How can AI tool(s) support the scenario planning process? A systematic guide

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Abstract

This study focused on the integration of artificial intelligence tools, ChatGPT plus and DALLE-3, into the scenario planning process as a means to address the dual challenges of organizational struggle with AI adoption and the inefficiencies of traditional scenario planning techniques. With the widespread acceptance and integration of AI technologies such as ChatGPT, organizations recognize the potential of AI to disrupt various sectors, yet they frequently possess insufficient knowledge and expertise to fully exploit the advantages of AI. This gap, coupled with market uncertainties and the limitations of traditional scenario planning methods, necessitates a more efficient approach. Therefore, this study focused on these gaps by answering the research question: '*How can AI support the different steps of the scenario planning process in a way that it overcomes the scenario planning weaknesses and organizational struggle with AI, while maintaining the scenario quality?'.* This research proposes a systematic guide for adopting, using, and leveraging AI throughout the scenario planning process to enhance efficiency, consistency, and productivity, thereby generating organizational value. The guide's effectiveness and AI's impact on the scenario planning process were tested in a single case study during a one-day workshop. The findings suggest that by incorporating AI into the scenario plannig process, it functions as a supportive tool that can augment human decision-makers, streamline the process, and mitigate traditional shortcomings. However, users must actively guide AI, contextualize its outputs, and critically assess potential biases and technical limitations. This approach not only improves the scenario planning process but also helps organizations overcome their struggles with AI adoption, emphasizing the need for a collaborative human-AI partnership in the scenario planning process.

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1. Introduction

Although artificial intelligence (AI) isn't new, as it appeared first as a concept in the 1950s (McCarthy et al., 1959) and being applicated in business for the first time in the 1980s (Schoech et al., 1985), it's attention has increased a lot in recent years (Ransbotham et al., 2018). The deployment of AI-driven applications like ChatGPT and their widespread acceptance worldwide have significantly risen AI's popularity across society (Dwivedi et al., 2023; Huang et al., 2023). However, while AI is a widely used concept there is not one-single definition (Duan et al., 2019). This study defines AI as "*a technology that aims to enable systems to identify, interpret, make inferences, and learn from data to achieve predetermined organizational and societal goals*" (Enholm et al., 2022, P. 1713). AI is perceived as a disruptive force for global businesses across multiple sectors, highlighting its relevance for organizations (Davenport, 2018; Davenport & Ronanki, 2018).

Organizations have recognized this and have started to concentrate on identifying and exploiting business opportunities that emerge from adopting AI (Enholm et al., 2022). These business opportunities are aimed at enhancing the competitive edge, redesigning products or services, or reevaluating business strategies (Campbell et al., 2020). As a result, more and more organizations from diverse sectors increasingly apply artificial intelligence (Davenport & Ronanki, 2018; Dubé et al., 2018). A study by Ransbotham et al. (2017) discovered that over 80% of organizations view AI as a strategic opportunity, while nearly 85% consider AI a means to secure a competitive advantage. The interest in artificial intelligence has risen significantly between 2010 and 2019 and it was expected that this growth would continue beyond 2019 making artificial intelligence one of the main interests of organizations nowadays (Sestino & De Mauro, 2022). However, despite organizations becoming more and more interested in AI, they are still struggling to derive value from AI applications, mainly due to their lack of knowledge on AI adoption and leveraging (Fountaine et al., 2019).

A crucial factor in adopting and leveraging AI in a way that it produces high quality output and realizes value is compliance with AI enablers such as high-quality input data and having the right technology infrastructure (Enholm et al., 2022; Mikalef & Gupta, 2021). Moreover, it is essential to verify the by artificial intelligence produced output, as these systems may produce inaccurate information (OpenAI, 2023; Spaniol & Rowland, 2023; Tubaro et al., 2020). Missing the relevant AI related knowledge and skills is currently forming a barrier for

organizations that they must overcome in order to gain the potential benefits AI has (Fountaine et al., 2019; Makarius et al., 2020).
The benefits of adopting and leveraging AI have already shown in several fields, such as public relations, where AI is used for monitoring social media and forecasting media trends (Galloway & Swiatek, 2018). Furthermore, AI has proven its usefulness in the fashion industry, where it is employed to forecast customer behaviors, predict upcoming trends, and enhance recommendation systems (Wamba-Taguimdje et al., 2020).
In these business applications AI was mainly used for its analytic and predictive capabilities, to overcome uncertainties and support the decision-making process (Galloway & Swiatek, 2018; Wamba-Taguimdje et al., 2020). These business applications displayed AI's ability to learn from data, makes inferences, formulate predictions, and identify associations, which outcomes served as a basis for informed decision making (Enholm et al., 2022). Organizations already using AI for its predictive and analytic capabilities experienced an increase in their ability to develop potential future scenarios based on data. Moreover, they experienced a decrease in the time and costs of making preparations for the future by using AI to develop potential futures and anticipate on them (Agrawal et al., 2018).

Making preparations for potential futures by developing these potential futures and anticipating on them becomes more and more important as the current society is increasingly characterized by uncertainty, innovation and change leading to uncertainties for organizations (Amer et al., 2013). There is an increase in these uncertainties as a result of the rapid technological innovations and fluctuating market conditions, attributed to the diversification of customer needs (Geum et al., 2014). As the environment is changing and the uncertainties increase, it becomes more important for organizations to adapt to these changes and to anticipate on the increasing uncertainties in order to keep their relevance within the market (Grant, 2003; Mintzberg, 1978, 1994).

Organizations acknowledge this and therefore increasingly make use of scenario planning techniques to prepare for potential futures by developing future scenarios and anticipating on them (Enholm et al., 2022). Scenario planning has in the past shown to be an effective means to cope with uncertainties and positively contributes to the organizations performance (Phelps et al., 2001). Scenario planning is seen as a method for developing plausible futures that can help deal with uncertainty and is used to make predictions about uncertainties in the future in order to anticipate them (Chermack & Lynham, 2002; Schoemaker, 1995; Schoemaker, 1991;

Schwenker et al., 2013; Tapinos, 2012). Schoemaker (1995) explains that scenario planning outlines potential futures, encompasses a broad spectrum of possibilities, stimulates thinking about future uncertainties and challenges the existing mindset and the status quo. Scenario planning is a method of long-term planning and strategic foresight that enables organizations to adapt quicker to potential changes. It is a technique for crafting plausible futures to navigate uncertainties, formulate strategic actions, and proactively respond to potential developments (Martelli, 2001).

However, these used traditional techniques of scenario planning have several weaknesses, as these approaches often take a lot of a time and resources because they lack standardized processes and tools for developing the scenario. Organizations therefore struggle with finding the most efficient way of using the traditional scenario planning techniques (Bradfield, 2008; Schwenker et al., 2013). Since artificial intelligence techniques such as machine learning can be trained to autonomously learn from data, and subsequently draw inferences, formulate predictions, and identify patterns based on this data guiding the decision making process, this might be a good tool to support the traditional scenario planning techniques and overcome this weakness (Goodfellow et al., 2016; Murphy, 2012). Moreover, artificial intelligence applications have shown that it can decrease the time and cost of making predictions about potential futures decreasing the number of uncertainties in an efficient way (Agrawal et al., 2018; Enholm et al., 2022; Galloway & Swiatek, 2018; Wamba-Taguimdje et al., 2020). Therefore, AI might be a solution to overcome the traditional scenario planning approaches their weaknesses, decreasing the needed resources and time, by taking the role of a supportive tool and do things humans cannot do.

One previous study has already acknowledged this and therefore focused on the usefulness of scenarios developed by AI and whether AI should be used to assist the development of scenarios (Spaniol & Rowland, 2023). According to this study, the AI user's ability to extract appropriate information plays an significant role in the usability of scenarios developed by AI (Spaniol & Rowland, 2023). This emphasizes the importance for organization to develop the right knowledge and skills how to adopt, use and leverage AI, in order to overcome the struggle organizations, experience regarding AI (Fountaine et al., 2019; Makarius et al., 2020; Spaniol & Rowland, 2023). The study concludes that artificial intelligence can support the scenario development process, supporting the earlier made statement about AI as supportive

tool being a potential solution to overcome the traditional scenario planning weaknesses (Spaniol & Rowland, 2023).

Although the study by Spaniol & Rowland (2023) focused on artificial intelligence supporting scenario development in general, it didn't provide a systematic approach overcoming the scenario planning weaknesses and overcoming the struggle organization have with using AI in a way that it realizes value. Thereby, the gap of how organizations could adopt, use, and leverage AI throughout the various phases of the scenario planning process, overcoming the scenario planning weaknesses in a way that it realizes organizational value, remains. This study focusses on this gap and the goal of this study is producing a systematic step-by-step guide that will function as a means to adopt, use and leverage AI throughout the various phases of the scenario planning process, overcoming the scenario planning weaknesses and organizational struggle regarding AI. By providing a correct systematic guide to a process, it will increase the efficiency, consistency and productivity of the process, generating organizational value (Rossi et al., 2018). Based on this gap the following research question was formulated: '*How can AI support the different steps of the scenario planning process in a way that it overcomes the scenario planning weaknesses and organizational struggle with AI, while maintaining the scenario quality?'*

This study contributes to literature by answering these questions and thereby reviewing artificial intelligence tools based on the criteria from the literature, selecting the best AI tool or best combination of AI tools for supporting the scenario planning process and describing in-depth how this tool can support the different steps of the scenario planning process. Moreover, this study contributes to practice by offering a solution to the scenario planning weaknesses in the form of selecting a combination of supportive AI tools and formulating a systematic guide how to use the combination of tools in the different steps of the scenario planning process. This produced guide provides value to its users by offering organizations a solution to overcome their struggle with adopting, using, and leveraging AI in a way that it realizes values and benefits for the organization. The users have to take into account that the guide offers one way to use AI in the scenario planning process and that there is the potential of other possible use-cases that were not explored further in this study.

The rest of this paper is organized as follows. The next section contains a review of the literature on artificial intelligence, scenario planning and quality criteria. The third section

contains the description and argumentation related to methodology used in this. Section four is about the findings of this study, followed by a conclusion in the form of an answer to the research question, and a discussion of the limitations and the theoretical and practical implications of this study.

2. Literature review

A systematic literature review is employed to define the core concepts of this study. The search terms and strategy applied for this systematic literature review are described in appendix 1.

2.1 Artificial intelligence

Artificial intelligence, commonly referred to as AI, has attracted considerable attention in recent years, partly because of the introduction of AI-based applications like ChatGPT (Dwivedi et al., 2023; Huang et al., 2023; Ransbotham et al., 2018). Nevertheless, there isn't a singular definition that includes the entirety of AI, leading to substantial ambiguity regarding its meaning and scope (Duan et al., 2019; Enholm et al., 2022; Mikalef & Gupta, 2021; Wirtz et al., 2019). Hence, numerous definitions of AI have been published in an attempt to cover the entire concept.

To get a good understanding of the definition of AI, it is key to first understand both internal concepts *"artificial"* and *"intelligence"* separately (Enholm et al., 2022; Wirtz et al., 2019). According to Cambridge Dictionary (2024) *"artificial"* is a human-made creation that mimics or replicates something natural. *"Intelligence"*, on the other hand, refers to cognitive processes, encompassing activities like learning, reasoning, and understanding (Lichtenthaler, 2019). Combining these two concepts, artificial intelligence can be defined as the creation of technological systems capable of emulating intelligence (Wamba-Taguimdje et al., 2020).

From the range of definitions used in various studies, it is apparent that there is a consensus regarding AI referring to providing computers with human-like capabilities. (Dwivedi et al., 2021; Makarius et al., 2020; Mikalef & Gupta, 2021; Wamba-Taguimdje et al., 2020). This implies that computers can execute tasks that typically require human intelligence. Such activities encompass understanding, learning, reasoning, and problem-solving (Lichtenthaler, 2019; Mikalef & Gupta, 2021). The objective of AI is to evolve into a cognitive technology

capable of emulating the functions of the human mind, enabling computers to think and behave like humans (Enholm et al., 2022).

There are two approaches to defining AI. Firstly, as a tool designed to solve and execute specific tasks that are either impossible or exceedingly time-consuming for humans to accomplish. (Demlehner & Laumer, 2020; Enholm et al., 2022; Makarius et al., 2020). Secondly, AI can be defined as a system that emulates, but does not replace, human intelligence, behavior, and cognitive processes. This includes capabilities such as making inferences, learning, and interpretation (Mikalef & Gupta, 2021). Both definitions affirm that AI functions not as a replacement for humans, but rather as an augmentation tool that handles challenging and time-consuming tasks (Demlehner & Laumer, 2020; Enholm et al., 2022; Makarius et al., 2020; Mikalef & Gupta, 2021).

However, the second category assumes that AI possesses the capacity to emulate human behavior (Kolbjørnsrud et al., 2017; Mikalef & Gupta, 2021) While the first category characterizes AI as a tool, implying it cannot precisely replicate human behavior (Demlehner & Laumer, 2020; Enholm et al., 2022; Makarius et al., 2020; Wamba-Taguimdje et al., 2020).

This study uses the definition of Enholm et al (2022, p. 1713) which defines AI as "*a technology that aims to enable systems to identify, interpret, make inferences, and learn from data to achieve predetermined organizational and societal goals*." This definition is based on a literature review in which different definitions of artificial intelligence are reviewed. This study of Enholm et al (2022) formulated a definition of artificial intelligence by focusing on the commonalities among various AI definitions and their underlying assumptions. Consequently, this definition is regarded as comprehensive, encapsulating the entirety of the AI concept. (Enholm et al., 2022).

2.1.1 AI technologies

AI is still a broad definition compassing various types of AI technologies, with machine learning being one of the most widely used techniques over the last few years (Enholm et al., 2022). Machine learning can be defined as the capability to empower computer-based applications to autonomously identify patterns in data and to take action without explicit programming for each task (Goodfellow et al., 2016; Murphy, 2012).

The surge in available data combined with the advances in computational power resulted in a stronger interest for machine learning. The objective of machine learning is to equip machines with the capacity to autonomously learn from data, draw inferences, make predictions, and identify associations based on this data, thereby guiding the decision-making process (Goodfellow et al., 2016; Murphy, 2012).
Next to machine learning there are several other closely related AI technologies such as data mining and predictive analytics. Data mining is defined as the extraction of implicit, previously unknown, and potentially valuable information from data, thereby aiding the decision-making process. (Glowacka et al., 2009). Siegel (2013) defines predictive analytics as a technology that learns from experience (data) to forecast future outcomes and optimize the decision-making process. Data mining and predictive analytics employ sophisticated data analysis techniques on extensive datasets to uncover patterns and make predictions about potential futures. (Delen & Demirkan, 2013; Siegel, 2013). Data mining and predictive analytics have a wide range of applications in various sectors. For instance, banks utilize predictive analytics and data mining to identify credit card risks and detect potentially fraudulent customers (Kumar & Garg, 2018). Additionally, data mining and predictive analytics are often used to predict future trends based on existing data, for example on social media or in fashion by monitoring social media and customer habits (Galloway & Swiatek, 2018; Wamba-Taguimdje et al., 2020).

Recently more and more new AI based tools emerge, with Chat Generative Pre-Trained Transformer better known as ChatGPT, with its widespread global adoption, being the most popular one (Dwivedi et al., 2023). According to OpenAI (2023) is ChatGPT is a language model created by OpenAI, belonging to the GPT (Generative Pre-trained Transformer) series of models. It is built upon the GPT-3.5 architecture. Generative Pre-trained Transformer (GPT) is a type of language model that can generate human-like text. It's called "pre-trained" it undergoes learning from extensive text data prior to deployment for particular tasks. GPT models are engineered to produce text resembling human language based on input, rendering them suitable for diverse language processing tasks, such as chatbot interactions. ChatGPT has been extensively trained on internet data, enabling it to comprehend and produce coherent responses in conversational settings. It harnesses the capabilities of deep learning and transformer neural networks to analyze and generate text. Deep learning refers to a type of machine learning and enables ChatGPT to learn complex patterns and representations from the vast amounts of text data they are trained on (OpenAI, 2023).

Transformer neural networks are a special type of architecture in deep learning that is really good at understanding how words in a sentence relate to each other. The transformer neural networks enable ChatGPT to weigh the importance of different words in a sentence and generate meaningful representations. Transformers use a technique called self-attention to figure out which words are important in a sentence and how they should be connected. This allows them to generate text that makes sense and sounds natural. ChatGPT aims to provide helpful and informative responses, answer questions, assist with problem-solving and engage in solutions. However, it may occasionally produce incorrect or nonsensical responses (OpenAI, 2023).

2.1.2 Leveraging AI

In order to leverage AI's benefits, it is important that organizations are capable to deploy AI techniques to support organizational operations, activities, and processes, this is referred to as AI capability (Enholm et al., 2022; Mikalef & Gupta, 2021). As AI becomes increasingly integral to organizational operations, there is a growing interest in exploring how AI technologies and techniques can be utilized to facilitate the achievement of organizational objectives (Enholm et al., 2022). AI capability can be defined as the organization's capacity to effectively select, coordinate, and utilize its AI-specific resources (Mikalef & Gupta, 2021). Previous studies identified several important AI enablers for organizations (Enholm et al., 2022; Mikalef & Gupta, 2021).

2.1.2.1 Data

One of the key enablers for leveraging the potential of AI is data availability, since data is used to train AI algorithms how to make decisions (Mikalef & Gupta, 2021; Pumplun et al., 2019; Ransbotham et al., 2018). Lacking enough training data is often seen as a challenge for using AI. Training data can therefore be seen as an important criteria for comparing the different AI tools (Baier et al., 2019). Data timeliness is also a crucial factor in determining the output quality of AI. Timeliness refers to the speed at which data is collected and refreshed. AI systems depend on data timeliness, making timeliness a critical criterion for AI systems. (Gregory et al., 2021; Mikalef et al., 2018). Lastly, data quality plays a significant role in the quality of the output of AI systems (Mikalef & Gupta, 2021; Pumplun et al., 2019; Ransbotham et al., 2018). Using low quality training data as input will also result in low quality output. Training data quality can therefore also be seen as an important criterion when assessing AI systems (Lee et al., 2019). Challenges related to data quality include incomplete

data, inaccurate inputs, noisy data, and biased data (Baier et al., 2019). These factors must be taken into account when evaluating the data quality of an AI system (Enholm et al., 2022; Mikalef & Gupta, 2021).

2.1.2.2 Technology infrastructure

Having the right technology infrastructure to adopt AI is an equally important AI enabler, critical for organizations (Enholm et al., 2022; Mikalef & Gupta, 2021). Technological infrastructure encompasses all technological assets, including software, hardware, and data, as well as systems, components, and networks essential for implementing an AI system.

To effectively integrate AI into organizations, three critical components are essential: robust computing power infrastructure, sophisticated algorithms, and comprehensive datasets (Wamba-Taguimdje et al., 2020).

A report by McKinsey (2018) states that the absence of adequate technological infrastructure within organizations stands as one of the primary barriers to AI adoption. AI technologies require significant infrastructure investments across various levels, posing a major obstacle, particularly for smaller organizations.. (Dwivedi et al., 2021). The investments needed in the infrastructure highly depends on the AI technologies used. Since the needed technological infrastructure to adopt AI is AI technology or tool dependent there aren't general criteria for the needed technological infrastructure for organizations. Therefore the needed technological infrastructure needs to be determined on case level (Mikalef & Gupta, 2021).

However, there are some basic resources needed to adopt and leverage AI. Since most organization are new to AI and are just experimenting with a certain AI tool or system, they need time to become an expert and leverage the tool or system in a way that it produces value (Ransbotham et al., 2018). Another important aspect for organizations to adopt and leverage AI is providing the financial resources to do so (Chui & Malhotra, 2018). Time and financial resources the key resources for adopting and leveraging AI in a way that it realizes organizational value (Enholm et al., 2022; Mikalef & Gupta, 2021).

2.1.2.3 Organizational culture

Previous studies showed that organizational culture is considered critical in the AI adoption decision and process (Mikalef & Gupta, 2021; Pumplun et al., 2019). Since AI is an innovative technology that might change an organization's business model, organizations must be capable of adapting to this change (Lee et al., 2019). Employees play a crucial role in this dynamic as they are the individuals directly interfacing with the technology. Hence, the

organization's employees must be willing to engage and collaborate with AI (Pumplun et al., 2019). Furthermore, employees must exhibit a willingness to learn and innovate, as this facilitates the adaptation and utilization of AI (Lee et al., 2019). Employees with an innovative mindset are more receptive to AI adoption and are better positioned to recognize and capitalize on new opportunities for AI applications. Therefore, fostering an innovative culture is a crucial criterion for organizations when embracing AI (Mikalef & Gupta, 2021).

One of the most critical factors in adopting AI is the support by top management, because they play crucial role in providing the needed organizational culture (Alsheibani et al., 2018; Demlehner & Laumer, 2020; Lee et al., 2019). Moreover, they can aid in the adoption of AI by providing resources and financial funds (Alsheibani et al., 2018).
Organizational readiness, encompassing the availability of complementary organizational resources required for AI adoption, such as financial and human resources, is also a crucial factor in adopting AI (Alsheibani et al., 2018; Enholm et al., 2022; Mikalef & Gupta, 2021). This because the adoption of AI requires significant financial resources. Moreover, the skills of employees and the availability of human resources are crucial in the implementation of AI. Therefore, organizations adopting AI require employees with the appropriate technical skills to effectively adopt an AI system (Pumplun et al., 2019). Additionally, employees that understand the workflows, tasks and processes also play an important role as they have the ability to determine where and how AI can improve (Alsheibani et al., 2018; Pumplun et al., 2019). Therefore, organizations have to evaluate the internal availability of expertise. The managerial staff should know how to provide AI tools and technologies with the right expertise and where these tools can support the business (Mikalef & Gupta, 2021).
Employee-AI trust is also a part of the organizational culture, as AI preforms tasks that replicate human cognition or that were previously done by employees (Enholm et al., 2022; Mikalef & Gupta, 2021; Zheng et al., 2017). Hence, it is crucial for employees to comprehend the significance of AI, its anticipated role, and the implications for their roles and responsibilities within the organization (Makarius et al., 2020). Employees have to trust AI and its produced output and must have a comprehension of AI’s functionality. This will enhance the AI adoption process (Makarius et al., 2020).

