase.

**Fixed Costs:** LAGERMEISTER has low fixed costs since it does not own warehouses or hardware. The highest fixed costs include office utilities, rent, software maintenance, and research and development (R&D) expenses. LAGERMEISTER does not demand a high standard of office. Thus, expenses are kept to a minimum. Software maintenance fees cover such expenses as platform and app upgrades. LAGERMEISTER aims to invest a percentage of the cost in R&D to build its smart warehouse management technologies, such as video surveillance, cargo pickers, weight, temperature sensors, etc. In the long term, investing in such R&D will lessen our reliance on external technology businesses. Furthermore, if necessary, LAGERMEISTER may need to pay for partnerships like DHL.

**Variable Costs:** LAGERMEISTER's variable costs are divided into three areas. The first is employee training and compensation. When onboarding warehouses, it is necessary to standardize processes and employee training. Furthermore, as client relations are a key success element for LAGERMEISTER, the company requires a considerable number of customer support and customer network personnel. The second

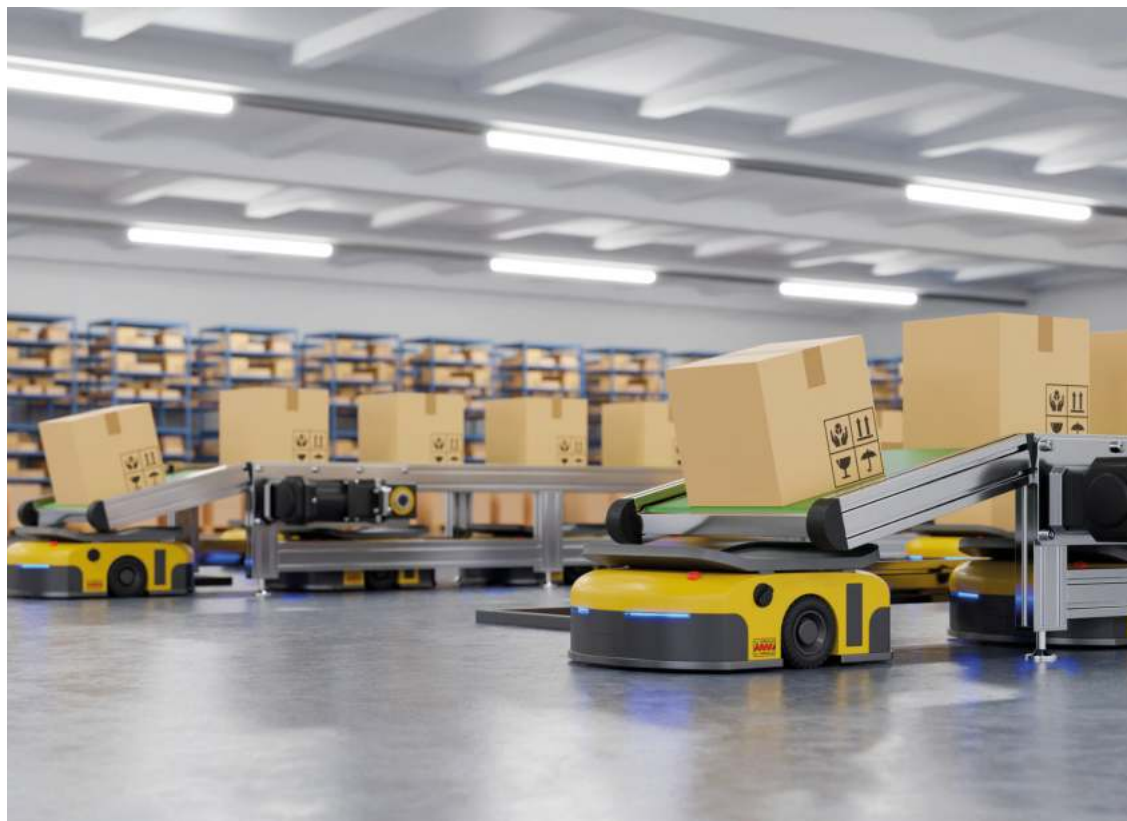
cost segment is marketing costs. LAGERMEISTER must engage in numerous ways to attract customers, including online and offline channels. Lastly, LAGERMEISTER has the cost of hardware facilities, logistics, and so on that third-party partners may charge for the supply of services, which will vary based on customer demands.

### Eco-Social Costs

Although LAGERMEISTER improves the efficiency of warehouses and encourages sharing resources, ecological and social costs must be considered. Eco-social prices refer to

the implications of our business model on the environment and society, respectively. It is crucial to take these costs into account since, a lot of the time, they have significant financial and legal implications on the continuity of the business.

LAGERMEISTER might disrupt the motivation of warehouse owners to continue their business operations and innovation by providing an additional revenue stream. Effectively, most empty warehouse spaces are caused by a decrease in production. Suppose LAGERMEISTER starts to generate a more accessible, stable, and decent revenue or even starts being perceived as a passive income stream for some companies. In that case, they might switch their primary business to being a



LAGERMEISTER warehouse provider. This could result in the original company workers losing their job. Furthermore, that could prevent some companies from innovating and finding solutions to declining industries. Another effect could be the decrease in employment opportunities for people building and operating warehouses due to the digitalized processes of LAGERMEISTER.

From a social perspective, it is undeniable that energy sources are crucial for LAGERMEISTER's operations (e.g., transportation, electricity). The changes and unpredictability of energy sources' prices affect the end consumer and society. Consumers end up paying the full social marginal cost of products. These price rises can lower the demand, create inequality within the society, and affect production.

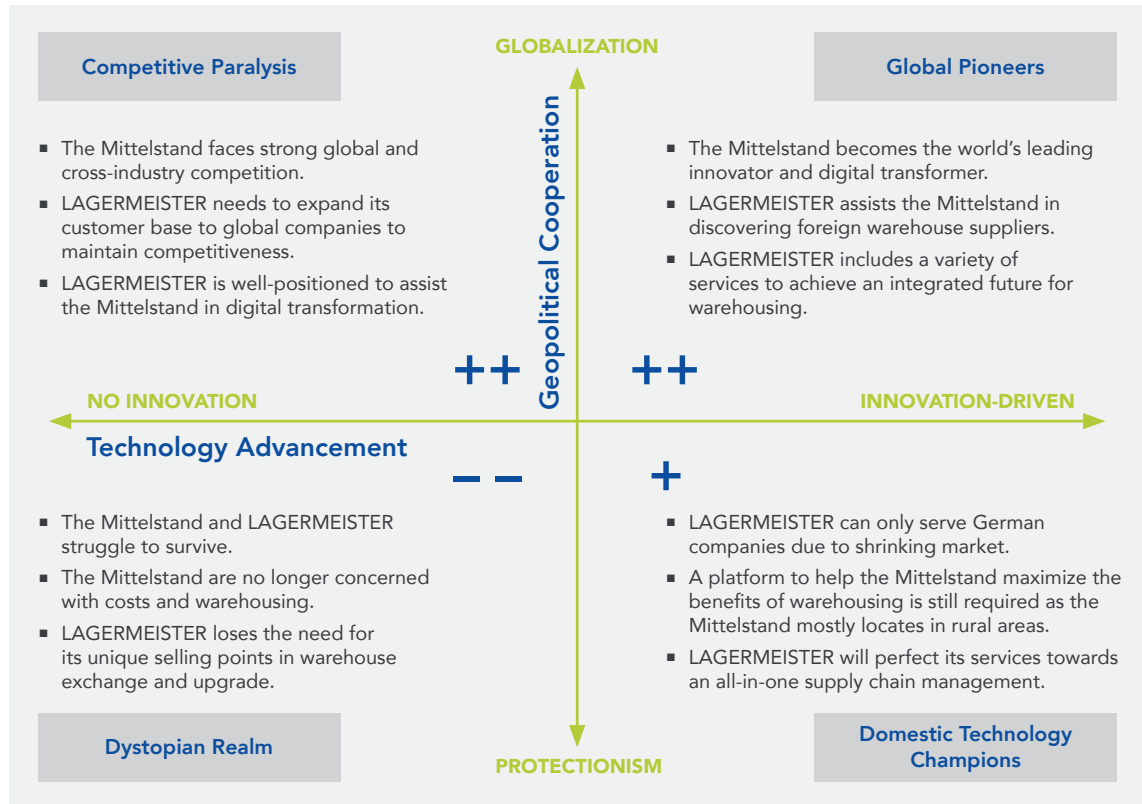
On the environmental side, LAGERMEISTER's logistics optimization will lead to decentralized storage closer to the end customer to reduce the final delivery time. However, this would lead to more frequent but shorter trips, with each truck transporting less cargo. While this strategy ensures better delivery times, it causes more carbon emissions.

In a nutshell, these environmental costs can impact society through carbon taxes that make individuals and firms pay the total social price of carbon pollution. The latter might result in tax evasion and companies moving to other countries.

 **Eco-Social Benefits**

The higher utilization of existing warehouses will reduce the overall energy consumption of warehousing in Germany and, therefore, the emitted CO<sub>2</sub>. High utilization of existing warehouses reduces the need for building different warehouses. Warehouse base frames are predominantly made from steel, which has a high carbon footprint. Subsequently, fewer warehouses mean less steel usage, which results in the saving of unnecessary CO<sub>2</sub> emissions.

Municipalities across Germany restrict building new warehouses to improve the quality of living for residents. The reduced traffic volume will make municipalities more attractive to residents. LAGERMEISTER connects Mittelstand companies around Germany by sharing their warehouse space. This will create synergy effects for the entire sector, improve collaboration and possibly pave the way for further sharing models such as machine sharing. The increased revenue of



warehouse owners will lead to higher tax charges (e.g., sales tax) which in turn can be used to improve the lives of citizens.

Starting a business that sells physical goods typically requires a high upfront investment for acquiring warehouse space. LAGERMEISTER reduces this obstacle by providing affordable storage solutions increasing the chances for successful entrepreneurial endeavors. This, in turn, leads to higher prosperity, employment, and tax returns.

**Scenario Fit**

**Global Pioneers:** Mittelstand companies are the world's leading innovators and digital transformers and are the biggest winners in this scenario. With a solid relationship with the Mittelstand, LAGERMEISTER is constantly improving its services. In line with globalization, LAGERMEISTER will expand its services to assist companies in discovering foreign warehouse suppliers. In addition to logistics, LAGERMEISTER also includes customs clearance, sustainability, and a variety of other compliance requirements to achieve an integrated future for warehousing. Simultaneously, as the Mittelstand improves its R&D, LAGERMEISTER will contribute to safe-

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Ideation

guarding clients' intellectual property rights in terms of data security and cargo safety by refining LAGERMEISTER's data analysis and intelligent systems. In this scenario, LAGERMEISTER can develop additional services outside the warehouse exchange, such as better industry demand and supply prediction to optimize the supply chain. Therefore, LAGERMEISTER will be a winner in this scenario.

**Competitive Paralysis:** In this scenario, the Mittelstand will face the impact of international and cross-industry competitors and will be at a disadvantage when it loses its innovative core competencies. As LAGERMEISTER's initial target customers are Mittelstand companies, LAGERMEISTER needs to expand its customer base to maintain competitiveness while retaining existing customers. Since warehousing is a critical need for any company, especially for multinationals, LAGERMEISTER can still find many business opportunities. At the same time, for the Mittelstand, the lack of technological advancement means that they still require traditional logistics or warehousing systems. LAGERMEISTER is well positioned to assist them in undergoing the digital transformation necessary to keep up with the changing times. As a result, LAGERMEISTER will reach its full potential in this scenario.

**Dystopian Realm:** The Mittelstand will struggle to survive and maintain its core competencies in the face of protectionism and lagging technological development. It will either cooperate with the government or consolidate into gigantic corporations. The government will also invest in the military to maintain its international standing. LAGERMEISTER will thus face two challenges. The first is a shrinking market due to fewer Mittelstand companies and a closed domestic market. The second challenge is changing customer needs. The focus of development will no longer be on sustainability and intelligence. The Mittelstand may shift to produce the materials required by the country and will no longer be concerned with costs and warehousing because the government will plan the warehousing and use of materials uniformly. As a result, LAGERMEISTER, whose unique selling point is warehouse exchange and upgrade, suffers a drop in demand. In such a scenario, LAGERMEISTER may struggle to survive.

