



Scenario Planning in the Context of Industry Transformation Identifying Key Drivers for the Effective Application in the German Automotive Industry

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Abstract

Title: Scenario Planning in the Context of Industry Transformation:
Identifying Key Drivers for the Effective Application in the
German Automotive Industry

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This master dissertation examines the role and effectiveness of scenario planning as a strategic approach in the context of the profound transformation of the German automotive industry. The research aims to identify critical internal and external drivers as well as success factors for the effective application of scenario planning under uncertainty. Based on a theoretical framework and a qualitative analysis of twenty expert interviews from manufacturers, suppliers, associations and consultancies, a comprehensive understanding of the organizational, cultural, and strategic embedding is developed.

The results show that the effectiveness of scenario planning strongly depends on its anchoring in top management, interdisciplinary collaboration, cultural openness, and the handling of regulatory, technological, and geopolitical uncertainties. Four developed future scenarios throughout the thesis illustrate different future pathways for the industry up to the year 2040 and serve as a basis for strategic action options.

The thesis concludes with concrete recommendations for the institutional anchoring and iterative application of scenario planning. It underscores the potential of scenarios as a strategic operating system for actively shaping transformation.

Key Words: Scenario Planning, Strategic Foresight, Transformation, Automotive Industry, Volatility, Uncertainty, Complexity, Ambiguity, Strategy, Long-Term Planning, Systemic Risk, Forecasts, Future Scenarios, Strategic Implementation

Resumo

Título: Planejamento de Cenários no Contexto da Transformação Industrial:
Identificação de Fatores-Chave para a Aplicação Eficaz na Indústria
Automobilística Alemã

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Esta dissertação de mestrado examina o papel e a eficácia do planejamento de cenários como uma abordagem estratégica no contexto da profunda transformação da indústria automotiva alemã.

O objetivo da pesquisa é identificar os principais impulsionadores internos e externos, bem como os fatores de sucesso para a aplicação eficaz do planejamento de cenários em contextos de incerteza. Com base em um referencial teórico e em uma análise qualitativa de vinte entrevistas com especialistas de fabricantes, fornecedores, associações e consultorias, desenvolve-se uma compreensão abrangente da inserção organizacional, cultural e estratégica. Os resultados mostram que a eficácia do planejamento de cenários depende fortemente de seu ancoramento na alta gestão, da colaboração interdisciplinar, da abertura cultural e da forma como são tratadas as incertezas regulatórias, tecnológicas e geopolíticas. Quatro cenários futuros desenvolvidos ao longo da dissertação ilustram diferentes caminhos possíveis para a indústria até o ano de 2040 e servem como base para opções estratégicas de ação.

A dissertação conclui com recomendações concretas para a ancoragem institucional e a aplicação iterativa do planejamento de cenários, ressaltando o potencial dos cenários como um sistema operacional estratégico para moldar ativamente a transformação.

Palavras-chave: Planejamento de Cenários, Prospecção Estratégica, Transformação, Indústria Automobilística, Volatilidade, Incerteza, Complexidade, Ambiguidade, Estratégia, Risco Sistêmico, Previsões, Cenários Futuros, Implementação Estratégica, Planejamento de Longo Prazo

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List of Abbreviations

CASE	Connected, Autonomous, Shared, Electric
CO	Carbon Dioxide
ESG	Environmental, Social and Governance
EU	European Union
EV	Electric Vehicle
ICE	Internal Combustion Engine
KPI	Key Performance Indicator
MC	Main Category
OEM	Original Equipment Manufacturer
OTA	Over-The-Air
R&D	Research and Development
SC	Subcategory
US	United States
VDA	German Association of the Automotive Industry
VUCA	Volatility, Uncertainty, Complexity, Ambiguity

1 Introduction

Today's economies are dramatically changing, driven by the development in emerging markets, the accelerated rise of innovative technologies, sustainability policies and changing consumer preferences. The ability to identify future trends and market shifts has become a key determinant of organizational competitiveness. Moreover, a firm's ability to navigate industry uncertainties and respond swiftly to changes has emerged as both a critical success factor and major challenge for organizations. Especially the automotive sector is undergoing a profound transformation as the future of mobility is marked by numerous uncertainties. Critical variables such as the electrification of vehicles, the technological potential of connectivity and autonomous driving or political decisions regarding environmental regulations constantly evolve and demand ongoing strategic adjustments from both automotive manufacturers and suppliers. In particular, scenario planning has emerged as the most critical component of strategic planning processes, as success or failure of an organization depends significantly on the ability to anticipate and prepare for multiple future possibilities. Flawed strategic planning often has serious implications for companies, regardless of their size or market position as economic disruptions often affect all organizations in a market. The application of this strategic foresight approach is gaining increasing relevance in the context of the ongoing transformation of the automotive industry, especially in Germany. Scenario planning is considered one of the few established instruments through which organizations can enhance their ability to anticipate and manage uncertainties. Furthermore, it serves as a transformative guide that improves critical thinking, challenges established beliefs, expands perspectives and at its most effective, fosters new opportunities for the future.

The strategic importance of scenario planning in transforming industries remains underexplored. Although it is increasingly applied in practice, there is still a lack of well-founded scientific engagement with its role in industrial transformation processes, a circumstance that highlights the need for both theoretical and empirical exploration. The majority of current research concentrates on traditional strategic planning techniques for markets and products but ignores critical drivers and success factors for scenario planning, which have a significant impact on how companies navigate the dynamic complexity and speed of change in the automotive industry. To succeed, companies must move beyond traditional forecasting methods and adopt dynamic scenario planning to explore the wide range of transformation drivers in order to enhance strategic agility for the better navigation of an industry's future.

1.1 Background and Motivation

Particularly over the past decade with the onset of disruptive changes from common combustion engines to electric drivetrains, it has become evident that scenario planning is among the most critical competencies in strategic foresight to prepare and guide organizations throughout the transformation (Eichenberger, 2020, p. 31). Not only has the shift toward electromobility impacted organizations, but also the emergence of new industry competitors, raw material shortages, and ongoing supply chain disruptions illustrate that scenario planning is becoming increasingly essential for ensuring organizational survival in evolving markets. The transformation in mobility affects especially the German automotive sector, which represents the world's largest car industry (Di Bitonto, 2024, p. 3). The accelerating pace of change in the automotive environment brings about novel challenges for manufacturers and suppliers in terms of strategic foresight. With the rapid changes and developments in the car industry, companies are required to apply effective long-term scenario planning instead of classical short-term strategic planning (Mogge, 2024, p. 5). Organizations that fail to prepare adequately for industry transformation see their product demand decrease and eventually become insolvent as they cannot adjust to upcoming market shifts. Former industry leaders like General Motors lost major market share to direct and new competitors as they failed to adapt to the long-term trends of more sustainable mobility technologies (Heikkinen, 2023). Inability to allocate sufficient investment toward the shift from fuel-intensive vehicles to more efficient technologies spurred by changing consumer demands and rising environmental concerns has left many automotive firms bankrupt. An end to the ongoing transformation of the industry remains out of sight. Whether driven by new mobility concepts, effects of digitalization or autonomous technologies, the sector will continue to undergo fundamental change. The resulting strategic challenges, combined with operational complexities and constant market shifts, necessitate proactive action through scenario planning.

1.2 Objectives of the Study and Research Questions

The main objective of this master thesis is to investigate the impact of scenario planning in the context of the transforming automotive industry in Germany. The study aims to analyze what key drivers influence an effective application and what success factors are necessary to prepare for the uncertain future. To manage strategic uncertainties in the automobile industry, this study employs a qualitative content analysis in accordance with the Mayring criteria to methodically investigate trends and patterns in scenario planning and to answer the following research questions:

1. Which key drivers should be considered in the application of scenario planning to enhance its strategic effectiveness in the transforming automotive industry?
2. What are critical success factors for adopting strategic scenario planning in the transforming automotive industry?

With regard to the transformation of the German automotive sector, the study aims to offer practical consequences for practitioners and organizations as well as insights and suggestions on how to successfully manage uncertainty. Furthermore, it highlights critical drivers and success factors for the adoption of scenario planning in the automotive sector to effectively design strategic planning and foresight processes. Based on the qualitative analysis, empirical evidence for the application of specific approaches in the context of scenario planning is validated and challenged and new conceptualizations are proposed.

1.3 Structure of the Study

This dissertation is divided into five core chapters. After the brief introduction incorporating the objectives, research questions, and structure of this study, chapter two represents the literature discussion with the fundamentals of scenario planning in the context of industry transformation as well as fundamentals of the German automotive sector. The concept of scenario planning and the systematic approach, including guiding principles are exemplified in the theoretical model of the VUCA framework. A general overview and economic impact of the automotive industry in Germany, including its past evolution and newest trends, provide the current status quo of this economic sector. Furthermore, the future trajectory of the industry towards the year 2040 is described and elaborated in the context of the strategic implementation of scenario planning. Chapter three outlines the empirical framework, including the data collection and research methodology. The qualitative study is divided into two dimensions, the outline of the research findings as well as the discussion of the results. Additionally, this section covers the limitations of the study and further research as well as recommendations for the effective application of scenario planning in the context of industry transformation. Based on the research findings and discussion, chapter four provides recommendations for the effective application of scenario planning in practice. The closing chapter five presents the conclusion.

2 Theoretical Framework

The main objective of this chapter is to provide an overview of the fundamentals of scenario planning and the transforming German automotive sector. The chapter is based on literature reviews with primary and secondary data collected from academic publications and other

scholarly sources. It involves an evaluation of the relevance and reliability of the sources used to support the academic evidence of the theoretical framework. In addition, publicly accessible articles from reliable sources are included to give a comprehensive overview of the topic.

2.1 Fundamentals of Scenario Planning

In times of growing significance for strategic foresight and continual adaptations in organizational contexts, it becomes imperative to understand the concept and key elements of scenario planning, as well as comprehend the guiding principles to prepare companies for the future. To this end, the commonly used framework of VUCA and different approaches to scenario building are explained to provide a structure for anticipating upcoming developments and enhancing strategic planning under conditions of uncertainty.

2.1.1 Concept and Definition

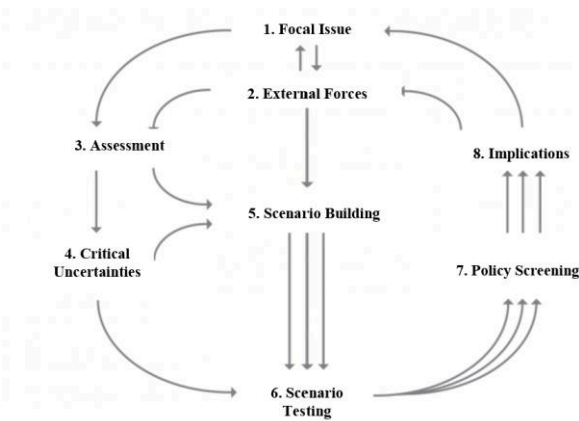
The growing complexity and continuous transformation across many industries present organizations with the challenge of consistent adoption to rapidly evolving conditions. The future is frequently marked by a great deal of uncertainty due to the increased global multifariousness, which calls for a greater ability to assess the main forces behind change and proactively find viable answers to new problems. A company's success or failure may depend on its capacity to react swiftly to significant interruptions (Bostock, 2015). Hence, over the past decades, scenario planning has become the most useful tool as it provides a way to develop plans for a number of scenarios that encompass possible future events (Varum, 2009, p. 355). In this regard, scenario planning includes speculation about the uncertainty of futures in industries and to build different possible outcomes for the situation under scrutiny (Chermack, 2001, p. 8). However, it cannot provide an accurate description of the future, rather the approach aims to help organizations to recognize the uncertainties of their environment and to better manage them in their strategic planning (Varum, 2009, p. 356). Scenario planning consists of two components, scenario building and strategic preparation for possible outcomes. In this regard, it is crucial to note that scenarios are not forecasts or predictions as their goal is to question established ways of thinking and present a range of potential future events rather than precisely forecasting the future (Bostock, 2015). Business organizations began to use scenario planning in the early 1970s when Shell Oil applied the strategic method to foresee possible shifts in the global oil market (Peterson, 2003, p. 358). Shell's planners identified potential tensions and production limits in oil-producing countries and envisioned scenarios where a coalition might restrict production and drive prices up. This foresight enabled Shell to adjust its

operations and prepare for higher prices. As a result, they were able to adapt more swiftly than competitors to the oil crisis in the same year and showcased the strategic value of scenario planning (Peterson, 2003, p. 358). Given that industries and organizations face multiple potential scenarios, it is essential to prioritize those with the greatest impact and highest probability of occurrence. The most effective approach involves the generation of between two and five distinct scenarios, as an excessive number becomes unmanageable and leads to confusion (Peterson, 2003, p. 359). This range reflects the variety of uncertainties while allowing a multi-disciplinary approach to develop different theories about the future (Peterson, 2003, p. 359). Furthermore, each scenario should be described in sufficient detail to allow a full assessment of the feasibility of strategic responses (Bostock, 2015). Since every industry is impacted by distinct trends and disruptive forces, differences in the effective application of scenario planning across sectors exist. It is a crucial approach in the anticipation and preparation for impending industry changes in some sectors, while in others it assists in identifying white spaces for early adopters (Heikkinen, 2023). Therefore, businesses can improve resilience or seize new business models by including scenario planning into strategic decision-making.

2.1.2 The Systematic Approach and Planning Process

The scenario planning process typically follows a structured, methodical approach consisting of eight interacting stages, often conducted in organizations within workshops of research scientists, policymakers, or other stakeholders (Peterson, 2003). Figure three illustrates the eight-step process of scenario planning, outlining the interconnected stages that influence one another. The complete cycle can take up to four months, starting with the identification of a specific issue or driver and ending with the implementation of solutions (Bostock, 2015).

Figure 1: The Eight-Step Scenario Planning Process



Source: Modified according to Bostock, 2015

Given the complexity and diversity of potential developments, scenario planning must be carefully targeted to remain effective. Clearly defined focal issues form the central starting point of the scenario process and emerge from a system relevant to the company. They are determined through negotiations among participants, should reflect key stakeholders' interests and be systematically analyzed for relevance and strategic value (Peterson, 2003, p. 360). Subsequently, a scenario team compiles a comprehensive list of variables influencing the issues. The process requires both creative and critical thinking to go beyond the obvious while ensuring feasibility (Varum, 2009, p. 356). It is essential to identify uncertainties and analyze how external changes could affect system dynamics to ensure alignment with the complexity of the industry (Varum, 2009, p. 356). Based on the insights gained during the assessment process, a set of scenarios is developed to depict potential future developments shaped by key uncertainties. These scenarios should be organized as succinct narratives that link past and present developments with speculative future events in order to challenge and widen current ideas on the system (Chermack, 2001, p. 9). Underlying assumptions and differences between the scenarios must be explicitly stated. Consistency checks throughout the process ensure plausibility and eliminate contradictions or unrealistic assumptions. This examination relies on quantitative methods, expert evaluations, and scenario comparisons (Schumacher, 2012, p. 122). Testing the scenario process supports continuous improvement and early identification of potential weaknesses. After the scenarios have been developed, the approach functions as a tool for evaluating and developing strategies to enhance organizational resilience to future events. Existing measures can be analyzed within the scenarios in terms of their robustness or vulnerability (Varum, 2009, p. 357). Furthermore, the involvement of stakeholders strengthens the evaluation and opens up opportunities to actively influence desired future paths. The decisive step generates appropriate courses of action and the evaluation potential impacts and options (Cordova-Pozo, 2023, p. 2). Companies evaluate various strategic approaches through logical analysis to identify common response patterns. In practice, this is often realized in pilot projects. Overall, the eight-step process functions as an effective tool which provides guidance to organizations in the preparation for different future scenarios while enhancing their ability to adapt in changing environments.