2.1.3 Humans collaborating with AI

As more AI tools and technologies arise and organizations more and more focus on adopting AI, it becomes crucial for humans to collaborate with these tools and techniques (Enholm et al., 2022). According to Wilson & Daugherty (2018) humans can work together with AI in three ways: training, explaining, and sustaining.

Table 1 Human role in collaborating with AI

Human Role	**Definition**
Training	Teaching AI algorithms to perform the work they're designed to do
Explaining	Explaining the by AI produced outcomes and assess the usefulness of these outcomes
Sustaining	Consistently strive to ensure that AI systems operate effectively, safely, and responsibly

According to literature the human thinking aspect plays an significant role in the scenario planning process (Schoemaker, 1993, 1995). Therefore, an important criterium for this study is to keep humans involved in the scenario planning process by collaborating with AI in at least one of the three ways. Therefore, this study focusses on the supportive role AI can fulfill in the scenario planning process.

2.2 Scenario planning

Scenarios serve as valuable tools for organizations, aiding in preparation for potential events and enhancing organizational flexibility and innovation (Hiltunen, 2009). Scenarios do not have one-single definition. This study defines scenario planning as a method for developing plausible futures that is used to make predictions about uncertainties in the future in order to deal with this uncertainty and to anticipate on them (Chermack & Lynham, 2002; Schoemaker, 1995; Schoemaker, 1991; Schwenker et al., 2013; Tapinos, 2012)

The systematic use of scenarios originates from the 1950s after World War II, when the planners of the US Department of Defense used it as a method for military planning (Chermack et al., 2001; Durance & Godet, 2010; Schoemaker, 1995; Van der Heijden, 2005). The scenario methodology expanded in the 1960s and was extensively used for social forecasting, public policy analysis and decision-making processes (Bradfield et al., 2005; Van der Heijden, 2005). Scenarios first became part of strategic organizational planning in the 1970s by Royal Dutch Shell which used it to complement their traditional forecasting tools.

By this scenario planning emerged (Bradfield et al., 2005; Cornelius et al., 2005; Schoemaker & van der Heijden, 1992).

Shell made scenario planning part of their strategy and used it to cope with the oil crisis in the 1970s (Schoemaker & van der Heijden, 1992). Research showed that after this oil crisis there was a boost in the adoption and application of scenario planning techniques by organizations in the US (Linneman & Klein, 1979, 1983). In the early 1980s almost 50% of all fortune 1000 companies were actively using scenario planning, with it being most popular at corporate level for a strategic planning of 10 years or more (Linneman & Klein, 1979, 1983). Since the early 2000s scenario planning usage has increased significantly (Rigby & Bilodeau, 2007).

Schoemaker (1995) states that scenario planning outlines potential futures, captures various options, stimulates thinking about future uncertainties and challenges the established mindset and existing norms. Additionally, Schoemaker (1995) states that thinking about these possible futures significantly enhances organization's ability to deal with uncertainty and supports the decision-making process.

Research supports these statements and shows that the use of scenario planning techniques minimizes the level of uncertainty, unpredictability and instability of an organizations (Malaska et al., 1984). As business environments become increasingly uncertain due to rapid technological developments and the rise of new business models, more and more organizations adopt scenario planning techniques (Amer et al., 2013; Oliver & Parrett, 2018; Rigby & Bilodeau, 2007). Brown and Eisenhardt (1998) emphasizes that due to this increasing uncertainty it becomes more important to "prob the future" to gain insights into what is likely to occur and to anticipate on these possible events. Scenario planning is a method to do this since its long term planning and strategic foresight enable organizations to respond quicker to changes (Martelli, 2001).

2.2.1 Scenario planning techniques

According to literature there are multiple methodologies that offer an approach to develop scenarios (Amer et al., 2013; Bishop et al., 2007; Bradfield et al., 2005; Chermack et al., 2001; Keough & Shanahan, 2008; Schoemaker, 1995; Schwartz, 2012; Van der Heijden, 2005; Varum & Melo, 2010). The two most popular and highly cited scenario planning techniques are the scenario planning techniques by Schoemaker (1993, 1995) and Schwartz (1996). These techniques offer a step-by-step approach to develop scenarios. Both techniques concentrate on systematically defining issues, identifying key drivers, stakeholders, trends, constraints, and other pertinent factors (Amer et al., 2013). Other techniques such as the model of van der Heijden (1966) are according to literature simpler and less resource intensive. However, these models see the scenario planning process as a learning process and do not offer a step-by-step systematic approach (Bradfield et al., 2005). A systematic approach leads to an increase in efficiency, consistency, and productivity (Rossi et al., 2018). Therefore, the systematic nature of the models of Schwartz (1996) and Schoemaker (1993, 1995) compared with the high number of citations and high popularity is the reason this study prefers these techniques over other techniques.

2.2.1.1 Schoemaker

The model of Schoemaker is an often in scenario planning literature cited and considered popular systematic scenario building model (Amer et al., 2013; Chermack et al., 2001; Keough & Shanahan, 2008; Varum & Melo, 2010). This model is a detailed iterative model that consists of 10 steps and comprehensively describes what to do in each step. The goal of the model is to develop two scenarios, one utopian and one dystopian (Schoemaker, 1993, 1995). See table 2 and figure 1 for the description and visual representation of the scenario planning model of Schoemaker. The criteria: relevance, internal consistency, archetypal and long term focus, should be used check the quality of the developed scenario (Schoemaker, 1993, 1995).

Table 2 Scenario planning model Schoemaker (1993, 1995).

Step	Definition
1. Define the scope	The goal is to define an appropriate scope that will form the basis of the scenario. This should be based on the past, for example the last 10 years and based on this anticipate a similar amount of change or more.
2. Identify the major stakeholders	The goal is to identify the primary stakeholders and analyze their roles, interests, and power dynamics, along with how these factors have evolved over time.
3. Identify basic trends	Identify basic trends on political, economic, societal, technological, legal and industry level. Everyone should agree on these trends otherwise the trend becomes part of step 4. The goal is to Identify each trend and briefly explain each trend, why and how it is relevant for the organization.
4. Identify key uncertainties	The goal is to identify the significant economic, political, societal, technological, legal and industry uncertainties which will affect the scenario. The relationship between these uncertainties should also be identified since not all combinations may occur.
5. Construct initial scenario themes	The goal is to construct one utopian and one dystopian scenario by clustering all positive elements and all negative elements.
6. Check for consistency and plausibility	Check the consistency, and plausibility of the scenario themes. Three tests to check this: 1. Do the trends align with the selected time frame? 2. Do the scenarios integrate results of aligned uncertainties? 3. Are the primary stakeholders positioned in roles they find unfavorable and subject to change? The goal is to solve inconsistency and create a compelling story line.
7. Develop learning scenarios	The goal is to develop learning scenarios. Therefore, identify the themes that are strategically relevant to the organization and organize the possible trends and outcomes around them.
8. Research needs	The goal is to identify the research needs for the further research needed to understand the uncertainties and trends related to the in step 7 developed learning scenarios.
9. Develop quantitative models	Review the internal consistencies of the scenario and formalize the interactions into a quantitative model. The goal of this step is to utilize formal models to prevent the development of unrealistic scenarios.
10. Evolve toward decision scenarios	Reconsider the outcomes of the previous steps to see if the scenarios are the wanted outcome. If this is the case then the process is finished, if not the steps 1 to 10 should be repeated. The goal of this step to make sure that the developed scenarios are good enough to share in the organization so they can be used to test strategies and generate new ideas.

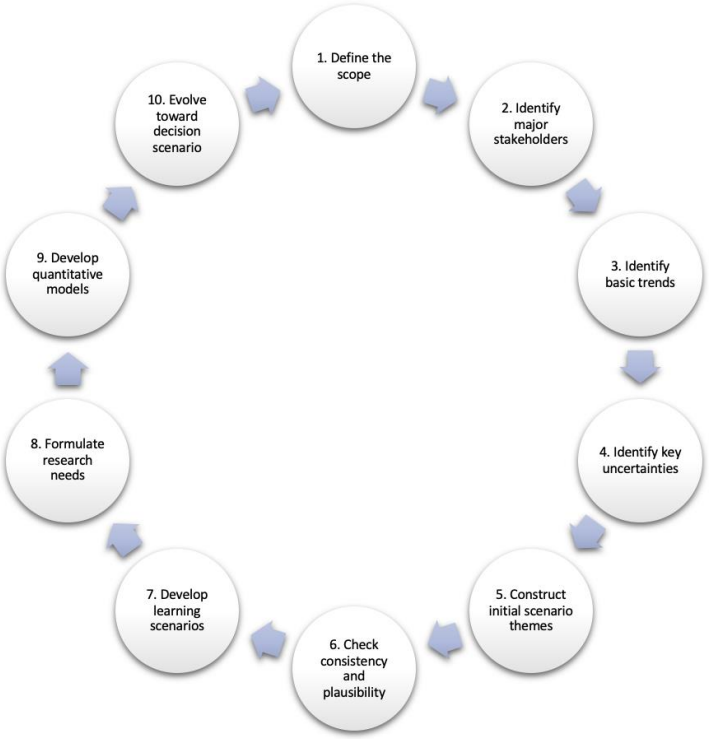


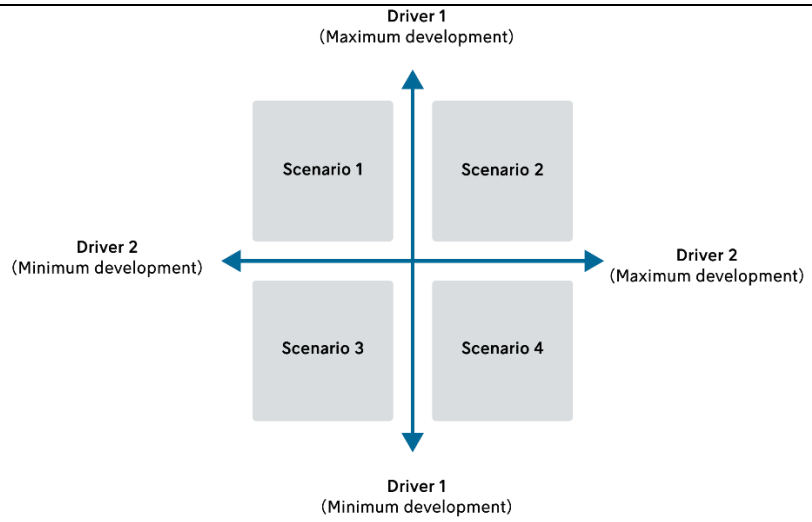
Figure 1 Scenario planning model Schoemaker (Schoemaker, 1993, 1995).

2.2.1.2 Schwartz

The model by Schwartz (1996) is another systematic scenario building model that is popular and highly cited in scenario planning literature (Amer et al., 2013; Chermack et al., 2001; Keough & Shanahan, 2008; Varum & Melo, 2010). This model consists of eight in detail described steps. The model suggests to first plot scenario drivers in order to develop various scenarios (Schwartz, 1996). See table 3 and figure 3 for the description and visual representation of the scenario planning model of Schwartz.

Table 3 Scenario planning model Schwartz (1996)

Step	Definition
1. Identify focal issue or decision	The goal is to identify focal issues or decisions relevant for the organization that require analysis. Determine what issues or decisions are relevant for them and define the scope and timespan in which this will happen.
2. Identify key factors in the local environment which influence the decision	The goal is to identify external factors from the local organizational environment which influence the selected decision(s). After identifying these key factors, evaluate them to make sure they are relevant for the in step one identified decision or issue.
3. Identify driving forces that influence key factors in the local environment	The goal of this step is to identify these driving forces and their potential development directions, that influence the key factors identified in step 2. These driving forces are typically external forces that might impact the key factors and thereby the issues or decisions. These driving forces can be political, economic, social, technological, and regulatory.
4. Rank by importance and uncertainty	Assess and rank the identified key factors and driving forces based on importance and uncertainty. Importance refers to the level of impact or influence on the focal issue while uncertainty relates to the level of unpredictability associated with the factor or driving force. The identified critical factors and driving forces will then be explored deeper by identifying their internal predetermined elements and critical uncertainties. In order to understand their underlying elements.
5. Select scenario logics	The goal is to determine which futures are worth developing as detailed scenarios. Therefore, the top 2 driving forces/factors identified in step 4 will be used to name the axes of a 2-by-2 matrix (see figure 2). This matrix will then be used to develop 4 scenario logics or themes that present potential futures.

	 *Figure 2 Scenario matrix Schwartz (1996)*
6. Flesh out scenarios	The goal is to develop the scenarios themes/logics into consistent scenarios that provide a comprehensive picture of the potential future. The trends and developments that lead to the scenario will be described.
7. Formulate implications	The goal is to formulate implications based on the developed scenarios. These implications for the scenarios have to be relevant for the issue or decision. Moreover, the risks, opportunities, challenges, and trade-offs associated with each scenario have to be assessed. Prioritize the implications that are related to every scenario.
8 Select the leading indicators and signposts	The goal is to select indicators and signposts that can be used to monitor and assess the scenarios. These indicators serve as early warning signals and help assessing the likelihood of the different scenarios. Monitoring these indicators enables organizations to adapt their strategies accordingly.

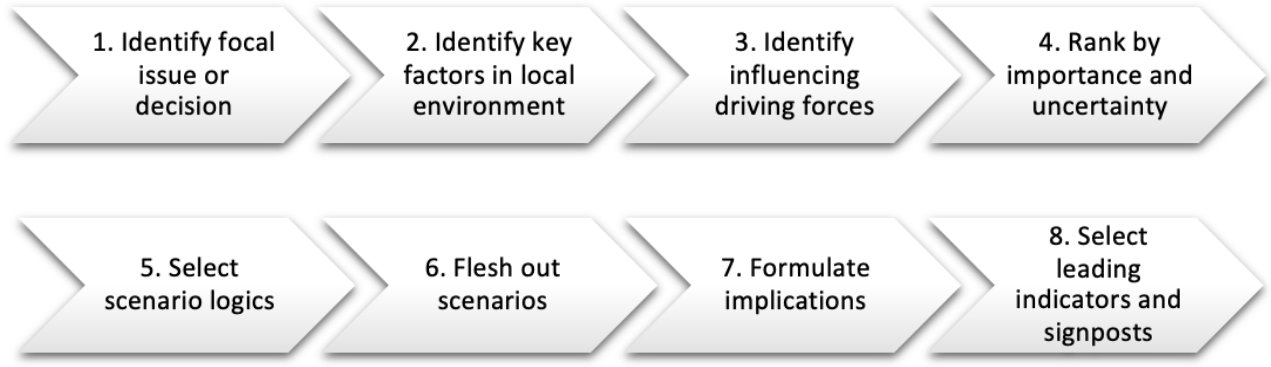


Figure 3 Scenario planning model Schwartz (Schwartz, 1996)

2.2.2 Comparing models

More new models emerge as more studies focus on the methodological part of scenario planning (Varum & Melo, 2010). These studies review existing models and try to combine their strengths to develop a better, more complete model for practice (Keough & Shanahan, 2008). Experts are concerned about this development as many of these models may be impractical and often are not adequately tested. Moreover, they are concerned about this leading to a "methodological chaos" (Bishop et al., 2007; Bradfield et al., 2005; Schnaars, 1987). Therefore, this study remains with the traditional scenario planning approaches described above. The different steps of the scenario planning models of Schoemaker and Schwartz are compared in table 4 in order to make a well-considered decision.

Tabel 4 Comparison steps models Schoemaker and Schwartz

Steps	**Schoemaker**	**Schwartz**
1.	Define the scope	Identify focal issue or decision
2.	Identify major stakeholders	Identify key factors in the local environment
3.	Identify basic trends	Identify influencing driving forces and potential development directions
4.	Identify key uncertainties	Rank by importance and uncertainty
5.	Construct initial scenario theme	Select scenario logics
6.	Check for consistency and plausibility	Flesh out scenarios
7.	Develop learning scenarios	Formulate implications
8.	Identify research needs	Select leading indicators and signposts
9.	Develop quantitative models	XXX
10.	Evolve toward decision scenarios	XXX

The comparison of the different steps of the models of Schoemaker and Schwartz showed that there are many similarities between both models. Both models start with defining the scope and agenda in the form of a time frame (Schoemaker 1993, 1995; Schwartz, 1996). Moreover, both models consist of steps focused on identifying trends and influencing factors from the environment. Additionally, both models construct scenarios, assess these scenarios on plausibility and consistency and selects scenarios based on this assessment (Schoemaker 1993, 1995; Schwartz, 1996).

However, the models also showed some differences as part of Schoemaker's model is to identify major stakeholders, identify research needs, develop quantitative models, and evolve toward a decision scenario (Schoemaker 1993, 1995). On the contrary Schwartz's model consists formulating implications and select leading indicators and signposts (Schwartz 1996). The comparison showed that the model of Schoemaker is most complete compared to Schwartz's as it "misses" only 2 steps compared to the 4 steps that the model of Schwartz "misses" (Schwartz 1996, Schoemaker 1993, 1995). However the model of Schoemaker is focused on developing quantitative models while according to literature qualitative models are preferred (Martino, 2003). Quantitative methods are frequently criticized in literature because they rely on historical data and assume that past trends will recur in the future (Gordon et al., 1974). According to literature the usefulness of quantitative models declines when looking into the future and the usefulness of qualitative models increases (Pillkahn, 2008). Therefore, while Schwartz' model is more qualitative of nature this model is used in this study (Schwartz, 1996).

2.2.3 Quality criteria

Quality criteria form the basis on which practitioners can assess the usefulness of the developed scenario. According to literature there are three key quality criteria. These quality criteria are, "relevant", "challenging" and "plausible". Each criterion is defined in Table 5.

Table 5 Scenario quality criteria by Van der Merwe (2008)

Quality criteria	**Definition**
Relevant	Scenarios have to address current organizational concerns but also think beyond the current assumptions.
Challenging	Each scenario must provide a new view which differs from the current on.
Plausibility	Scenarios demonstrate internal consistency, align with relevant historical patterns, incorporate credible projections of current trends, acknowledge the interplay of societal, economic, and technological forces, and account for significant uncertainties that could impact future outcomes.

According to Wack (1985), the purpose of scenarios was to shift thinking. However, there should be a good balance in the amount of challenge as too challenging scenarios or not challenging scenarios won't be taken seriously by the decision maker. The scenarios should

be internally consistent and realistic so that the scenario is possible of happening (Schwartz, 1991). Therefore scenarios should be supported by data (Van der Merwe, 2008).
In short, scenarios must be relevant by addressing organizational concerns, challenging by expanding the thinking of the organization and its decision makers and plausible by being well analyzed, researched and supported by data (Van der Merwe, 2008).

2.3 Process quality control

Process quality control is a long-used technique used to maintain the quality of a process as it dates back to the Egyptians where it was already part of the process of building the pyramids. Since then, many tools, methods and techniques have developed. The primary goal of process quality control is to achieve consistent and reliable outcomes by reducing variations and errors (Mitra, 2016). According to Mitra (2016, p. 12) is quality control defined as "*a system that maintains a desired level of quality*". Process quality control is of significance importance to organizations as maintaining and assuring process quality is a way to assure that the process produces outcomes that meet the needs. Process quality control plays a crucial role in ensuring process quality and thereby ensuring the productivity, efficiency and consistency of a process and is therefore of great importance to every process and every organization. Moreover, process quality control is a way to reduce the costs and mitigate the risks of processes as it is way to continuously improve the processes and thereby work towards a competitive advantage (Mitra, 2016).

2.3.1 IPO model

A model that can be used to control the quality of a process is the Input-Process-Output model. The Input-Process-Output model is also known as the IPO model widely used in quality management to understand and improve processes within organizations. The IPO model provides a structured way to analyze and optimize the flow of resources, activities, and information throughout a process, aiming to enhance efficiency, consistency, and ultimately the quality of the produced output. The IPO model breaks down a process into three essential components (Ilgen et al., 2005). See table 6 for a description of the three components of the IPO model.

Table 6 IPO model (Ilgen et al., 2005)

Quality criteria	Definition
1. Input	The resources, materials, data, and information required to initiate and execute a particular process. The inputs are critical because they are the foundation of the process and have great influence on the final output. Identifying and ensuring the quality of the input is therefore crucial when using this model. A way to do this is by setting certain input related quality criteria.
2. Process	The series of activities, tasks, and steps performed to transform the inputs into desired outputs. This includes systematic approach employed to achieve a specific outcome.
3. Output	The result or deliverables generated from the process. The quality of the output reflects the effectiveness of the inputs and the efficiency of the processes. The output quality can be tested by using output related quality criteria.

3. Methodology

The aim of the study is producing a systematic step-by-step guide how to adopt, use and leverage AI in the different steps of the scenario planning process overcoming the scenario planning weaknesses and organizational struggle regarding AI. Since no previous study has specifically focused on this topic, this study is of exploratory nature (Spaniol & Rowland, 2023). This qualitative approach allows the researcher to get a deeper understanding of the topic by uncovering new perspectives, generating hypotheses, identifying patterns and trends, exploring contextual factors and by being an iterative and reflexive process (Stebbins, 2001).

3.1 Selection of AI tools

The first phase of the study started with desk research focused on AI tools. Since the literature review showed that there was limited to no literature available on the new emerging AI tools, there is made use of other online (non-academic) sources to compare the different AI tools relevant for this study. For the selection of the generative AI tools there is made use of the top 10 generative AI tools by AI Magazine (2023), which is an official publication of the Association for the Advancement of Artificial Intelligence (AAAI). The artificial intelligence tools relevant for this study that resulted from the top 10 generative AI tools by AI Magazine (2023) are evaluated on the criteria training data, timeliness of the data, flexibility, ease-of-use, ethical AI, and costs, which resulted from the literature review (Taulli, 2021). Based on this evaluation the tool or combination of tools that scored the best on these criteria is selected and used in the rest of this study.