**Domestic Technology Champions:** In this scenario, LAGERMEISTER can complete its mission, namely, to exchange and upgrade warehouses. Even though LAGERMEISTER can only serve German companies due to the shrinking market, more than 3.5m Mittelstand customers can already enable LAGERMEISTER to reach a profitable margin. Furthermore,

the majority of the Mittelstand stays in the suburbs. A platform to help them maximize the benefits of warehousing is still required. Meanwhile, LAGERMEISTER can broaden its customer base to include all corporations in need throughout Germany. As a result, LAGERMEISTER can promote German company unity and connectivity. With such an extensive network in Germany, LAGERMEISTER recognizes the importance of an integrated service from transport, storage, packaging, monitoring, and so on. As a result, it will perfect its services to achieve the all-in-one supply chain management goal. In conclusion, LAGERMEISTER will thrive, but without meeting its full potential.

### Challenges

- LAGERMEISTER's primary challenge is the imbalance between warehouse demand and supply. However, if corporations cluster into one region, LAGERMEISTER's demand will be significantly reduced; as a result, LAGERMEISTER must also increase its supporting services to remain competitive.
- LAGERMEISTER is a platform that relies on partners such as logistics companies and warehouse owners to supply services. As a result, the quality of partners influences LAGERMEISTER's reputation.
- Because LAGERMEISTER has global competition, maintaining a competitive pricing structure while offering holistic service entails precise calculations of revenues and costs.



- As the platform in charge of transportation and logistics monitoring for warehouse tenants, LAGERMEISTER must assure security, particularly for enterprises transporting specialized materials.

### Outlook

In consideration of current developments, LAGERMEISTER has enormous potential. LAGERMEISTER will initially focus on the Mittelstand, assisting in creating additional revenue streams with unused warehouse spaces and providing warehouse services for companies that lack storage spaces. LAGERMEISTER may rely on external technology providers to ensure digitalized and efficient warehouses in the early stages. Still, it will develop its intelligent matching algorithm and data analytics platform. LAGERMEISTER is expected to have partnerships in various European countries within the next ten years, legal and regulatory teams to assist in solving cross-border transportation challenges, and a sustainability team to assist in creating an environment-friendly supply chain. Simultaneously, LAGERMEISTER's established services assure providing integrated services for transportation, storage, customs, packing, and monitoring, considerably reducing warehouse tenants' burden. Depending on the changing global environment, LAGERMEISTER may opt to increase its global client base and focus on developing intelligent systems in the next 20 years.



# REBATTERY

## Circular Economy for Batteries

Battery production is a crucial puzzle piece for the electrification of our future. The development and adoption of the technology are creating the foundation for efficient renewable energy storage and e-mobility. Thereby, they have the potential to improve virtually any aspect of our daily lives. Businesses utilizing batteries are, however, strongly reliant on raw materials from a handful of countries outside of the EU and thereby dependent on fragile and complex supply chains. As battery demand is projected to increase further and the materials are known to be both scarce and hazardous, increasing attention is given to the efficient management of the battery end-of-life.

REbattery enables battery life cycle circularity by establishing an end-to-end solution to manage battery end-of-life with transport, storage, and second life allocation. REbattery col-

lects used batteries from diverse sources like cars, home batteries, or other energy storage systems. Once collected, the batteries are transported in hazard-proof containers to storage facilities and assessed on their current state of health. This enables optimal repurposing or reuse of batteries in good condition and recycling of batteries in worse condition. The storage, managed according to the determined degradation model of individual batteries, enables the collected delivery of large amounts of similar batteries to modern recycling facilities.

Close collaboration with actors involved in the battery life cycle enables REbattery to create value for multiple partners. Battery providers, such as Mittelstand companies using batteries along their operations, benefit from the services as their hazardous waste is seamlessly managed. This shields

them from recent EU regulations limiting the outsourcing of battery waste to foreign countries. Partners manufacturing products with batteries are regarded as reusers or repurposers as they get direct and cheap access to high-capacity batteries determined for a second life. Recyclers gain value from efficient supplies of large quantities of similar batteries, thereby enabling them to scale their operations and recover more materials that can restart their journey in the battery life cycle. This circularity lowers the dependence of the Mittelstand on the battery supply chain, creates a foundation for new players to emerge, and decreases material waste.

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## Business Model

 Key Partners

- Logistic companies and equipment manufacturers provide means for safe battery transportation
- Battery and database providers (e.g., automotive OEMs, workshops, and recycling facilities) to obtain the data of the supplied batteries for modeling purposes
- Industry alliances (e.g., German Electrical and Electronic Manufacturers' Association) to participate in the regulatory definition and to raise awareness for REbattery

 Key Activities

- Pick-up and transport
- Diagnosis of battery health and degradation modeling
- Consolidation and storage
- Allocation and second life/recycling
- Hand-over of used batteries

 Key Resources

- Technical and operations expertise in batteries and IT
- Logistics backbone
- Storage and transportation technology
- Digital infrastructure
- Logistics partnerships

 Value Proposition

## Battery Providers

- Disposal and transportation
- Best prices due to optimal second-life solution
- Battery quick check and evaluation of health
- Optimal storage

## Battery Purchasers

- Shipping of ordered batteries
- Receiving specified quantities of batteries fulfilling individual requirements
- Cheaper batteries
- Certified and tested batteries

 Customer Relationships

## Battery Providers

- Transactional relation
- Integrated partnerships

## Battery Purchasers

- Close relationships and knowledge transfer, including co-innovation of technology

 Channels

- Homepage
- Targeted advertising (fairs, cold calling, etc.)
- Networks in the battery industry

 Customer Segments

## Battery Providers

- Among others, Mittelstand companies and OEMs
- Providing REbattery with own already used batteries

## Battery Purchasers

- For recycling, reusing, and repurposing used batteries

 Cost Structure

## Initial Investments

- Developing the algorithms
- Data acquisition

## Fixed Costs

- Research and development costs
- Employees
- Office
- Marketing operations and related processes

## Variable Costs

- Data storage and acquisition
- Data scientists for consulting

 Revenue Streams

- Basic services, implementation and setup fees
- On-demand services, higher-fidelity simulation and interpretation support

 Eco-Social Costs

- Providing social impact has a related cost in energy usage
- Providing social impact has a related cost in terms of privacy

 Eco-Social Benefits

- Climate change mitigation and adaptation
- More transparent and effective urban planning

 Value Proposition

**Battery Providers:** REbattery collects the dismantled batteries from workshops, companies, and other battery collection points and transports them to the company's own central warehouse. Once at the warehouse, a battery quick check will be performed to assess the battery's state of health. The required battery data is either measured directly or existing data from the workshop, OEM, etc., is used. After the initial assessment, REbattery stores the batteries in optimal conditions (temperature and state of charge). For optimal storage, cell chemistry and geometry, state of health, and the overall condition are considered. Additionally, REbattery takes calendar aging during storage into account by using degradation models. The results of the initial battery check and the degradation model define the future application of the battery. Based on this, REbattery performs a battery-customer matching in which customer requirements are compared with the cell characteristics. This results in the best price guarantee for the used battery of the battery provider.

**Battery Purchasers:** After the battery is sold, REbattery ships the ordered batteries to their destination. The performed battery-customer matching ensures that the customer receives the best second-life batteries for the planned projects. Additionally, REbattery leverages its battery expertise and certifies every sold battery. This way, the customer can rely on the quality of the delivered product. Since the batteries are already used in the first life, the product's price is highly attractive and competitive with new batteries. The battery purchasers are able to minimize their critical global supply chain dependencies and are provided with the opportunity to exploit the battery value chain.

 Customer Segments

**Battery Providers:** REbattery collects used batteries as a service from their former users and owners. Thereby, REbattery focuses on B2B customers in Germany. In general, larger battery systems, such as electric vehicles (cars and trucks) and photovoltaic batteries, are in scope. Thus, the customer base of used battery providers consists of OEMs without proprietary battery reverse logistics infrastructure (e.g., automotive, residential energy/heating) and Mittelstand companies providing battery systems for residential usages (e.g., home energy storage) and industrial applications (e.g., short-term

backup energy, off-grid electric machinery). REbattery acts as a service provider to these customers and is not the buyer of used batteries. This keeps the business model financially asset-light.

**Battery Purchasers:** After collection, diagnosis, and storage of used batteries, REbattery re-distributes batteries for their second life. In general, three options are possible for used batteries: reuse, recycle, and repurpose. Each option has different customers and partners seeking access to used batteries. For reuse, batteries will be returned to their original manufacturer, e.g., leased battery cells of electric vehicles. These OEMs typically operate proprietary recycling/remanufacturing operations for their used batteries. REbattery is primarily paid for the logistics services provided. For recycling, typical recycling sites, as well as specialized battery recycling customers, are considered. Depending on the battery type and condition, these sites are able to extract valuable materials, such as lithium and cobalt, from the used batteries. Thus, these stakeholders will be willing to pay for used battery material, offering additional revenue streams for REbattery. For repurposing, a wide variety of use cases and stakeholders is in scope. A primary use case will be bundling used batteries in battery parks to provide short-term energy to the grid. Such operators are willing to pay for standardized battery systems in good, reliable conditions.

 Customer Relationships

**Battery Providers:** REbattery collects used batteries as a service from their former users and owners. In general, REbattery focuses on Business-to-Business (B2B) customers to grow sufficient battery volumes – without incurring the complexity of thousands of customer relationships. Depending on the user type and battery technology, the relationship depth varies from transactional customers to integrated partnerships. For standardized battery systems with large installed bases, REbattery is able to commoditize the logistics process, thus requiring minimal interaction upfront. A typical transactional customer relationship is with a small to medium-sized heating installer company, e.g., for the pick-up of used residential battery systems. For battery systems that require in-depth knowledge and data exchange before transportation, REbattery establishes integrated partnerships. An example of this relationship type is with automotive OEMs, respectively their contract workshops, that require special off-boarding and handling for their batteries.

**Battery Purchasers:** Core to REbattery's value creation is the optimized allocation of battery systems for their second life options. This process requires in-depth analytics for each battery cell type and aligned requirements with the second-life stakeholder. For each of the three second-life options (reuse, recycle, repurpose), strong customer-partner relationships are a prerequisite, yet with varying levels of knowledge sharing. For reuse, data exchange on the battery condition and special requirements for battery off-boarding are typically a prerequisite. Thus, next to the commercial relationship, operational integration of systems and standards will be required. For recycling, limited knowledge transfer is required – yet upfront, REbattery needs to understand the recycling capabilities of respective sites to ensure an optimized recycling outcome for all cell types. For repurposing, the closest level of integration is expected, including the co-innovation of technology and processes. For each use case (e.g., consolidated battery parks), new requirements and standards need to be defined.

 Channels

**Online Platform:** Next to a landing homepage, REbattery uses an online platform for managing customer communication. The target of the online platform is to perform efficient customer operations and to create awareness via presence in trade directories and targeted online marketing. Stakeholders such as logistic companies use the homepage to contact REbattery and to stay up-to-date regarding new developments and activities. REbattery aims to maintain and foster long-term and trusting relationships with its partners and customers.

**Acquisition of Battery Providers:** REbattery focuses on B2B transactions. This results in the opportunity to grow sufficient battery volumes without managing thousands of customer relationships. To be perceived on the market, REbattery aims for recommendations from existing partners or customers and to leverage its network. A major focus will be on cooperation with OEMs since the electronic vehicle battery market is expected to grow rapidly in the next five years. Nevertheless, REbattery also aims to cooperate with companies in other industries, such as operators of electric scooters or producers of electric bikes. The respective acquisition method depends on the potential volume of used batteries. Small volumes of used batteries could accumulate, for example, in independent automotive workshops. In this case, the order and the

aftersales process are handled online via the REbattery platform. Large volumes of used batteries could, for example, be gathered from automotive OEMs, represented through contract workshops. In this case, REbattery creates a personalized channel administered by customer success managers to foster customer relationships. REbattery approaches large volume customers proactively through the sales team.

**Acquisition of Battery Purchasers:** The individual needs of each distribution channel (reuse, repurpose, recycle) require the installation of individualized channels to react to the respective requirements. For each distribution channel, there are teams actively approaching potential battery purchasers if there is a fitting quantity of batteries coming up. Long-term business partners, potentially purchasing large volumes of used batteries, have priority through individualized agreements. New and smaller partners can gain initial experience and trust with the offered service via REbattery's platform.