2.1.3 Guiding Principles

Once plausible scenarios have been created, it is essential to imagine how well the organization would operate in each of these futures. Every detail in this context can raise novel issues, strategic concerns or reframe old issues. Successful scenario planning is based on three guiding

principles, the long view, outside-in thinking and the application of different perspectives (Scarce, 2004, p. 10). Daily business is often driven by short-term priorities and challenges with the necessity to deliver immediate outcomes. Consequently, the strategic planning is more near-sighted and lacks long-term perspectives to anticipate future opportunities. In contrast, scenario planning requires organizations to extend their horizon beyond the immediate demands and consider potential developments of a ten-year period (Varum, 2009, p. 357).

Scenario planning differs from predictions and forecasts because it uses a long-term perspective to analyze future opportunities or deep-seated problems and their effects on strategic decisions (Barrott, 2025, p. 5). The second essential element of scenario planning depends on outside-in thinking. Organizations typically direct their strategic planning efforts toward their internal structure and immediate industry because these domains represent their areas of maximum understanding and control. The outside-in thinking process requires organizations to analyze systematically all external factors which include social elements, technological developments, economic conditions or working environment components such as customers, competitors and partners (Peterson, 2003, p. 359). This outside-in approach fosters imaginative thinking about potential changes and strategies that may be overlooked with an internal focus, helping organizations break out of their existing mindset. Unlike an inside-out approach, which prioritizes internal control to shape external circumstances, outside-in thinking methodically examines both, the working and broader contextual environments (Chermack, 2001, p. 11). Organizations gain the ability to detect and enable strategic responses for trends but also uncertainties and opportunities through external perspectives which they would otherwise miss from a purely internal view. Scenario planning requires multiple perspectives because it tests assumptions while offering different strategic viewpoints on organizational issues (Scarce, 2004, p. 12). Organizations that gather stakeholders and industry insights can minimize cognitive biases while creating resilient scenarios which leads to adaptive strategies for complex and uncertain environments. By combining these three guiding principles, scenario planning becomes a powerful tool that makes organizations more resilient to uncertainty and proactively opens up avenues for action in disruptive futures.

2.1.4 The VUCA Framework

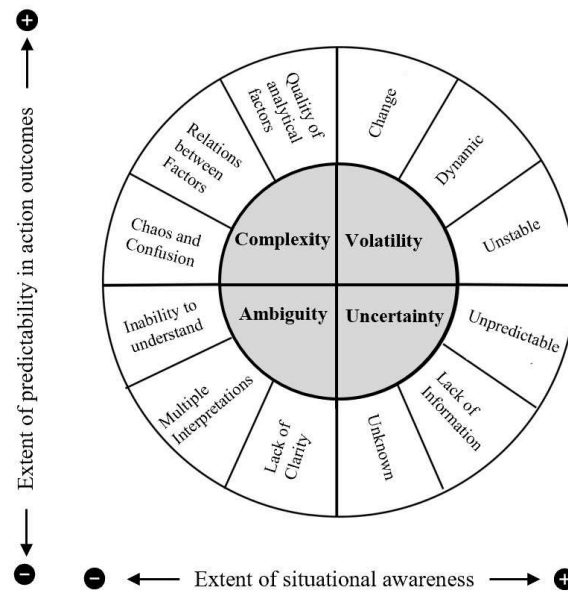
Change and ambiguity in business organizations and industries are not new. What is new, however, is the speed of change and transformation in many industries. The result is an increased level of unpredictability and complexity with unforeseeable problems that constantly

require new strategies and capabilities to adapt to these changes. VUCA emerges as the most widely used model with its letters standing for volatility, uncertainty, complexity, and ambiguity, which defines today's business challenges (Kienl, 2024, p. 38) The idea was first developed at the US Army War College in the 1990s to describe the multipolar new world order after the Cold War (Niehaus, 2024, p. 8). It was later adopted by business organizations to describe chaotic, unstable and changing work settings and became more relevant in the aftermath of the 2008 global financial crisis and the 2020 Covid-19 pandemic (Taskan, 2022, p. 197).

VUCA effectively captures the four core characteristics of the environment encountered by most business organizations. Volatile environments are characterized by the rapid and frequent nature of changes, without any discernible trend or consistent pattern of recurrence such as market fluctuations (Kienl, 2024, p. 38). In volatile environments, information is accessible, and the overall situation can be assessed, however, the pace and unpredictability of change pose significant challenges to organizational planning (Bennett, 2014, p. 2). The definition of uncertainty describes a situation with insufficient knowledge about the importance of an event to establish its role as a meaningful cause (Taskan, 2022, p. 197). Complex situations consist of numerous interconnected elements which create difficulties to identify and understand root causes and contributing factors of a problem. Regarding complexity, interconnected elements do not necessarily drive change but rather form intricate networks of information and processes that are difficult to comprehend (Kienl, 2024, p. 39). Ambiguity denotes a lack of knowledge and clarity, leading to multiple interpretations of information (Kienl, 2024, p. 40). In this context, the underlying causes of a phenomenon are not well understood and the absence of precedents complicates the ability to make reliable predictions. This is particularly evident in situations involving unclear industry regulations that create ambiguity, especially for companies operating in multiple countries or industries (Bennett, 2014, p. 2).

Figure two illustrates the VUCA framework, mapping its components against two key dimensions, predictability of outcomes and situational awareness. Ambiguity and uncertainty hinder foresight due to knowledge gaps, while volatility and complexity allow limited predictability through patterns and analysis. Situational awareness remains stronger in volatile and complex environments yet ambiguity and uncertainty reduce awareness because they generate information gaps and multiple possible interpretations.

Figure 2: Conceptual Map of the Acronym VUCA



Source: Modified according to Taskan, 2022, p. 219

An inverse relationship exists between predictability and situational awareness as higher predictability reduces the need for extensive awareness, whereas low predictability necessitates heightened awareness to navigate dynamic and complex conditions. The dynamic relationship between these elements demonstrates why organizations need adaptive strategies and thorough analysis when operating in uncertain conditions. In recent years, a concept has emerged that frames the response to VUCA as another VUCA, with the letters in this case standing for vision, understanding, clarity, and agility (Bendel, 2021). This approach emphasizes that organizations can overcome volatility through clear vision, uncertainty by deep understanding, complexity through clarity and ambiguity with agility to enhance their navigation of dynamic environments. Organizations are required for both superior situational awareness and effective uncertainty management to succeed in such environments. VUCA in strategic planning demands organizations to maintain flexibility alongside adaptability and proactive approaches to better navigate these situations.

2.2 Fundamentals of the German Automotive Sector

As Germany’s largest and most important industrial sector, the automotive industry has undergone a profound transformation in recent decades and will continue to face comprehensive changes in the upcoming years. To better understand the dynamics and transformation of this key sector, chapter 2.2 provides an overview of the industry’s economic significance and its

structural developments from past to present day, including projected developments and forecasts until the year 2040 and strategic adjustments through the application of scenarios.

2.2.1 Overview and Economic Impact

The automotive sector is the most significant industry sector in Germany and the largest vehicle manufacturing industry and sales market in Europe (Di Bitonto, 2024, p. 3). In 2023, the industry achieved a total revenue of €564 billion by selling 4.1 million passenger cars and 351,000 commercial vehicles like buses and trucks (BMWK, 2025). The ten German-based original equipment manufacturers (OEMs) produced vehicles with over 458 billion euros worth of revenue which represents three-quarters of the total industry turnover. In addition, German automotive suppliers generated 106.6 billion euros from their operations which accounts for 19.2 percent of the total turnover (BMWK, 2025). The industry employs 780,000 employees at 154 assembly sites and produces 24 percent of Germany's gross national product (Di Bitonto, 2024, p. 4). The wider ecosystem includes engineering firms, repair workshops, car dealerships and fuel stations in addition to multiple vehicle-related service providers (Blatt, 2017, p. 17).

Besides the domestic market, international trade is crucial for German automotive companies. Automotive exports accounted for 17 percent of all German exports in 2023, making it the product group with the largest export share (Di Bitonto, 2024, p. 3). In addition to the 4.1 million passenger cars produced in Germany, more than 10 million vehicles were produced by German car manufacturers overseas, predominantly in non-European markets, which account for two thirds of the turnover of German automotive companies (BMWK, 2025). Among these, China represents the nation with the highest production of four million passenger cars, followed by countries of the European Union with three million vehicles produced (Blatt, 2017, p. 16). Beyond Germany's borders, the industry maintains over 2,000 production facilities worldwide. This development dates back to 2010, when the number of German vehicles manufactured abroad began to exceed domestic production (Blatt, 2017, p. 19).

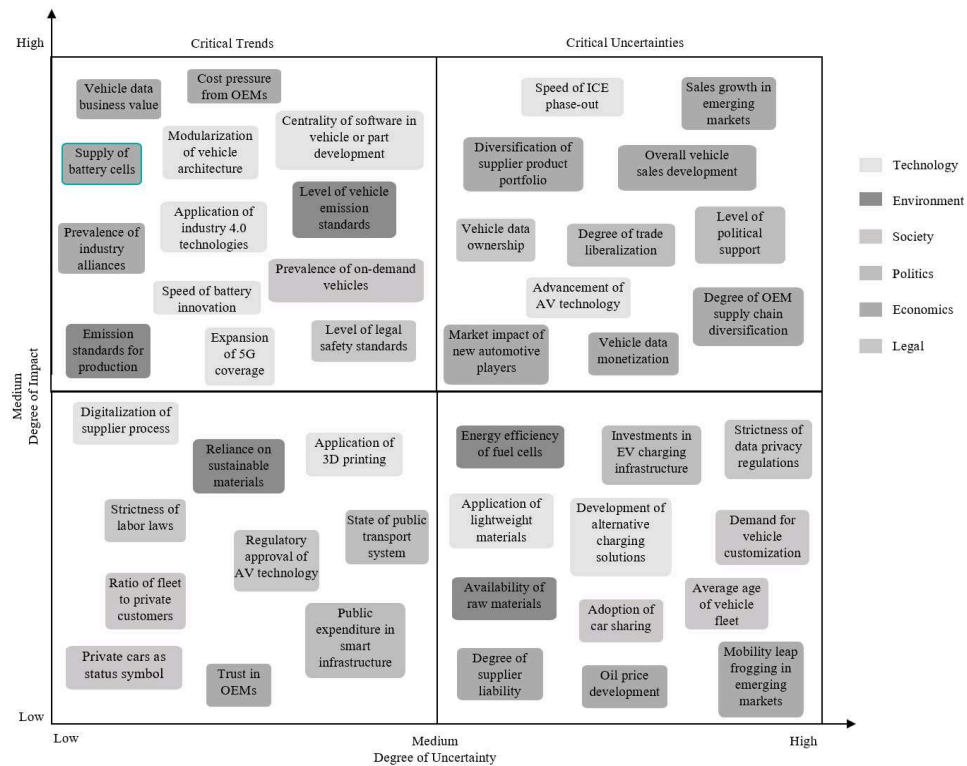
2.2.2 Key Drivers of Structural Transformation and Industry Uncertainties

Since Karl Friedrich Benz launched the first practical car with an ICE in Mannheim, Germany in 1885, marking the beginning of the automotive industry in Germany, the industry has undergone continuous transformation over the last century. From the emergence of numerous German global players after World War II and the leading role in high-performance vehicles to today's software-defined cars with multimedia interface and high-end control systems, the sector has continuously evolved in response to various driving forces (Proctor, 2025).

The current era of the German automotive industry is mainly characterized by four key trends that are described by the acronym CASE, which represents the development of car connectivity, autonomous driving, shared mobility and electrification (Winze, 2021, p. 4). Connectivity refers to vehicles that communicate and exchange information with infrastructure, passengers, and other vehicles, whereas autonomous driving enables vehicles to operate independently without the need for a human driver (Winze, 2021, p. 4). Shared mobility indicates the ability for a single vehicle to be utilized by multiple users and reduces the need for private ownership whereas electrification represents the adoption of electric drivetrains (Winze, 2021, p. 4).

In the past five years, the industry in Germany has already invested more than 150 billion euros in the transformation of the four key trends (Winze, 2021, p. 6). According to a survey by the consultancy “Strategy&”, almost half of the manufacturers and suppliers are focusing their investments in the CASE dimensions on the area of electromobility, followed by the further development of autonomous driving (Kliesing, 2021, p. 3). Due to the elevated level of investment and advanced development of this CASE dimension, electromobility can be described as the most important key driver. The transformation is also driven by challenges in the broader industry environment. The expansion of Chinese car manufacturers in Europe increases competition and pushes the need to produce both high-end and cost-efficient vehicles (Kliesing, 2021, p. 3). Additionally, chip production bottlenecks and reliance on global supply chains accelerate the development of in-house chip production to reduce dependence on other markets (Galgóczi, 2019, p. 219). Another key trend and threat to German car manufacturers is the rising capital market valuation of pure electric vehicle manufacturers in contrast to that of traditional car manufacturers. Overseas competitors such as Tesla or BYD have easier access to capital for research and development than many German manufacturers and can push ahead with the acceleration of advancements in electric vehicle efficiency (Kaas, 2016, p. 4). To keep pace, many automotive companies form strategic alliances with technology firms. For instance, Mercedes-Benz collaborates with Microsoft to enhance software for connected driving and facilitate knowledge exchange and innovation (Galgóczi, 2019, p. 223). However, numerous uncertainties influence the sector as well, which often have different impacts on the transformation. Figure three shows current critical trends and uncertainties related to their degree of impact on the car sector. These factors are based on the PESTEL framework, which describes the external influences of politics, economics, social, technology, environmental and legal on businesses.

Figure 3: Critical Trends & Uncertainties in the Automotive Sector



Source: Modified according to Proff, 2021, p.7

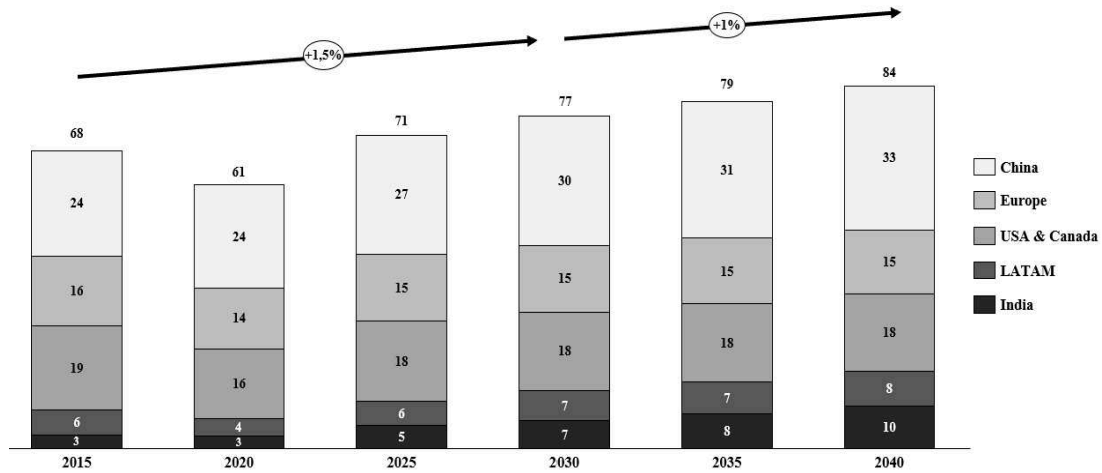
The automotive industry faces both stable trends and hardly predictable uncertainties. While developments such as the increasing importance of software-based vehicle functions, stricter emission, safety standards and the availability of battery cells are considered certain, the progression of many influencing factors remains unclear. These include the speed of the internal combustion engine phase-out, market growth in emerging economies and the societal acceptance of autonomous vehicles (Proff, 2021, p. 8). Critical uncertainties are not purely technology-driven but are closely linked to political and economic conditions. They have the potential to profoundly transform existing business models. At the same time, it becomes apparent that competition extends to systemic dependencies, platform architectures and new market entrants. Against this background, it is imperative to strategically address robust trends but also plan flexible responses to uncertain developments (Proff, 2021, p. 9). Hereby, scenario planning helps to consider alternative future paths and derive strategic options and thus, becomes a key instrument for maintaining decision-making and adaptability in a volatile industry over the long term. Traditional manufacturers are increasingly required to enter partnerships with technological firms in order to facilitate knowledge transfers and innovation support concerning the digital features of vehicles and to be able to compete against new competitors in the market.