3.2 Formulation of the guide

During the second phase of this study, a guide for integrating artificial intelligence into the scenario planning process was formulated, building upon prior literature which has established that a structured guide is an effective method for delineating the application of AI (Hopgood, 2021; Koçak et al., 2019; Negnevitsky, 2005). Furthermore, in alignment with the second step of the Input-Process-Output (IPO) model, it is recommended to employ a systematic process approach to transform the inputs utilized into the desired output. A guide provides such a systematic approach, thereby making it, according to the IPO model, an effective means to enhance and regulate the quality of the process (Ilgen et al., 2005)

However, since there is limited to no literature available on formulating a guide, the guide is based on the anticipated information requirements necessary to use AI in the different steps of

the scenario planning process. For the design of the guide there is made use of the criteria, “Simple is best”, “Keep it short”, “Start with an overview”, “Help the reader prepare for each step”, “Write instructions at a consistent level”, “Tell an interesting story” and “Stay positive”, are taken into account while constructing the guide (Forsey, 2022). Additionally the guide and the guidelines were evaluated on the criteria: quality, validity and applicability in practice (Terrace, 2003). The evaluation process was an iterative process containing multiple rounds of improving the guide based on the set criteria of Forsey (2022) and Terrace (2003). For the evaluation of the guide there is made use of two independent external persons who tested the guide based on the set criteria of Forsey (2022) and Terrace (2003). The outcomes of these test were used to improve the guide its quality, validity and applicability.

Table 7 displays the guide lay-out including the discussed information per section.

Tabel 7 Guide lay-out

Section	**Content**
1. Introduction	Introduction of the problem and the role the guide aims to fulfill
2. Artificial intelligence tool(s)	Description of artificial intelligence and the selected AI tool(s) to give the user a good insight in how the tool(s) works.
3. Scenario planning model	Describes the selected scenario planning model with an in-depth description of each step
4. Process quality	Describes the IPO model and how the quality of the process related to the process is maintained.
5. Quality criteria	Contains the quality criteria that should be used to assess the by AI provided output and developed scenarios
6. AI in the scenario planning process	Describes how the selected AI tool(s) can support the different steps of the scenario planning model

3.3 Prompt engineering

The prompts for this study are designed based on the potential role AI can fulfill in each step of the scenario planning process and the related goal of that step as described in appendix 2. For the formulation of the prompts that were use in the guide there is made use of the techniques described in the paper by Ekin (2023). While there are no specific criteria with which a “good” prompt should comply there is made use of the best practice iterative testing

and refining, since this is considered as one of the most effective ways to improve prompt engineering (Ekin, 2023). Moreover, the chain of thought of the prompts is used in order to get an understanding of the interpretation of the prompt by the selected AI tool(s). The chain of thought comprises a sequence of intermediary reasoning steps, articulated in natural language, that AI tool(s) take in order to provide the output. These chain of thoughts are reviewed in order to optimize the prompts to make sure it provides a response that matches the goal of its related step of the scenario planning process of Schwartz and the output quality criteria of Van der Merwe (2008). This chain-of-thought (CoT) prompt-engineering technique is considered as one of the best techniques to formulate a specific tailor made prompt that provides relevant output (Wei et al., 2022). Thereby, prompts were evaluated based on their provided output and chain of thought, after which the prompts were refined in order to engineer the best prompt that provides the best output according to the scenario criteria: relevance, challenging and plausible (Ekin, 2023; Van der Merwe, 2008).

The goal of the use of predefined prompts was to enhance the input quality of AI in the scenario planning process. According to the IPO model is the input quality considered a crucial aspect in order to ensure the process and output quality. The predefined prompts are used for this as a means to ensure and enhance the input quality of the scenario planning process in order to ensure a high-quality process and related output (Ilgen et al., 2005).

3.4 Data collection

The formulated guide was tested at a single case in the third phase, making this study a case study. The case study methodology is a potent and insightful approach employed by researchers to gain a comprehensive understanding and explore real-life phenomena within their natural contexts. A case study entails a thorough examination of one specific case or multiple cases (Yin, 2018). Case studies prove particularly valuable when researchers seek to investigate complex, multifaceted phenomena that are not easily explored using traditional experimental or quantitative methods (Stake, 1995). This research methodology adopts a holistic approach to acquire a deeper understanding of the case, its operations, and its interactions within its real-world contextual environment (Yin, 2018). According to literature a single-case study is a good way to get a deeper understanding of things, to test theories and to evaluate programs (Anderson, 1983; Baxter & Jack, 2008; Dyer & Wilkins, 1991; Pinfield, 1986). This methodology is particularly well-suited for exploratory research, theory building, and obtaining rich insights into specific cases or unique contexts (Stake, 1995; Yin, 2018).

The case study methodology is therefore considered a good fit for this study, as this study is of exploratory nature and tries to gain rich insights into the usefulness of the provided guide.

The case in this study is Nedap located in Groenlo, The Netherlands. The case study had the form of a one-morning workshop at Nedap in which the guide was tested by a total of 8 of Nedap's employees from different roles and different market segments, having different experiences and knowledge related to scenario planning and AI. Thereby, the guide was tested in a more diverse context providing insight in the quality, validity and in applicability in practice within different roles and different market segments. The reasoning behind this participant composition was the goal of the guide to be applicable by all, no matter the role, segment, experience or knowledge of the user. This participant composition allowed to test this goal and formulate required adjustments. For the workshop protocol see appendix 3. The researcher was present at the workshop but did not interfere making it a non-participant observation. The strength of this methodology is that the guide was tested without any insider knowledge, making it a good reflection of reality, and therefore preferred in this study. It is therefore expected that this methodology leads to most reliable insights (Morgan et al., 2017). Qualitative data in the form of notes is gathered during the observations, as taking notes is considered as an appropriate data gathering method during non-participating observations. The focus of the notes was on the reactions and behaviours of the users regarding the presented guide and its usefulness. It was expected that this information would provide rich insights in the strengths, weaknesses and usefulness of the guide provided in this study. This data was used to formulate implications regarding the guide and future research (Ciesielska et al., 2018).

Additionally, the workshop was video recorded which enabled the researcher to review and evaluate the workshop afterwards. Thereby potential important events that occurred during the workshop and were missed by the observer were still caught on the recording. Video recordings allow researcher to do more complex analysis of events. It was therefore expected that recording the workshop and analysation of this recording, would lead to more complete data which could be used to formulate implications regarding the guide and future research (Jewitt, 2012).

After this workshop an evaluation took place with the participants of the workshop in the form of a semi-structured group interview using open ended questions. Semi-structured

interviews is a type of qualitative research method used to gather information and insights from participants. In a semi-structured interview, the researcher follows a general outline or a set of predetermined questions but allows for flexibility and adaptability during the interview process. This methodology is suited to gather information about a persons' thoughts, behaviours and is a good tool to explore new issues in depth. Interviews were therefore considered as a good tool to gather evaluation input and was preferred over other methodologies such as surveys (Boyce & Neale, 2006).

The interview was performed at group level while this is less time consuming than the more traditional face-to-face interviews and therefore preferred by the case company. Group interviews have several advantages over individual face-to-face interviews while they are more efficient, since that group members stimulate each other to provide answers. Moreover, it is flexible, can stimulate new ideas and expands the depth and variation in responses or descriptions. However, it also presents disadvantages, as responses can be influenced by factors such as group size, the interviewees' perception of the interview's purpose, and variations in the backgrounds of group members. Moreover, individuals may be kept down and become biased rather than stimulated by the group.

In order to cope with these disadvantages, an individual interview sheet containing the interview questions and purpose was shared with the participants prior to the interview to provide them individual preparation time. By doing so, the participants were able to prepare their own personal answers to the interview questions without getting influenced by the group members. It was expected that this would lead to less biased responses and a better understanding of the purpose of the interview. Moreover, it was expected that the interview sheets would improve the validity and reliability of the provided responses since this allowed the participants more time to prepare their responses in an individual manner. Additionally, the interviewer took a more active role in order to ensure everybody's participation (Frey & Fontana, 1991). For individual interview sheet that was provided to the participants during the workshop see appendix 4.

For the design of the interview there is made use of the literature by Boyce & Neale (2006). The interview focused on the perceived quality of the scenario using the criteria of Van der Merwe (2008) which resulted from the literature review and on the quality of the guide and its guidelines which was evaluated on the criteria: quality, validity and in applicability in practice (Terrace, 2003).

According to the literature by Boyce & Neale (2006) questions should be open-ended rather than closed-ended and factual question should be asked before opinion questions (Boyce & Neale, 2006). They also listed a number of helpful probes which were included in the interview guide.

The interview questions are based on the example questions of Boyce & Neale (2006) combined with the criteria of Van der Merwe (2008) and the criteria of Terrace (2003). The use of this existing literature as the basis of the interview questions improved the reliability and validity of the interview (Roberts & Priest, 2006).
See appendix 5 for the interview guide.

The data collected with the interview, individual interview sheets, observations notes and individual notes was complemented with the logs of the conversation of the users with the selected AI tool(s).

3.5 Data analysis

For the first analysis of all the gathered data there is made use of excel. The data analysis was an iterative process with a focus on data relevant to the research question of this study. The interview recording is watched multiple times in order to extract all the data relevant to this study. Additionally, the individual interview sheets, observation notes and individual notes are also assessed multiple times in order to make sure all relevant data was included in the analysis. The relevant data and statements that resulted from the interview, individual interview sheets, observations and individual interview notes were placed in excel. Next, they were grouped based on their similarity in theme and relevance to the research question. Additionally, the conversation logs were analysed and compared with a focus on the by AI provided outputs in order to get insight in prompt interpretation, response consistency and response quality. Moreover, they were analysed and compared with a focus on extra by the user provided input and context in order to get an insight in the need for additional context and instructions to get more relevant output. Lastly, the conversation logs were used to find data to support the data and statements that resulted from the analysis of the interview, individual interview sheets, observations notes and individual notes. It was expected that combining all the gathered data would lead to more comprehensive insights. While At the

same time, these five different data gathering mechanisms contribute to the data triangulation in this study and, thereby, to the quality of this study (Carter et al., 2014).

All the gathered raw data was further analysed by using the Gioia method. The Gioia method is a good way to get from raw data to themes and eventually dimensions and was therefore considered a good fit for this study. This because the Gioia method is a systematic process of coding and categorizing qualitative data to derive meaningful themes and patterns. It is an often-used method in the analysis of interviews and field notes. This method helps researchers to gain a deeper understanding of qualitative data by systematically analyzing and interpreting the information. It provides a structured approach to derive meaningful insights and conclusions from qualitative data sources. Since this study focused on qualitative data and the Gioia method systematically helps researchers to gain a deeper understanding of qualitative data, this method was considered a good fit for analyzing the data gathered in this study (Gioia & Chittipeddi, 1991).

During the workshop there was a focus on data relevant to the research question: '*How can AI support the different steps of the scenario planning process in a way that it overcomes the scenario planning weaknesses and organizational struggle with AI, while maintaining the scenario quality?'.* The second part of the data analysis started reassessing the different types of gathered raw data in order to get familiar again with the gather data. In this 1st-order analysis the data relevant to the research question was coded. During the coding there was made use of excel to ensure it was done systematically. Thereby the codes and related quotations were placed in a tabled to create a structured overview. This initially resulted in 120 codes. The codes and related data are reviewed multiple times in order to ensure no data was missing. Throughout the reviews, particular emphasis was placed on identifying similarities and relevance among the data, while ensuring that the coding was mutually exclusive and collectively exhaustive. The final data structure that resulted from this process contained 37 1st-order concepts. These 1st-order concepts were then grouped based on their similarity and theme in the 2nd- order analysis into 2nd-order themes. The themes were named based on the similarities of their underlying 1st order concepts and related quotations. This resulted in 12 2nd-order themes. The 2nd-order themes are more theoretical abstract constructs based on the similarities of their underlying 1st order concepts and related quotations. Subsequently, these themes were clustered based on their similarities to create aggregate dimensions, resulting in a total of 5 aggregate dimensions. The aggregate dimensions are more theoretical abstract constructs based on the similarities of their underlying 2nd-order

themes with their underlying 1st order concepts and related quotations (Gioia & Chittipeddi, 1991). The final data structure can be found in the findings section.

4. Findings

This section contains the findings of this study including the formation of the guide and the results of the workshop.

4.1 Guide

The goal of this study was to provide a systematic guide that would help organizations adopt and leverage AI in the scenario planning process in order to overcome both the scenario planning weaknesses and organizational struggle regarding AI. While no specific literature on formulating a good guide lay-out resulted from the literature review, the guide lay-out is based on the expected information that is needed for a good guide on how to use the selected AI tools in the different steps of the scenario planning process. Therefore, the guide contains 6 different sections (see table 7). During the formation of the guide and its guidelines there was a focus the criteria: quality, validity and applicability in practice as described by Terrace (2003).

Table 7 Guide lay-out

Section	**Content**
1. Introduction	Introduction of the problem and the role the guide aims to fulfill
2. Artificial intelligence tool(s)	Description of Artificial intelligence (AI) and the selected AI tool(s) to give the user a good insight in how the tool(s) works
3. Scenario planning model	Describes the selected scenario planning model with an in-depth description of each step
4. Process quality	Describes the IPO model and how the quality of the process related to the process is maintained
5. Quality criteria	Contains the quality criteria that should be used to assess the by AI provided output and developed scenarios
6. AI in the scenario planning process	Describes how the selected AI tool(s) can support the different steps of the scenario planning model

Each section of the guide is discussed below in order to provide an insight in the formation process and it is content.

4.1.1 Introduction

For the introduction of guide there is made use of the introduction of this study combined with the related literature which resulted from the literature review. The introduction of the guide gives a comprehensive description of the relevance of the guide, the gap it aims to fulfill and thereby the goal of the guide. The relevance of the guide is based on the organizational struggle regarding AI adoption and leveraging, the need for scenario planning by organizations, which still contains several weaknesses and the potential role AI can fulfill in the scenario planning process overcoming both the struggles regarding AI and the scenario planning weaknesses. The goal of the introduction was to create an understanding and describe the relevance and goal of the related guide. The introduction of the guide is more concise, compared to the introduction of this study, according to the criteria "Keep it short" of Forsey (2022).

4.1.2 Artificial intelligence tools

The second section of the guide contains a description of artificial intelligence and a description of the selected AI tools. For the description of artificial intelligence there is made use of the literature that resulted from the literature review. For the description of the selected AI tools, these tools had to be selected first.

For the selection of the AI tools there is first made use of the scenario planning model of Schwartz in order to determine the role AI can fulfill in each step. Subsequently, the outcomes of this analysis were used to concentrate on a particular category of AI tools. The top AI tools that fell within this category and were considered relevant for this study were then selected and reviewed in depth, after which the best combination of AI tools was selected, used and described in the guide.

Role AI in the scenario planning process

For the determination of the role AI can fulfill in the scenario planning process there is made use of the goal of each step of the scenario planning process of Schwartz combined with literature on AI applications.

The results of the analysis of the scenario planning model of Schwartz and the role AI can fulfill in it are summarized in table 9.

See appendix 2 for the full analysis.

Table 9 Role AI in scenario planning model Schwartz

Step model Schwartz	**Goal step**	**Role AI**	**Output**
1. Identify focal issue or decision	Identify focal issues or decisions that require analysis, define the scope and timespan in which this will happen.	Supportive, generating mechanism, interactive brainstorm partner, inspiration	Potential issues or decisions relevant for the organization, with a related potential scope and timespan.
2. Identify key factors in the local environment which influence the decision	Identify key factors that might have a direct or indirect influence on the issue or decision	Supportive, generating mechanism, interactive brainstorm partner, inspiration	Potential key factors that might have a direct or indirect influence on the in step 1 selected issue or decision
3. Identify driving forces that influence key factors in the local environment	Identify the driving forces and their potential development directions that influence the key factors identified in step 2	Supportive, generating mechanism, interactive brainstorm partner, inspiration	Potential driving forces that influence the key factors identified in step 2, with potential development directions of the identified driving forces.
4. Rank by importance and uncertainty	Assess and rank key factors and driving forces based-on importance and uncertainty	Supportive, generating mechanism, interactive brainstorm partner, inspiration	Critical reflection regarding the importance and uncertainty of the identified kay factors and driving forces. Ranking of the identified key factors and driving forces based this critical reflection. Insights with regard to the influence of the key factor or driving forces on the focal issue and the unpredictability of the factor or driving force. Potential internal predetermined elements and critical uncertainties related to the in step 3 identified driving forces
5. Select scenario logics	Determine which futures are worth developing as detailed scenarios	Supportive, generating mechanism, interactive brainstorm partner, inspiration	Potential scenario logics or themes based on the in step 4 identified top 2 driving forces/factors. A list of potential scenario logics or themes based on these combinations.
6. Flesh out scenarios	Develop scenarios into consistent scenarios that provide a comprehensive picture of the potential future	Supportive, generating mechanism, interactive brainstorm partner, inspiration	Specific scenarios based on the combination of the results of the previous step. Visualized scenario by generating an image of the potential future based on the previously by AI generated textual scenario.
7. Formulate implications	Formulate implications based on the developed scenarios	Supportive, generating mechanism, interactive brainstorm partner, inspiration	Potential implications and its consequences based on the developed scenarios.
8. Select the leading indicators and signposts	Identify leading indicators and signposts that can be monitored to track the progress of each scenario.	Supportive, generating mechanism, interactive brainstorm partner, inspiration	Potential indicators and signpost that have to be monitored in order to track the progress of each scenario. Potential strategies for the organization to cope with changes in these indicators or signposts.

Based on the results of this analysis there can be concluded that AI will function as an interactive brainstorm partner that generates (new) information which will lead to insights and can be used as an inspiration in the decision-making process. Thereby, AI will fulfill a supportive role in the scenario planning process.

This study therefore focused on generative artificial intelligence since generative AI can autonomously produce new content, resembling human-generated data. These systems learn patterns from large datasets and generate novel outputs, such as text, images, or video, that decision makers can use in the decision-making process. Generative AI is therefore considered the best fit to the previous identified supportive role that AI will fulfill in the scenario planning process. Moreover, generative artificial intelligence has already shown to be a good fit for scenario development (Fui-Hoon Nah et al., 2023; Spaniol & Rowland, 2023).

While the goal of scenario planning model of Schwartz (1996) is to develop textual scenarios, there was a focus a generative AI tools that generate text as output, also known as large langue models. Additionally, AI has the ability to visualize text by generating images, which can be used to support step 6 of the scenario planning process. Therefore, AI image generators were also reviewed in order to determine its relevance to this study.

Selection AI tools

For the collection of generative AI tools relevant for this study there is made use of the top 10 generative AI tools by AI Magazine (2023), which is an official publication of the Association for the Advancement of Artificial Intelligence (AAAI). The artificial intelligence tools relevant for this study that resulted from the top 10 generative AI tools by AI Magazine (2023) are evaluated on the criteria: training data, timeliness of the data, flexibility, ease-of-use, ethical AI, and costs, which resulted from the literature review (Taulli, 2021).

The results of this review are summarized below and in table 10 and 11. For the full review and selection process see appendix 6.

Based on the review of the different AI tools there can be concluded that every tool has its own strengths and weaknesses and not one tool is a perfect fit. First looking at the large language models, there are 4 possibilities: Bard, Bing Chat, ChatGPT and ChatGPT Plus.

The free version of ChatGPT does not have access to real time data which makes it unable to provide information about data that originates after January 2022. Thereby, ChatGPT scored lower on the criteria timeliness of the data compared to the other tools. Additionally, this free version can just provide output in the form of text and code which makes its use cases and thereby its flexibility more limited compared to the other 3 large language models and therefore a lesser fit for this study (OpenAI, 2023).

Bard can provide output in the form of images but uses images from the web instead of generating own images based on the user's needs, this lowers the potential use cases and thereby the flexibility compared to ChatGPT Plus and Bing Chat. Additionally, these images from the web are not suited for commercial use which also lowers the use cases and flexibility of the tool. Therefore, an additional AI image generator is a must in order to visualize the generated scenario text. This requires extra user efforts and thereby lowers the ease-of-use since it requires a second tool in a new interface rather than working in one interface like with ChatGPT Plus and Bing Chat (Bard.google, n.d.; Microsoft, n.d.; OpenAI, n.d.).

Bard also tends to hallucinate a lot and thereby often provide false answers. Additionally, it does not save chat history which makes it unable to go back to provided output at a later moment in time. Bard also has a token limit of just 1000 tokens which makes it less suited for larger data inputs. These factors also lower the flexibility and ease-of-use of the tool. This combined with ethical concerns related to Bard makes the tool less suited compared to Bing Chat and ChatGPT Plus (Bard.google, n.d.; Microsoft, n.d.; OpenAI, n.d.).

Bing Chat and ChatGPT Plus have a lot of similarities while they both make use of DALLE-3 for image generation, which enables users to do work in one interface for both text and image generation. Thereby these tools score higher on the criteria ease-of-use and flexibility. Moreover, they are both based on the GPT-4 model and both have access to real time data. Therefore, they also scored higher on timeliness of the data (Microsoft, n.d.; OpenAI, n.d.).

However, there are some key differences since Bing Chat has the ability to suggests related follow-up questions and in-text footnotes/links & learn more links whereas ChatGPT Plus does not. Additionally, Bing Chat offers their users 3 different conversation styles whereas ChatGPT Plus does not (Microsoft, n.d.; OpenAI, n.d.).

However, ChatGPT offers its users additional plugins which offer extra functions and use cases and thereby positively contributes to the flexibility of the tool. Moreover, ChatGPT Plus automatically generates prompts for DALLE-3 based on the by the tool provided output in order to visualize the text in the best way, which lowers the needed user effort and thereby positively contributes to the ease-of-use. ChatGPT also allows users to set custom preferences which the tool will consider when providing the output, whereas Bing Chat does not. This allows users of ChatGPT Plus to provide the tool with context to get more relevant output (Microsoft, n.d.; OpenAI, n.d.).

Bing Chat has lower helpfulness and trustworthiness scores than ChatGPT and the by the tool provided outputs are perceived as of poor quality not being better than responses of a standard search engine. Although Bing Chat offers additional functions such as the suggested follow up questions, that should lower the effort needed to use the tool, these additional functions are often imperfectly executed, limiting the user instead of helping them. Thereby Bing Chat scores lower on ease-of-use compared to ChatGPT Plus (Niels Norman Group, 2023). ChatGPT Plus also has a higher token limit and higher request limit, which makes the tool more flexible. This combined with the previous mentioned higher flexibility and additional functions of ChatGPT plus that lower the needed user effort makes ChatGPT Plus the best fit for the scenario planning process and therefore for this study (OpenAI, n.d.).