### Key Activities

**Transport and Consolidation:** The first of REbattery's six main activities relates to the logistical process of collecting batteries from factories and small and medium-sized enterprises (SME) that have used batteries to hand over and transporting them to the company's own storage facility. Here, the focus is on the means of transport provided by the partners and the equipment to ensure safe and efficient transportation of used batteries to customers.

**Diagnostics and Calendar Aging Model:** After the transport and consolidation of the used batteries into the warehouse of the REbattery facilities, the second main activity starts. This focuses first on the diagnosis of the battery's state of health, where the aging degree and the general condition of the batteries are quantitatively checked. Based on the data

obtained in this way and the data received from the partners, degradation modeling then follows. Thereby, a prediction based on statistical analyses is made about the aging process during storage in the warehouse, and a general forecast is given about the development.

**Storage:** Once the data is available, the third key activity can follow: Storage. The optimal storage for the respective batteries is derived from specialized diagnostics and future development.

**Customer and Battery Matching:** As soon as a customer demands used batteries, battery matching takes place. Here, the used batteries are assigned to the respective customers based on their diagnostic characteristics and their degradation model by matching them with the customers' preferences.

**Logistics and Distribution:** The last step is delivering and distributing the used batteries to the matched customer. Thus, after the contractual bases have been settled, the means of transport are used again, and all ordered batteries are transported to the corresponding customer.

### Key Resources

**Technical and Operations Expertise:** REbattery is a technology and operations champion. The expertise – and with that, the people and respective partnerships – are a key resource. Technical expertise splits into battery and IT specialists. Battery specialists will contribute their know-how along the battery journey. They ensure safe transport and storage of batteries, build analytics capabilities per cell type, define requirements for optimized battery storage, and provide the guardrails for repurposing and recycling opportunities. Most of this know-how is developed in-house and in cooperation with universities and the broader battery ecosystem in Germany, such as startups and Mittelstand companies. Moreover, the IT specialists build the digital infrastructure, customer-facing, and back-end, to ensure a high level of automation and flexibility. Additionally, operations experts set up optimized route planning, transportation consolidation, and warehousing.

**Storage and Transportation Technology:** The key to REbattery's value proposition is the technology to enable a second life for batteries. This includes physical assets such as storage

## REbattery

facilities and transportation equipment, including respective safety systems, as well as analytics and software, e.g., battery health monitoring and allocation algorithms for recycling and repurposing. Parts of these technologies are outsourced to established companies, such as battery transportation containers. Others, such as analytics software, are developed in-house and co-innovated with OEMs, research institutions, and startups.

**Digital Infrastructure:** Digitizing operations is key for a sustainable cost structure at REbattery. At its core, REbattery builds a platform to automate customer interaction, as well as logistics scheduling along the end-to-end battery journey. This infrastructure is characterized by scalability via cloud technology and flexibility in a modern API architecture.

**Logistics Partnerships:** Part of REbattery's value proposition to investors is an asset-light business model. In the beginning, REbattery does not build proprietary logistics operations but relies on strong partnerships with established logistics firms. These logistics companies take over the transportation of batteries between the customers and REbattery using REbattery's containers. Thereby, developing joint operations and aligning battery-optimized transportation standards is key to value delivery.

### Key Partners

#### **Logistic Companies and Equipment Manufacturers:**

REbattery closely works together with several core partners responsible for the company's basic infrastructure and process capabilities. These primarily include logistics companies and equipment manufacturers accountable for producing transport equipment, such as secure boxes for delivering specific batteries. These partnerships aim to ensure the means of transport necessary for the transportation of batteries and to guarantee secure supply chains through specific equipment for safe battery transportation.

**Battery and Database Providers:** Another key partnership addresses REbattery's relationship with battery and database providers, such as automotive Original Equipment Manufacturers (OEM), workshops, and recycling facilities, both from the domestic as well as the global market. The purpose of these partnerships has two core aspects. The first relates to collecting used batteries from the market by having selected partners supplying REbattery with their used batteries. The



second aspect relates to data. To allow the battery health assessment processes to be carried out within REbattery's storage facilities more efficiently, the connection of data collected during the previous use of the battery, for example, is of central importance. Indeed, a rich battery database enables detailed data modeling, which subsequently provides information on the optimal storage of the corresponding batteries.

**Industry Alliances:** Finally, the partnership with associations, such as the German Electric and Electronic Manufacturers' Association, represents an essential basis for REbattery. Since suppliers and logistics partners usually reach their customers through word of mouth and private contact referrals, it is essential for REbattery to be perceived in the market. Specific battery-focused associations have the advantage that such referrals and recommendations appear to originate from a reliable source and thus have greater appeal in the market. Especially for the medium-sized market, such a recommendation implies a trustworthy and high-quality position.

### Revenue Streams

The generated revenue stream strongly depends on the used batteries. There are two major possibilities that need to be taken into consideration. The first scenario is that the batteries that REbattery handles are of low value. This could be the case for destroyed batteries, for example, batteries from accident electric vehicles. In this case, the battery provider is paying for the service. The second scenario describes the more likely situation in which the battery has a high value. In this case, the battery purchaser is paying for the service. Either way, REbattery acts as a service provider and is not the buyer of used batteries. This keeps the business model asset light.

**Revenue from Battery Providers:** In this case, the battery provider is paying a service fee to REbattery for taking care of the batteries. REbattery collects the batteries and tries to generate some additional residual revenue. This could, for example, be possible by selling large amounts of old batteries to a recycling company.

**Revenue from Battery Purchasers:** In the typical case, the receiver of the batteries is also paying for them. The purchaser is paying REbattery a service fee for the logistics, the certification, and the optimal allocation of those batteries that meet the individual requirements. The money for the battery itself will be directly forwarded to the battery provider. A typical example would be when a Mittelstand company wants to buy certified, used batteries to realize a stationary energy storage system. The Mittelstand company would purchase the batteries, stored and tested at REbattery, directly from an OEM. REbattery is charging the Mittelstand only a service fee.

### Cost Structure

**Initial Investment:** Long-term, REbattery's success depends on cost-efficient operations and scalability. The backbone of this strategy is twofold. Firstly, ongoing investment in building an online platform with a corresponding back-end to automate customer life-cycle management and logistics operations is required. This is primarily driven by personnel costs for technical staff. Secondly, investments in R&D for the technologies that enable optimized battery transportation and storage, including building partnerships with technology providers, are necessary. Notably, REbattery aims at staying asset-light to facilitate scaling of operations and lower costs of capital.

**Fixed Costs:** Firstly, fixed costs are driven by the acquisition, rent, and maintenance of physical assets. This includes rent and climatization for proprietary warehouses and office spaces, acquisition of storage infrastructure, as well as operative equipment, e.g., fire extinguishers, hazard containers, workstations, and forklifts. This also requires costs for transportation equipment, such as battery containers. Secondly, personnel costs are a major cost item. This includes white-collar positions in software engineering, management, customer service, sales, and logistics, as well as blue-collar staff for warehouse and transportation operations. Thirdly, costs for digital infrastructure, e.g., cloud computing, licenses, and third-party vendors, are incurred.

**Variable Costs:** Variable costs are driven by the number of transports, acquired customers, and recycling quality. For transportation, REbattery partners with logistics companies and provides equipment and driver up-skilling. For each route, the logistics partners charge a transportation fee. Thus,

REbattery avoids the costs of building a proprietary logistics infrastructure. For customer acquisition, costs are driven by marketing expenses and customer onboarding costs. For smaller customers, costs are limited as the online platform automates the process. However, for the onboarding of larger customers and second-life stakeholders, in-depth partnership relations are fostered, including technical customizations and integrated operations. Thirdly, REbattery manages costs for failed recycling/reuse. This could be the case if battery quality or type is insufficient for retrieving valuable materials.

### Eco-Social Costs

**Environmental Costs:** The business model of REbattery is dependent on the transportation and storage of used batteries. Currently, combustion engines are still the predominant propulsion technology in transportation. This is especially the case for heavy-duty commercial vehicles, which are needed to transport multiple batteries of cars or even trucks. Therefore, at least in the near future, the transportation of batteries will lead to greenhouse gas emissions, causing climate change.

Additionally, the storage of the batteries negatively impacts the environment. Firstly, the warehouses require sufficient

space, which is no longer available to nature. Secondly, REbattery stores the batteries in a controlled environment with regard to temperature, humidity, etc. Considering the current share of renewable energies in Germany, ensuring these constant conditions might require the use of non-renewable resources such as oil or gas or the emission of greenhouse gases.

Furthermore, used batteries are classified as hazardous products. When damaged from improper use, storage, or charging, they may present a fire or explosion risk. Usually, the bi-products from a lithium battery combustion reaction are carbon dioxide and water vapor. In some cases, highly hazardous hydrofluoric acid might be produced.

**Social Costs:** Climate change, which is also driven by the transportation and storage of REbattery, has severe effects on society. Negatively impacting human health, food availability, and labor productivity, it can lead to long-term economic harm.

Moreover, dealing with used batteries not only poses a risk to the environment but also to the workers as they can be injured by exploding or burning batteries. In addition, they might be harmed by hydrofluoric acid, which is hazardous as symptoms of exposure may not be immediately evident.




**Eco-Social Benefits**

**Environmental Benefits:** REbattery offers a solution that helps to achieve global environmental and climate goals. Typical use cases here are the deployment of batteries in the transition to locally emission-free electric vehicles and the stationary storage of renewable energy, for example, in battery accumulators. However, in the life cycle assessment of batteries, it is very important to consider the impact of manufacturing. Newly built batteries have a large ecological footprint, which must not be disregarded. REbattery's solution helps in enlarging the lifetime of batteries and therefore minimizes the environmental footprint. Defective batteries that would normally have ended up in the trash are now collected by REbattery and sent to the recycling cycle. This reduces the need for fresh raw materials, such as cobalt, silicon, nickel, or lithium. As a result, the greenhouse effect, which is particularly strongly associated with the depletion of the resources just mentioned, is significantly minimized. Further, REbattery equips companies with sufficient batteries and therefore accelerates the transition to sustainable technologies.

**Social Benefits:** REbattery provides a recycling and allocation solution for used batteries that primarily aims to strengthen the domestic market. This results in the economic opportunity for the Mittelstand to produce batteries "Made in Germany" and to become more independent from the foreign market. In particular, cobalt is mined mostly in Africa under bad and dangerous working conditions. REbattery reduces the dependence on cobalt from abroad and, at the same time, helps avoid exploiting workers. In the domestic market, this simultaneously leads to additional jobs in battery logistics, testing, remanufacturing, and recycling. REbattery stabilizes the supply chain of batteries and rare raw materials and reduces the dependence on autocratic states. This results in better global negotiating power for Germany. In the long term, REbattery also helps to reduce the energy dependence of other countries. Ultimately, this results in a better global negotiating position for Germany and long-term energy independence.

### Scenario Fit:

**Global Pioneers:** REbattery thrives as a used battery logistics service provider for global and domestic operating Mittelstand companies. REbattery's core competency of battery-optimized logistics is well sought after, and supporting



technologies fuel the partner ecosystem REbattery requires to establish its operations. However, global logistics operations add increasing layers of complexity to REbattery's business model. The need for partners abroad to provide global services reduces profitability. Additionally, global competition is fierce, and REbattery has to compete with many companies trying to capture the value of used batteries. Furthermore, REbattery's second value proposition – enabling circularity in the battery supply chain – is under pressure. Globalized supply chains facilitate the delivery of rare minerals worldwide, thus diminishing the need for recycling and repurposing used batteries. Nonetheless, fueled by rapid electrification and sustainability requirements, resource scarcity is still looming, bringing REbattery's business model to a favorable future.

**Competitive Paralysis:** REbattery's scope is growing slowly in line with the limited technological advancement in the Mittelstand for recycling/repurposing opportunities and battery technology. Due to the lack of standardized battery technology, REbattery faces high complexity in battery analytics. Thus, REbattery concentrates on selected battery cell types. As regional recycling and repurposing opportunities are limited,

REbattery primarily focuses on logistics services for used batteries – fulfilling only partially their promise towards true circularity. Simultaneously, global competitors enter the European and German markets igniting fierce competition and attacking slim margins. Nonetheless, fueled by rising electrification and sustainability requirements, mitigating resource scarcity is still a priority. This slowly but steadily pushes technology development in battery recycling and repurposing space.