This aspect becomes crucial as major tech companies including Google and Apple continue to develop their own mobility solutions which will expand market competition further (Galgóczy, 2019, p. 224). Since every trend and uncertainty varies in its degree of probability and impact, it is important for manufacturers and suppliers to take all internal and external factors into account for their scenario planning to be prepared for any future development.

2.2.3 Future Trajectories and Industry Projections towards 2040

The ongoing disruption in the automotive sector shapes the growth trajectory for the period to 2040. Technological innovation will be the main driver of the transformation with a central development in the rise of electric vehicles (EVs), which are expected to take 71 percent of global new car sales by 2040 (Onica, 2020). Forecasts predict that Europe will lead with a 90 percent EV share, followed by China and North America with 70 and 60 percent (Mogge, 2024, p. 5). This shift is backed by declining battery costs and improvements in the infrastructure with an expected global growth of 1,200 percent in charging stations in the next fifteen years (Kaas, 2016, p. 7). In Western markets, where vehicle ownership has peaked, growth will be limited, while the worldwide demand for mobility will continue to grow by three percent each year until 2040 due to urbanization and the growing middle-class in China and the Global South (Mogge, 2024, p. 7). However, the nature of mobility will change significantly. Shared mobility solutions such as ride-hailing and car-sharing are predicted to account for up to ten percent of new vehicle sales as these services are expected to rise due to congestion, shortage of parking space and the convenience of on-demand services (Kaas, 2016, p. 6). Increasingly, urban mobility systems will incorporate multimodal solutions of public transit, micromobility such as e-bikes and scooters, and on demand transportation to create seamless transportation (Proff, 2021, p. 7). In contrast, private car ownership will remain prevalent in rural areas (Proff, 2021, p. 7). Because of the stagnation of vehicle sales in Western markets, the power balance will shift from the key player Germany towards China, where domestic manufacturers will own the market and lead in technological innovation (Kliesing, 2021, p. 4). German manufacturers are going to face major issues in reviving their market share, requiring them to innovate and adapt to new consumer expectations and regulatory environments (Kliesing, 2021, p. 5). Figure four shows the development of new vehicle sales in the key regions up to 2040. The traditional core markets of German automotive companies, Europe and the United States, are experiencing stagnation in sales. On the other hand, the Chinese market expands significantly and is anticipated to solidify its position as the highest sales market.

Figure 4: Sales of New Vehicles by Key Regions, 2015-2040
[million vehicles]



Source: Modified according to Mogge, 2024, p. 30

In order to take advantage of this growth, automakers will increase their strategic attention on China and reallocate resources from other areas. Moreover, new markets will emerge and gain in importance, such as India, where a sale of ten million cars is expected in 2040. This underlines the importance of scenario planning in the next fifteen years, not only with a focus on current key markets, but also in direction of strategic planning towards emerging markets.

Autonomous vehicles will experience restricted market adoption due to enormous regulatory difficulties and customer doubts while advanced driver-assistance systems become standard and mandatory to enhance safety and comfort (Mogge, 2024, p. 28). The connectivity will simultaneously transform vehicles into software-defined platforms which can analyze real time data by engaging with roads and the broader infrastructure to enhance user experience and create a new business model. By 2040, connected car services are expected to create \$1.5 trillion in additional sales, which demonstrates the increasing significance of data-driven revenue model (Mogge, 2024, p. 28). The strategic priorities will shift toward high-tech components to create digital platforms that foster collaboration between technology firms and traditional OEMs. German manufacturers need to adapt to these new conditions by focusing on technological progress and digital services as well as new mobility models to remain competitive in this rapidly changing market landscape where China emerges as a major innovator and market influencer (Kaas, 2016, p. 5). The future of Germany as a production location depends on the systematic combination of traditional manufacturing know-how with innovative digital technology since the future industry will serve as the main hub for data and information processing to support sustainable and competitive manufacturing operations.

2.2.4 Strategic Implementation of Scenario Planning in Automotive Organizations

Few industries are currently being transformed as deeply as the automotive sector. Disruptive forces continuously reshape the demand and requirements of scenario planning and create complex and highly volatile business environments. Akio Toyoda, chief executive officer of Toyota, the world's largest automotive manufacturer, describes the current transformation of the industry as an "era in which the correct answers are unknown", underlying the strategic need for scenario planning (Onica, 2020). The sector undergoes changes primarily due to rapid technological advancements in vehicles but also due to ongoing transformations in engineering and manufacturing processes. The prevalent method in automotive scenario planning is the application of what-if scenario models to evaluate business outcomes from multiple potential developments (Barrott, 2025, p. 5).

These models analyze assumptions with different probability levels to evaluate how future developments would affect the industry. Companies use systematic scenario analysis to discover strategic risks and opportunities and develop responses which they then use to build their long-term plans (Onica, 2020). The automotive sector benefits most from what-if scenarios when dealing with uncertainties about technological progress and regulatory changes and shifting consumer preferences, an approach in which scenario planning is initiated by the question "what-if" to prepare for potential outcomes of different disruptors. The structured framework enables firms to evaluate their strategies against different conditions while making proactive adjustments to new challenges (Eichenberger, 2020, p. 31). The approach strengthens organizational resilience while promoting innovation through its ability to foster creative thinking about upcoming trends and possibilities. Scenario building must be integrated into strategic planning with a long-term horizon of over ten years in order to align it with a timeframe that accounts for emerging challenges (Eichenberger, 2020, p. 33). Companies that proactively implemented scenario planning ahead of the industry's transformation, for example by emphasizing market research and development to realign their product portfolios with evolving demands in electronics and software, now possess a sustainable competitive advantage (Barrott, 2025, p. 5). In contrast, organizations without long-term vision and market adaptation capabilities face major setbacks and serve as warning examples for the industry. Companies that fail to engage in forward-looking scenario planning already experience declining demand and customer attrition, as they struggle to adapt to the transformative shifts that reshape the sector (Eichenberger, 2020, p. 33).

Forecasts in the area of electric vehicle adoption predict that 75 percent of the world's top one hundred automotive suppliers may not withstand the industry's transition to EVs, unless they implement proactive adaptation strategies (Onica, 2020). Additionally, automotive companies must move beyond conventional scenario planning approaches that not only align with their internal strategic objectives but also account for the rapidly evolving external industry landscape (Eichenberger, 2020, p. 35). This enables firms to enhance resilience but also to capitalize on emerging opportunities and ensure long-term success in volatile markets.

3 Empirical Framework

The third part of this master thesis is about the empirical framework, including the conducted research and analysis of the results. This section aims to explain and analyze the multifaceted drivers of scenario planning in the German automotive industry and how organizations effectively apply this strategic foresight approach. Following the explanation of the design and methodology, including the data collection and evaluation, this section provides empirical insights from the research findings structured along the key aspects and influential factors of scenario planning, its practical application and the strategic adoption to the transformation of the industry. Key drivers and industry uncertainties relevant for scenario planning are identified and serve as the foundation for scenario building. Hereby, four transformation scenarios of the automotive sector are outlined and serve as the basis for the development of strategic responses. Finally, the implications for corporate strategy as well as success determinants are examined for the effective application of scenario planning. Based on the research discussion, the limitation of this study and further research approaches are outlined in section 3.4.

3.1 Research Design and Methodology

The empirical framework is based on expert interviews to examine the perspectives and experiences of knowledgeable experts and to shed light on the underlying drivers for successful scenario planning in times of transformation. With the insights shared in the interviews, this research endeavors to contribute to the existing body of knowledge and provide valuable insights for applying scenario planning. Through the conception and formulation of key statements derived from the interviews, a deeper understanding of the drivers and approaches of the scenario planning process is sought. These insights are analyzed to effectively address the research questions at hand.

3.1.1 Data Collection

The present study employs a qualitative survey method in form of expert interviews to gather primary data on scenario planning in the German automotive industry. The sample consists of twenty individuals in strategic positions from suppliers, manufacturers and consultancies of the industry, as well as two experts from the association of the German automotive industry (VDA). In total, 884 minutes of interview data have been collected and transcribed with the software *happyscribe* and spanning 147 pages. The data collection process involved standardized interviews with an average duration of 45 minutes to entail the utilization of pre-defined and formulated questions, whereas additional open interview questions focus on established topics and goals, allowing for unrestricted responses. The utilization of open-ended questions aims to avoid predetermined answer categories and facilitated a more exploratory approach (see Appendix A, Questionnaire for Interviews, p. 41). The questionnaire was developed with the existing theories from the literature and expanded with specific inquiries to address the key drivers of scenario planning in the German automotive sector. Interviews were chosen as the preferred data collection method due to their ability to provide unique and unpublished insights into individual perspectives and experiences towards scenario planning (Opdenakker, 2006, p. 2). Table one provides an overview of all interview partners of the qualitative study.

Table 1: Overview of Interview Partners

Interviewee	Job Position	Automotive Sector	Age	Gender
1	Chief Strategy Office	Supplier	55	Female
2	Transformation Project Manager	Supplier	38	Female
3	Transformation Project Manager	Supplier	40	Male
4	Manager Group Strategy & Development	Supplier	45	Female
5	Head of Business Unit	Supplier	51	Male
6	Chief Transformation Office	Supplier	59	Male
7	Regional Head of Central and South America	Supplier	57	Male
8	Manager Supplier Network	Manufacturer	35	Female
9	Business Development Manager	Manufacturer	31	Male
10	Strategic Portfolio Manager	Manufacturer	42	Female
11	Regional Business Analyst	Manufacturer	29	Male
12	Sustainability Manager	Manufacturer	30	Female
13	Product Strategy Manager	Manufacturer	46	Female
14	Product Strategy Manager	Manufacturer	50	Male
15	Head of Public Affairs & Regulatory Affairs	VDA	53	Female
16	Head of Innovation & Future Mobility	VDA	55	Male
17	Consultant in Automotive	Consultancy	32	Male
18	Consultant in Automotive	Consultancy	44	Male
19	Consultant in Automotive	Consultancy	40	Male
20	Consultant in Automotive	Consultancy	29	Female

Source: Own illustration

The interview partners were deliberately selected to represent key strategic functions within various segments of the automotive industry. All participants possess solid experience with strategic planning processes and were directly or indirectly involved in scenario-related activities. By including experts from different segments, such as OEMs, suppliers, associations (VDA) and consultancies, a broad and differentiated perspective on the application and effectiveness of scenario planning in the industry can be obtained. The diversity of positions, age groups, and sectoral backgrounds enables a capture of internal corporate dynamics and external influencing factors, as well as cross-sectoral viewpoints. This strengthens the validity of the qualitative analysis and allows to examine key drivers, challenges and success factors of scenario planning from different organizational perspectives.

3.1.2 Data Evaluation

This section undertakes the methodological approach of the empirical analysis in order to assess and address the two research questions formulated in section 1.2 of this dissertation. This analytical approach involves the collection of qualitative data from the interviewees, followed by a systematic examination utilizing coding schemes to identify prevalent themes and patterns. Specifically, the methodological framework employed consists of a qualitative content analysis according to the Mayring process model which facilitates the systematic evaluation of the data set based on interpretative and reconstructive propositions (Mayring, 2014, p. 5). Prior to conducting the interviews, potential over-arching categories were deductively developed from the theory and interview guideline. During the initial coding phase, text passages that precisely captured the category's description were coded and noted as anchor examples. In cases of difficulties in differentiation or allocation between categories, coding rules were established. Additionally, individual categories were modified or renamed when necessary. Once no further changes were made to the preliminary category system, the entire material was coded by using the software *MAXQDA*. Subcategories (SC) were formed inductively from the data material. Relevant sentences were coded with respect to the research question and in accordance with the defined coding rules. By using Mayring's qualitative content analysis, an approach for the systematic reduction of qualitative data by summarization and categorization through inductively developed research categories, quotes were collected and subsequently paraphrased, generalized, and categorized with the aim to reduce the entire data material (Mayring, 2014, p. 6). This process resulted in the creation of subcategories as well as new overarching categories that were added to the final category system and the process of the category formation followed a circular path. Finally, all relevant text passages from the

entire data material were coded based on the category system. In total, the following seven main categories (MC) were developed: *MC1 application of scenario planning*, which refers to the utilization in practice, including its purpose and scope, *MC2 internal drivers*, that describe organization-specific factors that impact the effectiveness of scenario planning, *MC3 external drivers*, that includes all external influences, *MC4 strategic application*, covers how scenario planning supports strategic functions, *MC5 organizational capabilities and barriers*, that refers to the internal competencies or obstacles within an organization, *MC6 methodologies and tools*, that encompass specific methods, tools or frameworks for scenario planning and *MC7 future trends and overlooked drivers*, to address emerging developments and less-recognized aspects in the application of scenario planning. The coding guideline and the complete category system with overarching and explanation of subcategories are outlined in the appendix on page 48.

3.2 Research Findings and Qualitative Insights

To facilitate a comprehensive discussion of the research findings, this section provides an overview of the qualitative insights derived from the study. The prevailing themes are identified and form the foundation for the subsequent analysis and discussion of the findings. In addition, core patterns and notable deviations are juxtaposed and contextualized to make consistent trends and critical inconsistencies in the dataset transparent and interpretable.

3.2.1 Influential Factors of Scenario Planning

The empirical results clearly show that the effective application of scenario planning in the German automotive industry depends on a combination of structural, cultural, and strategic factors. While classical models in the literature primarily focus on methodological design and systematic process flows, the interviewees emphasize that success is largely determined by internal organizational drivers and active engagement with external uncertainties (Interviewee 3, col.8), (Interviewee 6, col. 8).

The organizational perspective on scenario planning recognizes its essential role in social and cultural processes beyond its function as a methodological tool. A key role refers to the top management. Scenario planning is only effective when it does not remain isolated within strategy teams but is integrated into the overarching management logic of a company. Several interviews report that scenario processes are operationalized through quarterly management reviews and KPI-based control mechanisms (Interviewee 13, col. 56). This strategic anchoring enables the use of scenarios as a decision-making basis for investments and portfolio reallocations. In addition to structural integration, cultural openness to uncertainty and dissent

is critical. Scenario planning is particularly effective in organizations that provide psychological safety and encourage critical thinking, which improves the validity of scenarios and enhances their strategic applicability (Interviewee 6, col. 44). Another key factor identified is the ability to detect weak signals at an early stage and incorporate them into the scenario logic. This is related to external influencing factors, which play a vital role in initiating scenario-based processes. Almost all interviewees refer to increasing regulatory uncertainty, for example through the European Green Deal or CO₂ limits, as a reason to make strategic planning more robust using scenarios. Additionally, external shocks such as trade wars, energy price fluctuations and technological leaps, create new dependencies and uncertainties. These developments reinforce the hypothesis that classical planning tools are no longer sufficient to ensure strategic capability. Scenarios that ignore such factors quickly lose relevance (Interviewee 1, col. 12). A detailed overview of additional foresight and strategic planning tools is outlined in appendix C, on page 43.

It becomes evident that the effectiveness of scenario planning does not primarily depend on methodological rigor, but on organizational integration, cultural openness and strategic anchoring to address external uncertainty. The findings support traditional theoretical frameworks by showing that scenario planning success depends on context-specific and adaptive implementation methods.