Looking at the AI image generators there are again similarities while both DALLE-3 and Adobe Firefly image generator generate new unique content. However, there are some key differences, since Adobe Firefly image 2 is based on copyright free content only and it is unknown whether the tool has web access which limits the use cases and thereby flexibility since the tool might not know about most recent developments. On the other hand, DALL-E 3 does have web access which makes it able to also create content related to most recent developments. Moreover, DALL-E 3 is integrated in ChatGPT Plus which allows users to work in the same interface and thereby requires less user effort and positively contributes to the ease of use. On the contrary, Adobe Firefly is a separate tool which requires the users to work in a second interface which lowers the ease of use (Adobe, n.d.; OpenAI, n.d.).

Adobe Firefly image 2 does provide its users with prompt suggestion. However, DALL-E 3 excels in this while ChatGPT Plus will generate specific detailed prompts for DALL·E 3 to

bring the ideas of the users to life. Therefore, DALL-E 3 scores better on ease of use compared to Adobe Fire fly image 2.
Additionally, the free version of Adobe Firefly watermarks its images and has a limit of 25 generations each month. The Plus version does not watermark however does still have a limit of 100 generations each month, while DALLE-3 like ChatGPT Plus just has a limit of 50 generations every 3 hours. The higher generation limit of DALLE-3 makes the tool also more flexible compared to Adobe Firefly.
Adobe Firefly might be better from an ethical point of view, however, DALLE-3 contains a safety feature that should minimize any ethical concerns related to the tool (Adobe, n.d.; OpenAI, n.d.).

While DALLE-3 is integrated in the same interface as ChatGPT Plus, it has access to real time data, uses the by ChatGPT generated prompts to visualize text in the best way, and has a higher generation limit this AI image generator is considered the best fit for this study.

Table 10 Results review AI tools - large language models

	Training data	Timeliness data	Ease-of-use	Flexibility	Ethical AI	Cost	Total score
ChatGPT	+	-	--	-	+	+	--
Bard	++	+	-	-	-	+	-
Bing Chat	-	+	+	+	+	+	+
ChatGPT Plus	+	+	++	++	+	-	++

--= insufficient, -=mediocre, +=sufficient, ++=good

Table 11 Results review AI tools - AI image generators

	Training data	Timeliness data	Ease-of-use	Flexibility	Ethical AI	Cost	Total score
DALLE-3	x	++	++	++	+	-	++
Adobe Firefly image 2	x	-	+	+	++	+	+

--= insufficient, -=mediocre, +=sufficient, ++=good

4.1.3 Scenario planning process

The third section of the guide presents a detailed description of Schwartz's scenario planning process, drawing upon Schwartz's (1996) literature as identified in the literature review. This section offers an overview of each step in Schwartz's process, including the expected output and the goal associated with that step. This approach enables the user to gain an understanding of the process and what is expected in each related step.

4.1.4 Process quality control

The fourth section of the guide describes the IPO model which resulted from the literature review in order to ensure process quality. Therefore, the three components of the IPO model are specified to the guide and the related process in order to ensure the process quality and inform the user how to maintain it. The literature on the IPO model that resulted from the literature review is used to do so. This resulted in using fixed prompts to ensure input quality, using the guide to ensure process quality and using quality criteria to ensure output quality.

4.1.5 Output evaluation

The fifth section of the guide describes the three output quality criteria by van der Merwe (2008) which resulted from the literature review. These criteria, relevance, challenging and plausibility, should be used to assess the by AI provided outputs and scenarios. Each criterium is explained in a manner that facilitates practical application, in order to comply with the guide criterium ‘applicability in practice’ by Terrace (2003).

4.1.6 AI in the scenario planning process

The sixth and final section of the guide contains an in-depth description how the selected AI tools can support the different steps of the scenario planning model of Schwartz. This section is split up into the 8 steps of the scenario planning process. For each step is described how the selected AI tools can fulfill the previous identified role related to that step, in order to reach the related goal. For this there is made use of so-called prompts which form the inputs for the selected AI tools, ChatGPT and DALLE-3. A prompt refers to a form of interaction between a human and a large language model, facilitating the generation of the desired output by the model. These prompts can have the form of a question, text, code snippets or examples. In this case, a prompt is a phrase or instruction users give ChatGPT or DALLE-3 to generate a response (TechTarget, 2023).

Prompt engineering entails the process of designing, refining, and optimizing prompts to effectively communicate the user's intentions to a language model such as ChatGPT. It is essential for obtaining accurate, relevant, and coherent output from ChatGPT. As ChatGPT evolves, proficient prompt engineering becomes increasingly critical for users to leverage ChatGPT to its maximum capacity and achieve optimal results (Ekin, 2023).

Prompts are the primary means of communication between the users and ChatGPT. While the prompt its quality directly affects the quality of the by ChatGPT provided output, it makes understanding how to engineer good prompts a crucial aspect for effective use of ChatGPT. In order to engineer prompts in the most effective way there are some techniques and best practices that should be considered (Ekin, 2023).

For the formulation of the prompts that were used in the guide there is made use of the techniques described in the paper by Ekin (2023). While there are no specific criteria with which a “good” prompt should comply there is made use of the best practice iterative testing and refining, since this is considered as one of the most effective ways to improve prompt engineering (Ekin, 2023). Moreover, the chain of thought of the prompts is used in order to get an understanding of the interpretation of the prompt by the selected AI tools. The chain of thought comprises a sequence of intermediary reasoning steps, articulated in natural language, that AI tools take in order to provide the output. These chain of thoughts are reviewed in order to optimize the prompts to make sure it provides a response that matches the goal of its related step of the scenario planning process of Schwartz and the output quality criteria of Van der Merwe (2008). This chain-of-thought (CoT) prompt-engineering technique is considered as one of the best techniques to formulate a specific tailor made prompt that provides relevant output (Wei et al., 2022).

The prompts were tested by putting them into the selected AI tools. Next, the prompts were evaluated based on the provided output and CoT, after which the prompts were refined in order to engineer the best prompt that provides the best output according to the goal of the related step of the scenario planning model and the scenario criteria: relevance, challenging and plausible (Ekin, 2023; Van der Merwe, 2008). This was an iterative process.

The custom instructions of ChatGPT were first set up by using the CoT prompt-engineering technique, while this forms the basis for the rest of the conversation. Custom instructions

enable users to incorporate preferences or requirements that they want ChatGPT to take into account when generating responses. The model will consistently consider these instructions with each response, lowering the user effort by taking their preferences or information into account in every conversation. Users can hereby provide ChatGPT with extra context related to their questions. This is considered highly relevant to this study since it can also be used to add organizational information and thereby provide organizational context. The by the tool provided outputs will be then based on this set organizational information (OpenAI, 2023).
Next the prompts related to each step were set up according to the CoT prompt-engineering technique and taking into account the related goal of the step and the quality criteria by van der Merwe (2008).
For the custom instructions and prompts related to each step of the scenario planning process see appendix 7.

For a preview of guidelines as described in the guide see figure 4.
For the full guide see appendix 8.

1. **Identify key factors in the local environment which influence the selected focal issue(s) or decisions. Therefore, put the following prompt in the text box:**

Identify and analyze the key external factors from the local organizational environment that directly or indirectly influence our chosen focal issues: [Selected focal issues]. In your analysis, clearly distinguish between micro factors (specific to our direct organizational environment) and meso factors (related to the broader industry and market context) for each focal issue. Additionally, consider the interplay among the focal issues. Provide a structured breakdown for each focal issue, citing current and relevant examples specific to [specify industry or market segment]. This analysis should inform our scenario planning by elucidating these influences and proposing potential strategies to either leverage or mitigate them. Focus on incorporating recent trends and up-to-date data to ensure that the analysis is both current and actionable. Finally, create a summarized overview table of each selected focal issue alongside its related micro and meso external factors.

2. **Fill the brackets [] with the focal issues (name) you selected**
3. **Fill the brackets [] with the industry or market segment you want to focus on**
4. **Click on** 
5. **Critically evaluate the identified external factors from the local environment based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:**
   - *Please elaborate [specify external factor].*
   - *Please include [specify external factor] in your answer.*
   - *Make the external factors more [e.g. financially focused].*
6. (Not required) **copy the provided summarized overview table to the Word document in order to create an overview.**

Figure 4 Guide preview

4.2 Case study results

The workshop results are split up in the different aggregate dimensions, that resulted from the data analysis according to the Gioia method. For the full data structure including the 1st-order concepts, 2nd-order themes and aggregate dimensions that resulted from the Gioia method see figure 5. The findings are used to create a dynamic model based on the identified aggregate dimensions.

1st-order concepts	2nd-order themes	Agreggate dimensions
AI as supportive tool	AI as brainstorm partner	Augmented Humans
AI as infrormation gathering mechanism		
AI as collaborative partner		
AI as a non-replacement for human oversight		
User as a multifaceted operator	Human aspect	
User as director and controller		
User as the critical evaluator		
Strategic human involvement		
Analytical and interpretative user focus		
AI's inconsistency and interpretation challenges	Cognitive limitations	Technical shortcomings
AI's limited creativity and connection-making		
AI being prone to bias		
AI being compliant to the user	Limited critical thinking	
AI not being able to challenge the by the user provided input		
Understanding of AI's boundaries is required	Critical knowledge	Success factors
Understanding of the methods and reasons behind actions is required		
Knowledge for assessing AI output is required		
Having a clear focus is required		
Clarity and detail in AI instructions	Input requirements	
High quality AI inputs		
Necessity for Collaborative Expertise	Collaborative enhancement	
Guide is clear and applicable	Guide usability	Guide effectiveness
Guide is to extensive		
Guide contained good predefined prompts		
Iterative process design	Practical improvements	
User role clarity and self-sufficiency		
Contextual adaptability in prompts		
Enhanced guide usability		
Limited specificity and creativity of AI output	AI response precision	AI performance and impact
Utility and Distinctiveness of AI output		
Information management in AI output		
AI output quality and structure	AI output effectiveness	
AI output relevance and novelty		
AI output engagement and argumentation		
AI output applicability		
Influence of AI on user behavior	AI-Driven process dynamics	
Efficiency and effectiveness of AI integration		

Figure 5 Final data structure according to the Gioia method

4.2.1 Augmented Humans

The aggregate dimension "Augmented Humans" encompasses the collaboration between humans and artificial intelligence within the scenario planning process. This dimension includes two 2nd-order themes: "AI as a brainstorming partner" and "Human aspect". Both themes resulted from the identified 1st-order concepts.

During the workshop the participants collaborated with the selected AI tools in order to go through the scenario planning process. The gathered data shows that the participants have different perceptions of the role that AI fulfils in the scenario planning process. According to one of the participants AI just functions as a data provider while another states "*AI does similar work as consultants*". This participant even stated "*Consultants will take a month for the work that AI just did in a few hours, however you can't outsource it to AI.*" The other participants agreed that it is not possible to fully outsource the process to AI. These statements indicate that AI cannot replace humans. Based on these statements was the 1st-order concept "AI as a non-replacement for human oversight" formulated.

Another participant indicated the usage of AI as inspirational tool by stating "*AI can provide a good starting point for a discussion for which it can produce input*". This statement was complemented by another participant, stating "*AI provides a baseline that can be used for sparring with the team*". These statements both indicate that the tool can be used to provide inspirational answers that can be used to create a baseline for a discussion with the team. Moreover, another participant stated "*AI is really good at gathering all the information for you*". All these statements indicate that AI functions as a data gathering mechanism. Based on this similarity between these statements was the 1st-order concept "AI as information gathering mechanism" formulated.

Additionally, one participant referred to AI as "*a sparring partner that is always available*" on his individual interview sheet. Three other participants agreed with this since they also referred to AI as a "*partner*" on their individual interview sheets, indicating the partner role that AI fulfills in the process. Based on these statements was the 1st-order concept "AI as collaborative partner" formulated.

While there were some different views on the specific role AI fulfilled, all participants did agree during the interview and on their individual interview sheets that AI is a supportive tool in the scenario planning process. Based on these similarities between these findings and related quotations was the 1st-order concept "AI as supportive tool" formulated.

According to the combination of all the gathered data, AI functions as a partner to its user and can help them create a baseline by gathering data, providing inspirational answers and insights including the related argumentation. Thereby AI fulfills a supportive role while the process can't be outsourced to AI. These findings indicate that AI functions as brainstorm partner in the scenario planning process and thereby support the (human) user. These findings and their related 1st-order concepts were used to formulate the 2nd order-theme "AI as brainstorm partner".

While the users are leading in the process, they should also fulfill a specific role in order to reach the desired outcome. According to one of the participants "*Humans have to guide the tool with very specific guidelines in order to ensure that AI provides relevant outputs*" another participant complemented this by stating "*Humans also have to critically evaluate the provided output to ensure its relevance*". Additionally, a participant stated "*while AI provides you the information, the user should extra critically evaluate this information to see if it is correc*t". These statements indicate the role of humans to provide the tool with clear instructions and to critically evaluate the provided outputs. These findings indicate that the users should fulfill different role simultaneously since they have to provide AI with instruction and also have to evaluate the by AI provided output. Based on these findings were the 1st-order concepts "User as a multifaceted operator", "User as director and controller" and "User as the critical evaluator" formulated.

Additionally, the conversation logs with the selected AI tools indicated that the users also have to provide the tool(s) specific organizational context in order to get better responses. Especially in step 1, the selection of the focal issue(s), was a lot of additional organizational information required. An example of additional organizational context provided by a participant is "*Please note that Nedap Retail develops technology for fashion retailers as a SaaS solution.*". This organizational context was later complemented with "*our SaaS solution provides technology for fashion retailers. RFID is a technology that is heavily used within our product.*". Another example of providing the tool(s) with extra organizational context is "*It*

appears that you consider Nedap to be a food production company but in fact Nedap is a technology provider to the industry.". The conversations logs showed that all of the participants provided the tool extra organizational context during their collaboration with AI in the scenario planning process. This indicates that providing the tool with organizational context is also considered part of the human role in collaborating with AI in the scenario planning process. These statements were also used to formulate the 1st order concept "User as director and controller".

Moreover, the participants did agree that the humans remain a must in the process as one of the participants stated *"humans are leading and should guide the tool in a certain direction in order for it to work properly"*. This statement was supported by another participant that stated "*Humans are a must in the scenario planning process*". The other participants agreed with these statements. Based on these statements was the 1st-order concept "Strategic human involvement" formulated.

Based on the data it is evidence that the participants agree that humans should fulfill the role in which they guide the tool with clear instructions and organizational context, additionally they agreed on the fact that humans should critically evaluate the by AI provided output. Thereby, humans should fulfill different roles in order to properly collaborate with AI in the scenario planning process. However, user should have a higher focus on data interpretation instead of collecting and structuring, while AI will do this for you. This allows the users to fulfill a more specific role as a result of the inclusion of AI in the scenario planning process. These findings and their related 1st-order concepts were used to formulate the 2nd order-theme "Human aspect".

4.2.2 Technical shortcomings

The aggregate dimension "Technical shortcomings" entails the technical shortcomings of AI that resulted from the application of AI in the scenario planning process during the workshop. This dimension includes two main themes: "Cognitive limitations" and "Limited critical thinking". Both themes resulted from the identified 1st-order concepts.

The results of the workshops indicated that AI had some technical shortcomings which negatively influenced the scenario planning process. The participants had the feeling that AI did not produce new information. One of the participants even rose the question "*Is AI*

actually capable to project trends into the future or is repeating information that it was trained on/found online?" he supported this question by his statements "*the tool didn't create new cross connections that we wouldn't have found/thought of ourselves*". Another participant responded to this "*I think AI is not really reasoning as it just repeats what it sees on the internet*". This data indicated that according to the users AI does not create new connections but just repeats what it finds online. Based on these statements was the 1st-order concept "AI's limited creativity and connection-making" formulated.

During this discussion another participant asked "*I wonder if we make it worse if we add context?*". One of the participants responded to this by stating "*I mentioned the pandemic to the tool, and it just adds it the list instead of critically challenging my input*". This indicated the tool is prone to bias, while providing AI with information makes the tool biased as it just assumes the information is correct.

AI being prone to bias was supported by the conversation logs in which ChatGPT was instructed "*Can you give me another revised analysis, expanded with the following meso factor trends for focal issue 3: firstly the availability of off-the-shelf and open source AI solutions that can be integrated with and secondly trends in expectations for convenience of workplace solutions.*". Instead of critically challenging the instruction ChatGPT just added the two by the user formulated meso factors. Another user wasn't satisfied with the by AI provided ranking and therefore provided the tool with the following instruction: "*Thank you, I was expecting that there is a difference in ranking related to the market focus, eg. markets of physical access control for organizations that require maximum security, organizations that are spread over multiple locations but lean more towards convenience than security or organizations that work from standard office buildings. Can you regenerate your answer taking this into consideration?*". Instead of challenging this instruction, AI just regenerated the ranking taking this instruction into account. The analysis of the conversations logs thereby indicated that AI is complaint to its users and that providing AI with information makes the tool biased. This was also discussed during the previous mentioned conversation about AI as consultant, in which one of the participants critically responded, to the statement about AI functioning as consultant, "*However, AI does not critically challenge you like consultants do*". Additionally, one of the participants stated "*the tool needs to be more stubborn*" with which the others agreed. Based on these statements were the 1st order concepts "AI being prone to bias", "AI being compliant to the user" and "AI not being able to challenge the by the user provided input" formulated.

Another technical shortcoming that resulted from the workshop was AI often misinterpreting information. In the conversation logs of one of the participants there was a focus on the retail segment of Nedap. However, the tool interpreted this as Nedap being a retailer. Therefore, the participant had to correct the tool with the prompt ” *Please note that Nedap Retail develops technology for fashion retailers*”. Another participant had a similar problem where AI thought Nedap to be a food production company, while in reality it is a technology provider to the food production industry. Therefore, the participant had to correct the tool with the prompt “*it appears that you consider Nedap to be a food production company but in fact Nedap is a technology provider to the industry. So, as an example, local climate conditions are a micro factor to Nedap's clients but not to Nedap. Could you reformulate?*”. These findings indicate the tool misinterpreting information and also emphasize the importance of the earlier mentioned role of humans to critically evaluate the by AI provided output.
Additionally, AI misinterpreted some of the prompts or interprets the same prompt in different ways while the analysis of the conversation logs indicated that AI did not always create the 2-by-2 matrix or visualization prompts correctly. Thereby the non-consistent interpretation of a prompt is also considered a technical shortcoming. These findings were therefore used to formulate the 1st-order concept “AI’s inconsistency and interpretation challenges”.

4.2.3 Success factors

The aggregate dimension "Success factors" encompasses factors that resulted from the workshop and that are considered critical in order to work with AI in an efficient manner. This dimension includes three main themes: " Critical knowledge", " Input requirements" and “Collaborative enhancement”. The themes resulted from the identified 1st-order concepts.

During the workshop some critical factors such as critical knowledge, input requirements and collaborative enhancement came to light. The participants were asked what they see as critical success factors for reaching a high-quality outcome with AI in the scenario planning process. According to the individual interview sheets critical success factors are having a sparrings partner, having a clear focus, having high quality prompts, provide the tool with additional context and provide the tool with clear instructions.

Additionally, one of the participants stated "*as a user you should know the boundaries of the tool and how AI can fit in the process*" he later added to this statement "*you should also know how and why you do what you do in order to understand what role AI can play in the process*". The other participants agreed with this and therefore the 1st- order concepts "Understanding of AI's boundaries is required" and "Understanding of the methods and reasons behind actions is required" were formulated.
Another participant later stated "*in order to ensure the relevance of the AI provided output you also need to have knowledge in that to understand it*". This was supported by the fact that all the participants reported that they evaluated the relevance of the by AI provided output based on their own knowledge and thereby struggled with this. Therefore, the 1st-order concept "Knowledge for assessing AI output is required" was formulated. Based on these 1st-order concepts combined with the 1-st order concept "Having a clear focus is required" which resulted from the individual interview sheets, was the 2nd-order theme "Critical knowledge" formulated.

One of the other participants stated "*it is too intensive to do alone, while I could just focus on certain aspects from my expertise. Therefore you need an expert team containing members with different expertise*." Another participant complemented this by stating "*I also think it is too intensive to do alone since it provides a lot of information and therefore I need a sparring partner to discuss the provided output.*" The other participants agreed with these statements. Moreover, this also resulted from the observation during which different participants discussed the need for a sparring partner because of the information overflow created by the responses of AI. Based on these statements, the individual interview sheets and the observation notes was the 1st-order concept "Necessity for Collaborative Expertise" and related 2nd order theme "Collaborative enhancement" formulated.

The quality of the prompts was also mentioned as critical factors by two of the participants during the interview. Since this was also mentioned multiple times on the individual interview sheets, this was also transformed in a 1st-order concept as "High quality AI inputs".
Lastly one participant added context as critical factor. He stated *"I think the additional context is also required in order for AI to provide relevant answers*". This is statement was supported by the other participants and also supported by the conversation logs which showed that all the participants provided AI with additional organizational context in order to make its responses more relevant for the organization. Based on this was the 1st-order concept "Clarity

and detail in AI instructions" formulated. Combining these two concepts resulted in the 2nd order theme "Input requirements".

4.2.4 Guide effectiveness

The aggregate dimension "Guide effectiveness" entails feedback that resulted from the workshop, related to the in this study formulated guide. This dimension includes two 2nd-order themes: "Guide usability" and "Practical improvements". The themes resulted from the identified 1st-order concepts.

During the workshop, the participants worked with the guide that is formulated as part of this study. The gathered data shows that the participants were very positive about the guide, while according to the data gathered with the interview sheets it scored an 8 on quality and a 9 on applicability. These scores were supported by several statements, such as "*the guide is good, clear and applicable, it took us through the process*" and "*good predefined prompts*", with which all of the participants agreed. This was also supported by the data gathered by the individual interview sheets on which the guide was referred to as "*clear and usable*" by several participants. Moreover, several participants found it easy to copy and paste the prompts and found the guide well structured. This was also evident during the observation while there were a few to none questions related to how to use the guide, showing the clear and applicable nature. Based on these findings were the 1st-order concepts "Guide is clear and applicable" and "Guide contained good predefined prompts" formulated.