**Dystopian Realm:** REbattery operates with a strong regional focus in a protectionist environment. Due to trade restrictions and sanctions, German access to rare mineral resources and other materials required for battery production is increasingly difficult. This drives regulation towards more circularity in all sectors and specifically in battery manufacturing. Thus, REbattery's value proposition is well placed. However, they struggle with the implementation and technology. The broader battery and technology ecosystem within the Mittelstand develops slowly. Therefore, REbattery invests more time and resources to build up capabilities in-house. Compounding these challenges are the limited repurposing

and recycling opportunities within Germany. Thus, REbattery focuses on selected cell types and use cases. Nonetheless, considering the need for domestic material retrieval, governments invest steadily in establishing the circular supply chain for batteries.

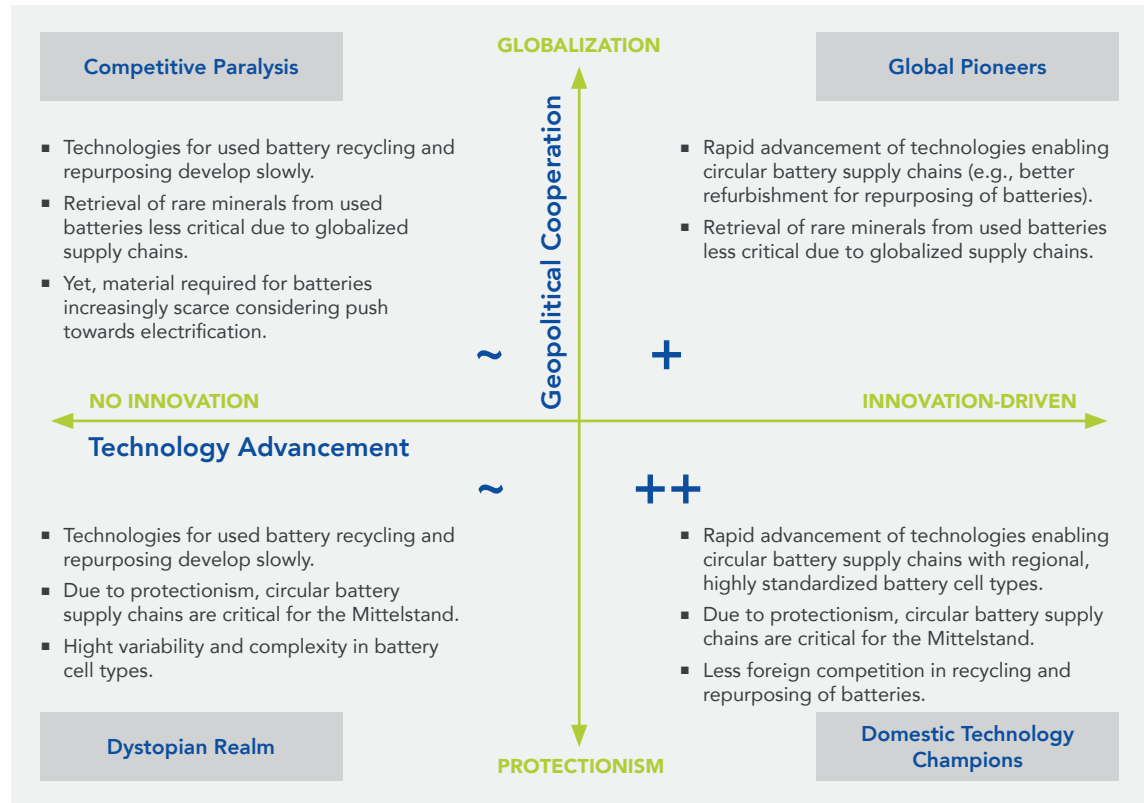
**Domestic Technology Champions:** REbattery faces significant tailwinds in a technology-driven and protectionist environment. Firstly, resource scarcity through increasing electrification and severe international trade restrictions drives the need for domestic retrieval of rare minerals and other materials in battery manufacturing. Secondly, regulation pushes the German industry towards the mandatory establishment of circularity in their products. Thirdly, the broader battery ecosystem in the German industry, specifically in logistics and battery companies, provides the breeding grounds for circular operations established by REbattery. Combining these tailwinds, the value proposition of regional circularity for batteries pushes REbattery's business model into the most favorable condition. Standardization of battery cell technology and various recycling and repurposing opportunities elevate REbattery to an important middleman facilitating the transition towards a sustainable and green economy.

## Challenges

- Ensuring safe transportation of used lithium-ion batteries without thermal runaway is challenging.
- High investments are needed for building and operating the necessary infrastructure, logistics network, and special warehouses.
- There can be difficulties in finding a sufficient number of qualified workers.
- Refurbishing and preparing for repurposing is difficult due to unstandardized batteries and the resulting lack of automatability.
- Customers need to be convinced of the high quality of REbattery's second-life batteries.
- Finding a fitting location for the warehouses, preferably in proximity to a recycling company, is challenging.
- The question of liability in case of a battery accident at the battery purchasers is currently unresolved.

## Outlook

REbattery provides end-to-end services to enable a circular battery supply chain: from pick-up of used batteries to consolidation and storage, up to their second life purpose. This



is a key service with regard to the electrification of industries and residential applications, e.g., cars and home battery systems.

In the short term, REbattery will build the backbone infrastructure to kick-start the operations: a customer-facing online platform and the logistics back-end. For this, initial partnerships with logistics providers and recycling and repurposing facilities will be required. Within this pilot phase, REbattery focuses on selected battery types, such as home battery systems of a specific OEM and the German market. In the long term, REbattery will invest heavily in its battery diagnostics and optimized storage solutions. In-house as well as co-innovation R&D concepts are essential to this technol-

ogy build-up. From that onwards, the scope of battery cell types widens, more recycling and repurposing facilities will be onboarded, and operations will be streamlined. Considering the push in regulation towards circularity and sustainability, a European expansion is a subsequent step. With increasing scale, unit costs will decrease, and profitability – after an initial investment period – will be reached.

# AQUATOS

Transform Water Usage

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## AQUATOS

### Water Reuse Solutions for the Mittelstand

Germany is drowning in heat. 2022 – this year's summer – set many new temperature records throughout regions in the country, with temperatures over 40 degrees not unseen. However, it is not only these high temperatures that cause problems but also the increasing prevalence of sunshine throughout the summer: the year 2022 was the sunniest summer since the beginning of the recordings in 1881. The resulting drought disrupted the water supply in hundreds of municipalities, making the water prices spike. This trend seems to be ongoing as the branch associations expect the water price to increase even more in the upcoming years.

As Germany has been a water-abundant country in the past, mitigation of increasing water prices and water shortage has often not been considered by Mittelstand companies. While major corporations can hire experts to manage their water usage effectively, many Mittelstand companies are overwhelmed with this emerging topic.

Aquatos is precisely addressing this issue. By providing end-to-end water reuse solutions, Aquatos is providing Mittel-

stand companies the systems they need to mitigate water shortage, be less dependent on external water sources, and be less affected by increasing water prices. An innovative pricing model disperses significant upfront investment costs and enables all companies to profit from the solutions. In addition, Aquatos is offering its solutions to industrial parks and entire municipalities for even more efficient and interconnected use of water.

Aquatos' end-to-end water reuse solutions consist of four stages. (1) Aquatos experts analyze the water reuse opportunities in a customer's company. This includes measuring the exact water usage and quality before and after every production step. (2) Aquatos determines the needed filtering systems and develops a dynamic water distribution network inside the company to filter and reuse the water as often as possible. The network itself and the production processes that use water are constantly measured with IoT (Internet of Things) sensors. (3) After construction and installation, (4) Aquatos fully maintains the systems. A digital twin of the

distribution network allows further optimizations even after the installation and helps to predict when certain parts of the facility require maintenance.

To reduce the burden of initial investment costs, Aquatos offers flexible construction fees. A recurring monthly payment after installation based on water usage ensures a positive, regular cash flow.



**Business Model**

 **Key Partners**

- Contractors who install the individual circulation systems on site
- Producers of filter systems that Aquatos uses in their solutions
- Suppliers of pipes, fittings, valves, and sewage technology

 **Key Activities**

- Analyze companies' water usage and provide individualized solutions
- Coordinate and supervise the construction
- Analyze data from built-in IoT devices for predictive maintenance

 **Key Resources**

- Engineers to plan individual solutions
- Maintenance and support workers
- Valid procurement system
- Integrated system planning competencies

 **Value Proposition**

- Easy onboarding
- Constant support and maintenance
- High-quality filtering
- Mitigate water shortage
- Local water supply security

 **Customer Relationships**

- Fixed project manager as the primary contact person for each customer
- Long-term, trusted partnership on a personal level
- Same technician team that maintains running systems

 **Channels**

- Direct mail and sale
- Connect through think tanks like Bayern Innovativ and branch associations
- Fairs and industry summits
- Connect with the help of municipalities

 **Customer Segments**

- Chemistry industry (57% of overall water usage)
- Metal industry (10%)
- Paper industry (8%)
- Other industries that use water, e.g., for cooling purposes

 **Cost Structure**

- Initial Investments
- Legal and administration costs
  - IT infrastructure & equipment
  - Subcontractors acquisition costs
- Fixed Costs
- Project engineers & other salaries
  - Office rent & other operations

- Variable Costs
- Facilities transportation and installation
  - Facilities maintenance
  - Customer support
  - Sales, customer acquisition
  - Waste disposal costs

 **Revenue Streams**

- Initial system planning
- Installation fees
- Operation fees
- Consulting on water scarcity
- Selling filtered by-products

 **Eco-Social Costs**

- Utilities lose a large share of demand from Mittelstand companies
- Increased electricity use unless heat recovery implemented
- High CO<sub>2</sub> emissions due to increased electricity use and the nature of water contaminated

 **Eco-Social Benefits**

- Decreased diversion of water from sensitive ecosystems
- Decreased discharge to sensitive water bodies
- Overall energy usage reduction on municipal and state levels
- Maintain the level of employment and income of local society

## Value Proposition

Climate change will inevitably bring more droughts to Germany in the upcoming years, causing severe water shortages. As a result, public authorities might ration water usage for private households and the industry. From 2025 on, this will already be the case in parts of Brandenburg. To reduce the effects, Aquatos secures a constant and clean water supply for its Mittelstand customers. Mitigating water shortage is the core value of the circular water systems Aquatos offers to mainly Mittelstand companies. Having closed water loops allows water reuse and therefore saves fresh water. As a result, companies that have installed the solution are less dependent on external water sources: Even if fresh water is temporarily unavailable from local utilities, customers can keep their production going. However, the circular water systems will not only make customers independent of external water supply but also independent of price spikes. Since water will be short and a rare good, prices are expected to start spiking even in the early stages of droughts. Thanks to the Aquatos water systems, customers can ensure their utility bills do not rise proportionally with the prices, as the same water is reused in several cycles.

Aquatos helps companies to think forward, realize their water-saving plans, and make their production more sustainable. We provide a tailored solution that only requires a minimum of human resources from the client's side. This way, closing water cycles becomes feasible for Mittelstand companies.

Aquatos' expertise allows for advanced project planning, such as connecting several companies to one central filter system. In this hub, several companies can share their water sources: even if the water quality is no longer sufficient for one company after multiple iterations of filtering, another company might still be able to use it. Furthermore, the hub solution reduces the investment costs for single businesses, making it attractive for companies unwilling to invest in their own system.

## Customer Segments

Water shortage is a problem independent of a company's sector. Therefore, the range of potential customers is vast. Every company that uses water at some point in their processes can apply the Aquatos water systems. Especially for

businesses with high water consumption, it will become crucial to save and therefore reuse water. Currently, the chemistry industry is responsible for 57% of the overall water usage, followed by the metal (10%) and paper industry (8%).

**Individual Solutions:** With 90% of the chemical industry being Mittelstand companies, this industry is highly relevant for Aquatos: Small and medium-sized companies often do not have the resources or expertise to close the water cycles on their own. In these cases, the filtering itself is also highly complex since the water is polluted by chemicals – providing cleared water that fulfills the requirements to be reused is an even more significant challenge. At the same time, saving water is crucial in this sector due to the high water consumption. This is precisely what the product targets: Aquatos provides expertise in high qualitative filtering for individual solutions. However, the solution also benefits companies that do not need to filter their water with chemicals. In many cases, cleaning the water with mechanical filters – for example, sieves – is sufficient too.