3.2.2 Scenario Planning in Practice

Admitting the ongoing transformation of the automotive industry, scenario planning has developed from a theoretical concept into a central component of strategic and operational decision-making. The empirical findings from the experts' interviews indicate that this strategic approach is increasingly used to navigate potential industry uncertainties and improve corporate transformation processes. Organizations leverage scenario planning to analyze divergent development paths in relation to internal factors like capital allocation, investment decisions and external regulations such as geopolitical tensions or material availability (Interviewee 8, col. 16). Modeling different scenarios helps automotive firms to plan adaptive strategies and increase their operational flexibility and strategic responsiveness. The importance of scenario planning in practice is underlined by the fact that this strategic approach is even used at the highest management level in decision-making processes. For instance, C-level executives at an automotive supplier utilize developed scenarios to guide investment decisions and capacity expansion in the production for electric drive trains, while maintaining a certain degree of

flexibility in the area of conventional drives in order to cushion possible delays in the transformation (Interviewee 1, col. 38). In the practical application, scenario planning fulfills a dual function as it serves to anticipate risks and uncertainties, but also to identify innovative potential in a targeted manner. Examples of how scenarios on the second-life use of batteries have led companies to new product strategies and partnerships and highlight the innovation potential of this strategic tool (Interviewee 9, col. 12). Nowadays, scenarios are closely linked to concrete decision-making processes and are activated by “trigger points” which describe predefined indicators such as commodity prices or regulatory developments that automatically trigger operational responses to changes that are established within the scenarios (Interviewee 20, col. 64). Often, the strategic planning takes place in dedicated foresight teams or “transformation pods”, which anchor scenario-based work across different departments and expertise to enable rapid adaptation to new industry conditions (Interviewee 2, col. 44). The added value of scenario planning becomes particularly clear when dealing with strategic conflicts of objectives between the current and future operations. It allows a transparent balancing of short-term profitability goals and long-term transformation needs by anticipating future industry developments and adapting them to current production capabilities. Hereby, the practical application marks a paradigm shift away from occasional strategic planning towards continuous, data-based future orientation, and thus towards an integral component of strategic resilience in a dynamically changing industry environment.

3.2.3 Strategic Adoption to Industry Transformation

In the context of the transformation of the automotive industry, scenario planning is undergoing a strategic reassessment. It is not only an instrument for anticipating possible developments, but also a principal component of future-oriented corporate management. Scenario planning in successful companies is used for environmental monitoring but is also established as a structuring decision-making framework for long-term strategic transformation (Interviewee 14, col. 20), (Interviewee 8, col. 24). The main discovery shows that scenarios are becoming more specific to particular regions. Companies now avoid using identical future projections across all markets and instead create separate scenarios for their main markets including Europe, China and North America. This differentiation allows for targeted adaptation of strategic measures to regulatory, infrastructural, and socio-economic conditions, while simultaneously increasing the compatibility of strategies within the respective markets (Interviewee 5, col. 92). Scenarios thus become an integral part of regionalized strategy processes, especially in location decisions or country-specific product strategies.

Another central finding concerns the systematic linkage of scenarios with company-wide innovation and investment processes. In particular dynamic or disruptive scenarios, such as those driven by regulatory transformation or technological upheaval scenarios form the basis for allocating R&D budgets, prioritizing strategic initiatives and structuring investment decisions. Particularly innovative is the use of scenarios for cross-sector coordination. Companies initiate partnerships already during the conceptual phase of scenarios with actors from adjacent industries such as energy, digitalization, or mobility infrastructure. The aim hereby is to develop a shared understanding of future challenges and to identify potentially complementary solution approaches together (Interviewee 14, col. 24). These alliances contribute to the creation of robust, cross-industry transformation strategies.

Internally, scenarios function as catalysts for organizational development. They reveal existing goal conflicts between short-term profitability and long-term sustainability, promote prioritized decision-making logic, and enable the strategic synchronization of different business units with varying time horizons. In doing so, scenarios contribute not only to responding to external impulses but also to actively shaping internal corporate development logics under uncertainty. At the same time, they generate reflexive organizational learning by deconstructing implicit assumptions and helping to overcome cognitive path dependencies in dynamic markets.

3.3 Discussion of Research Results

Following the empirical insights from the qualitative study, this section engages in a critical discussion of the research findings. Drawing upon the results, key drivers and industry uncertainties necessitating scenario planning are discussed and serve as the foundation for potential future industry scenarios within the context of transformation in the German automotive industry. Based on the research discussion and the formulated scenarios, strategic responses are evaluated, including implications for corporate strategy and critical success factors for scenario planning.

3.3.1 Key Drivers and Industry Uncertainties

The empirical findings clearly indicate that the effective application of scenario planning in the automotive industry is primarily determined by a combination of internal organizational drivers and the handling of exogenous uncertainties. While the discussed classical theories of scenario planning often take a strongly method-centered approach, practice shows that structural, cultural, and strategic prerequisites are combined crucial for establishing scenarios as an effective management tool (MC₁).

This becomes evident in the area of internal drivers, especially with regard to the role of top management. All interviews emphasize that scenarios have an impact when they are actively integrated into strategic management processes and do not remain as an “isolated project in the strategy department” (Interviewee 12, col. 16). This indicates a central discrepancy with theory. While most theoretical models assume an ideal-typical integration into decision-making processes, the expert interviews show that this only succeeds if scenarios are not only initiated but also regularly reviewed, discussed, and operationalized (SC_{1.1}). This is particularly effective when they are linked to control systems such as budgeting and KPI logics. Appendix D (p. 46) offers a detailed overview of the key control metrics relevant to scenario planning. In addition, the cultural composition of an organization proves to be a decisive factor for successful application. Scenario planning thrives on dealing with uncertainty, diversity and dissent, characteristics that can only be productive in open and learning-capable corporate cultures (SC_{1.2}). Scenarios unfold the greatest impact when they are “uncomfortable but still discussed” and when they are accepted as a framework for critical thinking in which constructive conflicts between current states and future anticipated developments arise (Interviewee 6, col. 18), (SC_{1.3}). This observation sheds a critical light on the underexposed question in the literature of how cultural norms and informal power structures can promote or block scenario processes.

The strongest external drivers are clearly regulatory uncertainties, technological volatility, and geopolitical dynamics (MC₃). Almost all companies report massive adjustment processes due to political decisions, such as the European Green Deal or the American Inflation Reduction Act. These aspects are usually treated in the literature only generally as exogenous factors, in practice however, they are concrete triggers for scenario realignments (SC_{3.2}). Especially automotive firms are often required to completely change existing strategic plans since “every political decision can render roadmaps obsolete within weeks” (Interviewee 1, col. 40). At the same time, cross-sector dependencies are gaining enormous importance (SC_{3.3}). Dependence on semiconductors, platform architectures, and digital ecosystems are creating new dimensions of uncertainty that cannot be systematically addressed without scenario planning. This trend is driven by the profound shift in the strategic logic of the industry, away from product-based implications towards system-based uncertainties, which pose new demands on scenario planning beyond the own expertise and knowledge. Especially the interviewed external consultants and industry representatives emphasize the need to think beyond traditional industry boundaries (Interviewee 12, col. 24). Decisions must be made under conditions that change quickly and unpredictably. This shift ties to the concept of VUCA outlined in section 2.1.4.

Scenarios thus serve not only for anticipation but also for building resilience by capturing political developments through multiple, equivalent future images and translating them into strategic options. Successful application requires that scenarios are not created in isolation but are strategically anchored and operationally actionable (MC₄). Practical cases show the implementation in form of “trigger points”, for example through regulatory target values that automatically trigger strategic adjustments (Interviewee 20, col. 64). This reflects methodological maturity and an evolving understanding of scenario planning as a dynamic, decision-guiding mechanism (SC_{4.1}). Simultaneously, systemic goal conflicts between short-term performance and long-term innovation can only be managed through scenario thinking (SC_{4.2}). Another key driver is the ability to anticipate relevant uncertainties early on. Scenarios are especially effective when they not only extrapolate trends but also “make the unthinkable thinkable” (SC_{4.3}), such as disruptive developments in global energy policy, new mobility needs, or breakthroughs outside the traditional competitive field. The classical idea of one-time created future scenarios is now outdated and instead, iterative processes with continuous data integration dominate (SC_{4.3}).

Increasingly, hybrid models emerge as the preferred approach for scenario planning, combining qualitative narratives with quantitative early indicators, an approach postulated in theory but implemented more consistently in practice (MC₇). This relates to a shift in the content focus of scenarios. While classical planning is often tech- or market-based, social and systemic uncertainties are gaining importance (SC_{7.1}). Young target groups, sustainable mobility patterns, or new data economies are increasingly recognized as strategically relevant but are often insufficiently integrated (SC_{7.2}). Scenarios that address these aspects help “anticipate cultural change and not just technology trends” (Interviewee 13, col. 36).

3.3.2 Scenario Building and Formulation

The specific approach for the formulation and development of scenarios in the automotive industry varies across companies, both in terms of methodological approaches and organizational implementation (MC₆). Unlike theoretical approaches that often postulate a systematic, linear planning process with fixed planning horizons often between ten to fifteen years, practice shows a shift towards iterative, flexibly adaptable processes (Interviewee 1, col. 24). This is driven by the dynamics of regulatory, technological, and societal developments, closely tied to the uncertainties of VUCA. Several interviewees report that scenarios are no longer seen as one-time projects but as “dynamic thinking tools” (Interviewee 19, col. 12),

(Interviewee 15, col. 14), (Interviewee 3, col. 12). Instead of rigid 2x2 matrices or purely quantitative models, hybrid approaches are preferred, combining qualitative narratives with systemic methods such as trend mapping, decision trees, or causal diagrams (SC_{6.1}). A complete overview of additional foresight and strategic planning tools and methodologies is outlined in the appendix on page 43. This contrasts with traditional approaches that mainly focus on technological and market drivers. Today's data availability about socio-cultural trends, such as changing mobility preferences among younger customer groups, are explicitly integrated into scenarios (SC_{6.2}). Another key finding concerns the institutional anchoring of scenario development. While the literature describes scenarios as products of strategic planning, the interviews show that the most effective scenarios emerge in interdisciplinary teams that involve experts from strategy, technology, sales, and production. When all strategically important departments work together, "scenarios turn into action" (Interviewee 4, col. 8). This cross-functional integration serves to validate the results and increases the feasibility (SC_{6.3}).

In scenario development, three central process steps can be identified. First, the collection of relevant influencing factors and uncertainties, supplemented by early indicators such as political initiatives, raw material price developments, or technological breakthroughs (MC₂). This supports the second step, the formulation of coherent and divergent future scenarios, sometimes deliberately in an extreme manner to reveal strategic tensions (SC_{2.1}). Lastly, the derivation of strategic implications along so-called "trigger points", are often implemented, for example by thresholds (CO₂ price over X €/t) that automatically trigger decisions (Interviewee 7, col. 40), (SC_{2.2}). Comparing these findings with the theoretical foundations from chapter 2.1.2, the results show that many companies deviate in the application of scenario planning from normative ideal models. The reflected eight steps model serves as guidance but is heavily adapted in practice. In particular the interviewed automotive consultants emphasize the need to see scenarios not as a methodological end product but as a starting point for continuous learning processes (Interviewee 17, col. 56), (Interviewee 19, col. 54). Scenario planning in the automotive industry is particularly effective when it is used as an adaptive, reflective, and operational process, which is embedded in control mechanisms, validated by external expertise, and supported by a culture that productively engages with uncertainty. In accordance with the eight-step scenario building processes, outlined in section 2.1.2 and based on the expert interviews, four possible scenarios have been developed to showcase potential transformations and status quo of the automotive industry within the next ten years.

Table two provides an overview of the developed scenarios, including the focal issue and transformation driver, the scenario formulation as well as the key drivers, critical uncertainties and potential strategic implications.

Table 2: Scenarios for Disruptive Innovation-Driven Transformation

	Scenario 1	Scenario 2
Focal Issue	Green regulation push: regulatory-driven change	Dominance of technology: the software-defined vehicle
Scenario Formulation	In this scenario, transformation is accelerated by political intervention and environmental regulation. Global CO ₂ limits, combustion engine phase-out deadlines, and the promotion of emission-free mobility are driving the transformation. In the key markets Europe, China and the US, nationwide charging infrastructures are being created, supported by subsidies and tax incentives for e-mobility. Companies that invested in battery and cell production at an early-stage secure market share. Traditional OEMs are coming under pressure. ESG requirements are directing capital flows toward sustainable technologies, thereby fostering the industry’s transformation (Interviewee 2, col. 34).	The industry directs its attention toward software and digital services for value creation and mobility. Vehicles become connected platforms with constant updates and digital features. Tech companies from Silicon Valley and China enter the market as mobility providers while traditional OEMs must innovate to survive. Autonomous fleets, AI-based routing and data-driven business models gain importance. The core business of OEMs shifts away from traditional engineering expertise towards software operations. The evolution from private car ownership to sharing and on-demand models is accelerated by digital competencies and new customer needs (Interviewee 16, l. 20).
Key Drivers	<ul style="list-style-type: none"> ➤ Stricter regulations in EU, US, China ➤ Public subsidies for EVs and rising CO₂ taxes ➤ Demand shift driven by environmental awareness 	<ul style="list-style-type: none"> ➤ Breakthrough of Artificial Intelligence and autonomous driving ➤ OTA updates, software architecture and on-demand mobility ➤ Client acceptance of data-driven services
Critical Uncertainties	<ul style="list-style-type: none"> ➤ Scale and pace of e-mobility infrastructure rollout ➤ Political stability and reliability of e-mobility subsidies ➤ Adaptability of key international markets 	<ul style="list-style-type: none"> ➤ Speed of software capability development at OEMs ➤ Breakthroughs and acceptance of autonomous technologies ➤ Evolution of data security standards
Implications	<ul style="list-style-type: none"> ➤ Adoption of OEMs to latest technology ➤ Securing battery and raw materials becomes key operation ➤ New business models for sustainable mobility 	<ul style="list-style-type: none"> ➤ Value creation from hardware to software ➤ Declining OEM influence prompts supplier repositioning ➤ Competitiveness shaped by strategic tech partnerships

Source: Own illustration

In the first scenario, the transformation is driven by regulation. The interviews confirm that companies are increasingly confronted with tightened CO₂ targets, planned bans on combustion engines (in the EU from 2035), stricter ESG requirements, and national funding programs (Interviewee 2, col. 34), (Interviewee 5, col. 32). As a result, companies that have invested early in zero-emission technologies secure competitive advantages. Regulatory pressure creates a

structural need for transformation, especially for OEMs focused on conventional powertrains. The second scenario describes a profound change in the value creation logic. OEMs must build capabilities in software, AI, and data management (Interviewee 16, col. 20). This results in a paradigm shift from hardware to software and digital services and leads to structural challenges such as building proprietary software platforms or forming new partnerships with tech companies (Interviewee 14, col. 34).

Table 3: Scenarios for Reactive and Adaptive Transformation under Uncertainty

	Scenario 3	Scenario 4
Focal Issue	Resource scarcity & deglobalization: resilient production	Transformation gridlock: The fragmented transition
Scenario Formulation	Geopolitical tensions and shortages of critical raw materials force the industry to transform from global markets towards regionalized value chains. OEMs and suppliers relocate their production and procurement networks closer to critical markets and focus on closed-loop systems. Key players in the industry may lose their leadership and the global market will split into domestic markets with regional players. The transformation results from reactive, rather than innovative impulses, to minimizing risk and ensuring security of supply. Strategic planning serves to cushion supply crises and market volatility for robust decision-making (Interviewee 12, col. 4).	The transformation of the automotive industry is uneven and inconsistent. While developed regions like Europe and the US transform into mass markets for electric vehicles, emerging markets continue to rely on combustion engines for cost and infrastructure reasons. OEMs must maintain parallel technological platforms, market strategies and production processes. This offset transformation increases complexity, costs and coordination efforts. Political decisions and infrastructural developments in different markets represent crucial factors (Interviewee 4, col. 16). The focus shifts on managing multiple paths simultaneously.
Key Drivers	<ul style="list-style-type: none"> ➤ Availability of semiconductors or lithium ➤ Political instability and trade conflicts ➤ ESG reporting & supply chain laws 	<ul style="list-style-type: none"> ➤ Inconsistent policy measures globally ➤ Price awareness in emerging markets ➤ Infrastructure gaps in charging stations
Critical Uncertainties	<ul style="list-style-type: none"> ➤ Availability and cost trends of critical raw materials ➤ Viability of regional supply chains and production structures ➤ Pace of innovation in battery recycling and alternatives 	<ul style="list-style-type: none"> ➤ Acceptance of alternative drives in cost-sensitive markets ➤ Complexity and cost of maintaining parallel technologies ➤ Coordination across global operations with diverse architectures
Implications	<ul style="list-style-type: none"> ➤ Localization of supply chains and production (nearshoring) ➤ New strategies for resilience (e.g., shadow supply chains) ➤ Scaling of circular economy approaches 	<ul style="list-style-type: none"> ➤ OEMs need dual product strategies ➤ Platform flexibility & modular kits are becoming the standard ➤ Transformation is more expensive and complex, consolidations are increasing

Source: Own illustration

Scenario three points to the growing relevance of geopolitical and resource-related risks. Interviewees mention developments such as export restrictions, trade conflicts, and new legislation (Interviewee 12, col. 4), (Interviewee 10, col. 6). Companies must diversify their supply chains, implement nearshoring strategies, and establish closed-loop material cycles.