However, there were some practical improvements as one of the participants stated "*it is sometimes hard to know where you are in the process, therefore add a visual reading guide at the top of each page that shows what step you are currently working on*." Additionally, another participant stated "*it was sometimes a bit too much information, try to make the reoccurring steps iterative*". These statements were supported by the data gathered with the individual interview sheets where the reading guide was mentioned twice. Moreover, making reoccurring steps iterative was also mentioned twice. These statements and the data gather with the individual interview sheet, were used to formulate the 1st-order concepts "Enhanced guide usability" and "Iterative process design".

Additionally, the users were asked what they missed in the guide/are recommendations for the guide. One of the participants stated "*I would like to know, how to make a good prompt*

yourself in case I want to make adjustments to the provided responses". Another participant stated "*I would like to have some evaluation questions that I can use to review the provided output, the check that I did right now was pure on feeling and my own knowledge*." Moreover, two participants mentioned they would like to have a section that describes the expectations of the human in each step of the process. One participant complemented this by stating "*you can split up the page vertically with one half describing the prompts for AI and the other describing the role plus expectations of the humans*". These statements were also supported by the data gathered with the individual interview sheets, since all these aspects were mentioned there as well. Based on these statements and the data gather with the interview sheets was the 1st-order concept "User role clarity and self-sufficiency" formulated.

Lastly, multiple participants mentioned that the output later on in the process became more general, due to missing variables in the prompts that can be used to add specific organizational information or due to the length of the prompt which made it harder for AI to interpret all aspects. This was also supported by the data gathered with the conversation logs which displayed responses related to prompts early in the process, which were both shorter and contained variables were more specific to the organization than responses to prompts later in the process, which were longer and did not contain adjustable variables. Based on these findings was the 1st-order concept "Contextual adaptability in prompts" formulated.

4.2.5 AI performance and impact

The aggregate dimension "AI performance and impact" entails the results of AI's performance and impact due to its inclusion in the scenario planning process. This dimension includes the 2nd-order themes: "AI response precision", "AI output effectiveness" and "AI-Driven process dynamics". The themes resulted from the identified 1st-order concepts.

During the workshop the focus was on the scenario planning process with AI and thereby on scenario development by using AI. The gathered data indicated that AI influenced this process and the scenario development in several ways. Firstly, AI's output precision influenced the scenario development while participants often mentioned in both the interview and on the interview sheets that the provided output was too broad/generic. This also resulted from the analysis of the conversation logs which showed a lot of overlap between the different conversations indicating the generic nature of the by AI provided output. Due to this broad nature, it became harder to specify the provided output as one of the participants stated "*the*

output is sometimes so generic that it's hard to specify it and to get data to support it". Additionally, AI was not seen as being creative while one of the participants stated "*in terms of creativeness it is probably not that good, in terms of completeness it was pretty good*" one participant complemented this by stating "*all the information about trends was information that we already know for years, so it's not really providing new information*". These statements were supported by the data gathered with the individual sheets since one participant stated "*the output is complete however, not very unique, precise or disruptive*". Additionally, AI provides their user with too much information. As previously mentioned during the observation a discussion occurred about AI providing too much information leading to an information overflow which made it harder for the users to critically evaluate the provided output. These data and statements were used to formulated the 1st-order concepts "Limited specificity and creativity of AI output", "Utility and Distinctiveness of AI output" and "Information management in AI output". These 1st-order concepts were then used to formulate the 2nd-order theme "AI response precision".

AI's output quality also influenced the scenario development in a certain way while the output should meet the criteria of challenging, relevant and plausible. According to the interview sheets, AI scored a 7 on quality, a 7 on plausibility and a 7 on challenging. Additionally, the interview and individual interview sheets contained several statements regarding the output quality as one participant stated "*the output is mostly relevant however mainly due to its general nature, additionally it does sometimes provide information that is not relevant at all*". Other participants agreed with this with one of the participants stating "*I had the same experience and struggled with finding the right level of abstraction*". The participants also struggled with assessing the plausibility while they didn't search for additional data to support it but based their assessment on their own knowledge. However once again the general nature of the responses was mentioned in relation to the plausibility since one participant stated "*I think the likelihood of the output is high, however mainly due to its general nature*". Regarding the criterium challenging there were different perspectives as one participant stated *"AI provides new topics from different angles*" while another stated "*the output is not really challenging while I already have certain knowledge and experience in the field leading to certain expectations*". All the participants did agree with AI providing good, structured and excessive output and argumentation. However as previously mentioned this led to an information overflow for some participants. These data and statements were used to formulated the 1st-order concepts "AI output quality and structure", "AI output relevance and

novelty", "AI output engagement and argumentation" and "AI output applicability". These 1st-order concepts were then used to formulate the 2nd-order theme "AI output effectiveness".

Lastly the process of scenario development was influenced in several ways by the inclusion of AI and thereby also influenced the scenario development. While all of the participants stated on their interview sheet and thereby agreed that the human role changed. As previously mentioned, humans could fulfill a more specific/different role since AI takes over the information gathering which is normally being done by humans. One of the participants even stated "*due to the inclusion of AI there is a tendency to become lazy since it does a lot of the work for you*". This was complemented by another participant that stated *"I had the feeling that I became more reliant on AI while it took over a part of the work*". However, the participants concluded that AI enhances the scenario planning process rather than hindering it, as one of the participants stated "*AI speeds up the process*" and another participant stated "*AI makes the process more efficient*". However, one participant stated "*the further in the process it became harder to provide the tool with relevant feedback. I didn't know where to make adjustments in order to get a better fitting response. I had the feeling I was already so far with the process that I just continued*". This statement indicated that it becomes harder to correct AI when the process is longer. These data and statements were used to formulated the 1st-order concepts "Influence of AI on user behavior" and "Efficiency and effectiveness of AI integration". These 1st-order concepts were then used to formulate the 2nd-order theme "AI-Driven process dynamics".

4.2.6 Dynamic model

Based on these findings the dynamic model emerged in which there is a positive relation between augmented humans and AI performance and impact. This relation is negatively moderated by the technical shortcoming while these limit the usefulness of AI. On the other hand, the guide effectiveness positively moderates the relation between augmented humans and AI performance and impact, while it helps the users adopt and leverage AI in the scenario planning process in a systematic way. The critical factors also moderate the relation between augmented humans and AI performance and impact both positive and negative while it depends on the extend of meeting these factors. See figure 5 for the dynamic model.

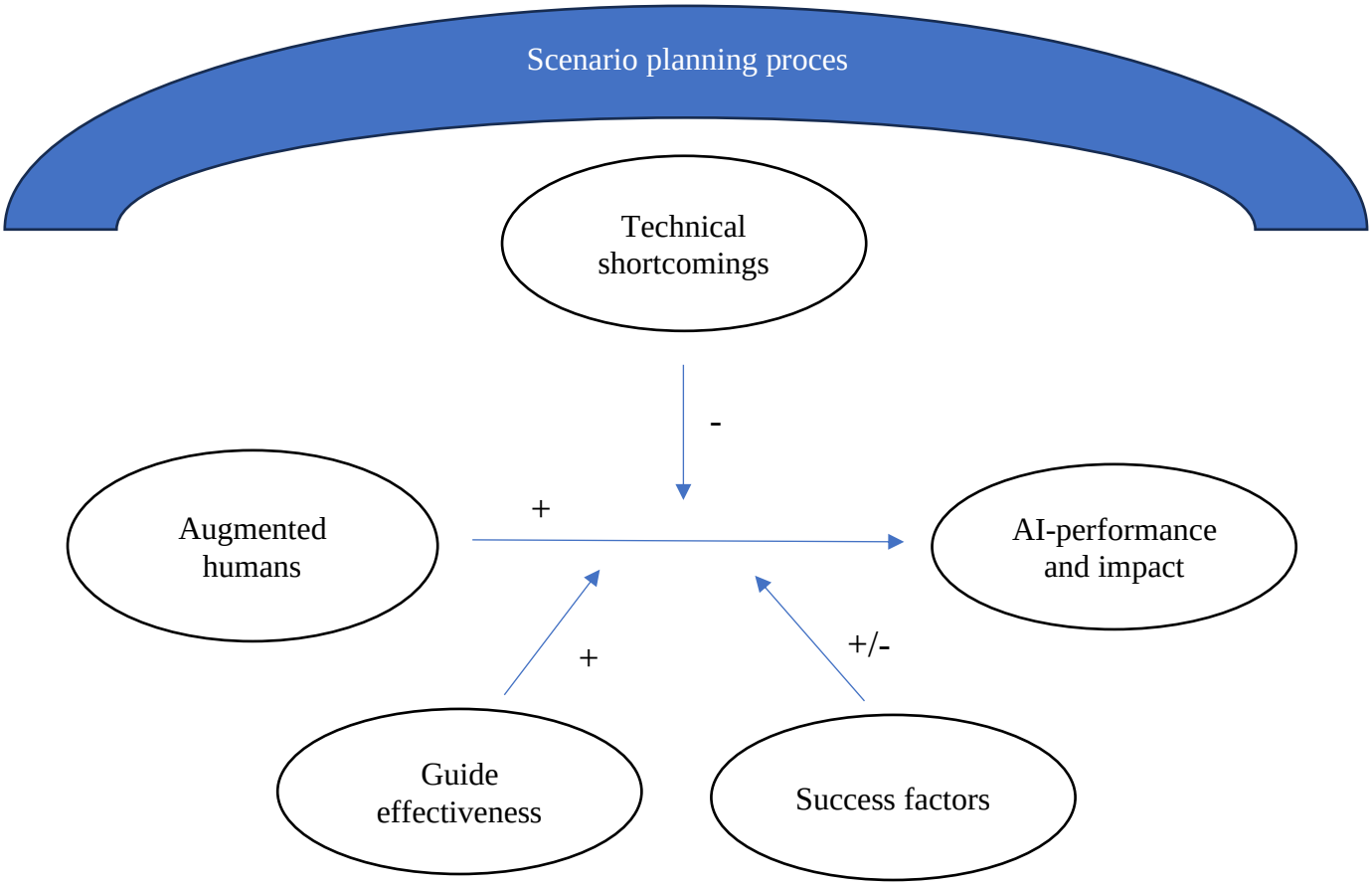


Figure 5 Dynamic model

5. Discussion and conclusion

This section contains a discussion in which the results of this study are evaluated and discussed. The discussion contains the limitations and implications of this study. Additionally, this section contains a conclusion which forms the answer to the formulated research question.

5.1 Discussion

The discussion contains the contributions of this study, the limitations of this study, future research directions and implications.

5.1.1 Contributions

The findings of this study make several contributions to both academic literature and practical application. The findings of this study contribute to existing literature by complying with the findings of the previous study by Spaniol & Rowland, (2023). While in both studies AI functions as a tool that can be used in the scenario planning process rather than taking over the process from the human decision makers. This study builds upon the study of Spaniol & Rowland (2023) and goes further by also focusing on the collaboration between humans and AI and providing a guide that contains specific prompts how to use AI in the different steps in the scenario planning process. Thereby, this study contributes to literature by extending the previous study of Spaniol & Rowland (2023) by providing a specific guide how to use the selected AI tools in the different steps of the scenario planning process and also by reviewing and evaluating the effect and role of AI in the scenario planning process (Spaniol & Rowland, 2023). Therefore, his study can function as a basis for future studies regarding the role AI can fulfill in the scenario planning process. These future studies can use the in this study gathered information, formulated guide, made considerations and collected findings as a basis for their study

Additionally, the findings comply with the study of Bouschery, et al., (2023) which states that AI should function as a brainstorm partner, while this enhances the process. This was also evident in this study while AI functioned as a brainstorm partner enhancing the scenario planning process.

The findings of this study related to the role that AI fulfills also matches the two definitions of AI that resulted from the literature review, as both the findings of this study and the two definitions that resulted from the literature review state that AI serves as an augmentation tool rather than a replacement for humans, by tackling complex and time-consuming tasks (Demlehner & Laumer, 2020; Enholm et al., 2022; Makarius et al., 2020; Mikalef & Gupta, 2021). This was also evident in the final data structure of this study in which augmented humans formed one of the aggregate dimensions.

The findings related to success factors for leveraging AI also match with the findings of previous studies. According to the studies by Mikalef & Gupta (2021) and Rantbotham et al. (2018) is the quality of the input data considered a critical success factor for AI to function properly. This was supported by the findings in this study related to the input requirements. While these findings state that clear instructions are required and that the quality of the prompts is critical for AI to work properly. Additionally, the study of Makarius et al. (2020) states that understanding the importance of AI, what role it will play and how it will change the human role and responsibilities is considered a critical aspect in order to leverage AI Moreover the study of Makarius et al. (2020) states that employees have to trust AI and its produced output and must have an understanding of how AI works while this will enhance the AI adoption process. This was also supported by the findings of this study that state that user knowledge such as understanding the boundaries of AI and the role it will fulfill are considered as critical in leveraging AI in the scenario planning process.
Findings related to the need for additional time to perform the process imply that time is a must in order to work with AI in the scenario planning process in a good way. These findings comply with the study of Ramsbotham et al. (2018), which states that time is a must in order to become an expert and leverage AI in a way that it produces value. This because most organizations are relatively new to AI and therefore need time to get a good understanding of it (Ramsbotham et al., 2018).

Moreover, the findings of this study related to the human role in the collaboration with AI comply with the three defined roles training, explaining and sustaining that resulted from the literature review (Wilson & Daugherty, 2018). The users should train AI by providing it with input in the form of prompts and data. Additionally, they should explain the by AI provided output in order to ensure its relevance. Lastly, they should sustain in order to ensure that AI is functioning properly, safely, and responsibly regarding the scenario planning process. An

explanation for this match between the findings of this study and the human roles defined in literature is that these roles are based on a collaboration with AI which is also the case in this study.

According to the findings of this study, AI has several technical shortcomings such as not providing new information, being prone to bias and misinterpreting information and prompts. These shortcomings match the shortcomings mentioned in literature such as AI only being able to provide output based on the data it has access to, AI being prone to bias due to bias in data/input, AI lacking in creativity and flexibility and AI's limited understanding of context (Enholm et al., 2022).

However, while AI as a brainstorm partner enhances the scenario planning process these findings comply with the study of Bouschery, et al., (2023) which states that that integrating AI with human expertise in the brainstorm process results in better performance.

Lasty, the findings of this study comply with the findings of the study by Wei et al., (2022), while this study states that prompt-engineering technique based on the chain of thought is considered as one of the best techniques to formulate a specific tailor-made prompt that provides relevant output. This matches the findings this study while this technique was used to formulate the prompts and according to the findings these formulated prompts were of high quality leading to relevant output.

The results of this study also enhance academic understanding by providing insight in the function Artificial Intelligence (AI) fulfils in the human collaboration during the scenario planning process. Moreover, this study identifies and discusses several technical shortcomings of AI and the selected AI tools that hinder effective collaboration with humans in scenario planning. These technical shortcomings offer opportunities for future improvements related to AI and the selected AI tools. This study also identifies several success factors that are essential for AI-human collaboration and AI integration into the scenario planning process. While there was limited to no literature available on the development of a guide and its guidelines, this study fills this gap by providing a basis for such a guide and its guidelines. Additionally, it extends the existing academic literature by exploring the impact of AI integration into the scenario planning process and scenario development and by presenting a dynamic model that illustrates the effects of technical limitations, success factors, and the

guide effectiveness on the relationship between augmented humans and AI performance and impact.

From a practical standpoint, the insights gained from this research offer a valuable guide for adopting and leveraging AI in scenario planning. It outlines specific roles, technical challenges, and crucial factors that practitioners should consider to effectively adopt and utilize AI in this context. Furthermore, the study enriches the scenario planning process by integrating AI and formulating related essential elements such as, identified technical limitations, critical factors, and the guide, thereby this study provides a more effective scenario planning approach.

5.1.2 Limitations

Reflecting on the design of this study and related research process, there are several limitations and consequences that potentially influenced the results of this this study. These limitations and consequences should be taken into account when interpreting the results. While there was limited to no literature available on the inclusion of AI in the scenario planning process, there was only limited theoretical foundation for the in this study identified research question. Consequently, there was a notable lack of established theoretical frameworks, methodologies, and empirical evidence to guide the research design, potentially affecting the study's validity. In order to cope with this there is made use of theoretical frameworks, methodologies, and empirical evidence of studies related to the scenario planning process and artificial intelligence. This data was combined and used as theoretical foundation of this study (Theofanidis & Fountouki, 2018).

The research methodology employed, particularly the selection of a single case study involving only eight participants from a single organization, introduces further limitations. The data gathered with this single case study is limited to the experiences and perspectives of the eight participants from a single organization, impacting the study's reliability and generalizability. Despite attempts to mitigate these limitations through data triangulation, incorporating five distinct data types, this still limited the representativeness and generalizability of this study (Yin, 2018).

Time constraints significantly restricted the depth of the case study analysis, particularly evident during the group interview phase, where time did not allow for individual responses to

research questions. Therefore, the questions were discussed in group format, resulting in uneven participation among subjects, with some being more active than others. Efforts by the researcher to involve less active participants, although well-intentioned, may have inadvertently introduced bias into the interview findings. For instance, leading questions posed by the researcher could have influenced the participants' responses, thereby affecting the integrity of the data collected (Frey & Fontana, 1991). Nevertheless, integrating findings from other data sources such as individual interview sheets and other data collection methods was used in order to ensure the data reliability and validity (Carter et al., 2014).
While there was made use of a group interview there was the possibility of the participants becoming biased by the answers given by others. In order to cope with this there was made use of interview sheets that the participants had to fill in individually prior to the interview. These interview sheets were then used by the participants to answer the interview questions during the group interview, minimizing potential bias that may result from the answers given by others (Frey & Fontana, 1991).

The constrained timeframe and limited participant number also meant the scenario planning process had to be condensed individually into a single session, diverging from typical collaborative practices. The constrained timeframe and not being able to collaborate in the process due to the limited number of participants made the case study derive from an everyday situation limiting the representativeness of this study. Thereby, participants might have acted and responded different compared to in an everyday situation. These limitation thereby also influenced the study's reliability and validity (Theofanidis & Fountouki, 2018). This was evident from findings such as “to intensive to do alone” and “break up the process” which both due to the unavailability to collaborate due to the limited number of participants or due to the constrained timeframe.

The selection of AI tools, based on a top 10 list from AI Magazine, also limited this study. While due to the focus on this top 10 list, there is the possibility that AI tools which are more suitable for scenario planning may be overlooked. The exclusion of these more suitable AI tool could have detrimentally affected this study's quality and validity.

5.1.3 Future research directions

Based on the limitations of this study, several future research directions can be formulated. Taking into account this limitation related to the single case study only containing 8

participants of one organization, future research should aim to broaden the scope to determine the applicability and representativeness of these findings in other contexts. The findings of these other studies can be used in order to reflect on the representativeness, validity and reliability of the findings of this study.

This study was limited by the constrained timeframe and limited number of participants, both forcing the scenario planning to be condensed individually into a single session, diverging from typical collaborative practices. Thereby this study did not represent an everyday situation limiting the representativeness, reliability and validity of this study. Therefore, future studies on the role AI can fulfill in the scenario planning process should contain a larger population, a larger timeframe and the possibility to collaborate in order to represent an everyday situation and enhance the representativeness of the study. The findings of these future studies can be used in order to reflect on the representativeness, validity and reliability of the findings of this study.

While for the selection of AI tools, there was made use of the top 10 list from AI Magazine, this may have resulted in overlooking tools more suitable for scenario planning. Therefore, future research should focus on a wider range of AI tools, considering the continuous evolution of AI technologies. These future studies can use the insights from this study as a foundation on AI's role in the scenario planning process. However, there is the need for a broader exploration of applicable AI tools.

Taking into account the identified future research direction, a follow-up study should further explore the potential of AI in the scenario planning process. This follow-up study should conduct a multi-case study involving a diverse set of organizations, varying in size, industry, and geography in order to validate the findings of this study across different organizations and industries. Additionally, the follow-up study should include larger participant groups over extended periods in order to allow collaborative scenario planning sessions, rather than individual, condensed sessions. Moreover, this follow-up study should assess a wider range of AI tools, including emerging AI tools specifically designed for scenario planning in order to select the best AI tools for the different aspects of scenario planning process, taking into account the continuous evolution of AI technologies. In doing so, the follow-up study could offer substantial advancements in understanding the potential role AI can fulfill in the scenario planning process. By addressing this study’s limitations and building on the

foundation of this initial study, the follow-up study can contribute to a better understanding and more comprehensive view of how AI technologies can enhance scenario planning processes across various contexts

5.1.4 Implications

Based on this study there are both practical and theoretical implications that should be taken into account. The previous formulated adjustments related to the guide that resulted from this study should be made to the existing guide in order to optimize it. It is expected that this will increase the quality of the guide and thereby increase the applicability and usability of AI in the scenario planning process.

Moreover, organizations should use the selected AI tools ChatGPT and DALLE-3 in combination with the in this study formulated guide in order to adopt and leverage AI in the scenario planning process. In doing so, they should take into account the previous discussed human role in the collaboration with AI, the technical shortcoming, the critical factors, the recommendations for the guide and the influence of AI on scenario development. Thereby it is expected that AI will enhance the scenario planning process by speeding up the process and increasing the efficiency in a way that it produces organizational value overcoming both the scenario planning weakness and organizational struggle regarding AI.

5.2 Conclusion

The goal of this study was to answer the research question: "*How can AI support the different steps of the scenario planning process in a way that it overcomes the scenario planning weaknesses and organizational struggle with AI, while maintaining the scenario quality?".*
Based on the findings of this study there can be concluded that ChatGPT Plus and DALLE-3 scored the based on the criteria training data, timeliness data, ease-of-use, flexibility, ethical AI and cost. Therefore, these tools are considered the best combination of AI tool(s) to support the scenario planning process.
The findings of this study make it evident that AI fulfills a supportive role in the scenario planning process. In doing so it acts as a partner, providing inspirational answers that provide insights and can be used to create a baseline. Thereby, AI functions as a brainstorm partner to the human decision makers. The human decision makers should guide the tool in the desired direction in order for it to provide answers which are relevant to both the scenario planning process and the organization. Additionally, they should critically evaluate the provided output

and provide AI with extra organizational context in order to ensure the response's relevance. Thereby it is expected of the users to fulfill different roles at the same time.