**Hub Solutions:** Another customer segment Aquatos targets are industrial parks. However, the prerequisite is that the association of companies that want to use the hub requires similar filtering processes. Otherwise, individual solutions are more reasonable. In a later step, municipalities could profit from the Aquatos systems, too: To avoid water shortage, private water waste can be recycled and used again in households, especially for purposes where no tap water quality is required – e.g., toilet flush or garden watering – to keep the filter processes simple.

## Customer Relationships

Aquatos is seeking long-term, trusted partnerships with its customers. These evolve from the first formal contact to a more personal setting. This approach ensures that Aquatos is perceived as a competent, professional partner. At the same time, Aquatos is open to responding to the individual long-term demands of its customers as the deployed solutions are long-lasting products.

After a customer has completed the initial meeting with the sales team and the Aquatos team has analyzed the opportunities to reuse water, the construction planning and installation team takes over. An assigned project leader from the Aquatos team is the long-term personal contact person for

the customer and acts as the initial contact throughout the construction and installation phase. After entering the maintenance phase, an Aquatos technician lead takes over the service and support role. The project leader is still responsible for the long-term strategic partnership. In case of an emergency, a 24/7 emergency technician team is available. Potential outcomes of this partnership could be selling improved versions of the Aquatos water network, upgraded IoT and sensor hardware, future software management tools, or other not-yet-planned products. Seeking long-term customer relationships also helps acquire new customers since already existing partners are more likely to recommend the Aquatos service to their business partners.

Even though Aquatos is using subcontractors for the construction and the installation, the customer's primary contact partners are people that have been affiliated with Aquatos for a long time. This ensures that those people are likely available for contact also in the future.

## Channels

**Direct Channels:** Although the risk of water scarcity is already discernible in most parts of Germany, many companies are not affected by the consequences yet. Only in the federal state of Brandenburg, the number of water companies may use annually is capped by public authorities. Contrary to the energy crisis, which has a direct impact, many companies are unaware of the need for immediate action concerning water shortage and future water supply. To move this issue to the forefront, Aquatos is directly approaching companies to point out the need for action and indicate how they could benefit from the circular water systems. To establish the first connection and to develop trust, Aquatos offers interested companies to analyze on-site how they could reuse water in their processes without any charge or future obligations. This way, even skeptical customers can directly see the benefit for their business. Apart from directly contacting companies, Aquatos is present at fairs and industry summits. At booths or presentations, Aquatos visualizes the advantages by discussing customer success stories and exhibiting a demo version of the Aquatos water reuse system.

**Indirect Channels:** Branch associations and think tanks like Bayern Innovativ offer Aquatos a great network to educate and acquire customers without directly approaching individual companies. Since those associations already established

a trustful relationship with the members, Aquatos can use this benefit to convince even restrained customers and companies that operate their business more conventionally. Via joint events and workshops with these associations and think tanks, Aquatos can explain the urgency to act and provide a solution to these companies.

### Key Activities

Aquatos takes care of the whole process of closing water cycles within companies. This comprises four main activities:

**Analyze How the Customer Uses Water:** Aquatos analyzes the company's water consumption before planning individual solutions. This includes identifying possibilities for reuse water and which water quality is required for specific processes.

**Create Individual Solutions:** as soon as the required data is collected, Aquatos plans individual circular water systems. These are adapted to companies' unique needs: the exact course of pipes and the location of the water tank are adjusted, and the kind of filter system is required.

**Supervise the Construction Process:** although Aquatos is not constructing the water system independently, a dedicated project manager will oversee the building site and be in close contact with the contractors, the customer and other project partners.

**Implement Predictive Maintenance:** once the system is installed, Aquatos maintains it for its customers. With the help of IoT devices, the company avoids water supply outages since they detect system flaws before breaking them down. If something goes wrong, customers can call an emergency

hotline that will send Aquatos technicians to the company to repair the facilities.

Besides their operational business, Aquatos developers will improve and innovate the IoT technique used for predictive maintenance. Therefore, they will use data collected in the facilities to gain valuable knowledge and improve processes and products.

### Key Resources

**Circular Water Systems:** High-quality hardware components for the water facilities are crucial for Aquatos. These include pipes, water tanks and cisterns, water pumps, and filter systems. Depending on the customer's industry, these filter systems can consist of mechanical filters or special chemicals that treat the water. Besides the mechanical components, each water system has built-in IoT devices. With that help, flaws can be detected early before they cause significant disruptions. The IoT devices, the data they collect, and the information analysts retrieve are additional resources.

**Human Resources:** Apart from the hardware components for the existing systems, Aquatos needs human resources to provide value to its customers. Most important are engineers with profound expertise in sustainable water systems. Those engineers will be responsible for planning individual solutions for companies and checking the market regularly for innovative hardware components that could be applied in the circular water systems. Furthermore, maintenance and support workers are crucial for the business to keep a close and trustful relationship with the customers.

**Intellectual Property and Network:** Due to specialization in circular water systems, Aquatos build specific expertise and knowledge: the plans for the facilities are the intellectual property of Aquatos and can be reused in case customers deal with similar conditions. Furthermore, Aquatos is closely connected to organizations like Bayern Innovativ and shares an extensive network of Mittelstand companies.

**Finances:** Although customers pay an upfront fee for the installation, this will not cover the costs for the construction of the entire system. Financial resources are therefore crucial for the Aquatos to be able to pay construction companies and the hardware components of the facilities themselves.



## Key Partners

There are two main types of Aquatos partners. First, there are the contractor partners who will, in the end, put the plans for the circulation system into practice and install the system. Second, there are producers of the hardware components we use in our solutions.

**Contractors:** The expertise within Aquatos is mainly focused on finding individual solutions adapted to the customers' needs. However, they will not realize the plans independently but instruct contractor partners. During the construction works, an assigned Aquatos project manager will be in close contact with the contractors and will coordinate the construc-

tion site. Aquatos customers do not have to communicate with the contractors at any point.

This kind of partnership brings three main advantages for the startup. Firstly, Aquatos does not have to hire construction workers independently. If the number of active projects varies, Aquatos does not have to hire an additional workforce or fire people in a wrong-order situation. Secondly, by working with contractors, Aquatos does not need to have construction workers located all over the area in which they are active. This way, they are less dependent on the location of their potential customers and can also accept requests from companies that are not closely located to Aquatos offices. Lastly, Aquatos does not have to invest upfront in large and expensive machinery needed to construct the plants.

**Hardware Suppliers:** Aquatos buys the main hardware components for their systems from external suppliers. This includes pipes, fittings, valves, sewage technology, and the core part – the filtering system. The high-quality standard and technological innovation will be driven together with firm contractors by sharing valuable data on the performance of the components in practice.

## Revenue Streams

Aquatos provides highly specialized solutions based on the customers' business and needs with a personalized pricing scheme. There are two main revenue streams, the size of which is negotiated with each client individually.

**Installation Fees:** Based on the size and the type of filtering systems required, the clients pay an initial facility and installation fee. Aquatos has the expertise to choose and advise the optimal system manufacturer for the clients. However, it stays open to customer preferences and can provide installation and servicing of any selected filters. The upfront fee can be reduced to make the system affordable for small businesses. In return, the recurring fees will be higher in the first years. If customers are part of a hub solution, the participants are charged relatively to their size.

**Operation Fees:** After the system starts running, the client pays monthly recurring fees based on the amount of water that runs through the filtering systems. The long-term agreement is signed for the system's lifetime and ensures a fixed rate per cubic meter of water that runs through the loop. The rate is negotiated individually based on the installed filtering system and the level of contaminations, considering the extraction of by-products. In the case of a hub solution, the monthly fee is proportionally distributed among the hub participants based on the amount of inflowing water for filtering.

Additional revenue streams include on-request consulting projects. The Aquatos specialists have high expertise in water management systems and water scarcity mitigation. Therefore, they can advise companies that have the human resources for such projects and want to implement the solution on their own. Lastly, the by-product of filtering processes is taken away from the clients and sent to the recycling stations; the valuable materials can be further sold as recyclable masses.



## Cost Structure

**Initial Investments:** the upfront costs mainly include operational costs such as investments in office and equipment. Aquatos will acquire project developers, managers, industrial engineers, and financing experts as core business specialists. In addition, the company needs to attract labor for operational tasks such as HR (Human Resources), marketing, and IT system administrators. Subcontractors' acquisition and establishment of long-term agreements will require additional spending on legal advice.

**Fixed Costs:** the main line item in the fixed costs are the salaries of full-time employees. These are mainly people involved in the core business, the project development. Aquatos also provides continuous customer service, including safety and quality checks. This type of regular servicing is also partly done by subcontractors. The initial setup of IT systems is essential. Aquatos will pay recurring license fees for software programs for engineering, construction planning, and core business operations such as hiring, financial reporting, CRM (Customer Relationship Management), etc.

**Variable Costs:** the number of expenses related exclusively to a particular project will vary since solutions are adapted to each customer's individual needs and processes. Customer acquisition costs include visiting conferences and fairs to obtain connections and advertise the services. Such events do not happen regularly and may incur high participation fees. Subcontractors take over the components and material transportation as well as construction. The installation costs will vary depending on the system's size and complexity. Besides the regular safety and quality checks, Aquatos ensures timely facility maintenance and urgent repairs. On request, servicing subcontractors will carry out these tasks. In this case, payments are allocated according to the required complexity and equipment needed. Besides the costs linked to the facilities, the filtering process extracts a certain amount of waste, which needs to be recycled or utilized. Aquatos takes care of the transporting customers' waste to disposal stations.

## Eco-Social Costs

The triple bottom line evaluation of water recovery and reuse methods showed that, overall, the benefits across six different criteria increased as the percentage of water recovered rose, including total energy consumption. However, these technologies still pose a challenge regarding CO<sub>2</sub> emissions: depending on the water recovery technology used, CO<sub>2</sub>

emissions can either increase or decrease compared to the situation when no water is filtered. In the case of advanced wastewater treatment, CO<sub>2</sub> emissions can be higher than the process without water reuse due to higher electricity consumption and the nature of water contaminants to be removed from the water, e.g., methane or nitrous oxide [298]. The increased electricity use is because the process requires recirculation pumping. However, heat recovery can partly offset the energy consumption, reducing overall energy use.



The amount of CO<sub>2</sub> emissions directly correlates with the manufacturing process Aquatos will be dealing with. When nutrient removal is not required, there are fewer CO<sub>2</sub> emissions than lightly contaminated hot and cold waste streams. For example, cooling water contains minimal nutrients and provides opportunities for energy recovery. Hence, a careful analysis should be conducted to identify better which manufacturing processes Aquatos can contribute to most without increasing companies' CO<sub>2</sub> emission footprint [298].

The choice of materials for recovery also plays a significant role in greenhouse gas emissions. For example, using virgin fibers instead of recycled fiber accounts for increased CO<sub>2</sub> emissions. Aquatos has this in mind and, therefore, partners with sustainable materials suppliers [298].