Strategic requirements include regional procurement networks and raw material partnerships with political backing. In the fourth scenario, the industry faces a coordination dilemma. Political instability, limited charging infrastructure, and divergent markets force OEMs to operate both electric and combustion engines. This is visible through ongoing demand for combustion engines in regions like Latin America or Southeast Asia and a simultaneously increasing demand for electric cars in developed markets. Consequences include rising complexity costs, stretched development capacities and different platform strategies. The four scenarios depict plausible future developments and allow the derivation of concrete strategic consequences. Companies that use scenarios to develop action strategies increase their strategic robustness and have a central navigation tool in an industry whose future is shaped by uncertainty and disruption.

3.3.3 Development of Strategic Responses

Scenario planning in the automotive industry is increasingly used as a basis for concrete strategic responses to shape the profound transformation. The focus is no longer solely on developing plausible future scenarios, but on translating them into structured, strategic responses (MC₅). Companies use scenarios to reveal strategic goal conflicts, reweight target systems, and structure decision-making under uncertainty. This is no longer merely used for risk minimization but serves as a proactive platform for strategic collaboration and market-oriented innovation (SC_{5.1}). It becomes evident that cooperation no longer begins in the implementation phase of new products or services but is increasingly initiated during scenario development. Companies collaborate across industry boundaries with partners from technology, science, infrastructure, or energy to jointly design potential future scenarios based on their different perspectives, data access, and market knowledge (SC_{5.2}). The aim of this cross-sector planning is to validate assumptions and to identify shared strategic fields of action, from which all parties benefit, whether through common standards, pre-competitive alliances, or complementary solution approaches (Interviewee 11, col. 44). This early, interdisciplinary collaboration strengthens scenario quality and creates trust-based foundations and strategic partnerships in the transformation process. A key finding concerns the structural integration of scenarios into company-wide control systems. Scenarios act as a reference framework for strategic investments, personnel planning, and innovation projects. The Interviewees report that major decisions are “always reflected against two or three scenarios” to ensure robustness and coherence (Interviewee 1, col. 38), (Interviewee 5, col. 36). Especially in decentralized organizations, scenarios serve as a common decision-making basis. Different functional areas

align around a shared understanding of the future to collectively work towards strategic responses throughout the entire organization (SC_{5.3}). Another essential element in strategic response development is “scenario-driven portfolios,” where investment decisions, R&D priorities, and partnerships are dynamically linked to future paths. Especially OEMs, who face various uncertainties, use this method to combine flexibility and direction (Interviewee 1, col. 38). The establishment of “transformation pods”, interdisciplinary teams that continuously update scenarios and realize actions into roadmaps and budgets, is a common approach (Interviewee 2, col. 44). In practical implementation, this often occurs through defined thresholds such as CO₂ price limits or regulatory milestones that automatically trigger operational adjustments (Interviewee 7, col. 40). Scenarios thereby help to identify reactions for external shocks and enable early strategic alignment with long-term trends such as electrification or platform economies. Furthermore, companies develop “roadmaps with integrated scenario backup,” which influence decisions depending on probability of occurrence (Interviewee 2, col. 44). Particularly in scenario one, that describes regulation-driven transformation through CO₂ pricing and ESG criteria, investment decisions are linked to sustainable scenarios. In relation to the literature discussion, it becomes clear that theoretical planning processes are being replaced by agile, iterative control models. Scenario planning is increasingly understood not as a methodology but as a strategic operating system, relevant to OEMs, suppliers, and consultancies alike. This shows that strategic responses to transformation do not require perfect scenarios but robust, actionable processes that reflect and productively address uncertainty.

3.3.4 Implications for Strategy and Success Determinants

Strategic implications in scenario planning are not limited to general risk prevention but increasingly aim at building structural resilience. This is illustrated in scenario three, where companies systematically develop strategies for diversifying supply chains, localizing value creation, and establishing closed-loop material cycles. These measures have already been implemented in many organizations, for example, through strategic raw material partnerships or investments in recycling capacities (Interviewee 12, col. 4). Another finding is that scenarios are increasingly used to productively shape organizational tensions, for example, between short-term profitability and long-term innovation (SC_{4.2}). Scenario planning thus becomes a platform to make goal conflicts visible, set priorities, and develop alternative courses of action. A frequently overlooked but central success factor refers to the ability to present strategic implications not only analytically but also narratively. Scenarios only have an effect “if they

are communicated in a way that resonates, not as an Excel model, but as a strategic story” (Interviewee 7, col. 24). Narrative formats facilitate integration into existing leadership processes and strengthen collective orientation in uncertain times. This is related to the establishment of “strategic corridors”, systematic fields of action that can be derived from divergent future scenarios (Interviewee 7, col. 22). This approach allows companies to prepare strategic options within a defined framework without committing too early to one specific scenario. This refers not to the ability “to know the exact path, but the direction and the boundaries within which one can move” (Interviewee 6, col. 64). Hereby, organizational robustness is supported, as it enables a flexible reaction to new signals without fundamentally questioning the transformation direction. With regard to the four developed scenarios, specific strategic implications can be derived. In the first scenario, it becomes necessary to integrate emission pricing mechanisms and ESG risks into investment logics at an early stage to gain competitive advantages, for example through the introduction of CO₂ shadow prices that are embedded in investment decisions (Interviewee 2, col. 34). Another instrument is adaptive roadmaps that are linked to regulatory threshold values. Such structured response mechanisms enable to monitor regulatory risks, manage them strategically (SC_{3.2}), and thus decarbonize products and reallocate R&D budgets. In the second scenario, the shift in value creation towards software creates a fundamental need for action. Companies must build digital core competencies, establish agile software teams and decouple their previous development and supply chains. This results in strategic needs such as building proprietary software platforms, separating hardware and software development and forming new partnerships with tech companies. Crucial are technology investments as a strategic response and the ability to internalize platform logics and establish marketable business models such as mobility-as-a-service. The third scenario requires a paradigm shift from efficiency to resilience logics. Companies must pursue dual-sourcing strategies, enter into political raw material partnerships and integrate closed-loop systems into the supply chain (Interviewee 12, col. 4). These measures serve as risk hedges and competitive advantage, for example through stable supply in volatile markets. Scenarios help with the identification of systemic dependencies and the establishment of robust procurement networks (SC_{5.3}). The decisive factor for success is the ability to diversify risks and establish structural reorganizations of global production networks. In the fourth scenario, the strategic challenge lies in serving divergent markets simultaneously. OEMs are forced to develop parallel platform strategies, for markets with high e-mobility adoption on the one hand and for markets with continued demand for ICE on the other (Interviewee 4, col. 16). The resulting complexity leads to increasing coordination costs and requires clear internal

prioritization. Strategic responses include modular system architectures and differentiated market strategies. At the same time, companies must enhance their coordination capabilities and actively manage goal conflicts, such as between market adaptation and cost efficiency.

In addition, the interviews reveal success factors that have received little attention in the literature. Integrating scenarios into capital allocation improves investment quality and enables a balance between future opportunities and risk mitigation. Particularly in transformation projects like scenario two, the need for iterative reviews is highlighted, as decisions must adapt to changing regulatory and technological conditions. The analysis shows that the success of scenario planning largely depends on its strategic integration into leadership processes, the institutionalization of iterative scenario work and early operational implementation. A more profound overview of the critical success factors for effective scenario planning is provided in appendix D, on page 47. These factors are especially effective when scenarios do not remain strategic discussion but tested pilot projects, developed by interdisciplinary teams.

3.4 Limitation of the Study and Further Research

Like any research project, this dissertation has its limitations. Since it focuses primarily on the key drivers and success factors of scenario planning from different organizations within the automotive industry, the findings need to be validated in other research settings. This includes further research with organizations from different industries and cultures in order to obtain a broader research background regarding the approach of scenario planning and the related industry. Additionally, the data for this master thesis is exclusively obtained from German interview experts, thus a potential cultural bias cannot be discounted. Furthermore, the results of this research may be subject to bias such as the expert's personal experience perception towards scenario planning. As this study mainly focuses on the key drivers for the successful application of scenario planning in the automotive industry, it should be noted that other factors may also contribute to the success or failure of these strategic initiatives, such as organizational structure, external stakeholder or unforeseeable black swan events, which are not examined in depth in this thesis. The expert interviews conducted enable conclusions to be drawn solely with respect to personal perception and individual experiences to scenario planning. In the future, research settings with larger sample sizes are necessary to validate the results.

In addition, further research should examine the interaction between decision-makers and involved stakeholders in the context of scenario planning, as a dynamic and collaborative relationship can significantly enhance the effectiveness of such strategic initiatives in the

transforming automotive industry. Based on the latest advancements in artificial intelligence and big data analytics, it is recommendable to focus further research on the integration of emerging technologies and how these digital tools can enhance strategic foresight. Since the conducted research of this thesis solely focuses on the scenario planning in the automotive sector, further investigations could analyze best practices from other industries undergoing transformation, like the energy sector, to provide additional cross-industry comparison.

4 Recommendations

Based on the discussed findings of all twenty expert interviews, clear recommendations for practitioners in the effective application of scenario planning in the transforming German automotive industry can be derived. The results show that scenario planning only unfolds its full strategic impact when it is not understood as an isolated planning tool but deeply embedded in corporate leadership and governance structures. Particularly crucial in this regard is the active involvement and continuous support of top management. The approach remains ineffective as long as it is only anchored at the departmental level of strategy. In organizations where corporate leadership uses scenarios as part of strategy reviews, robust decision-making bases for investments, product development, and transformation projects, they emerge and contribute to an effective organizational preparation for further transformation. Particularly in the context of growing regulatory uncertainty in the automotive industry, such as combustion engine bans, or new recycling quotas, carmakers and suppliers must actively use scenarios to future-proof their investment decisions. This highlights that internal governance processes must be adjusted to establish scenario processes not as one-off projects, but as recurring leadership tools throughout the daily business. Furthermore, it becomes evident that traditional linear planning cycles are no longer sufficient to keep pace with the speed of change. Companies need to move away from rigid annual cycles and instead switch to dynamic, iteratively designed scenarios that are updated regularly, for example, on a quarterly basis. Especially in the course of the fast-paced transformation accelerated by the influence of several factors, it is often necessary to recalibrate scenarios every four months to ensure that strategic measures keep up with external dynamics (see Appendix C, Key Transformation Driver per Main Research Category, p. 46). These cyclical adjustments must be based on real-time indicators, such as political developments, raw material prices, or market strategies of new competitors. Another success factor is the systematic integration of operational and strategic functions into scenario development. Strategic planning processes are particularly effective when they are cross-departmental and interdisciplinary in design. In successful companies, experts from

procurement, logistics, production, product development and sales are involved not only in deriving scenarios but already in their formulation and analysis, for example, to evaluate alternative raw material strategies, regional supply networks, or software-based structures. This functional interlocking is essential and guarantees that scenarios do not remain abstract theories but rather translate into tangible operational measures, particularly in the automotive industry where disruptive transitions frequently have a significant impact on vertical integration and manufacturing processes. For scenarios to become strategically effective beyond analytical functions, suitable tools are needed to support their implementation. These include scenario-based key performance indicators, strategic trigger points, or decision trees. Investments in future technologies or business models as part of the automotive industry's transformation should be systematically tested for their robustness across different scenarios, for example, with regard to at least three consistent future visions that should also include negative developments in the industry to account and reflect worst-case scenarios. Only through such methodological bridges between scenario analysis and strategic steering can it be ensured that the developed future visions do not remain in the conceptual phase but instead guide transformation decisions.

Overall, scenario planning is particularly successful where it is understood as a strategic navigation framework, not as a rigid forecast but as a flexible mental model that reflects different future developments and enables robust courses of action amid regulatory requirements, technological innovations, geopolitical dependencies, and changing customer needs. The application of effective scenario planning thus requires institutional anchoring, methodological agility, cultural openness, and above all, the willingness not to avoid strategic contradictions and uncertainties but to actively shape them.

5 Conclusion

Based on the theoretical framework that analyzed the conceptual foundations, the systematic planning process, and the principles of adaptive future work within the context of the VUCA framework, a differentiated understanding of scenario planning as a strategic management instrument under uncertainty is developed. At the same time, the theoretical section characterizes the German automotive industry as a sector marked by high value-added depth, technological dependencies, and increasing exposure to external regulatory and innovation impulses, which is expected to undergo further structural transformation in the coming years. This background provides the structural basis for the empirical investigation. The twenty expert interviews confirm the theoretically postulated requirements for scenario planning while

critically expanding them. The classical notion of a linear, planning-centered scenario process hardly exists in practice. Instead, iterative, data-driven, and cross-functional approaches are being established, that act as strategic operating systems and not as isolated forecasting tools. This is related to the paradigm shift toward systemic future work discussed in the theoretical framework, in which scenarios not only inform about development but also ensure decision-making capability in times of increasing ambiguity. Furthermore, the results show that the specific structure of the automotive industry, such as the simultaneous dependence on regulatory planning certainty and technological openness, poses specific demands on scenario work. The ability to differentiate between global frameworks and regional realities is a key prerequisite for the effectiveness of scenario-based strategies.

The first research question, concerning the identification of key drivers for the strategic effectiveness of scenario planning, is emphasized by the empirical analysis that indicates a significant determination of combined internal and external drivers. Internally, the commitment and active involvement of top management, as well as the structural anchoring of scenario processes in management instruments like budgeting, innovation portfolios, or KPIs, are particularly important. Cultural factors such as openness to uncertainty, dissent, and interdisciplinary dialogue also greatly enhance the effectiveness of scenario-based approaches. Externally, regulatory instability, geopolitical uncertainties, and technological disruptions, such as the increasing dominance of software or platform architectures, emerge as key triggers for scenario processes. The results confirm that companies face a paradigm shift as uncertainties today stem less from clearly identifiable product developments and more from systemic interdependencies, across industry boundaries. The ability to identify weak signals early and translate them into robust scenarios is a decisive competitive advantage.

For the second research question regarding critical success factors, the findings underline that institutional, strategic, and operational anchoring of scenario planning is a key success factor. Companies that establish scenarios as a continuous learning process with clear iteration cycles and interdisciplinary involvement demonstrate significantly greater strategic adaptability. Particularly effective is the use of hybrid methods, combining qualitative future narratives with quantitative indicators to evaluate strategic options and strengthen decision-making under uncertainty. Moreover, scenario planning is increasingly used not only for analytical purposes but also as a platform for cross-sector collaboration. Early alliances with partners from adjacent sectors enable a broader understanding of possible futures and support the joint development of robust transformation pathways. Scenarios thereby become the connecting element of

strategic cooperation. In conclusion, it becomes clear that scenario planning unfolds its strategic effectiveness not through standardization, but through integration into organizational routines, cultural openness, and strategic control systems. It is far more than an analytical tool, it is a strategic mindset that enables companies to remain capable of action and competitive, even in times of profound uncertainty and disruption.