Based on the findings it can also be concluded that AI does have some technical shortcomings which hinder the scenario planning process. The findings of this study indicate that AI does not provide new information or creates new cross connections, while it just repeats the data it has access to. Additionally, AI is prone to become biased based on the by the user provided input, while it just includes this input in its provided responses rather than challenging it based on its own knowledge. Moreover, when providing AI with certain information or prompts it also tends to misinterpret this information or prompts leading to responses which are wrong or not relevant.

In order to make AI function in the scenario planning process there are some critical factors that should be taken into account. While in order to use AI in an efficient way the user should understand the boundaries of AI, understand how and why they do what they do and should have the knowledge to critically evaluate the by AI provided output. Additionally, there are certain input requirements such as high-quality prompts, organizational context and clear instructions that are critical for AI to provide high quality responses which are relevant for both the scenario planning process and the organization. Moreover, collaboration is required while the process is too intensive to do alone, therefore a sparring partner or expert team consisting of members with different expertise is critical.

In order for AI to work properly in the scenario planning process there should be made use of the guide while according to the findings of this study this guide is good, clear and applicable. Moreover, it takes the users through the process in a systematic way and contains good predefined prompts for AI to provide output relevant for the scenario planning process. However, there are some practical improvements such as make reoccurring steps iterative, provide a reading guide at the top of each page, add a section that can be used to make good prompts yourself, define the human role in each step of the process, add adjustable variables to the prompts and review the length of the prompts.

Lastly, according to the findings there can be concluded the scenario planning process changes due to the inclusion of AI and working with the related guide. AI's output wasn't precise, unique, disruptive or creative while it was broad and generic which made it difficult for users to specify the information. Additionally, the output was not new and contained to much information leading to an information overflow. On the other hand, AI did score a 7 on all output quality criteria while it was useable and provides good and structured responses and argumentation. Additionally, AI speeds up the process and made the scenario planning

process more efficient. However, the human aspect, which is considered critical in the scenario planning process, changed while AI took over a part of the work. Thereby, humans had the tendency to become lazy and reliant on AI. Humans are still considered a must in the process in order to guide the tool in a certain direction. However, this became harder later in the process since the user did not exactly know where to correct the tool in order to increase the output relevance.

The overall conclusion based on this study is that the inclusion of AI and the related guide into the scenario planning process worked specifically well from a supportive perspective by providing inspirational responses during the identification of the focal issue, by gathering data to identify the key factors and driving forces and by provide argumentation during the ranking of the factors and driving forces, during the selection of scenario logics, and during the formulation of the scenario's, the implications and the leading indicators and signposts. Thereby, the inclusion of AI and related guide enhanced every step of the scenario planning process in its own way. However, improvements are still required in some areas, as the selected AI tools combined with guide often provided generic responses, did not consistently interpret prompts, and required specific additional context. Consequently, the output related to each step of the scenario planning process was limited and had to be reviewed and complemented by the user.

Looking back at the research question this can be answered in the following manner: the inclusion of AI in the scenario planning process enhances the process. Thereby AI functions as a supportive brainstorm partner which augments the human decision makers. The users should guide the tool, provide it with specific organizational context and evaluate the provided output in order to ensure its relevance. In doing so it should take the technical shortcomings of AI not providing new information, being prone to bias and the potential for misinterpreting information and prompts into accounts. Additionally, the user should be aware of the critical factors and therefore understand the boundaries of AI, understand how and why they do what they do, work with high quality prompts and have a clear focus. In doing so they should preferably work with a sparrings partner or expert team in order to discuss the provided output and lower the process intensiveness. Moreover, the users should use the guide while its good, clear and applicable. This guide contains predefined prompts that the user should use in order for AI to work properly in the scenario planning process. Lastly, the humans should be aware of the change in the human aspect in the scenario planning process

due to the inclusion of AI. While there is a tendency to become lazy and reliant on AI the users should prevent this by taking a more active role by critically challenging the by AI provided outputs. In doing so AI will enhance the scenario planning process by speeding up the process and increasing the efficiency in a way that it produces organizational value overcoming both the scenario planning weakness and organizational struggle regarding AI.

Appendix 1 Used search keys and strategy

To gather literature on artificial intelligence, Web of Science was utilized with a focus on literature reviews related to the topic. The search criteria included the keywords "artificial intelligence" AND "literature review" AND "business". Filtering for articles published within the last 10 years and in English language yielded 208 articles. These articles were sorted based on citation count, with a preference for higher-cited articles from ABS 3 or higher rated journals. Subsequently, snowball sampling and specific search keys were employed to further refine the search and extract specific information.

Similarly, for literature on scenario planning in business, the search strategy involved the keywords "business" AND "scenario planning". Filtering criteria included articles published within the last 10 years and in English language, resulting in 178 articles. These articles were sorted based on citation count, prioritizing higher-cited articles from ABS 3 or higher rated journals. Additional refinement was conducted through snowball sampling and specific search keys to obtain topic-specific information.

For literature on the intersection of artificial intelligence and scenario planning, the search keys used were ("scenario planning" OR "scenario analysis" OR "strategic planning”) AND ("artificial intelligence" OR "AI"). Again, filtering criteria included articles published within the last 10 years and in English language, resulting in 156 articles. These articles were sorted based on citation count, with a preference for higher-cited articles from ABS 3 or higher rated journals. Snowball sampling and specific search keys were then employed to further explore topic-specific information.

For referencing, EndNote 20 is utilized following the guidelines of the APA style.

Appendix 2 Artificial intelligence tool(s) in the scenario planning process

As described in the literature review the model of Schwartz consists of eight steps. The model focusses on plotting scenario drivers to develop various scenarios (Schwartz, 1996). The goal of each step is combined with the knowledge of the researcher and results of the literature review to determine the potential role AI could fulfill.

2.1 Identify focal issue or decision

The goal of the first step of the model is to identify focal issues or decisions that require analysis. The organization should determine what issues or decisions are relevant for them and define the scope and timespan in which this will happen (Schwartz, 1996).

Schmidt et al. (2020) suggest that AI can address the cognitive limitations of humans by integrating AI with human expertise to enhance decisions and optimize actions. Furthermore, Borges et al. (2020) argue that AI facilitates the acquisition of new insights from data, thereby improving decision-making processes. Generating new information and thereby new insights based on data is seen as one of the key strengths of AI (Enholm et al., 2022; Mikalef & Gupta, 2021). A previous study by Boucher, et al. (2023) focused on this and the role AI could fulfill as a brainstorm partner. This study showed that integrating AI with human expertise in the brainstorm process resulted better performance. Therefore, AI is considered to be a good brainstorm partner, while hybrid groups (humans and AI) outperform human only groups in brainstorming (Boucher, et al., 2023).

An important aspect to consider is that the by the AI tool provided outputs have to be combined with human knowledge and expertise since AI tools do not always provide correct information (Mittelstadt et al., 2023). Moreover, the human thinking aspect plays an important role in the scenario planning process since this a cognitive process that depends on human decision-making (Schoemaker, 1993, 1995). Therefore, combining the by the AI tool provided outputs with human knowledge is a must in every step of the scenario planning process. However, AI should not just function as output provider while this will decrease the human thinking aspect of the scenario planning process. Therefore, AI should interact with its users by critically reviewing and discussing the provided output.

While the goal of this step is to identify focal issues or decisions that require analysis and to define their related scope and timespan, AI tools can support this step by functioning as an interactive brainstorm partner that generates potential issues or decisions relevant for the organization. AI will, based on the available data combined with potentially provided case specific training data, formulate potential issues or decisions which provide new insights and can be used as inspiration. Moreover, once the issues or decisions are known, AI with its predictive capabilities can be used to define a potential scope and timespan. However, as previously mentioned AI should not just function as output provider while this will decrease the human thinking aspect of the scenario planning process. Therefore, AI should interact with its users.

2.2 Identify key factors in the local environment which influence the decision

The goal of this step is to identify key factors that might have a direct or indirect influence on the issue or decision. Many of these factors are obvious as they are part of the organization's business plan for example demand, competition, technology developments or supply chain changes. After identifying these key factors, they have to be evaluated (Schwartz, 1996).

AI can support this step by generating potential key factors that might have a direct or indirect influence on the in step 1 selected issues or decisions. Once again AI can support this step as interactive brainstorm partner that generates new insights which can be used as inspiration. AI can also be used in the evaluation of the identified factors by ranking them or by providing information relevant for the evaluation such as likelihood of happening.
Users can provide the tool with examples and/or a framework in order to help AI understand the desired response. In order to optimize this response, users can instruct AI to provide its chain of thought after which they can provide feedback in order to optimize the generated output. This is an iterative process.

2.3 Identify driving forces that influence key factors in the local environment

The goal of this step is to identify the driving forces and their potential development directions that influence the key factors identified in step 2. This step is more focused on searching for trends compared to step 2 of this process. These driving forces are typically external factors that might impact the key factors and thereby the issues or decisions. (Schwartz, 1996).

Once again AI can fulfill a supportive role in this step by generating potential driving forces that influence the key factors identified in step 2. Additionally, AI can be used to provide

potential development directions of the identified driving forces. It can also formulate relevant trends and arguments explaining its relevance. This provided output will lead to new insights that can be used as an inspiration.

2.4 Rank by importance and uncertainty

In step 3 the identified key factors and driving forces have to be assessed and ranked based-on importance and uncertainty. Importance refers to the level of impact or influence on the focal issue while uncertainty relates to the level of unpredictability associated with the factor or driving force. These driving forces will then be explored deeper by identifying their internal predetermined elements and critical uncertainties (Schwartz, 1996).

AI can be used to provide a critical reflection regarding the importance and uncertainty of the identified key factors and driving forces. Moreover, it can help ranking the identified key factors and driving forces based this critical reflection. It can generate insights with regard to the influence of the key factor or driving forces on the focal issue and the unpredictability of the factor or driving force. Additionally, it can generate potential internal predetermined elements and critical uncertainties related to the in step 3 identified driving forces. While scenario planning is a cognitive process in which human knowledge plays a central role as decision-makers, AI will function as interactive brainstorm partner for inspiration of these decision-makers, rather than just output provider.

2.5 Select scenario logics

The goal of step 5 is to determine which futures are worth developing as detailed scenarios. Therefore, the top 2 driving forces/factors identified in step 4 will be used to name the axes of a 2-by-2 matrix. This matrix will then be used to develop 4 scenario logics or themes that present potential futures. These logics represent different potential futures based on combinations of the identified factors and driving forces (Schwartz, 1996).

AI can generate potential scenario logics or themes, also called “scenario fingerprints” based on the in step 4 identified top 2 driving forces/factors. It can make sure these logics and themes are consistent and plausible and analyze potential overlap between the themes. AI can generate a large number of potential scenario logics or themes, outperforming humans on this aspect. Thereby, AI will once again function as an interactive brainstorm partner that generates content which decision-makers can use as inspiration.

2.6 Flesh out scenarios

The in step 5 selected scenario logics will be developed into detailed scenarios in step 6. The trends and developments that lead to the scenario will be described. The goal of this step is to develop scenarios into consistent scenarios that provide a comprehensive picture of the potential future (Schwartz, 1996).

AI can support this step by combining all the results of the previous step and thereby generate specific textual scenarios. AI can be instructed to provide the textual scenario in a certain narrative and tone, thereby the textual scenarios can be tailor-made. Moreover, AI can describe the different trends and developments that led to these scenarios. The chain of thought can be used to see the steps AI took in order to provide these scenarios. Additionally, AI can be used to visualize the scenario by generating an image of the potential future based on the previously by AI generated textual scenario.

2.7 Formulate implications

The goal of step 7 is to formulate implications based on the developed scenarios. These implications for the scenarios have to be relevant for the issue or decision. Moreover, the risks, opportunities, challenges, and trade-offs associated with each scenario have to be assessed. This helps understanding the potential consequences of the different futures and supports the decision-making process (Schwartz, 1996).

AI can formulate potential implications and its consequences based on the developed scenarios. Moreover, it can even assess the risks, opportunities, challenges, and trade-offs associated with each scenario and takes these factors into account when formulating the potential implications. It can also provide the users with mechanism or solutions to cope with these implications. The specificity of the provided implications depends on the extensiveness of the in step 1 by the users provided case specific training data. AI can also identify challenges and focus areas based on the overlap between the different generated scenarios. It can give an overview of which challenges are connected to what scenarios and how the current strategy will work in each scenario.

2.8 Select the leading indicators and signposts

Lastly in step 8 the leading indicators and signposts that can be monitored will be identified to track the progress of each scenario. These indicators serve as early warning signals and help assessing the likelihood of the different scenarios. Monitoring these indicators enables organizations to adapt their strategies accordingly. The goal of this last step is to select

indicators and signposts that can be used to monitor and assess the scenarios (Schwartz, 1996).

AI can formulate potential indicators and signpost that have to be monitored in order to track the progress of each scenario. It can even formulate potential strategies for the organization to cope with changes in these indicators or signposts. However, like in all the previous steps AI functions as an interactive brainstorm partner that generates and critically reflects output in order to provide insights that users can use as inspiration. The outputs therefore have to be reviewed and combined with human knowledge and expertise, while AI does not function as just an output provider.

Appendix 3 Workshop Protocol

What is expected of the participants?

- Bring a laptop
- Have a ChatGPT plus account
- Pen and paper for potential notes
- Preferably some basic knowledge of ChatGPT

What can participants expect of the researcher?

- Presentation
    - Introducing himself
    - Introducing himself and let the participant introduce themselves
    - Informing participants about the study and its relevance
    - Inform about the goal and form of the workshop
    - Present the guide
    - Introduce the case
    - Planning
    - Room for questions
- Guide for each participant
- Researcher will observe during case handling and result evaluation
- Evaluation interview with each participant individually

Planning

Time	Action	Description
8:30	Introduction	Presentation by Maxim Wielens: • Introducing himself and let the participant introduce themselves • Informing participants about the study and its relevance • Inform about the goal and form of the workshop • Present the guide • Introduce the case • Planning • Room for questions
9:15	Start workshop	Participants will individually start with working with the guide – Maxim Wielens will observe
10:45	Prepare interview	Participants will individually prepare the interviews by using the interview sheet
11:00	Evaluation interviews	The participants will be interviewed in group format by Maxim Wielens with the use of the interview guide
Lunch	End workshop	Participants will be thanked for their contribution and there is room for questions

Appendix 4 Interview sheet provided to participants

1. How did you experience working with AI in the scenario planning process? Please elaborate.

1 2 3 4 5 6 7 8 9 10

Terrible Amazing

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a. What did you like?

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b. What did you dislike?

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2. How did you perceive the quality of the by AI provided output? Please elaborate.

1 2 3 4 5 6 7 8 9 10

Terrible Amazing

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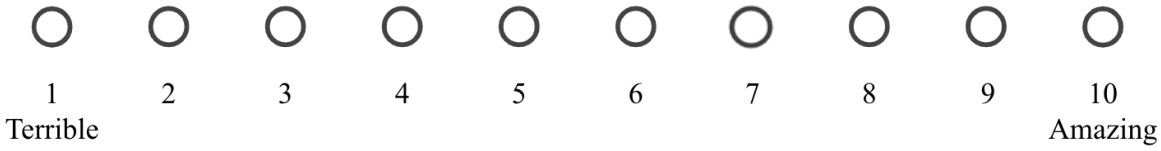
3. How did you perceive the plausibility of the by the AI provided outputs? Please elaborate.



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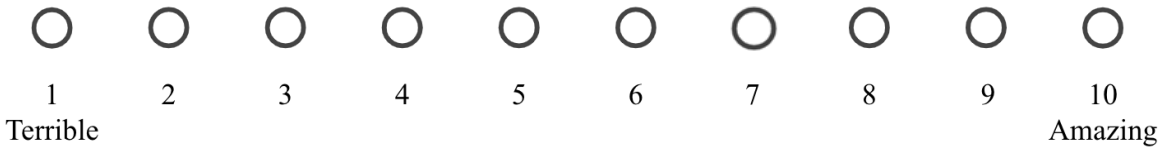
4. How did you perceive the criterium challenging of the by the AI provided outputs?



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5. How do you perceive the role AI played in reaching the outcome? Please elaborate

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6. Do you think the human role in the scenario planning process changed due to AI? Please elaborate.

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7. What do you see as critical success factors for reaching a high-quality outcome with AI in the scenario planning process? Please elaborate.

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8. To what extent did the selected artificial intelligence tool (s) enhance or hinder the scenario planning process? Please elaborate.

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9. Do you feel like the inclusion of AI enhances or hinders the scenario planning process in general? Please elaborate.

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10. How did you perceive the quality of the guide and its guidelines? Please elaborate.

○	○	○	○	○	○	○	○	○	○
1	2	3	4	5	6	7	8	9	10
Terrible									Amazing

.....

.....

.....

11. How did you perceive the applicability of the guide and its guidelines? Please elaborate.

○	○	○	○	○	○	○	○	○	○
1	2	3	4	5	6	7	8	9	10
Terrible									Amazing

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12. What worked well? Please elaborate.

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13. What were some barriers, if any, that you encountered? Please elaborate.

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14. What did you miss in the guide? Please provide a justification for your response.

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15. What information can be left out of the guide? Please elaborate.

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16. What recommendations do you have for the guide? Please elaborate.

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Appendix 5 Interview Guide

By Maxim Wielens

Research question: "*How can AI support the different steps of the scenario planning process in a way that it overcomes the scenario planning weaknesses and organizational struggle with AI, while maintaining the scenario quality?"*

Focus: on the role AI fulfills in the scenario planning process, the perceived quality of the scenario using the criteria of Van der Merwe (2008) and on the quality of the guide and it's guidelines which will be evaluated on the criteria: quality, validity and in applicability in practice (Terrace, 2003)

Helpful probes:

• Could you provide an example?

• Could you expand on that idea?

• Could you provide further explanation?

• I'm uncertain about what you're saying. Could you clarify?

• Are there any additional points you'd like to discuss?

Introduction 1-3 min:

Thank you for making time to meet with me today.

The purpose of this interview is to assess the guide you've recently utilized.

The interview is expected to last under 60 minutes. I'll be recording our session to ensure no comments are missed. Is this acceptable to you?

Please speak clearly to ensure your comments are captured accurately. All responses will be treated confidentially, meaning your contributions will be anonymized to protect your identity. Rest assured that any information included in my report will not identify you as the respondent.

Remember, you're under no obligation to discuss anything you're uncomfortable with, and you have the option to terminate the interview at any point. Do you have any questions regarding the information I've just provided?

Are you willing to participate in this interview?

Questions 10 - 15 min:

1. How did you experience working with AI in the scenario planning process? Please elaborate.
    a. What did you like?
    b. What did you dislike?

2. How did you perceive the quality of the by AI provided output? Please elaborate.
3. How did you perceive the plausibility of the by the AI provided outputs? Please elaborate.
4. How did you perceive the criteria challenging of the by the AI provided outputs? Please elaborate.
5. How you perceive the role AI fulfilled in reaching the outcome? Please elaborate.
6. Do you think the human role in the scenario planning process changed due to AI? Please elaborate.
7. What do you see as critical success factors for reaching a high-quality outcome? Please elaborate.
8. To what extent did the selected artificial intelligence tool (s) advance or hinder the scenario planning process? Please elaborate.
9. Do you feel like the inclusion of AI enhances or hinders the scenario planning process in general? Please elaborate.
10. How did you perceive the quality of the guide and its guidelines? Please elaborate.
11. How did you perceive the applicability in practice of the guide and its guidelines? Please elaborate.
12. What worked well? Please elaborate.
13. What were some barriers, if any, that you encountered? Please elaborate.
14. What did you mis in the guide? Please provide a justification for your response.
15. What information can be left out of the guide? Please elaborate.
16. What recommendations do you have for the guide? Please elaborate.

Closing Key 1-3 min:

Is there anything else you'd like to contribute before we conclude? I'll be analyzing and synthesizing the information gathered from you and other participants, aiming to complete my research by the end of February. If you're interested, I'd be delighted to share the results with you at that time.

Thank you for your valuable time and input.

Appendix 6 Reviewing and selecting AI tool(s)

For the selection of the generative AI tools there is made use of the top 10 generative AI tools by AI Magazine (2023), which is an official publication of the Association for the Advancement of Artificial Intelligence (AAAI).

This top 10 contains 3 large language models:

1. Google Bard: a large language model developed by Google AI that can generate different forms of text-based content based on questions and/or prompts provided by the user (Bard.Google, n.d.).
2. Bing Chat: a chatbot that can help with text queries such as research, writing assistance and coding. The tool also accepts images as inputs which makes it different from other tools. Bing chat provides content based on the questions asked by the users (Jackson, 2023).
3. OpenAI ChatGPT: open-source AI-powered natural language processing tool that provides users with answers to questions and information. It can support users in tasks such as composing emails or coding (OpenAI, n.d.).

And 2 AI image generators:

4. OpenAI DALL-E 3: A text-to-image model. Based on the outputs, ChatGPT will automatically generate prompts for DALL-E 3 to visualize the text (OpenAI, n.d.)
5. Adobe Firefly Image 2: An image generation tool to visualize text based on prompts provided by the users.

The other 5 AI tools did not fall within the focus of this study and are therefore considered as irrelevant. To review the selected 5 artificial intelligence tools for this study there is made use of the criteria, training data, timeliness of the data, flexibility, ease-of-use, ethical AI, and costs, which resulted from the literature review.

The comparison of the training data, timeliness of the data and costs for the large language models are displayed in table 8. The comparison of the training data, timeliness of the data and costs for the AI image generators are displayed in table table 9. The rest of the criteria are discussed below.

Table 8 Training data, timeliness of the data and cost of the large language models

AI Tool	**Training data**	**Timeliness of the data**	**Costs**
Google Bard	1.56 trillion words	Real time data	Free
Bing Chat	100 million words	Real time data	Free
OpenAI ChatGPT	300 billion words	January 2022/ real time data	Free/$20 per month

Table 9 Training data, timeliness of the data and cost of the AI image generators

AI Tool	**Training data**	**Timeliness of the data**	**Costs**
OpenAI DALL-E 3	Tekst-image pairs	Real time data	$20 per month
Adobe Firefly Image 2	Adobe Stock images, openly licensed content, and public domain content	Unknown	Free/ $4.99 per month

6.1 Training data

The training data that the AI tools use is assessed to review the quality of the data for each of the AI tools (Enholm et al., 2022).