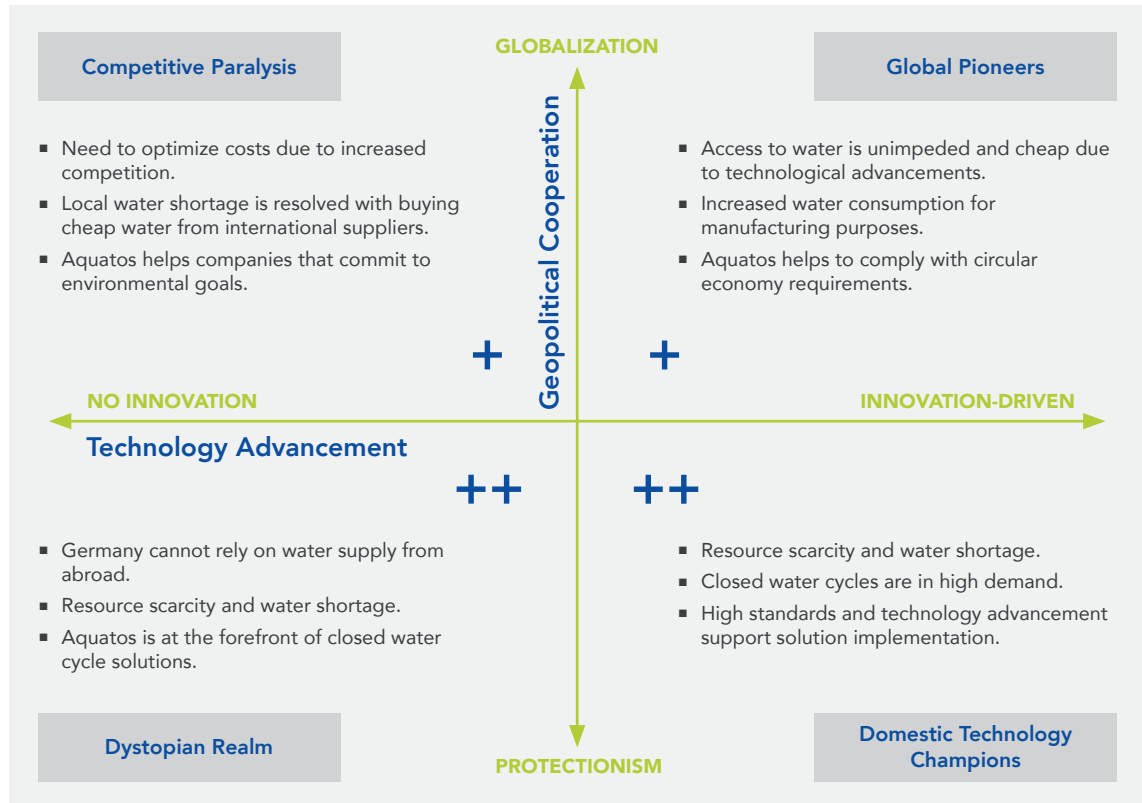
As for social costs, according to the research [298], state utilities' revenues decline due to water and energy usage reductions. This might lead to a consequent increase in water prices, affecting local consumers and decreasing their purchasing power.

 **Eco-Social Benefits**

Implementing closed-loop water systems makes the production process more sustainable and resilient to economic and environmental shocks. It also has an overall positive ecological effect. First of all, it decreases the diversion of water from sensitive ecosystems. This way, less water is taken away from the natural water bodies, such as rivers and lakes or ground sources. With droughts being more likely in the near future, water diversion stresses the vulnerable ecosystem.

Second, Aquatos solutions help to decrease the direct discharge to sensitive water bodies. At the same time, the decrease in indirect discharge helps to save energy. In this case, the pre-filtered water from the factories is sent back to city utilities for final high-quality filtering, which is not necessarily needed for all production lines. Its closed system allows the company to filter water only to the minimum standards and send it directly to production again. This avoids a lengthy and energy-consuming step of advanced centralized filtering.

Third, studies show that internal energy is significantly reduced by up to 15.2% with closed-loop water systems at a 90% water recovery rate. This also decreases greenhouse gas emissions by up to 6.5% at 90% water recovery [298].



The solution provided by Aquatos also has a social impact. Companies that will continue producing during water shortage will maintain their employment levels. In addition, the operation of Aquatos creates new jobs and opens more utilities and infrastructure project offers for subcontractors, which involve highly qualified specialists. Studies show that the comprehensive implementation of water reuse systems increases employment and income levels. For example, it was found that in Australia, employment and income rates increased by 1.5% and 2.6%, respectively, due to the savings made on water and energy usage reductions [298].

**Scenario Fit:**

**Global Pioneers:** Even if the temperature rise is limited to 1.5°C, droughts will become standard in Germany from 2040 onward. Although the climate crisis has been resolved in this scenario, water shortage is still an issue – the water supply will not be secured. Given the high technological advancement of companies in this scenario, their production capacities may increase, resulting in surged water consumption in manufacturing processes. However, due to a highly globalized and connected world, access to water resources will be less impeded, allowing companies to respond proactively to local water shortages. Technologies such as seawater

Trend  
Scenario  
Ideation

desalination and its subsequent transport can compete with the Aquatos solution in this scenario. Nevertheless, Aquatos' value proposition will be to enable and maintain a circular economy. Even in the case of a mitigated climate crisis, governments will enforce this principle to prevent further climate change. Thus, the demand for closed water cycle solutions will exist regardless of an affordable and accessible water supply. However, Aquatos should expect mediocre market returns, driven mainly by the need to comply with circular economy requirements.

**Competitive Paralysis:** Increased competition due to globalization and failings in the race for innovation puts Mittelstand companies in a difficult position in this scenario. To maintain competitive prices in the world of free trade agreements, they must optimize their cost structures whenever possible without losing too much of their product quality. Aquatos' solution becomes a life-saving opportunity for them, allowing them to not only cut their costs for water consumption but comply with global tightening environmental standards. On the other hand, water processing and transportation have become easier worldwide due to technological advancements, which reduce their prices significantly and resolve the problem of local water shortage due to draughts. This might leave room for companies to buy cheap water from abroad. However, this will still be a less environmentally friendly option compared to the water reuse offered by Aquatos. Consequently, in this scenario, companies' commitment to sustainability goals will mainly drive the demand for Aquatos products and, therefore, also influence the potential market size.

**Dystopian Realm:** In this scenario, geopolitical tensions lead to vulnerable supply chains and regression in technological developments. Energy and water prices surge, while significant essential resources have become inaccessible. This results in higher operational costs and threatens companies to shut down their business. Ongoing tensions worsen global warming, and a lack of rains and consequent draughts confront Germany with riots and conflicts over water resources. In the face of these challenges, Mittelstand companies fail to adapt to these changed circumstances. The businesses that have survived are nationalized and need solutions that can help reduce their water consumption. Otherwise, they cannot continue their operations since they lack the required water. Under these circumstances, Aquatos has developed into a crucial business that provides technology to lower water usage and secures its customers' production. Because of

low technology advancement, some manufacturing processes need urgent renovation and maintenance, which might require Aquatos more time to assess implementation approaches.

**Domestic Technology Champions:** In this scenario, the EU is separated from the rest of the world because of protectionist policies. This urges Mittelstand companies to adapt to resource constraints. Increasing geopolitical tensions and unstable trade regulations enforce a shift toward more regionalized and resilient supply chains. As a result, the extent businesses can reuse and recycle resources determines their future competitiveness and viability. However, heat waves and droughts worsen the situation, making water scarcity one of the biggest challenges for manufacturing companies. Both problems, vulnerabilities in supply chains and water shortage, are tackled by Aquatos' water system, which offers service to a broad customer base. The high level of innovation development among Mittelstand companies facilitates partnerships. The European quality standards companies use in their production processes allow Aquatos to implement the solution seamlessly. Therefore, in this scenario, Aquatos is leading in helping German companies close their water cycles.

### Challenges:

- In many production processes, water vaporizes. While it is technically possible to recondense this water, it drastically increases the overall complexity and cost of the systems. Major building blocks like chimneys must be covered to prevent vaporized water from streaming into the atmosphere.
- Like most Mittelstand companies in Germany, Aquatos is affected by the skilled labor shortage. The need for experts and technicians to travel a lot makes it even more challenging to attract skilled workers.
- In Germany, municipalities are responsible for providing all services of general interest, including water supply. Providing large-scale solutions for whole industrial parks and cities could cause legal issues as the German state sets market entry barriers to avoid water privatization.
- Different industries require different types of filtering. This increases complexity when connecting arbitrary companies via hubs.

### Outlook:

After launching the Aquatos water systems for individual companies, the next step is introducing a hub solution for industrial parks. The idea is to connect multiple companies requiring similar wastewater treatment systems. Instead of having one solution for every company, Aquatos connects various companies to a single central filter system – the hub. After establishing those two products in the German market, the plan is to expand first to the whole DACH region and afterward offer the solutions all over Europe. In addition to the market expansion, Aquatos will develop the product offer itself further: A water management platform that provides valuable insights to customers. This includes information on current water prices, water inflow and outflow control, efficiency, and water leakage monitoring. The application will retrieve the required data from the IoT devices already integrated into the systems and display it in a user-friendly interface. In the next step, the water management platform will be extended by an AI-based feature that predicts water usage. Together with weather data, the algorithm can predict how much groundwater will be available. It will also suggest measures to adapt the water usage to the user if needed.





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# MITTUP

## Enabling Mittelstand Companies as Angel Investors in the Startup Ecosystem

Mittelstand companies are increasingly challenged to integrate innovative processes and generate innovative products. Meanwhile, innovation serves as the core of many startups. However, startups often lack access to customers and partners with specialized knowledge and resources, a role which Mittelstand can readily fill.

MittUp is an investment platform which leverages the core capabilities of both parties to provide solutions to their key challenges.

By signing up and filling out a carefully crafted questionnaire, the interests and emerging opportunities of individual Mittelstand companies are revealed. These could range from certain innovation challenges in process implementation to newly emerging business opportunities, driven by technolog-

ical advancements. These insights are plugged into a powerful artificial intelligence (AI) search algorithm, which matches the challenge of each Mittelstand company to corresponding startups which could potentially contribute solutions. For instance, this could be through implementation of useful products the startups are already working on or through the initiation of co-innovation. Mittelstand companies can then make an angel investment into the relevant startups. In the short term, Mittelstand benefits because startups will cost-effectively tackle key challenges, and in the long term, it can be financially beneficial for both parties.

To be listed on the platform, startups must apply. If selected, they benefit from a financial investment that comes with significant added value. First, they work closely with a financially-incentivized and committed Mittelstand partner on a

highly relevant challenge. Second, they get access not only to the Mittelstand company's knowledge base, but also to material resources, such as equipment or working space. Finally, the network of the Mittelstand partner can be leveraged to provide personal introductions to other potential Mittelstand customers.

MittUp therefore provides significant value to both Mittelstand and startup companies, financially incentivizing them to thrive together in this newly formed innovation ecosystem.



## Business Model

### Key Partners

- Mittelstand organizations and ecosystems (e.g., Bayern Innovativ)
- Governmental institutions for financial support and contacts
- Universities that provide space and contact to startups, students, and lecturers)
- Startup initiatives
- Accelerators and incubators
- Alumni networks

### Key Activities

- Comprehensive Support
- Networking events, fairs, workshops and hackathons
- Matching
- Matching algorithm
  - Innovation opportunities

### Key Resources

- Online platform
- Event spaces
- Experts and lecturers
- Network managers

### Value Proposition

- For the Mittelstand
- Exposure to tech and talents
  - Working on co-innovation with startups
  - Lower risks
  - Agile and innovative work environment
  - Faster development
  - Access to a broad talent base
  - Cost reduction
- For Startups
- Easier access to the Mittelstand as potential customers
  - Long-lasting relationships for co-development and access to resources and expertise

### Customer Relationships

- Long-term, stable partnerships
- Dedicated personal assistance
- Online and offline community

### Channels

- Referral the Mittelstand
- Word of mouth
- Cold calling the Mittelstand
- Conferences and Events
- University institutions
- Online discussion boards
- Physical hubs

### Customer Segments

- Startups
- Early- and late-stage startups
  - Related to the Mittelstand: traditional verticals
  - Startups that haven't yet developed strong customer relationships
- Mittelstand
- Motivated to innovate
  - Remote locations
  - Lacking innovation

### Cost Structure

#### Initial Investments

- Development of an online portal
- Development of a matching algorithm

#### Fixed Costs

- Network manager
- Startup application review
- Support

#### Variable Costs

- Manual Mittelstand onboarding
- Venue rent
- Speakers

### Revenue Streams

- Subscription of the Mittelstand to gain platform-access
- Matching commission paid by the Mittelstand
- Funding of governmental institutions

### Eco-Social Costs

- Waste related to events
- Travel to in-person events

### Eco-Social Benefits

- Bring innovation to remote areas
- Boosting greener technologies
- Saving many jobs at the Mittelstand

 Value Proposition

MittUp enables collaboration between Mittelstand companies and startups by fostering financial ties through angel investments. It brings value to target customers by using an intelligent matching algorithm that fosters innovative, symbiotic relationships between Mittelstand companies and relevant startups.