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A. Questionnaire for Interviews

Phase	Question
Introduction	<ol style="list-style-type: none"> 1. Can you briefly describe your role and experience in the automotive industry, particularly in strategic planning? 2. Have you been involved in scenario planning before? If so, how has it been applied in your organization?
Identification of Key Drivers for Scenario Planning	<ol style="list-style-type: none"> 3. Is scenario planning in your organization used to build future scenarios in order to anticipate future changes in the industry or rather to explore white spaces for innovation? 4. In your experience, what are the most critical internal drivers (e.g., leadership commitment, resource allocation) that enable scenario planning to be effective? <ol style="list-style-type: none"> a. What are the most critical external drivers, beyond the obvious of the transformation towards electromobility? 5. How does the interplay between short-term profitability pressures and long-term transformation goals create a need for scenario planning? 6. To what extent do partnerships or ecosystems (e.g., alliances with tech companies or suppliers) act as drivers for effective scenario planning? 7. How does the growing unpredictability in the industry shape the need for scenario planning in strategic planning? 8. To what extent does the ability to forecast systemic interactions and cross-sector dependencies (e.g., EV adoption impacting charging infrastructure) enhance the efficiency of scenario planning? 9. In what ways does scenario planning assist in navigating strategic trade-offs, such as investing in innovative technologies while maintaining profitability in legacy products?
Identification of Critical Success Factors for Effective Scenario Planning	<ol style="list-style-type: none"> 10. Based on your experience, what organizational structures or frameworks are essential to support scenario planning in the automotive industry? <ol style="list-style-type: none"> a. How do cultural factors (e.g., openness for changes) within an organization influence the implementation? b. What are the most common organizational barriers to implementing scenario planning effectively and how can these be mitigated? 11. In your experience, what are the most critical organizational capabilities needed for successful scenario planning? 12. What are the key challenges you face when implementing scenario planning, especially in times of transformation pressure? 13. How does your company ensure that scenario planning leads to actionable strategies rather than just theoretical exercises? <ol style="list-style-type: none"> a. How do you balance short-term operational goals with the long-term strategic insights provided by scenario planning? 14. Are there specific methodologies or frameworks that you find particularly effective in scenario planning? <ol style="list-style-type: none"> a. What role do data availability and analytical tools play nowadays in improving the effectiveness of scenario planning? 15. How important is the ability to challenge assumptions and incorporate diverse perspectives in making scenario planning efficient? <ol style="list-style-type: none"> a. Or is it more useful to build scenarios based on own assumptions with a pure focus on the own firm?

Uncertainties in the Automotive Industry	<p>16. How does your organization incorporate uncertainties around the uneven development of critical technology (e.g., EV charging networks and smart infrastructure) into scenario planning? What strategies help you remain adaptable in such an unpredictable environment?</p> <p>17. How do disruptions from non-traditional market entrants, such as tech companies or startups, influence the scenarios you develop?</p> <p>18. Given the regional differences in EV adoption and shifting consumer preferences, how do you factor these dynamics into scenario planning to ensure your company remains competitive globally?</p> <p>19. To what extent do shifting regulations and geopolitical tensions disrupt your ability to forecast and prepare for future industry scenarios?</p>
Closing Questions	<p>20. Are there any overlooked trends, uncertainties, or drivers that you believe should be incorporated into scenario planning processes but currently are not?</p> <p>21. Looking ahead, how do you see the role of scenario planning evolving as the automotive industry continues to transform?</p>

Source: Own illustration

B. Interview Transcripts

The transcripts of all interviews conducted are available via the following link:

[Google-Drive: Interview Transcripts Master Thesis Moritz Willmann](#)

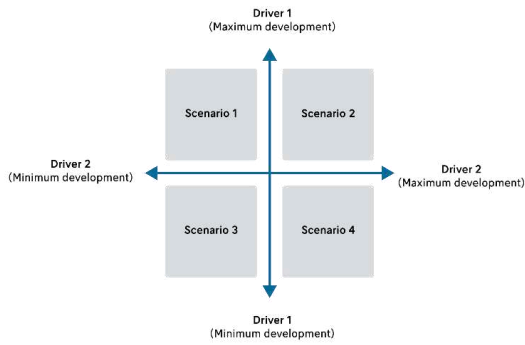
The interviews were primarily held in German and translated into English using artificial intelligence.

C. Foresight and Strategic Planning Methodology

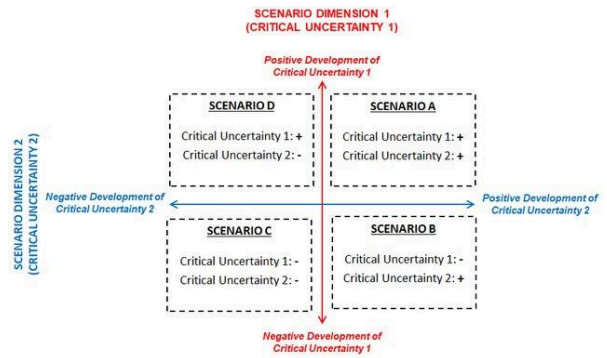
Methodology	Explanation
2x2 Scenario Planning Matrix	One of the most often used methodologies in strategic planning and foresight is the 2x2 Scenario Matrix. The matrix is typically built on major drivers and uncertainties to generate many scenarios and can be used for a variety of objectives, including strategy, risk management, and product development (Stucki, 2023). It is often used to answer a specific future question in relation to a time horizon, e.g., <i>how will the government support for electric cars impact the sales strategy for Mercedes Benz by 2027?</i> After key drivers for transformation or industry uncertainties have been identified, the two most crucial ones are chosen and compared against their substantial impact (positive/negative or maximum/ minimum) on an organization's strategy, business model or operations. Therefore, the matrix illustrates different viewpoints, impacts of scenarios, and describes combined challenges and opportunities (Stucki, 2023).
Future Backward Planning	The "Future Backwards" method is a strategic planning tool that helps to retrospectively analyze probable future scenarios. The starting point is a possible scenario or desirable future (target vision), from which the analysis starts backwards in order to identify decisive steps, events or developments that could lead to the scenario of future vision. In order to identify potential risks and unfavorable developments, this method also considers and depicts a negative future scenario. This approach supports organizations in the development of resilient implications through systemic thinking and the identification of decision factors to derive strategic options especially in uncertain dynamic environments (Rodrigo, 2023).
70/ 20/ 10 Methodology	The 70/20/10 rule is a strategic approach in corporate scenario planning, particularly for the resource allocation and was popularized by Google. The approach indicates that in future strategic planning, 70 percent of resources should flow into the core business and incremental innovations, 20 percent into adjacent, new business areas and 10 percent into radical, potentially disruptive innovations. The aim is to efficiently develop day-to-day business while at the same time creating space for future-oriented, transformative ideas. This approach helps companies to create a balanced innovation portfolio, spread risks and secure both short-term and long-term competitive advantages when comparing future scenarios (Altman, 2008, p. 12).
Wind Tunnel Strategy Foresight	The Wind Tunnel Strategy is a strategic foresight tool that helps organizations to test their strategies for robustness against various future scenarios. The idea comes from the aviation industry: just as aircraft are exposed to different air currents in a wind tunnel to test their stability, this methodology compares possible scenarios with existing or future corporate strategies. This methodology allows to revise whether the strategies and scenarios remain relevant and effective under different circumstances, for example, due to technological, economic or social changes. The objective is to identify weaknesses, risks and blind spots to modify strategies and scenarios if necessary. This leads to a more resilient and stable strategic approach even under conditions of uncertainty (Rohrbeck, 2018, p. 105).

Source: Own illustration

C.1 2x2 Scenario Planning Matrix

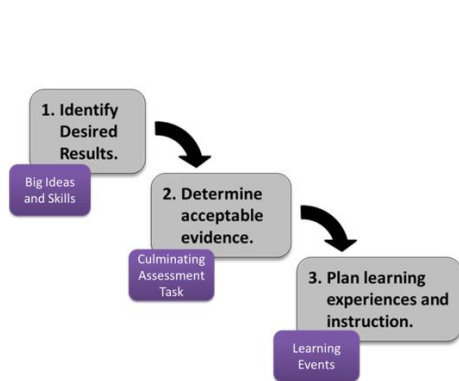


Source: Stucki, 2023

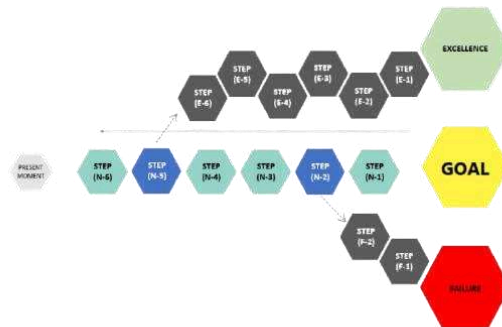


Source: Dean, 2019

C.2 Future Backward Planning

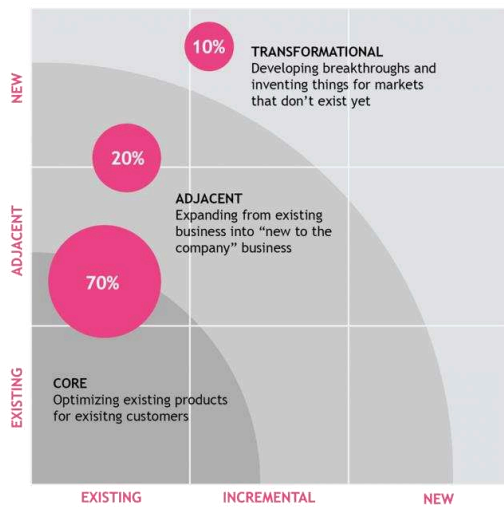


Source: Kurt, 2016

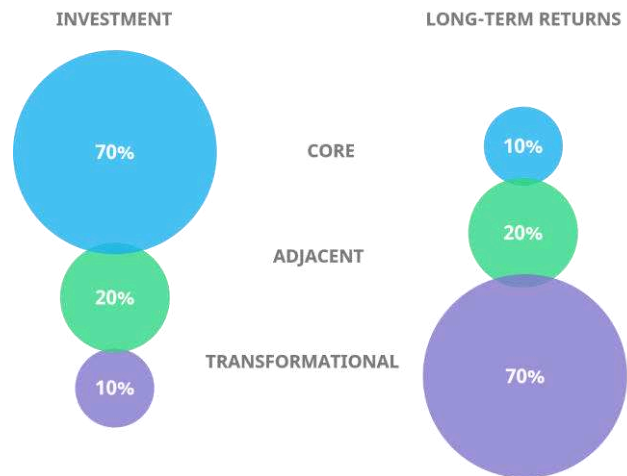


Source: Rodrigo, 2023

C.3 70/20/10 Methodology

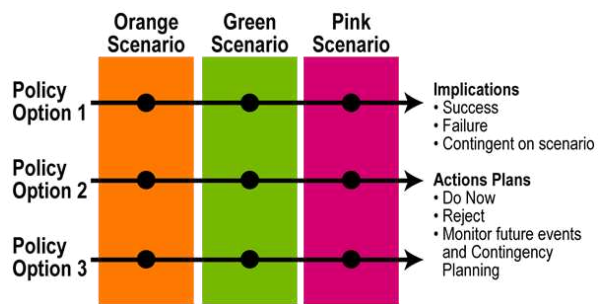


Source: Hoferer, 2023

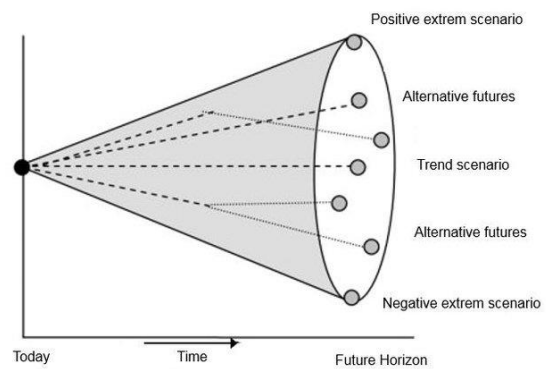


Source: Porumboiu, 2021

C.4 Wind Funnel Foresight



Source: Wireless, 2011



Source: Stotten, 2018

D. Key Transformation Driver per Main Research Category

	Main Category (MC)	Key Driver
1	Application of Scenario Planning	<ul style="list-style-type: none"> ➤ Integration of scenarios into strategic decision-making ➤ Expansion of use cases beyond traditional forecasting ➤ Triggering of strategic reassessment and innovation initiatives
2	Internal Drivers for Scenario Planning	<ul style="list-style-type: none"> ➤ Demand for long-term strategic orientation ➤ Executive-level support and sponsorship ➤ Cross-departmental coordination and alignment needs
3	External Drivers for Scenario Planning	<ul style="list-style-type: none"> ➤ Acceleration of technological transformation ➤ Regulatory dynamics and policy uncertainty ➤ Geopolitical instabilities impacting global supply chains
4	Strategic Integration	<ul style="list-style-type: none"> ➤ Scenario-based portfolio and investment adjustments ➤ Inclusion of scenarios in contingency and risk planning ➤ Alignment of strategy monitoring with scenario assumptions
5	Organizational Capabilities and Barriers	<ul style="list-style-type: none"> ➤ Limited foresight and systems thinking competencies ➤ Perceived resource-intensiveness of scenario processes ➤ Fragmented communication across organizational units
6	Methodologies and Tools	<ul style="list-style-type: none"> ➤ Combination of narrative and data-driven scenario techniques ➤ Use of visual formats to enhance strategic resonance ➤ Iterative scenario updates driven by environmental scanning
7	Future Trends and Overlooked Drivers	<ul style="list-style-type: none"> ➤ Shifts in consumer mobility behavior patterns ➤ Emerging relevance of climate-related physical risks ➤ Disruption of digital platform-based business models

Source: Own illustration

E. Key Performance Indicators for Scenario Planning

	Key Performance Indicator (KPI)	Explanation
1	Share of Research and Development Investment	Percentage of the annual R&D budget invested in technologies considered strategically viable in scenarios. Measures the degree to which future robustness is considered in strategic investments.
2	Scenario-Based Portfolio Reallocation	Share of product lines expanded, discontinued, or adjusted based on scenario analysis (measured annually). Indicates whether strategic priorities are being aligned with potential future developments.
3	Time-to-Strategy	Average number of months between scenario finalization and the implementation of initial strategic measures (e.g., change management measures). Assesses the responsiveness of strategic decision-making.
4	Scenario-Based Target Deviation in Strategic Controlling	The percentage of KPI deviations that were anticipated through scenario planning and accepted as calculated risks. It assesses the predictive quality and flexibility of strategic approaches.

Source: Own illustration

F. Critical Success Factors for Effective Scenario Planning

	Critical Success Factor (CSF)	Explanation
1	Strategic Anchoring in Top Management	C-level executives actively support and integrate to guarantee utilization and relevance in strategic decision-making. Secure scenario planning is not isolated but informs actual decision-making. Related to KPI 1.
2	Iterative Scenario Updating and Integration	The planning process requires continuous scenario updates to reflect market and regulatory changes (e.g., e-mobility and AI regulation). This metric evaluates the planning process's ability to adapt and respond to changes. Related to KPI 2.
3	Cross-Functional Involvement and Collaboration	The involvement of different departments across an organization (e.g., R&D, Sales, Supply Chain) enhances both the relevance of scenarios and chances of implementation. This approach helps to achieve internal alignment and practical applicability. Related to KPI 3.
4	Linking Scenarios to Strategic Options	The process of effective scenario planning requires moving past basic storytelling to develop concrete strategic options which produce real strategic value. Related to KPI 1 and 4.
5	Scenario-Based Decision-Making in Investment Planning	Investment choices (e.g., in battery technology) need to consider multiple scenarios and their projected durability. This approach enables sustainable investments by linking capital allocation to future-oriented planning. Related to KPI 1 and 4.
6	External Validation and Trend Monitoring	Inclusion of external perspectives (e.g., think tanks, suppliers, policy experts) improves scenario credibility and alignment with reality and includes diverse, external perspectives. Relates to KPI 4.
7	Cognitive Diversity in Scenario Teams	The inclusion of team members with different educational backgrounds, cultural experiences and professional expertise leads to more creative and resilient scenarios. It reduces blind spots and promotes alternative mental models. Related to KPI 4.
8	Early Experimentation and Strategic Piloting	Translation of scenario insights into small-scale pilots (e.g., new business models or supply chain setups) allows fast learning and implementation. Related to KPI 3.
9	Clear Governance and Process Ownership	Defined structures for responsibility, ownership, and maintenance of the scenario planning process. Prevents fragmentation and ensures continuity. This enhances institutionalization and accountability. Related to KPI 3 and 4.