6.1.1 Google Bard

The language model LaMDA which forms the basis of Google Bard was trained on a dataset called the Infiniset. This dataset is made up of the following elements: 12.5% C4-based data, 12.5% English language Wikipedia, 12.5% code documents from programming Q&A websites, tutorials, and others, 6.25% English web documents, 6.25% non-English web documents and 50% dialogs data from public forums. The training dataset had a size of 750 GB and contained 1.56 trillion words. Moreover, the model contains 137 billion parameters (Thoppilan et al., 2022). Parameters, in the context of artificial intelligence systems, are variables whose values are adjusted during training to determine how input data is transformed into the desired output. The higher the number of parameters the higher the capacity of an AI system to learn from data (Our World in Data, 2023). The origin of the data

used in this dataset is unknown since it's scraped from the internet. Bard has web access and thereby access to real-time data which enables the tool to provide real time answers to its users. Moreover, Bard continuously learns based on this real time data, and the prompts, reactions and feedback of its users (Thoppilan et al., 2022).

6.1.2 Bing Chat

Bing Chat is powered by OpenAI's GPT-4 model which is estimated to contain 1.76 trillion parameters (Koubaa, 2023). The tool is trained on a dataset provided by Microsoft estimated to contain 100 million words. The origin of the data used to train Bing Chat is unknown. However, Bing Chat has web access and thereby access to real time data. This data is used to continuously train the tool and also enables the tool to provide real time answers to its users. The tool also continuously learns based on each user interaction. Which means the tool's functionality increases every time it gets used (Microsoft, n.d.).

6.1.3 ChatGPT

ChatGPT has two versions, the free version which is powered by OpenAI's GPT-3.5 model and contains 175 billion parameters, and the paid version which is powered by OpenAI's GPT-4 model and has an estimated 1.76 trillion parameters (Brown et al., 2020; Koubaa, 2023). Both versions are trained on a dataset with a size of 570 GB containing 300 billion words. The composition of the dataset is displayed in figure 6. The exact origin of the data is unknown. While the Plus version of ChatGPT has web access it also has access real time data which it uses to provide real time information to its users. However, the free version of ChatGPT only has access to data up to January 2022. Therefore, this free version cannot provide real time answers and answer questions related to data which originates after January 2022. ChatGPT continuously learns based on the interactions with users (OpenAI, 2023).

Dataset	Quantity (tokens)	Weight in training mix	Epochs elapsed when training for 300B tokens
Common Crawl (filtered)	410 billion	60%	0.44
WebText2	19 billion	22%	2.9
Books1	12 billion	8%	1.9
Books2	55 billion	8%	0.43
Wikipedia	3 billion	3%	3.4

Figure 6 Composition dataset used to train ChatGPT (Brown et al., 2020)

6.1.4 DALL-E 3

DALL-E 3, which is also an AI tool based on the GPT model, in this case GPT-3 with 12 billion parameters, is trained on a large dataset that contains text-image pairs. The tool is trained on highly descriptive generated image captions. However, OpenAI did not reveal the specific content of the dataset. Since, DALL-E 3 is an extension of the Plus ChatGPT-4 it is

also able to use real time data to generate real time images. The exact size of the dataset used to train DALL-E 3 is not publicly known (Betker et al., n.d.).

6.1.5 Adobe Firefly Image 2

The Adobe Firefly Image 2 AI tool undergoes training on a dataset consisting of licensed content, including Adobe Stock, alongside public domain content where copyright has expired. Currently, Adobe is actively exploring innovative methods to empower creators to train the tool using their own images. This initiative aims to enable creators to generate content that aligns seamlessly with their distinctive style, branding, and design language, free from the influence of other creators' content. Adobe Firefly Image 2 is trained on a fixed dataset containing only licensed or copyright free content which limits image generation possibilities. Additionally, it is unknown whether the tool has access to real time data, if not this also limits image generation possibilities since it might not know about most recent development (Adobe, n.d.).

6.2 Flexibility

The usage options of the AI tools are reviewed in order to determine the flexibility of the selected AI tools (Taulli, 2021).

6.2.1 Google Bard

Bard, Google's experimental, conversational, AI chat service, has several usage options. Bard can generate codes to support the coding process, can analyze images and create related content based on uploaded images and can create new content such as emails and business plans or creative ideas for brainstorming. Additionally, bard can be used to compare different options, in which it will provide relevant information to help understand them better and find the best options. Moreover, Bard can provide images to visualize some of the request. Bard is thereby able to provide output in the form of code, text and images. However, Bard does not generate new images as it uses google search to provide existing images to its users. Users can provide bard with input in the form of text, but Bard also offers a function in which users can upload images which the tool will then analyze for you. According to Bard.google (n.d.), Bard can help users answer any question, even the question: 'Which came first: the chicken or the egg?'. The tool does have a limit of 1000 tokens for the input, this is the maximum number of tokens that a large language model can process in a single interaction. (Bard.google, n.d.).

6.2.2 Bing Chat

Bing Chat offers similar usage options as Bard. Users can use Bing Chat to summarize text or events, compare things, answer questions, provide text and images, reformat text, update images, and provide suggestions. Bing Chat is able to provide output in the form of images,

links, code and text. Additionally, Bing Chat's responses can also contain videos and ads. Moreover, Bing Chat can generate images based on text which allows users to visualize the provided output. Bing Chat also allows users to search with images in which users can take pictures upload it and ask related questions which the tool will try to answer.
The tool offers their users three conversation styles, "Creative" for more elaborate and imaginative responses, "Precise" for concise and direct answers that deliver information in a straightforward manner and "Balanced" which is a blend of both the Creative and Precise conversation styles. Bing Chat does have a token limit of 4000 tokens (Microsoft, n.d.).

6.2.3 ChatGPT

ChatGPT can be used to teach, brainstorm, summarize text, provide code, offer suggestions, generate text, rank items and more. According to OpenAI (n.d.) users can ask the tool anything. The free version of ChatGPT only provides output in the form of text and code whereas the Plus version can also provide output in the form of images. This allows users to visualize their ideas. ChatGPT Plus uses DALLE-3 to generate unique images based on the by the user provided input. The tool can see, hear and speak since it can chat with images, create new images and chat with voice. ChatGPT also offers its Plus users additional tools and plugins which gives ChatGPT access to a wide range of additional knowledge and information. These plug-ins enable extra use-cases and access to more recent and specific information. The free version of ChatGPT has a token limit of 4096 tokens whereas the Plus version has a token limit of 8000 tokens, which makes it better suited for analyzing larger amounts of data (OpenAI, n.d.).

6.2.4 DALL-E 3

DALL-E 3 is integrated in both ChatGPT Plus and Bing Chat. The tool can create images based on the by ChatGPT or Bing Chat provided output or based on the by the users provided input in order to visualize the text. This tool allows users to generate images based on textual descriptions. This tool creates new images based on existing images making it able to visualize everything and is therefore highly flexible in use. The specificity of the prompts however plays a crucial role in the image generation process. The more precise the input is the better the output provided by the tool will be. Examples of usage options of DALL-E 3 are logo designs, ad posters, art and design and infographics. The aim of the tool is to visualize all kind of word combinations in an image. DALL-E 3 is mostly used as an extension of ChatGPT Plus in which ChatGPT acts as an intermediary crafting multiple prompts for DALL-E 3 based on the by ChatGPT provided output. With this, ChatGPT functions as a brainstorm partner and refiner of the users prompts. When ChatGPT gets prompted with an

idea, it will automatically generate specific prompts for DALL·E 3 that brings the ideas of the users to life. (OpenAI, n.d.). However, as previously mentioned DALL-E 3 is also integrated in Bing Chat where users can also use it to visualize text into images (Microsoft, n.d.).

6.2.5 Adobe Firefly Image 2

Adobe Firefly Image 2 can create images based on text. This tool allows its users several usage options such as, “Text to image” in which users can generate images from detailed descriptions, “Generative fill” in which users can edit images by removing objects or painting in new ones, “Text Effect” in which users can apply styles or textures to words and phrases, and “Generative Recolor” in which users can generate color variations of their vector artwork. Users can adjust the generated images by changing image factors such as aspect ratio, style, color, and lighting in order to generate the perfect image. Additionally, photo parameters such as aperture, shutter speed, and field of view can be changed just like on a real camera.
The tool also allows its users to generate images based on an existing image from which it can take the style as a reference. However, Adobe Firefly Image 2 has limited image generation possibilities due to their limited content and thereby also has limited use cases. Examples of use cases are logo designs, product mockups, illustrations, posters and cartoons. The content created by the free version is not available for commercial use since this contains a watermark, this also lowers the number of user cases and thereby flexibility of the tool (Adobe, n.d.).

6.3 Ease of Use

The accessibility and effort needed to use the AI tools is reviewed to review the ease of use (Taulli, 2021).

6.3.1 Google bard

Bard is currently available, for free, in more than 40 languages and over 230 countries. Users need a personal Google account managed by themselves, or a Google Workspace account for which their administrator has enabled access to Bard. In the European Economic Area (EEA), Switzerland, and the UK the minimum age to access Bard is 18. The tool is online accessible on the browsers: Chrome, Safari, Firefox, Opera, or Edgium. In order to use Bard, users go to bard.google.com, sign into their account and enter their question in the text box at the bottom. Users can easily add an image to their prompt by using the “Upload image” button, after which they click submit. In case the prompt does not lead to the desired result the prompt can be edited by using the “Edit text” button. Additionally, Bard offers a function to check other responses to a single prompt which enables users to compare the output to select the most relevant output based on the provided input. Bard also provides a function to fact

check the provided information with the button “search on Google” after which Google is used to search the content that was used by Bard to provide the output. Moreover, Bard has several features with regard to its responses such as, copy code from a response, modify a response in its length, language simplicity or tone and make a chart based on the response. Bard does not have a request limit and is perceived as easy to use by its users. However, Bard often “hallucinates” and thereby provides false answers which lowers the ease-of-use since this makes the extra effort of fact checking a must. Bard also does not save chat history which makes it unable to go back to a provided output at a later moment in time. However, the tool does save the used prompts (Bard.google, n.d.).

6.3.2 Bing Chat

Bing Chat is also accessible on the web on bing.com/chat and is built into the sidebar of Microsoft Edge. The tool is also accessible on a smartphone or on tablet by downloading Microsoft Bing or Microsoft Edge. There is no account needed to access to the tool. According to Microsoft (2023) Bing Chat has a limit of 30 turns per conversation and 300 per day (Microsoft, n.d.). After the tool provides an answer, it suggests related follow-up questions and in-text footnotes/links & *learn more* links. These links make it easier for users to check the source and fact check the information. Bing Chat saves chats and thereby allows users to return to any previously saved conversation and pick up where they left off, which makes it easier to continue a conversation at a later moment in time. However, an account is required to use this function. Bing Chat has in AI image generator (DALL-E 3) integrated in the same interface this allows users to work in one interface containing both a large language model and AI image generator (Microsoft, n.d.). This lowers the needed user effort.
Users frequently criticize the tool for its follow-up questions, which are often deemed too basic, overly similar to the original question, and lacking persistence. Thereby, Bing Chat receives significantly lower scores in terms of helpfulness and trustworthiness compared to Bard and ChatGPT. Users felt that the responses provided by Bing Chat were similar to responses of a standard search engine. Moreover, a lot of the by the tool provided outputs contain ads and the provided references are not always accurate, current, and a match with the answer provided by the tool. While Bing Chat offers additional functions that should lower the effort needed to use the tool, these additional functions are often imperfectly executed, limiting the user instead of helping them. This leads to extra needed efforts and a lower ease-of-use (Niels Norman Group, 2023).

6.3.3 ChatGPT

ChatGPT, currently the most popular large language model, is also accessible for free on the web by going to chat.openai.com. This tool requires its users to have an account, which is free to make. After logging in or signing up, users can type any prompt after which the tool will provide an answer. After this, users are presented with several options: they can enter a new prompt, regenerate the response, copy the response, share the response, and express their preference for the response by liking or disliking it.

The free version of ChatGPT does not provide sources since it does not have web access, which makes fact checking even more important. However, the Plus version of ChatGPT does and thereby makes fact checking easier. Moreover, the Plus version of ChatGPT has in AI image generator (DALL-E 3) integrated in the same interface this allows users to work in one interface containing both a large language model and AI image generator. ChatGPT Plus automatically generates tailored, detailed prompts for DALL·E 3 to bring the provided idea to life in the best possible way. This lowers the needed user-effort. However, this Plus version has a max of 50 request every three hours. Both versions of ChatGPT offer a clear chat history which allows users to go back to a previous chat in a later moment in time. One key difference compared to other generative AI tools is that ChatGPT Plus allows users to set custom preferences which enables users to add their own preferences or requirements for ChatGPT to consider when generating responses. However, even ChatGPT Plus does not always provide correct answers which means they have to be fact checked. As mentioned earlier the Plus version of ChatGPT also offers its users additional plugins which offer extra functions such as for example “PromptPerfect” which helps users write the perfect prompt. These plugins are designed to help users and lower the needed efforts. While the Plus version of ChatGPT offers a lot of improvements these are only available for 20$ a month which lowers the accessibility (OpenAI, n.d.).

6.3.4 DALL-E 3

DALL-E 3 is accessible through two ways. The first one as mentioned above is through ChatGPT Plus and the second one is for free through Bing Chat. As mentioned before the access through ChatGPT Plus requires an account where Bing Chat does not. However, the images provided by Bing are watermarked. Which makes the generated images less suited for commercial use. Additionally, Bing Chat uses a “boosts” credit system. Once all the credits are used it takes longer to generate images. Bing grants new users 15 credits which can be used for boosted image generation. Just like Bing Chat, there is a maximum of 30 turns per conversations and 300 turns per day. On the other hand, DALL-E 3 in ChatGPT Plus can take

up to a maximum of 50 request every 3 hours. The real advantage of using DALL-E 3 is that it is integrated in two superior existing large language model (Bing Chat and ChatGPT) which allows users to do everything in the same interface. The by the tool created content can be downloaded. Moreover, the by ChatGPT, DALL-E 3 created content is owned by the user which makes it highly suitable for businesses. Users have the right to reprint, sell, and merchandise this created content. DALL-E 3 functions the same in ChatGPT and Bing Chat, users enter a prompt of what they want to see, and the tool generates a response that contains four different images from which the user can select the most relevant one. A weakness of the tool is that once an image is generated and the user edits the prompt it will generate a completely new image instead of editing the existing image. Both Bing Chat and ChatGPT Plus offer to go back to previous generated images. However, like with Bing Chat an account is required for this to work properly. One of the key benefits for using DALL-E 3 through ChatGPT Plus is that ChatGPT automatically provides its users with a tailored, detailed prompts for DALL·E 3 to bring the provided idea to life. Whereas with Bing Chat users have to generate this prompt themselves which makes it harder to generate the desired image. Therefore DALL-E 3 through ChatGPT Plus requires less effort and is easier to use. However, the accessibility is better through Bing Chat since this is for free (OpenAI, n.d.).

6.3.5 Adobe Firefly Image 2

Adobe Firefly Image 2 can be accessed in two ways, through a browser by going to https://firefly.adobe.com or through the newest version of photoshop. Users need an account which they can make for free. Adobe Firefly Image 2 offers two versions, one for free in which the users have 25 monthly generative credits which they can use to generate images and a Plus version which costs $4.99 a month for which users get 100 monthly generative credits, access to Adobe Fonts and no watermarks on the by Firefly generated images. Once logged in, users can put in a prompt to generate their own image. Additionally, users can use existing AI-generated images created by other users as an inspiration or by editing them. Hovering these images shows the prompt used to create this image. This gives a good insight in how the tool works and helps users get an understanding. The tool also helps its users by providing prompt suggestions in order to generate content which aligns with the vision of their users, this lowers the needed user effort and knowledge.

After putting in the prompt, the tool will generate 4 different images. Users can adjust these images by adjusting factors such as aspect ratio, content type, style, color, and lighting. Additionally, photo parameters can be changed in order to create the perfect image. Once the image is adjusted users can refresh the generation, add more prompts in order to make

changes to the image or select a reference image from the 4 which are available. A reference image will be used when generating future images. These future images will then be similar to the reference image. Users can then continuously update/regenerate images until one is perceived as a good fit to their needs. This one can then be used with the function “show similar” images to potentially find an even better fit. Adobe Firefly also offers additional functions such as generative fill, text effects and generative recolor. These extra functions and features lower the needed user effort, since it makes it easier for the users to generate the needed content. However, the content created by the free version is not available for commercial use since this contains a watermark, this lowers the number of user cases. The free version also has a lower number of generative credits which makes it more limited in the number of generations. Therefore, the Plus version is preferred. Since this Plus version costs $4,99 a month this lowers the accessibility of the tool (Adobe, n.d.).

6.4 Ethical AI

Ethical concerns and related practical examples of each AI tool are assessed in order to review the criteria ethical AI (Taulli, 2021).

6.4.1 Google Bard

Several ethical concerns related to Google Bard arose as result of a report by Bloomberg. According to this report by Bloomberg (2023), that interviewed 18 current and former Google employees, Google disempowered, and demoralized ethical concerns related to Bard because they wanted to publish the tool. According to the report the feedback provided by the Google employees that tested Bard was ignored. The tool often provided answers which where dangerous, for example, when the tool was asked how to land a plane, it gave incorrect instructions that would lead to a crash. Additionally, when the tool was asked to give scuba instruction, the by Bard provided answer would result in serious injury or death (Bloomberg, 2023). Moreover, as previously mentioned Bard often tents to “hallucinate” and thereby provide incorrect answers. Google tried to solve this problem by adding the search button which allows users to validate the output against Google’s search engines results (Niels Norman Group, 2023). Bard also makes use of past conversations, related product usage information and user locations which raises ethical concerns related to privacy. Google uses this data consistent with their privacy policy (Bard.google, n.d.).

6.4.2 Bing Chat

Microsoft’s Bing Chat also raises ethical concerns while the tool often provides incorrect information. Microsoft tries to cope with this by providing in-text footnotes/links & *learn more* links, which allow the users to fact check the information. Additionally, there are ethical

concerns regarding the collection and use of personal data of its users while this data is critical for the tool to function properly. Microsoft implemented a number of privacy and security measures in order to mitigate these concerns. Such as being transparent about the collection process, storing the data in a secure facility, and providing users control over their personal data. Another concern is that Bing Chat amplifies existing biases and inequalities since it learns from user interactions. Microsoft tries to mitigate this by actively investing in the development of Bing Chat in a responsible and ethical manner. Users have been reporting unethical behavior of Bing Chat. Examples are the tool showing emotions or not believing input provided by the users to be true while it actually is. Microsoft disclaims these reporting by stating Bing Chat is an experimental chatbot that can provide surprising or incorrect responses (Microsoft, n.d.).

6.4.3 ChatGPT

ChatGPT also has several ethical concerns such as bias, privacy and security, transparency, abuse, and authorship. An example of a bias according to OpenAI is that ChatGPT frequently overuses specific phrases, such as identifying itself as a language model trained by OpenAI. These issues stem from biases present in the training data. The ethical concern related to privacy and security originate from the fact that ChatGPT learns from its interactions with its users which may involve sensitive information and might be used in future conversations with others.

While OpenAI is not transparent regarding the data used to train ChatGPT this lowers the trustworthiness of the provided output. The Plus version of ChatGPT overcomes this weakness since it allows users to fact check this provided output by providing sources.

Since ChatGPT just requires an account, it can also be abused and used for harmful purposes such as phishing mails or political propaganda, this also raises concerns.

The most often mentioned ethical concern is related to authorship while the tool is heavily used by students and the difficulty to differentiate human written text from AI written text (Zhou et al., 2023).

6.4.4 DALLE-3

DALLE-3 also has some ethical concerns related to authorship, bias and discrimination, and privacy. While OpenAI states that the user owns the by DALLE created image and thereby has the right to reprint, sell and merchandise the image, there are still concerns about the potential for DALLE generated images to infringe on existing intellectual property rights. The tool could potentially generate images that copyright existing work and thereby infringe on the rights for the original copyright holder. Additionally, there are concerns for the generated

images containing logo or brand images that are similar to that of established companies, which would be trademark infringement (Zhou & Nabus, 2023). DALLE-3 does contain a safety feature which will stop image generation that may be copyright infringement. The tool will not generate images that contain living public figures or imitate the style of living artists. Additionally, this safety feature prevents the tool from generating images that contain adult, violent or hateful content (OpenAI, n.d.). Since DALLE-3 is trained on a large dataset it can copy biases existing in this data. This can result in the tool generating harmful stereotype and discrimination content. Since the exact data on which the tool is trained is unknown this raises ethical concerns (Zhou & Nabus, 2023). However, the previously mentioned safety feature should also prevent the tool generating such content (OpenAI, n.d.). Lastly, the tool might generate individuals who have not given their consent to do so, which also raises concerns. While the data in the dataset used to train DALLE-3 contains data scraped from the internet it might contain images of people, including their faces. By generating new images containing this personal data, there is the potential of unauthorized use of this data and the spread of false or misleading information (Zhou & Nabus, 2023). However, according to OpenAI (n.d.) the tool only generates images containing fake people.

6.4.5 Adobe Firefly image 2

According to Adobe (n.d.) they developed Adobe Firefly with an ethical approach, guided by their principles of accountability, responsibility and transparency. To address this, they restricted their training data to licensed content, such as Adobe Stock, and public domain material where copyright has lapsed. This prevents any concerns related to copyright and makes the tool commercially safe. Adobe even has an IP indemnity clause that protect enterprise customers from copyright claims on the by Firefly generated content. Just like with the other AI tools there are concerns related to potentially generating harmful content as a result of biases and stereotypes. Adobe tries to mitigate this by using diverse training data and do continuous testing. Additionally, they have an AI Ethics Review Board that does impact testing and makes use of diverse human oversight in order to minimize these ethical concerns. AI image generators can also generate incorrect images. Firefly uses Content Authenticity Initiative (CAI) in order to minimize the potential for incorrect images (Adobe, n.d.). While the tool is actively focusing on minimizing ethical concerns this is considered one of the key strengths compared to other AI image generators.