**The Mittelstand:** This approach is of high interest to Mittelstand companies because it reduces the risks and costs associated with research and development (R&D) and, more broadly, with innovation. Through the process of co-development rather than internal R&D, the Mittelstand can outsource its key challenges to startups that are willing to build commercial solutions to tackle them. Another advantage the platform provides to Mittelstand companies is accelerated innovation, as startups typically have much shorter product development cycles than large companies. By co-innovating, Mittelstand companies gain exposure to agile methodologies and specialized technical expertise that might not exist inside their companies yet.

**Startups:** Startups face decreased barriers when trying to connect with leadership boards at Mittelstand companies and, as a result, are more easily able to access their partner's resources and expert knowledge. This supports young, aspiring founders in two ways. The first is financial, through the angel investment process and the increased likelihood of finding a customer base among Mittelstand companies. The second is technical, through access to machinery and an experienced workforce. This allows startups to build and test their products more rapidly and be informed of constraints and previously unforeseen problems that might affect their solution. Lastly, the angel investment also ensures that the Mittelstand is incentivized to collaborate reliably to ensure the startup's success in the long term.

 Customer Segments

MittUp is a platform that aims to connect Mittelstand companies with startups. Therefore, the customer can be divided into these two segments which interface with each other through MittUp's platform.

**The Mittelstand:** Our platform targets Mittelstand companies with an active interest in innovating their products and processes. These can be companies that are already innovative but seek to be even more at the forefront of innovation. However, MittUp also targets companies lacking innovation and might not have enough resources for extensive in-house R&D and competitive talent acquisition. Still, for successful cooperation, the Mittelstand company's management should be personally committed and engaged in collaboration with startups and support an open-minded, innovation-driven culture in their companies. Lastly, the Mittelstand is required to be economically successful enough to invest in startups.

**Startups:** MittUp targets startups at any stage, as long as both sides – the startup and a Mittelstand company – could benefit from a strong, long-lasting relationship. Early-stage startups often have a burning need for an (initial) investment while only offering limited value and products in the short-term to the Mittelstand. Further, it is risky for a Mittelstand company to invest in early-stage startups, as success is often uncertain. However, these startups are usually more malleable, as they are easier and less expensive to incubate. This offers Mittelstand companies the opportunity to co-shape the journey towards a shared vision. Early-stage startups can be very interesting for innovative Mittelstand companies but might not be suited for companies lacking innovation experience.

On the other hand, later-staged startups usually already offer a strong vision, multiple investors, and higher chances of success. These more mature startups may directly provide value to the Mittelstand through an initial product version or a more refined roadmap to their first prototype. Hence, the co-innovation might need less active input from the Mittelstand and is more steered by the startup. This is especially beneficial for less innovative Mittelstand companies.

 Customer Relationships

MittUp strives to foster particularly close relationships with Mittelstand companies. Business relationships of Mittelstand companies are generally long-lasting and based on mutual trust. MittUp aims to capitalize on this by developing strong, personal ties to its Mittelstand customers. When a Mittelstand company eventually becomes a customer, MittUp already had several personal touch points to the company through its many offline events. Each Mittelstand company,

even prospective customers, is then assigned a dedicated account manager who provides continuous, personal assistance and avenues for feedback. This way, the necessary trust can be established, forming the foundation for a successful business relationship with the Mittelstand.

For startups, business relationships are often viewed as transactional and are rather measured in the value they can provide. Hence, it will be crucial for MittUp to clarify the value that MittUp, particularly their prospective investors, can provide. Research shows that startups are attracted to working intimately with customers to identify their business needs. Through the planned events series and physical hubs MittUp provides, MittUp offers an ideal place for the Mittelstand and startups to engage personally and bond, rather than simply acting as another fundraising platform.

 Channels

MittUp's communication channels can be split into those employed before a customer's onboarding, e.g., for engaging companies and motivating them to join, and those through which the service will be provided once they are members. Several strategies to reach potential customers have been identified to ensure platform scaling.

**Word of Mouth:** The Mittelstand features a strong, trusting network of companies and is primarily reached through more traditional, analog channels. Hence, MittUp wants to tap into this network and build a strong Mittelstand community that refers MittUp to companies not yet on the platform.

**Networking Events:** Events, such as startup conferences, are an easy way to interface with startups and Mittelstand companies already showing interest in collaboration and networking.

**Online Advertising:** Startups are primarily reached through digital channels. Hence, online advertising is the most suitable means of connecting with the C-level suite of startups. After onboarding, communication takes a different shape since the target audience is already part of the MittUp community. It can be done through several means:

**Internal Discussion Boards, Rooms, and Mailing Lists:** These are essentially any means to maximize engagement and promote discussion between members of MittUp.

**Personal Assistance via Email and Phone:** The dedicated account managers for the Mittelstand companies can be reached via a phone hotline and email.

**Physical Hubs and Meetups:** Physical open spaces and the meetups hosted therein would be fundamental for discussion between companies and startups and promote the formation of regionally centered communities.

### Key Activities

**Comprehensive Support:** MittUp provides continuous and personalized support to member companies throughout the duration of their subscription. Before starting their investment journey, members are given the first glimpse into the startup innovation ecosystem through targeted workshops, problem-specific hackathons, and networking events. Bringing Mittelstand companies and startups together during these events demonstrates the platform's value and introduces Mittelstand companies, who are often risk averse, to the concept of MittUp.

During the investment phase, MittUp helps to facilitate collaboration between the Mittelstand and startup partners by providing expert advice. This could range from supplying tips on managing expectation disparities, providing technical advice, and recommending the next steps in the co-innovation journey. MittUp helps streamline the angel investing process, which may be unfamiliar to both parties. This includes digitization of important documents, step-by-step guidance on contract creation, and legal advising.

**Matching:** Once a Mittelstand company joins the platform, they are provided with a questionnaire that serves as input for the proprietary matching algorithm. These questions aim to understand the company's current status, any major concerns they may have, and the goals they wish to achieve by angel investing. Matching is based on an AI search algorithm, which considers the personalized goals of the Mittelstand company, the involved industry, and the potential value relevant startup partners provide. A list of the top-k most suitable matches is generated, and Mittelstand companies are allowed to connect with the boards of the target startups.



### Key Resources

**Online Matching, Communication, and Investing Platform:** As an online platform, MittUp will require resources related to the development of a web portal and the AI-based matching model. This includes software engineers, front and backend developers, and other technical experts. Additionally, to prevent legal issues, there is a team of lawyers with experience in the angel investing process. Finally, strategy and innovation experts are needed to create a meaningful questionnaire and evaluate the generated matches.

**Regional Hubs:** Physical locations are planned in dedicated areas where MittUp is active. These hubs function as a neutral meeting ground for startups and Mittelstand companies. There are different use cases for these, but to provide an example, they could be used as a central location for the co-innovation processes of startups and the Mittelstand. This would enable the involved companies to send employees and work on their company's challenges in an innovative environment with employees from other companies and selected topic experts.

**Event Spaces:** A major channel for exposing Mittelstand companies to innovation resides in meet and mingle events with startups. This requires renting appropriate venues, as well as providing meals and drinks. Stable partnerships with institutions such as governmental organizations and universities make such resources more affordable.

**Expert Speakers:** MittUp offers targeted innovation workshops to address the challenges and goals of Mittelstand companies. These workshops include panel discussions concerning innovation in the startup ecosystem and opportunities for integration into traditional companies' pipelines. Connections to expert speakers are necessary to provide members with high-quality and valuable experiences.

**Network Managers:** By maintaining strong connections with members, MittUp can extend its outreach and widen its breadth of influence. A dedicated team of network managers exists to ensure adequate effort is invested in nurturing lasting relationships and building personal connections. To provide an example, these managers assist startups and the Mittelstand in making personal introductions to partners of their choice.

## Key Partners

MittUp cooperates with various innovation ecosystem players to build a comprehensive network to strengthen the ties between the Mittelstand and startups.

**Mittelstand-Related Organizations:** These include Non-Governmental Organizations like Bayern Innovativ or any association related to the Mittelstand. Partnerships with these organizations for the planning and execution of events provide an opportunity to introduce the Mittelstand to MittUp and the startup ecosystem in a trusted environment. This way, MittUp can be introduced to the Mittelstand as a trustworthy, reliable partner.

**Universities and Governmental Institutions:** Many public institutions in Germany have a specific focus on Mittelstand companies. Universities, for example, often focus their research on the Mittelstand. Thus, universities could be leveraged by providing access to expert lecturers focused on the Mittelstand. Further, universities could prove to be a cost-effective platform for hosting some of MittUp's workshops, providing both speakers and some of their premises. In turn, Mittelstand companies deliver valuable inputs for research studies.

**Startup Initiatives, Accelerators, and Incubators:** These are the most relevant lever for establishing connections with startups and ambitious founders. By co-organizing events like the "Startup-Verband," the Mittelstand leadership is brought closer to the origins of innovation and young technical experts. One potential idea in this regard is to collaborate with a specific accelerator and organize a cohort focused on finding solutions to some of the key challenges of the Mittelstand. Specific Mittelstand companies encountering these issues assist as sparring partners providing input and feedback on ideation. After some of the accelerator ideas materialize, Mittelstand companies become active investors in emerging startups.

## Revenue Streams

Thanks to its broad spectrum of users and features, MittUp acquires revenue in most parts of the process. First, the practicality and added value of the human networking and matching platform operates on a subscription basis, and the



act of investing money is funneled through the platform in exchange for advantages and ease of use.

**Subscription:** In MittUp, a monthly subscription is required for the Mittelstand companies to access the matching platform. This offers a small entry barrier for the Mittelstand to get to know MittUp and generate a reliable revenue stream. For startups, on the other hand, entering and listing themselves to potential investors is free. However, to gain this free access, startups must go through an application process that ensures that MittUp only lists startups that fulfill specific requirements and are of interest to the Mittelstand.

**Brokerage:** MittUp focuses on matching the Mittelstand companies with specific startups for long-lasting coopera-

tion. MittUp supports both parties on the entire journey, including the last step of finalizing the investment. However, the subscription-based model, designed to keep the entry barriers low, cannot cover the costs of this assisted matching and investment process. Thus, MittUp generates its main revenue through a commission of 3% on the investment amount of every successful investment into a startup.

**Governmental Funding:** It can be a significant additional revenue stream because the German government is highly interested in funding innovation and promoting the Mittelstand, e.g., through scholarships that offer viable solutions to challenges facing the Mittelstand.

## Cost Structure

The overall cost structure of MittUp is value-driven, with a high degree of personalized service. This is especially appealing to Mittelstand companies, who might usually be reluctant to join a novel platform like MittUp.

The highest running costs for MittUp will be generated through the comprehensive support it wants to provide. The organization of workshops, hackathons, and networking events will require dedicated employees, renting physical spaces, and promotional as well as advertising campaigns. All these factors will contribute significantly through salaries, rent, and advertising fees to the overall costs incurred by MittUp. Additionally, human capital is dedicated to supporting customers when they have inquiries about the platform. Since much of the communication with the Mittelstand is handled analogously, a handful of specialized co-workers are needed.

The development and maintenance of the online platform generate further costs, mainly through the human capital needed to develop and design the platform and model the AI-based matching algorithm. These tasks require software engineers (front-end, back-end), machine learning engineers, and user-journey/interface experts. A legal team is also needed to advise the angel investment process. Additionally, a team of strategy and innovation consultants would be able to assist with the co-development processes of customers when required and devise/update the relevant categories.

## Eco-Social Costs

The main social risk of MittUp is that it could disincentivize Mittelstand companies to develop their own innovative solutions and products. MittUp could be seen as a shortcut to outsource innovation rather than producing it through their R&D process. Hence, it could lead to a culture where Mittelstand companies become highly dependent on external partners instead of being empowered to become more innovative by themselves. The innovation gap between the Mittelstand and startup, which MittUp tries to close, would widen even further. MittUp should foster to create symbiotic, closely interwoven relationships between the Mittelstand and startup and guide both parties on how to successfully co-innovate without becoming too dependent on each other.



## Eco-Social Benefits

**Bringing Innovation to Remote Areas:** MittUp connects geographically remote companies with cutting-edge innovation through both physical meetings – which are central to its philosophy – and digital means. This symbiosis of the physical and online world helps companies keep up with more centrally located competitors regarding innovation and research while collaborating to solve their specific issues.