Source: Own illustration

G. Inductive Content Analysis

G.1 Empirical Research System Based on Inductive Category Formation

	Category	Definition	Anchor Example	Coding Rule	Count
MC ₁	Application of Scenario Planning in Practice	Refers to all practical applications, formats, and processes of scenario planning in companies of the automotive industry.			
SC _{1.1}	Use for the anticipation of future developments in the industry	As transformations of industries are often driven by various developments, the improvement of strategic preparation and future orientation is essential.	“Scenario planning helps us navigate these uncertainties by giving us a framework to anticipate possible outcomes and prepare accordingly.” Interviewee 7, col. 8	This code is used when scenario planning is applied for the anticipation or structured exploration of possible industry futures or market developments.	19
SC _{1.2}	Use for the exploration of innovation and white spaces	Most industrial transformations also offer the chance of new innovation fields, markets, or business models through exploratory future opportunities.	“Scenario planning helps us identify white spaces which represent untapped opportunities to create new products and solutions.” Interviewee 10, col. 12	This code is used when scenario planning is applied for the identification of innovation potential, white spaces, or future business opportunities.	11
SC _{1.3}	Use for the navigation about strategic trade-offs	Strategic planning usually entails the evaluation and balance of conflicting strategic options and objection trade-offs between current and future status quo.	“The strategic trade-offs become fully accessible through scenario planning. The company must decide between putting significant resources into electric vehicle development and maintaining support for its current internal combustion engine products.” Interviewee 14, col. 36	This code is used when scenario planning is applied to evaluate, manage, or navigate strategic trade-offs and tensions in the business of automotive companies.	9
MC ₂	Internal Drivers for the Application of Scenario Planning	Refers to all internal corporate drivers, resources and motivations for the use of scenario planning in companies of the automotive industry.			
SC _{2.1}	Organizational resources	Every internal organizational process requires resources, therefore the availability of personnel, financial, and data	“The ability to synthesize insights from different departments stands equally important because it allows you to merge supply chain data with market trends for complete	This code is used when internal capacities such as know-how, budget, staff, or management supports or limits scenario planning activities.	7

		resources for implementation is necessary.	understanding.” Interviewee 8, col. 56		
SC _{2,2}	Organizational culture	Organizational culture that is characterized by openness, learning ability, and tolerance for uncertainty.	“The execution of transformation initiatives in organizations depends heavily on cultural elements present within these organizations. An organization that welcomes openness, adaptability, and collaboration establishes an ideal environment for change.” Interviewee 2, col. 48	This code is used when organizational culture or values, drive scenario planning success.	8
SC _{2,3}	Organizational frameworks and structures	Organizational frameworks and structures encompass all formal processes, and responsibilities that are embedded within an organization.	“The success of scenario planning requires organizations to establish flexible structures which enable them to adjust quickly to changing circumstances. The organization should establish cross functional teams and maintain strong departmental communication channels and decision-making systems that enable fast adjustments when needed.” Interviewee 19, col. 44	This code is used when organizational structures and institutionalized processes shape scenario planning.	10
MC₃	External Drivers for the Application of Scenario Planning	Refers to all external influences such as market, politics, or technology that make scenario planning necessary within the automotive industry.			
SC _{3,1}	Industry partnerships and ecosystems	Many firms enter collaborations with other companies or external partners and networks for the joint planning of the future.	“The automotive sector undergoes transformation through collaborative efforts between companies that work together to develop autonomous driving solutions and charging infrastructure with technology and energy companies.” Interviewee 18, col. 28	This code is used when external collaboration, ecosystems, or interorganizational partnerships influence the use of scenarios.	11
SC _{3,2}	Unpredictability of transformation and evolving industry trends	Every industrial transformation is driven by numerous factors, often	“The industry's increasing unpredictability demands that	This code is used when unpredictability, external shocks, or	17

		based on uncertain trajectories of technological, political, and societal developments.	companies develop flexible strategic planning approaches to respond effectively.“ Interviewee 18, col. 32	accelerating transformation serve as motivators for scenario planning	
SC _{3,3}	Cross-sector dependencies	Most industries are interconnected and dependent on other industrial sectors, in the case of the automotive industry exists a strong dependency to sectors such as energy, IT, or infrastructure.	“Automotive companies can develop better scenarios through scenario planning by analyzing how changes in one area such as EV adoption will affect other areas including advanced charging infrastructure development and new energy storage business models.” Interviewee 19, col 36	The code is used when dependencies on other sectors, technologies or systems require strategic foresight.	12
MC₄	Strategic Integration of Scenario Planning into Organizations	Refers to all practical measures for including scenario planning into strategic decision-making and management processes in companies of the automotive industry.			
SC _{4,1}	Balancing short-term objectives with long-term transformation	In times of transformation, it becomes imperative to evaluate short-term profit and long-term transformation requirements and investments.	“Balancing short-term operational goals with long-term strategic insights requires a clear understanding of how both elements contribute to the overall success of the company.” Interviewee 2, col. 68	This code is used when companies align or manage tensions between short-term goals and long-term transformation through scenarios.	13
SC _{4,2}	Addressment of systematic dependencies	As many departments and business units within an organization are connected and dependent on each other, it is important to consider the complex interdependencies in strategy development and planning.	“Systemic interactions have become essential for the industry because it moves toward electrification and connectivity.” Interviewee 7, col 32	This code is used when scenarios form the basis for addressing complex system-level risks, interdependence, or cascading effects of the industry’s transformation.	16
SC _{4,3}	Support of actionable strategies versus theoretical exercise of scenario planning	Since the idea of scenario planning relates to a methodological theory, it can be either used as a theoretical exercise for reflection or as a concrete decision-making basis.	“The process of converting scenarios into practical strategies depends on establishing direct connections to defined decision-making frameworks.” Interviewee 20, col. 64	This code is used when scenarios actively inform decisions, as opposed to being used solely for theoretical reflection or workshops.	7

MC₅	Organizational Capabilities and Barriers for the Application of Scenario Planning	Refers to all structural, cultural, or personnel-related factors and capabilities of companies in the automotive industry that promote or hinder scenario planning.			
SC _{5.1}	Essential organizational capabilities	Companies possess different internal capabilities and competencies which can be useful for the effective application of scenario planning.	“The process of scenario planning requires uniting diverse stakeholders with complex information. The success of internal communication depends on both formal and informal methods.” Interviewee 8, col. 16	This code is used when specific skills, processes, or leadership qualities enable effective scenario work in automotive organizations.	13
SC _{5.2}	Barriers in the application	In contrast to useful internal capabilities, barriers for strategic planning such as resistance to change, lack of resources or limited methodological knowledge exist.	“The main difficulty stems from organizational resistance to dealing with uncertain situations. Scenario planning demands organizations to adopt a new mindset which accepts uncertainty while developing strategies for various potential future scenarios.” Interviewee 3, col. 52	This code is used when structural, cultural or operational limitations hinder the effective application of scenario planning.	8
SC _{5.3}	Mitigation strategies for overcoming barriers and challenges	In the case of the occurrence of problems, barriers and challenges in the use of scenario planning, strategies for the mitigation can be taken and implemented to enable to effective use of scenario planning.	“Adaptive learning is everything. We have implemented weekly 'lessons learned' sessions where teams share what is working and what is not.” Interviewee 4, col. 52	This code is used when any methods or strategies are applied to overcome internal challenges or improve organizational readiness for scenario work.	11
MC₆	Methodologies and Tools for the Application of Scenario Planning	Refers to all methodological approaches, models, and tools of scenario planning applied in practice of companies in the automotive industry.			
SC _{6.1}	Applied frameworks and methodologies	Scenario planning is based on different theoretical frameworks and methodologies that can be applied in the use of this strategic approach.	“Our most effective has been the "Future Backwards" exercise where we imagine it's 2030 and our transformation succeeded wildly - what does that look like?” Interviewee 2, col. 72	This code is used when special frameworks, scenario typologies, or step-by-step methodologies are applied in scenario planning.	10

SC _{6.2}	Role of data availability and analytical tools	Besides the application of common approaches and methodologies for scenario planning, the role of data, numerical indicators and analytical tools become more relevant,	“Data and analytics are key to effective scenario planning as they provide evidence-based insights that guide decision-making” Interviewee 2, col. 76	This code is used when the availability of data, analytics, or technological tools support scenario development.	13
SC _{6.3}	Importance of challenging established assumptions	It is important to not develop scenarios only based on own, preferred future developments, but critically questioning existing assumptions and mental models within the scenario planning.	“What would need to be true for heat pumps to become obsolete?” instead of “What if heat pump demand grows 30 percent by 2030?” Interviewee 4, col. 12	This code is used when questioning assumptions, development scenarios, mental models, or dominant logics as a key part of strategic planning is emphasized.	15
MC₇	Future Trends and Overlooked Drivers in the Application of Scenario Planning	Refers to all future developments and previously neglected influencing factors and drivers of scenario planning with strategic relevance for companies in the automotive industry.			
SC _{7.1}	Emerging trends and uncertainties	As the strategic approach of scenario planning also develops throughout the transformation, new and relevant trends or uncertainties in scenario planning with strategic significance exist.	“The development of digital ecosystems through vehicle connectivity and over-the-air software updates has introduced new business models that traditional manufacturers must rapidly adapt to.” Interviewee 11, col. 20	This code is used when new or emerging macro trends, shifts and uncertainties with strategic relevance for the industry drive the need for scenario planning.	10
SC _{7.2}	Overlooked drivers of transformation	Besides obvious internal and external drivers for the automotive’s transformation, underrepresented but potentially impactful drivers exist.	“Several underreported elements disturb my sleep because they have the potential to transform our industry through subtle changes.” Interviewee 1, col. 100	This code is used when underrepresented or overlooked drivers are stated as significantly influence of transformation.	9
SC _{7.3}	Future evolution of scenario planning	With the emergence of innovative technology and data availability, future developments in the use and institutional anchoring of scenario planning will take place.	“The practice of scenario planning needs to evolve into a more dynamic system which integrates with existing operations. The industry needs to shift from conducting single static scenario planning exercises to developing continuous real-time processes which adapt to industry changes.” Interviewee 6, col. 104	This code is used when a future outlook, visions, or reflections on how scenario planning itself may evolve in practice and theory over time is mentioned.	14

G.2 Inductive Category Formation According to Mayring

Reference	Quotation	Paraphrase	Generalization	Category
				MC₁ Application of Scenario Planning in Practice
Interviewee 10, col. 12	“Our primary goal is to identify external factors affecting the automotive sector including changes in consumer behavior and technological advancements and environmental regulation modifications.”	The main objective of scenario planning involves analyzing external elements like consumer trends, technological advancements or new regulatory requirements that affect the automotive industry.	Application to understand external influencing factors	SC _{1.1}
Interviewee 9, col. 12	“The approach combines both elements, but future industry changes receive more attention in our strategy.”	There exists an increasing emphasis on identifying changes within the industry at an early stage, as the market is continuously evolving.	Application of scenario planning to identify upcoming change at an early stage	SC _{1.1}
Interviewee 11, col. 12	“The main application of scenario planning in my organization involves evaluating our ability to withstand future uncertainties.”	Scenario planning is primarily used to test resilience against future uncertainties and to ensure that a company is prepared for external crises.	Applying scenario planning to test resilience against external uncertainties	SC _{1.1}
Interviewee 12, col. 12	“Scenario planning helps us to identify where we might face operational risks, such as supply chain disruptions due to climate-related events or resource shortages.”	Scenario planning is applied to illustrate the possible impacts of external factors such as climate regulations or societal sustainability demands on the industry.	Illustration of the impact of external pressure factors through scenario planning	SC _{1.1}
Interviewee 9, col. 13	“We are constantly asking ourselves, ‘What are we not seeing? Where are the gaps we could fill?’ It is an essential mindset if we want to stay competitive and avoid being caught off guard by new entrants or alternative mobility solutions.”	A continuous review of potential gaps and overlooked factors is essential to secure competitive advantages and to avoid being surprised by new players or mobility concepts.	Continuous review of competitive gaps through scenario building	SC _{1.2}
Interviewee 10, col. 36	“Systemic interaction forecasting in scenario planning produces more realistic and actionable results because it helps us understand how	Innovative ideas often result from extreme scenarios than from classical market analyses.	Innovation through unconventional scenarios	SC _{1.2}

	changes in one market area create subsequent effects.”			
Interviewee 11, col. 40	“Through future state simulation we gain better insight into how different trade-offs will develop throughout time.”	Scenario planning functions as a creative tool that reveals hidden market opportunities and previously underestimated customer demands	Identification of hidden market potentials	SC _{1,2}
Interviewee 12, col. 32	“The approach enables us to develop multiple adaptable plans which protect us from being restricted to a single strategy.”	Working with circular economy scenarios enables the development of new value creation ideas and thus fosters innovation.	Promotion of innovation through new value creation concepts	SC _{1,2}
Interviewee 1, col. 40	“A successful strategy in today's environment requires us to recognize multiple viable options rather than selecting a single correct path. The strategy should identify flexible options which stay relevant across various future scenarios while providing the capability to transform our plans as the future becomes clearer.”	Building scenarios indicates simulation of how different investment strategies affect long-term goals and market decisions	Simulation of strategic investment decisions through scenarios	SC _{1,3}
Interviewee 5, col. 36	“Our scenarios become more robust and actionable through the use of cross-sector insights.”	The depiction of different outcomes depending on investment levels in innovative technologies and product lifecycles from scenarios.	Analysis of different technology and product investments in scenarios	SC _{1,3}
Interviewee 16, col. 40	“The process of scenario planning proves essential for handling strategic trade-offs particularly when organizations need to decide between investing in new technologies and sustaining profitability from current products.”	Scenario planning is particularly well-suited to effectively resolve strategic conflicts.	Management of strategic goal conflicts	SC _{1,3}
				MC₂ Internal Drivers for the Application of Scenario Planning
Interviewee 13, col. 40	“The effective implementation of scenario planning requires adaptable organizational structures that facilitate teamwork between	The integration into corporate decision-making, ideally through a central coordination team	Integration of scenario planning through central and local structures	SC _{2,1}

	different departments. The process requires R&D together with finance and marketing and operations and external partners to participate in order to achieve diverse perspectives.”	complemented by regional teams with local expertise, is important.		
Interviewee 8, col. 44	“A strong cross-functional collaboration structure is essential.”	A key component is a solid risk management function that provides data for scenario planning.	Integration of risk management into scenario planning	SC _{2.1}
Interviewee 20, col. 44	“The success of scenario planning depends heavily on cultural elements. Organizations with cultures that welcome change and innovation create optimal conditions for scenario planning success.”	Effective scenario planning requires organizational structures that foster cooperation, flexibility, and forward-thinking.	Organizational structures for effective scenario planning	SC _{2.1}
Interviewee 10, col. 48	“Our organization supports a culture of curiosity and innovation which motivates employees to explore new perspectives outside established limits.”	An open corporate culture toward change is essential to actively integrate scenarios into decision-making processes and to foster scenario planning.	Cultural openness for effective scenario integration	SC _{2.2}
Interviewee 11, col. 48	“Organizations that question their assumptions and test new concepts will find it simpler to execute scenario planning successfully. Leadership acceptance of scenario planning as an organizational adaptability tool instead of strategy evaluation creates an environment where the whole organization can accept it.”	A corporate culture that supports critical questioning and a willingness to experiment improves the application of scenario planning.	Culture of critical questioning and experimentation	SC _{2.2}
Interviewee 8, col. 48	“Scenario planning becomes useless when a company's culture shows resistance to change.”	The practice of scenario planning fails to deliver results when corporate cultures resist change.	Importance of change readiness for scenario planning	SC _{2.2}
Interviewee 10, col. 44	“The development of effective scenario planning needs a collaborative framework which eliminates departmental silos.”	Successful scenario planning relies on cross-departmental collaboration that overcomes existing silos.	Break-down of organizational silos for scenario planning	SC _{2.3}
Interviewee 19, col. 44	“The objective is to establish flexible structures which enable them to	Inclusion of interdisciplinary teams, efficient communication pathways,	Interdisciplinary collaboration and flexible decision-making processes	SC _{2.3}

	adjust quickly to changing circumstances. The organization should establish cross functional teams and maintain strong departmental communication channels and decision-making systems that enable fast adjustments when needed.”	and flexible decision-making for effective scenario planning.		
				MC₃ External Drivers for the Application of Scenario Planning
Interviewee 15, col. 24	“The success of scenario planning depends heavily on partnerships because they help address the challenges of changing regulations and technological advancements.”	Partnerships play a significant role in scenario planning, particularly for regulatory changes and technological advancements.	Relevance of partnerships in times of transformation	SC _{3.1}
Interviewee 18, col. 28	“The automotive industry requires partnerships and ecosystems to execute effective scenario planning.”	In scenario planning in the automotive industry, partnerships and ecosystems are decisively important for effective use.	Importance of ecosystems in the automotive sector	SC _{3.1}
Interviewee 1, col. 28	“Partnerships have become essential components of our scenario planning process.”	Partnerships have become an essential component of scenario planning.	Indispensability of partnerships in scenario planning.	SC _{3.1}
Interviewee 20, col. 28	“The practice of scenario planning now depends heavily on partnerships and ecosystems.”	The importance of partnerships and ecosystems is continuously growing in scenario planning.	Increasing relevance of partnerships and ecosystems	SC _{3.1}
Interviewee 18, col. 32	“The industry's increasing unpredictability demands that companies develop flexible strategic planning approaches to respond effectively.”	Growing uncertainty in the industry demands greater organizational flexibility and quick adaptability.	Need for flexibility under uncertainty	SC _{3.2}
Interviewee 7, col. 28	“Traditional strategic planning fails to deliver in volatile environments because it depends on stability that does not exist in reality. Scenario planning requires us to evaluate multiple possible outcomes including those that are difficult to accept.”	Traditional strategic planning reaches its limits under high volatility like in the car sector because it assumes unrealistic stability.	Limits of traditional planning in volatile environments	SC _{3.2}

Interviewee 11, col. 32	“The rising frequency of industry disruptions through regulatory changes and technological advancements makes scenario planning an essential tool.”	The need for scenario planning becomes critical due to regular industry disruptions like regulatory or technological changes.	Increased relevance of scenario planning due to industry disruptions	SC _{3,2}
Interviewee 18, col. 36	“Systemic interaction forecasting and cross-sector dependency analysis serves as a fundamental requirement for successful scenario planning.”	The identification of systemic interactions between industries stands as a fundamental requirement for creating effective scenario plans.	Recognizing cross-sectoral interrelations	SC _{3,3}
Interviewee 17, col. 36	“The future of mobility exists in a complex network which connects with energy systems and telecommunications networks and urban infrastructure development.”	The future development of mobility strongly depends on industries like energy, data management and urban infrastructure.	Cross-sectoral interconnection of mobility	SC _{3,3}
Interviewee 17, col. 36	“The success of electric vehicles requires both EV technology progress and smart grid system development and charging infrastructure expansion.”	The growth of electromobility influences the automotive sector but also the fields of energy, infrastructure, and technology.	Impact of electromobility on multiple industries	SC _{3,3}
				MC₄ Strategic Integration of Scenario Planning into Organizations
Interviewee 15, col. 20	“The conflict between short-term profit requirements and long-term transformation goals especially regarding electrification and sustainability can be managed through scenario planning.”	Scenario planning helps to balance the conflict between short-term profit and long-term transformation.	Balancing short- and long-term goals through scenario planning	SC _{4,1}
Interviewee 6, col. 68	“The integration of short-term and long-term priorities stands as a major challenge for scenario planning within our highly pressured industry.”	A central challenge in scenario planning is aligning short- and long-term goals.	Challenge of balancing priorities in scenario planning	SC _{4,1}
Interviewee 7, col. 20	“The industry's rapid transformation requires us to make long-term planning unavoidable even though we operate in markets that demand short-term profitability. Scenario	The management of financial needs between short-term requirements and long-term goals remains a persistent difficulty in unstable regions.	Balancing different scenarios under economic volatility	SC _{4,1}

	planning provides us with a method to unite these opposing requirements.”			
Interviewee 11, col. 24	“Scenario planning enables us to handle this challenge by developing methods which reduce present-day risks while building future-oriented expansion opportunities.”	With the application of scenario planning organizations can create strategies which minimize risks while building sustainable long-term development.	Risk mitigation and long-term growth through scenario planning	SC _{4.1}
Interviewee 2, col. 36	“The approach stops isolated transformations from occurring. The ERP system upgrade required us to analyze both IT effects and their impact on workforce planning and supplier onboarding and carbon reporting processes.”	The adoption of a holistic perspective prevents isolated actions, by considering how system changes impact personnel, suppliers, and environmental reporting.	Holistic consideration of transformation measures	SC _{4.2}
Interviewee 19, col. 36	“Automotive companies can develop better scenarios through scenario planning by analyzing how changes in one area such as EV adoption will affect other areas including advanced charging infrastructure development and new energy storage business models.”	The consideration of sectoral interdependence in scenario planning helps companies to assess how changes in one area impact others.	Inclusion of sectoral interdependencies	SC _{4.2}
Interviewee 15, col. 55	“The process requires active participation from all stakeholders throughout its entire duration. The involvement of key decision-makers at an early stage ensures that developed strategies remain realistic and feasible for future implementation.”	The scenario planning process is designed to be as realistic and practice oriented as possible in order to derive concrete strategies for practice.	Realism and practical orientation of scenario planning	SC _{4.3}
Interviewee 6, col. 64	“The essential approach involves making scenario planning directly relevant to organizational decision-making processes.”	The direct integration of scenario planning into decision-making is essential for its success.	Linking scenario planning with decision-making processes	SC _{4.3}
Interviewee 16, col. 20	“Every business decision from capital investments to hiring plans and R&D priorities needs to	Necessity to connect scenario planning to specific decision occasions.	Connecting scenarios to concrete decision	SC _{4.3}

	maintain direct connections to actual business choices.”			
Interviewee 19, col. 60	“Scenario planning reaches its best potential when organizations use it as an active process to update their strategic objectives. The strategy remains adaptable and relevant through regular scenario assessments and updates that incorporate new data and developments.”	Scenarios are linked to concrete, measurable targets to ensure action-oriented strategies.	Measurability and goal orientation of scenario planning	SC _{4.3}
				MC₅ Organizational Capabilities and Barriers for the Application of Scenario Planning
Interviewee 14, col. 47	“The most important capabilities for successful scenario planning are strategic foresight, data analytics, and cross-functional collaboration.”	Strategic thinking, analytical skills, and interdisciplinary collaboration are central to successful scenario planning.	Strategic core competencies of successful scenario planning	SC _{5.1}
Interviewee 19, col. 44	“The success of scenario planning requires organizations to establish flexible structures which enable them to adjust quickly to changing circumstances.”	Organizations need flexible structures to respond to changes quickly.	Flexibility of organizational structure	SC _{5.1}
Interviewee 7, col. 16	“A defined decision context such as market shift preparation or new product strategy evaluation or investment plan stress-testing helps maintain focus and practicality in the exercise.”	A clear objective for scenario planning ensures focused and action-oriented implementation.	Clear objective of scenario planning	SC _{5.1}
Interviewee 17, col. 44	“An effective organizational structure for scenario planning should involve a cross-functional team.”	Requirement of a cross-functional team structure for effective scenario planning.	Interdisciplinary teams for scenario planning	SC _{5.1}
Interviewee 15, col. 51	“The main obstacle in scenario planning involves reconciling immediate operational requirements with the future-oriented insights that the method delivers.”	An important challenge refers to the connection of short-term operational needs with long-term scenario outcomes.	Alignment of operational and long-term objectives	SC _{5.2}

Interviewee 14, col. 51	“The main difficulty arises from matching extended planning requirements with the necessity to achieve short-term achievements.”	The central difficulty in scenarios is balancing long-term planning with short-term pressure to perform.	Balance between long-term planning and short-term demands	SC _{5,2}
Interviewee 6, col. 60	“The biggest challenge is managing the tension between urgency and thoroughness.”	Difficult challenge in finding the right balance between speed and diligence.	Balancing urgency and thoroughness	SC _{5,2}
Interviewee 5, col. 52	“Short-term thinking stands as one of the primary obstacles to implementing scenario planning.”	Short-term thinking is a major obstacle, as the long-term benefits of scenario planning are often not immediately apparent.	Overcoming short-term thinking in scenario planning	SC _{5,3}
Interviewee 14, col. 55	“Our scenario planning process includes continuous stakeholder involvement to develop strategies which remain both realistic and implementable.”	Necessity for an intensive collaboration with relevant stakeholders throughout the process.	Stakeholder integration in the planning process	SC _{5,3}
Interviewee 19, col. 44	“Leadership must present a clear vision to overcome internal resistance to change while organizations must demonstrate commitment to long-term goals even when immediate rewards remain uncertain.”	To reduce resistance to change, a clear leadership vision is required.	Visionary leadership fosters change	SC _{5,3}
Interviewee 6, col. 76	“We place a strong emphasis on follow-through to mitigate any barriers in scenario planning.”	Consistent implementation reduces barriers in scenario planning.	Consistent execution to overcome planning barriers	SC _{5,3}
				MC₆ Methodologies and Tools for the Application of Scenario Planning
Interviewee 20, col. 72	“The 2x2 matrix serves as a basic yet effective tool for studying different potential future scenarios.”	Existing methodologies like the matrix are straightforward and effective tools to analyze different future scenarios.	Use of simple frameworks for scenario analysis	SC _{6,1}
Interviewee 1, col. 70	“Our core framework is based on Shell’s famous scenario planning approach, but we have heavily modified it for the automotive context.”	Successful scenario planning results from combining classical methods with agile and iterative approaches.	Combination of classical and agile methods	SC _{6,1}

Interviewee 18, col. 68	“The automotive industry achieves its most effective scenario planning through the integration of forecasting models with cross-functional workshops and expert input.”	An effective method is the combination of forecast models with cross-functional workshops to incorporate diverse expert inputs.	Visualization of future scenarios	SC _{6.1}
Interviewee 19, col. 64	“The automotive industry uses scenario planning methods which combine quantitative and qualitative approaches for effective planning.”	Effective scenario planning methods in the automotive sector often combine quantitative analysis with qualitative assessments.	Combination of quantitative and qualitative methods	SC _{6.1}
Interviewee 13, col. 68	“The availability of data together with analytical tools functions as major game-changers for scenario planning.”	The availability of data and powerful analytical tools has changed the application of scenario planning.	Importance of modern data analysis for scenario planning	SC _{6.2}
Interviewee 20, col. 64	“Analytical tools and data availability play an increasingly significant role in improving the effectiveness of scenario planning.”	Data availability and analytical tools gain increasing importance for effective scenario planning.	Growing importance of data analysis	SC _{6.2}
Interviewee 11, col. 68	“Advanced tools like predictive analytics and machine learning allow us to identify patterns and trends that might be invisible to the human eye.”	Predictive analytics and machine learning, hidden patterns and trends can reveal would otherwise remain undiscovered.	Detection of hidden patterns through advanced tools	SC _{6.2}
Interviewee 6, col. 76	“Data and analytics form the core foundation of successful scenario planning operations in modern times.”	Data analysis is now an essential component of effective scenario planning.	Vital role of data and analytics	SC _{6.2}
Interviewee 20, col. 76	“The process of scenario planning requires organizations to challenge their current assumptions while integrating multiple perspectives.”	Effective scenario planning depends on critically questioning assumptions and including diverse perspectives.	Critical questioning and diversity of perspectives	SC _{6.3}
Interviewee 10, col. 72	“The whole point of scenario planning is to prepare for futures that might differ from our expectations.”	Scenario planning is meant to prepare companies especially for unexpected future developments.	Preparation for unexpected future scenarios	SC _{6.3}
Interviewee 11, col. 80	“The failure to question our current beliefs will result in scenarios that maintain our current strategies instead of preparing us for actual disruptive changes.”	Without critically questioning existing assumptions, the risk of merely developing scenarios that validate current strategies exists.	Risk of confirming existing strategies	SC _{6.3}

Interviewee 4, col. 66	“The ability to challenge assumptions and incorporate diverse perspectives is fundamental to making scenario planning a robust and effective tool.”	Scenario planning only becomes effective when existing assumptions are critically examined and different viewpoints are considered.	Incorporation of critical thinking and diversity of perspectives	SC _{6,3}
				MC₇ Future Trends and Overlooked Drivers in the Application of Scenario Planning
Interviewee 19, col. 92	“The connection between mobility and urbanization represents an important trend which receives insufficient attention.”	The connection between urban development and mobility solutions is often underestimated in the transformation.	Link between urbanization and mobility	SC _{7,1}
Interviewee 5, col. 20	“The rate at which consumers adopt new technologies including autonomous vehicles and subscription models strongly affects our scenario prediction.”	Changes in consumer behavior are often insufficiently considered in scenario planning.	Underestimated influence of consumer behavior	SC _{7,1}
Interviewee 3, col. 90	“Another critical driver is geopolitical stability, or instability.”	Stable or unstable geopolitical developments influence strategic future planning.	Influence of geopolitical dynamics	SC _{7,1}
Interviewee 18, col. 88	“The automotive industry needs scenario planning to lead the industry transformation because of technological advancements and changing consumer needs and regulatory changes.”	Technology adoption raises new social and ethical questions, such as data privacy in connected systems.	Social-ethical aspects of technological innovation	SC _{7,2}
Interviewee 2, col. 20	“The industry faces major challenges from geopolitical uncertainties and regulatory changes.”	A central external influence is the rapid advancement of regulatory requirements.	Regulatory dynamics as an external driver and overlooked trend	SC _{7,2}
Interviewee 3, col. 100	“The physical toll of transformation gets ignored. We recently had to slow our automation rollout because workers were struggling with new repetitive motions.”	The physical impacts of transformation processes on manufacturing employees are often overlooked.	Physical strain caused by transformation	SC _{7,2}
Interviewee 9, col. 100	“The physical toll of transformation gets ignored. The company had to reduce the pace of its automation	Emotional exhaustion caused by continuous change increasingly affects employees and customers.	Psychological effects of transformation fatigue	SC _{7,2}

	implementation because employees faced difficulties with repetitive tasks.”			
Interviewee 13, col. 96	“Scenario planning will expand its scope to include market 98 and technological drivers together with broader systemic risks that include climate change and resource scarcity and shifting societal values.”	In the future, scenario planning will consider broad risks like ecological change and societal transformation.	Integration of systemic risks into scenario planning	SC _{7.3}
Interviewee 1, col. 100	“Another overlooked area is the secondary effects of climate change on manufacturing itself.”	The indirect effects of climate change on production processes are often disregarded.	Secondary climate effects on production	SC _{7.3}
Interviewee 12, col. 88	“The industry’s growing environmental impact demands will transform scenario planning from a strategic tool into a fundamental business operation.”	Rising environmental responsibility requirements affects that scenario planning is becoming an integral business function.	Scenario planning as a core function in the sustainability context	SC _{7.3}