**Boosting Greener Technologies:** By innovating the output of Mittelstand companies, it becomes easier to integrate innovative and more efficient elements in the supply chain, such as groundbreaking technology. Furthermore, it eases the usage of new solutions, e.g., specialized software tooling for assessing the environmental impact.

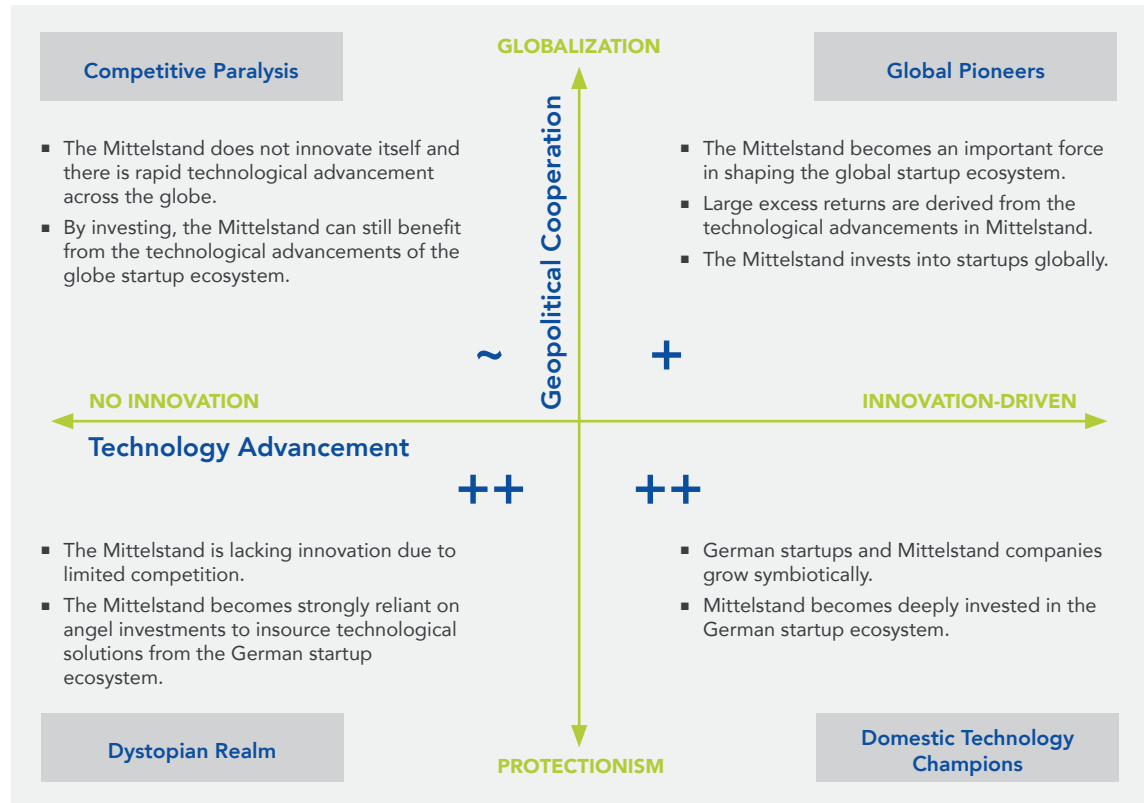
## Scenario Fit:

**Global Pioneers:** Through considerable technological advancements in the Mittelstand, significant financial returns are derived. These returns lead to substantial investments into startups, turning the Mittelstand into a major global innovation ecosystem shaping force. This gradually changes the misconceptions many individuals have about Mittelstand companies – including being traditional and retrograde institutions – thus increasing their attractiveness to talents and potential customers across the globe. MittUp scales accordingly and expands overseas, making it possible for the Mittelstand to engage in co-development projects internationally. As the number and diversity of players on both sides of the platform grow, the value proposition of MittUp's matching service becomes more relevant. Simultaneously, the accuracy and convenience of the matching system will steadily increase as more companies on both ends join the platform.

**Competitive Paralysis:** MittUp would become the savior of the Mittelstand. The Mittelstand would no longer develop innovative solutions and risks losing market share to competitive international players offering better products for comparable or cheaper prices. This is where MittUp comes into play: through collaboration with international startups, Mittelstand companies can effectively research new technologies and pursue innovation opportunities to catch up with competitors. They will therefore be spared from obsolescence while the rest of the Mittelstand struggles to survive.

**Dystopian Realm:** MittUp turns into the sole reliable partner of the Mittelstand. Decreased interest in R&D corresponds to decreased innovation drive and lack of global competition. All parties are generally satisfied with their current local products and see little incentive in enhancing them through new technologies. However, those that would still want to optimize their value offerings and processes could rely on MittUp to insource technologically advanced solutions from the German startup ecosystem. As this provides a competitive advantage in the local market, many Mittelstand companies would still be enticed to use the platform.

**Domestic Technology Champions:** MittUp is the predominantly local yet effective solution. Both startups and Mittelstand companies show great interest in innovation and are putting immense effort into integrating high-tech. Through MittUp's platform, both parties will grow symbiotically as the latter becomes increasingly invested in the German startup



ecosystem. In such an environment, MittUp would be thriving due to the growth in the number of startups in the local market which are focused on solving problems related to the challenges of Mittelstand.

## Challenges

- Many leaders in the Mittelstand are still reluctant to invest in innovation, let alone to co-develop with external, completely novel partners. This requires MittUp to keep the entry barriers as low as possible to make it easy to target Mittelstand companies lacking innovation.

- Startups usually seek flexibility and agility, especially in their early stages. Teaming up with the traditional Mittelstand might mean they must compromise on their wildest ideas to fulfill their partner customers' specific demands. Hence, the startups might fear balancing the Mittelstand needs and, at the same time, staying independent instead of building a tailor-made solution that only fits one company.
- MittUp needs to act as a mediator between these two different worlds and actively work on lowering the barriers and bringing both parties closer together. Hence, MittUp's success must offer sufficient support on the entire journey from onboarding to investing through, e.g., workshops,

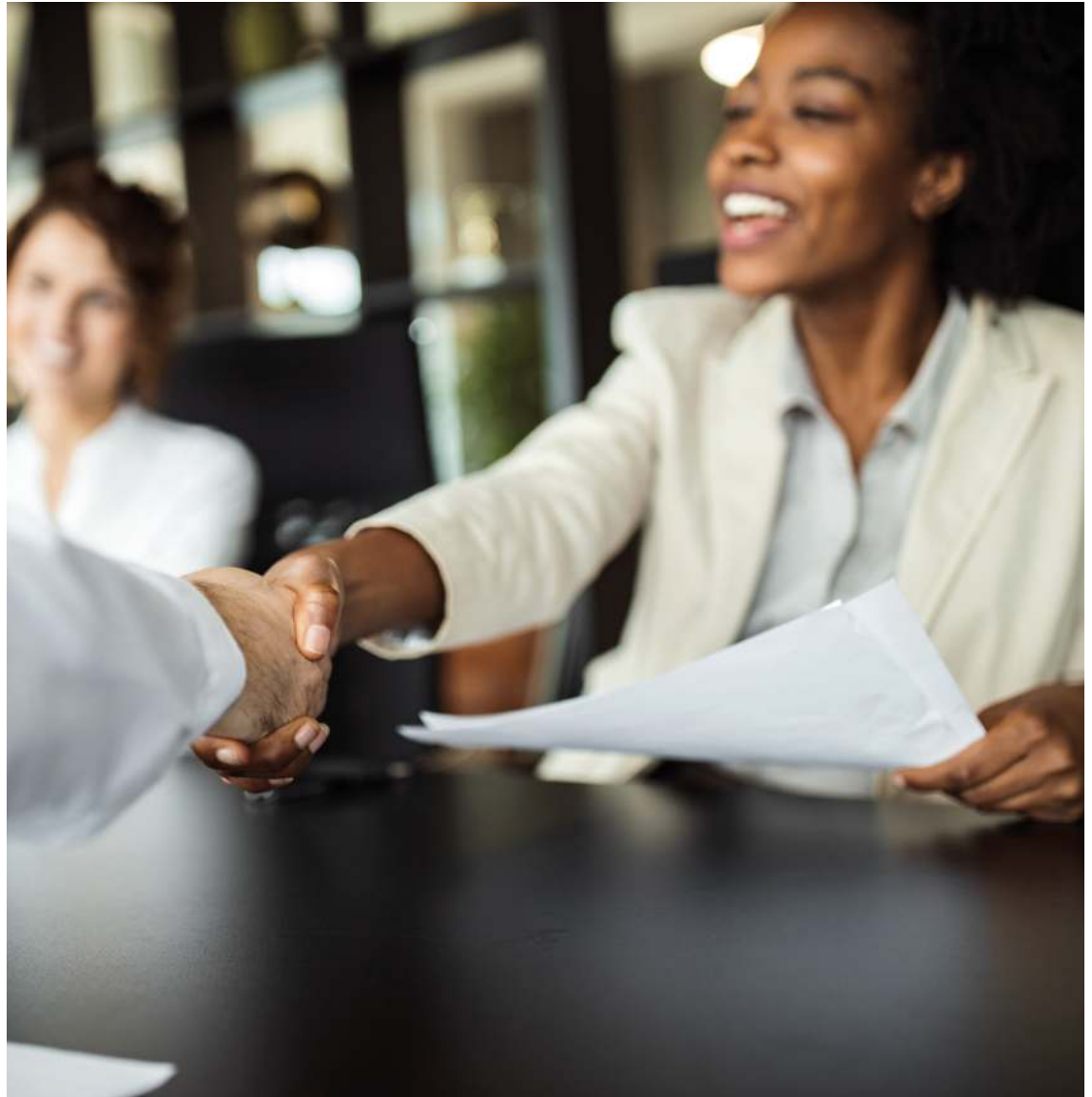
expertise, and advice. Especially at the beginning of MittUp, this will be a very labor-intensive and costly process.

- MittUp is a platform solution whose value proposition depends on many Mittelstand companies and startups being active on the platform. Only with enough engaged customers, MittUp can offer the opportunity to find a perfect match. Therefore, MittUp must quickly scale to provide customer value.

## Outlook

MittUp develops into a large-scale angel investing platform, connecting startups and eventually research institutions worldwide to the Mittelstand for the co-development of cutting-edge technologies. Thanks to MittUp, the Mittelstand and startups transition into global innovation ecosystem leaders, competing on eye-level with big tech players.

MittUp's collaborations extend beyond German organizations to international startup accelerators and world-renowned research institutions. By doing so, MittUp ensures that customers have access and can contribute to the development of disruptive technologies before being adopted by any competitor. MittUp will be a tremendous facilitator for such international angel investments – particularly when the Mittelstand leaders are not comfortable with foreign markets and languages. Another possible direction is to place MittUp as a platform that helps companies struggling to keep up with the pace of new tech worldwide. To do so, MittUp works on extending partnerships to international players that help establish connections to MittUp's target groups and eventually organize events and workshops at their locations. This would be an effort to offer Mittelstand leaders the opportunity to network with international startups and gain first-hand insights into the inner workings of major hubs worldwide.



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# THE FUTURE OF MITTELSTAND

The Mittelstand is an integral part of the German economic landscape. Its importance for Germany cannot be overstated as its influence is not limited to the economic aspect but extends to German culture on regional and supra-regional levels. At the same time, the Mittelstand is not spared in a world battered by all-encompassing changes.

Amid global political and economic turmoil and accelerated technological advancement, this report examines what lies ahead of the backbone of the German economy: Will current technological developments fundamentally change how Mit-

telstand companies operate? Do the economics of the future even allow for Mittelstand businesses to exist? How do environmental challenges and societal divisions play into this?

This report targets these questions and provides an understanding of the future of the Mittelstand in the next 20 years. It describes trends (political and legal, economic, social and environmental, technological, and business models) that explain the current and upcoming challenges Mittelstand companies face, identifies potential future scenarios, and innovates new business models, ensuring a balance between

sustainability, technology, and future prosperity. The generated business concepts include a program connecting Mittelstand with exceptional talent, an approach to closing the industry's water cycle, a sharing economy platform for warehouse space, a logistic and recycling platform for batteries, and an innovative app enabling the Mittelstand to invest in the startup space.



The Center for Digital Technology and Management (CDTM) is a joint interdisciplinary institution of education, research, and entrepreneurship of the Ludwig Maximilians University (LMU) and the Technical University of Munich (TUM).

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