Appendix 7 Artificial intelligence in the scenario planning process

ChatGPT and DALLE-3 provide output based on so called “prompts”. A prompt is a type of interaction between a human and a large language model that lets the model generate the desired output. These prompts can have the form of a question, text, code snippets or examples. In this case, a prompt is a phrase or instruction users give ChatGPT or DALLE-3 to generate a response (TechTarget, 2023).

Prompt engineering involves designing, refining, and optimizing prompts to effectively convey the user's intentions to a language model like ChatGPT. It is essential for obtaining accurate, relevant, and coherent output from ChatGPT. As ChatGPT advances, the importance of proper prompt engineering becomes an increasingly important skill for users in order to use ChatGPT to its fullest potential and achieve optimal results (Ekin, 2023).

Prompts are the primary mode of communication between the users and ChatGPT. While the prompt its quality directly affects the quality of the by ChatGPT provided output, it makes understanding how to engineer good prompts a crucial aspect for effective use of ChatGPT. In order to engineer prompts in the most effective way there are some techniques and best practices that should be considered (Ekin, 2023).

Techniques for effective prompt engineering are:

- Provide clear and specific instructions.
- Implement explicit constraints.
- Train ChatGPT with context and examples to enhance its accuracy and relevance in responses.
- Utilize context or example prompts to guide and train ChatGPT effectively.
- Employ both System 1 and System 2 questions.
    - Utilize System 1 questions for quick, intuitive, or pattern-recognition-based answers.
    - Utilize System 2 questions for more deliberate, analytical, or complex problem-solving.
- Control the verbosity of output to manage response length effectively.(Ekin, 2023).

Moreover, there are some best practices to consider:

- Iterative testing and refining;
- Balance user intent and model creativity;
- Ensure ethical usages and avoid biases (Ekin, 2023).

One of the key benefits ChatGPT has, is its “custom instruction” function.
This feature enables users to incorporate preferences or requirements that they wish ChatGPT to consider when generating responses. The model will take these instructions into account with each response, eliminating the need for users to reiterate their preferences or information in every interaction. Users can hereby provide ChatGPT with extra context related to their questions. This is considered highly relevant to this study since it can also be used to add organizational information and thereby provide organizational context. The by the tool provided outputs will be then based on this set organizational information (OpenAI, 2023).
This custom instruction contains two questions:

1) What would you like ChatGPT to know about you to provide better responses?
2) How would you like ChatGPT to respond?

The first question allows users to tell more about their function, organization and goal they want to achieve by using ChatGPT. The second question allows user to instruct ChatGPT how to respond.
For this study there is made use of both the custom instructions and prompts to instruct ChatGPT Plus and DALLE-3 what to do.

7.1 Custom instructions

While the custom instructions form the basis of the by ChatGPT provided output this should be set up first. The custom instructions were set up as:

1. What would you like ChatGPT to know about you to provide better responses?

   I am a scenario developer for *organization name* an organization located in *name city, name country*. My goal is to develop scenarios that are relevant, challenging and plausible.

2. How would you like ChatGPT to respond?

   Function as my interactive brainstorm partner that provides inspirational answers which are as much as possible based on data with a preference for data sources such as case studies or official reports. Include examples of real-world applications, case studies, or emerging trends, that align with the market segments of my organization, in your answers. Ask clarifying questions if needed in order to get more tailored and precise responses that align closely with my specific needs. Critically review the provided answers and rewrite based on this review. Make sure the provided answers are relevant, challenging and plausible.

These custom instructions included organizational context in the form of organization name and location. Moreover, it included the scenario criteria of Van der Merwe (2008), it instructs ChatGPT to function as an interactive brainstorm partner that that provides inspirational answers since this resulted from the analysis of AI in the scenario planning process of Schwartz.

Additionally, the tool is instructed to include examples related to the organizational market segments in order to make the provided output more practical. The tool is also instructed to ask clarifying questions and critically review the provided answers in order to get response that better align with the user's needs.

ChatGPT was instructed to provide the chain of thought in order to analyze and review the effectiveness of these custom instructions. For this case there was a focus on Nedap B.V. in Granello, The Netherlands.

1. **Understanding Context:** ChatGPT first considers how the query relates to scenario development, focusing on relevance, challenge, and plausibility within the context of your work. This involves thinking about how the information provided might influence or be applicable to the scenarios you are developing.
2. **Identifying Relevant Sectors:** Second, it would identify the market segments relevant to Nedap b.v., focusing on areas like healthcare, security management, retail, and identification systems, as these are Nedap's key areas.
3. **Gathering Data and Case Studies:** Next, the tool would seek out the latest case studies, official reports, and industry trends pertinent to these sectors. This could involve browsing for the latest industry reports, academic publications, and news articles that provide data-driven insights.
4. **Interactive Brainstorming:** Acknowledging the need for a brainstorming partner, it will approach responses with a mindset of building upon ideas, providing alternatives, and suggesting various angles or perspectives. This includes asking clarifying questions when necessary to refine the response further.
5. **Critical Review and Refinement:** Before finalizing any response, it critically reviews the content, ensuring that it meets the criteria of being inspirational, data-backed, and

aligned with the user's needs. This might involve rephrasing, adding additional context, or changing focus based on the initial overview of the answer.

6. **Clarity and Precision:** Throughout the interaction, ChatGPT strives for clarity and precision, ensuring that the responses are direct, understandable, and as specific as possible to the scenario at hand.

This chain of thought shows that ChatGPT starts with understanding context by considering how the by the user provided input is related to scenario development with a focus on relevance, challenging and plausibility, while this forms the basis of the scenario planning process. Then it will search for extra needed organizational information such as market segments. The tool even mentioned several market segments of Nedap b.v. this shows its ability to search for this information itself. In the next step it will search for data related to the organization and these sectors, with a focus on credible data source such as industry reports or academic publications. By focusing on real-world applications and trends that align with the market segments of Nedap b.v., the scenarios are more likely to be applicable and valuable to the organization. This tailored approach helps in creating scenarios that are not just theoretical but have practical relevance to the company's operations, challenges, and opportunities.

The tool acknowledges the role of an interactive brainstorm partner and therefore adjusts its responses to this role and asks for clarifying questions in order to interact with the users. This is key in understanding the specific needs and nuances of the scenarios required. Interactive brainstorming can lead to more nuanced and tailored scenarios, as it allows for real-time adjustments and clarifications.

Moreover, it critically reviews and potentially rephrases the content in order to make sure that if meets the users' needs. This iterative process is important for quality assurance and ensures that the scenarios are as effective and relevant as possible.

Lastly it focuses on clarity and precision to ensure the responses are direct, understandable, and as specific as possible to the scenario at hand. While the instructions encourage asking clarifying questions to get more tailored and precise responses, this helps in avoiding misunderstandings and ensures that the scenarios are exactly what the user is looking.

7.2 Prompts

This section contains the final prompts which are the results of the iterative prompt engineering process. The prompts are supported by their related chain of thought provided by ChatGPT in order to provide insight in the steps and reasoning ChatGPT does based on this

prompt. These chain of thoughts form the argumentation why the related prompt is considered a good fit to the related step in the scenario planning process.

For the prompt engineering there is made use of a Nedap b.v.

7.2.1 Identify focal issue or decision

The first goal of this step is to identify focal issues or decisions relevant for the organization. For this there is made use of a single prompt:

Provide me a list of 10 focal issues or strategic decisions that are relevant for my organization and in particular for our industry [specify industry, e.g., technology, healthcare, etc.] and require thorough analysis. These should be pertinent to our organization's current context, including aspects like technology adoption, market expansion, and operational strategies. Examples are "Should we invest in technology X?" or "What are factors that could disrupt our current strategy?" The focal issues and decisions should help me focus on the uncertainty for which I want to prepare. Please ensure these focal issues are relevant to the unique aspects of our sector and organizational goals.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. **Understanding the User Profile:** It first reviews the information about the role and the organization, Nedap b.v., noting the emphasis on scenario development and relevance to technology and security sectors.
2. **Identifying Industry Context:** It than considers the broader context of the technology industry, including common challenges and trends like cybersecurity threats, technological innovations, regulatory environments, and market expansion opportunities.
3. **Focusing on Organizational Goals and Challenges:** It reflects on typical goals and strategic considerations relevant to a technology company like Nedap, including operational efficiency, market competitiveness, technological advancement, and regulatory compliance.
4. **Listing Relevant Strategic Issues:** It will then draft a list of strategic issues or decisions, ensuring each point addressed aspects of technology adoption, market expansion, or operational strategies. ChatGPT aims for a balance between immediate

operational concerns (like cybersecurity or remote work policies) and long-term strategic planning (like investment in emerging technologies or market expansion).

5. **Ensuring Relevance and Challenge:** The tool aims to ensure that each focal issue is relevant to the unique aspects of the technology and security sector, as well as challenging and thought-provoking, to aid in scenario development and strategic planning.
6. **Critical Review and Finalization**: Finally, it will review the list to ensure it is comprehensive and adequately addresses the criteria of being relevant, plausible, and challenging focal issues for strategic decision-making in your organization.

This methodical approach was designed to provide a comprehensive and relevant set of focal issues and decisions that align with the strategic needs and challenges faced by Nedap b.v.. This prompt is considered as good while it provides a list of 10 focal issues or decisions and thereby complies with the goal of the related step of the scenario planning process. Moreover, looking at the chain of thought and provided output it is evidence that this prompt provides relevant, challenging and plausible output, which is particularly relevant to Nedap b.v. and its related industries. Moreover, the output has a focus on being challenging and thought-provoking in order to stimulate the thinking process of the decisionmakers and thereby contribute to the scenario development process. In doing so this prompt also matches the identified role AI can fulfill in this step of the scenario planning process.

Considering the defined role of AI, as interactive brainstorm partner that generates (new) information which will lead to insights and can be used as an inspiration in the decision-making process, it is likely that the human decision makers want to add certain focal issues or decisions to the provided list. Therefore, they can use the following prompt:

Please add the focal issue of [specify the issue] to the list of strategic decisions and focal issues.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. **Understanding the Context**: First it identifies the industry. Therefore, it recognizes that the organization is Nedap b.v., which operates in technology with a focus on identification solutions, security, healthcare, and retail. Next it understands the term "Focal Issue". Therefore, it recognizes that a focal issue is a critical, strategic point or

question that the organization needs to address or keep an eye on due to its potential impact on the organization's future.

2. **Clarifying the Request:** The second step is clarifying the response. It notices "[specify the issue]" is a placeholder for a specific issue or topic that needs to be identified or provided by the user. ChatGPT also understand that the prompt is a request to expand upon or add to an existing list of strategic decisions or focal issues, implying there is a pre-existing framework or list being referred to.
3. **Crafting the Response:** The tool ensures the response is in the form of a directive or a guide, providing clear instructions or suggestions on how to identify and articulate the focal issue.
4. **Ensuring Relevance and Quality:** The tool makes sure that any examples or guidance provided are relevant to the technology industry and, more specifically, to the areas Nedap b.v. is involved in. It checks for clarity, conciseness, and relevance in the response ensuring it's directed towards helping the user make strategic, informed decisions or considerations.
5. **Revision and Improvement:** Lastly the tool considers any feedback or additional context the user might provide after the initial response to further refine or adjust the advice or guidance offered.

By systematically going through these steps, it aims to provide a response that not only addresses the prompt but does so in a way that is actionable, relevant to Nedap b.v., and contributes to scenario planning and decision-making.

This prompt is considered good while according to the chain of thought it first considers the organizational context and the term “focal issue”. It understands that the prompt is a request to expand upon or add to an existing list of strategic decisions or focal issues. Moreover, it makes sure that the by the user provided specific focal issue or decision gets a directive or guiding form, providing clear instructions on how to identify and articulate the focal issue. Thereby it makes sure that the output is relevant, to the specific industry and organization in order to ensure its quality. Lastly, the tool considers any feedback or additional context the user might provide after the initial response to further refine or adjust the advice or guidance offered. In doing so it complies with the goal of the related step of the scenario planning process and the role AI can fulfill in it.

After the relevant focal issues or decisions are identified, the user should select the focal issues or decisions they want to work with in the rest of the process. Therefore, they should use the prompt:

For the rest of this conversation focus on focal issues or decisions XXX.

This prompt instructs ChatGPT to use the selected focal issues or decisions for the rest of the conversation.

The second goal of this first step is to define a potential scope and timespan for the selected focal issues. Therefore, there is made use of the prompt:

Please provide a detailed scope and timeframe, in months, for each of the selected focal issues or strategic decisions relevant to my organization. For each issue or decision:

1. ***Define the Scope**: Describe the specific aspects, areas, or elements of our organization that the issue or decision will impact. Include any relevant market segments, technologies, or operational areas.*
2. ***Estimate the Timeframe**: Provide an estimated timeframe, in months, for addressing or implementing the issue or decision. Indicate whether this is for initial impact, full implementation, or another specific milestone.*
3. ***Substantiate with Data**: Offer substantiation for each scope and timeframe estimation using relevant, real-time data, case studies, or industry benchmarks. Include sources where possible for data validation.*
4. ***Describe Trade-offs**: Explain the trade-offs considered in defining the scope and timeframe. This might include resource allocation, market conditions, technological feasibility, or other strategic priorities.*

The goal is to have a clear understanding of the scope and timespan for each focal issue or decision to better prepare for and address these strategic considerations.

Next combine these factors in one table to provide a clear overview.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. **Contextual Understanding**: First it recognizes the specific industry (technology) and the operational areas of Nedap b.v., including identification solutions, security, healthcare,

and retail. Next it clearly defines what is meant by scope, timeframe, substantiation with data, and trade-offs in the context of strategic decisions or focal issues.

2. **Information Gathering:** For the second step it identifies or refers to the specific focal issues or strategic decisions that need to be addressed. It will collect current data and trends related to each selected focal issue, especially as it pertains to the technology sector and the markets Nedap b.v. operates in. Therefore, it will look for relevant case studies, benchmarks, or reports that provide insight into similar strategic implementations or decisions.
3. **Response Formulation**: In the third step ChatGPT will for each focal issue or decision:
    - Define the Scope:
        - Identify Impacted Areas: Describe how the issue or decision impacts various aspects of the organization, including market segments, technologies, and operational areas.
        - Detailing Elements: Break down the components of the issue or decision to understand its breadth and depth within the organization.
    - Estimate the Timeframe:
        - Initial Analysis: Determine if the timeframe refers to initial impact, full implementation, or another specific milestone.
        - Timeframe Estimation: Provide a reasoned estimate, in months, for the duration of addressing or implementing the focal issue or decision.
    - Substantiate with Data:
        - Collect Data: Use recent studies, industry reports, and case studies as evidence.
        - Apply Data: Correlate the data specifically to the scope and timeframe, explaining how it informs the estimation.
    - Describe Trade-offs:
        - Identify Conflicting Elements: Recognize what might need to be balanced or sacrificed in pursuing the issue or decision (e.g., cost, time, other opportunities).
        - Explain Considerations: Discuss how these trade-offs affect the decision-making process and the overall strategy.
4. **Structuring the Response:** The tool organizes the response so that it sequentially addresses each focal issue with its corresponding scope, timeframe, substantiation, and trade-offs. It will also combine all this information into a single table for a consolidated

and clear overview. Ensure each column corresponds to one of the requested elements (Scope, Timeframe, Data, Trade-offs).

5. Quality Assurance: In order to assure the quality, it verifies that the information is accurate, especially the data used for substantiation. The tool also ensure that the response aligns with the organization's industry, needs, and strategic objectives and that the table and accompanying explanations are clear and to the point.

6. Finalization and Delivery: Lastly it will check the entire response for coherence, accuracy, and alignment with the prompt's requirements. Based on this it will present the completed table and detailed descriptions in a clear, professional format.

By systematically following these steps, ChatGPT aims to provide a comprehensive and actionable response that helps Nedap b.v. understand and prepare for the scope and timeframe of each selected focal issue or strategic decision. This would aid in the scenario planning process and potential resource allocation.

This prompt is considered good while looking at the chain of thought it complies with the goal of the related step of the scenario planning process and the role AI can fulfill in it. The tool first considers the organizational context and related industry. Next, it will focus on the previous selected focal issues and collects credible data in order to provide relevant insights. For these focal issues it will formulate the scope, timeframe, used data and related trade-offs. Lastly, the tool ensures the output quality by matching it to the organization’s industry, prompt requirements and related focal issues. It structured the response to ensure each focal issue was addressed consistently, with a clear definition of scope, timeframe, substantiation, and trade-offs. The tool aimed to make the information relevant to the role and organization set in the custom instructions by providing it with clear and actionable insights. By doing this it meets the goal of the related step of the scenario planning process and the identified role related to this step.

7.2.2 Identify key factors in the local environment which influence the decision

The goal of this step is to is identify key factors that might have a direct or indirect influence on the issue or decision. For this there is made use of a single prompt:

Identify and analyze the key external factors from the local organizational environment that directly or indirectly influence our chosen focal issues: [Selected focal issues]. In your analysis, clearly distinguish between micro factors (specific to our direct organizational environment) and meso factors (related to the broader industry and market context) for each

focal issue. Additionally, consider the interplay among the focal issues. Provide a structured breakdown for each focal issue, citing current and relevant examples specific to [specify industry or market segment]. This analysis should inform our scenario planning by elucidating these influences and proposing potential strategies to either leverage or mitigate them. Focus on incorporating recent trends and up-to-date data to ensure that the analysis is both current and actionable. Finally, create a summarized overview table of each selected focal issue alongside its related micro and meso external factors.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. **Understanding the Prompt:** First it identifies the specific focal issues mentioned in the prompt. It makes a clear distinction between micro factors (related to the direct organizational environment) and meso factors (related to the broader industry and market context). ChatGPT also acknowledges the need to consider how different issues might affect each other.
2. **Research and Information Gathering:** Next to tool will identify external factors, split up in micro factors and meso factors**:**
   - **Micro Factors:** Look for information specific to the organization's direct operational environment, like suppliers, customers, competitors, and local regulations.
   - **Meso Factors:** Research broader industry trends, market dynamics, economic indicators, technological advancements, and regulatory changes.

   For both factors it will gather recent case studies, articles, or data pertinent to the specified industry or market segment. For this there is a focus on the latest findings, statistics, and forecasts to ensure the analysis is up-to-date.

3. **Structured Analysis: ChatGPT will for Each Focal Issue:**
   - **Micro Analysis:** Describe how direct environmental elements impact the issue.
   - **Meso Analysis:** Discuss how broader industry and market trends influence the issue.
   - **Interplay Consideration:** Analyze how the issue interacts with other focal issues and what combined effect they might have.
   - **Citation of Examples:** Use specific, current examples to illustrate points and make the analysis tangible and relatable.

4. Strategy Suggestion: ChatGPT will propose how positive external factors might be used to the organization's advantage. The tool will also suggest strategies to mitigate or adapt to negative external factors.

5. Presentation: Based on the prompt it will design a table that lists each focal issue alongside its related micro and meso factors. Therefore, it ensures the table is easy to understand, with clear distinctions between different types of factors and their relationships to the focal issues.

6. Quality Assurance: Before providing the response, the tool will verify the accuracy of data and relevance of examples to the specified industry or market segment. It will review the analysis and create a table for clarity, conciseness, and coherence.

7. Delivery: The tool will organize the comprehensive analysis and overview table into a format that is easy to read and digest. It will make any necessary adjustments based on a final review of how well the response addresses the prompt's requirements.

By systematically following these steps, the response provides a detailed and structured analysis of the external factors influencing the organization's focal issues, including actionable strategies for leveraging or mitigating these factors, all presented in a clear and concise table format.

Looking at the chain of thought and the goal of the related step of the scenario planning process and the role AI can fulfill in it, this prompt is considered a good fit while it identifies micro and meso factors from the local organizational environment relevant to the selected focal issues. Moreover, it provides strategies how to mitigate or adapt to these external factors. Lastly, it ensures the output quality and relevance in order to make sure matches the goal of the related step of the scenario planning process.

Throughout these steps, ChatGPT leveraged its trained knowledge and understanding of business strategies, external environmental factors, and industry-specific dynamics. The goal is to ensure the response is not only comprehensive but also relevant and actionable for the selected organization's strategic planning.

The goal of the second part of this step is to evaluate the identified key external factors to make sure they are relevant for the in step one identified and selected focal issues or decisions. For this there is made use of the following prompt:

Please conduct an evaluation of the identified external factors from both the micro (direct organizational environment) and meso (broader industry and market context) levels that directly or indirectly influence our organization's selected focal issues. Provide a structured analysis distinguishing between micro factors, which pertain to the immediate business environment, and meso factors, which encompass the broader industry and market trends affecting our sectors. Include current, relevant examples pertinent to these industry segments. The goal is to inform the decision makers of the scenario planning process by understanding these external influences and suggesting potential strategies for either leveraging or mitigating these factors. Please ensure the analysis is up-to-date, actionable, and prioritizes each identified factor based on its relevance and impact on the focal issues and the organization as a whole. Include argumentation.

Next, create a ranking of all these factors based on their relevance and impact.

This prompt is designed to guide a comprehensive and systematic evaluation of the external factors impacting the selected focal issues, ensuring that the analysis is relevant, thorough, and aligned with the organization's strategic objectives.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. **Understanding the Requirement:** First it ensures understanding of the request for evaluating external factors affecting the selected focal issues. It recognizes the need to distinguish between micro (direct organizational environment) and meso (broader industry and market context) factors.

2. **Identifying Focal Issues:** Next it will consider the nature of the selected organization and its involvement in specific market sectors. It then identifies the selected focal issues based on the typical strategic challenges and opportunities in these sectors.

3. **Defining Micro and Meso Factors:** For each focal issue, it defines the previous identified relevant micro factors that are specific to the direct organizational environment, such as client expectations and supply chain dynamics. Similarly, it defines the previous identified meso factors relevant to the broader industry and market context, such as regulatory environment and market demand trends.

4. **Analyzing Each Factor:** It assesses each factor's relevance to the selected organization and its impact on the focal issues. For each factor, it considers potential

strategies for leveraging or mitigating its impact. It includes examples to illustrate how these factors might manifest in real-world scenarios relevant to organization's industry.

5. **Prioritizing Factors:** The tool ranks the factors based on their assessed relevance and impact to provide a clear prioritization that can inform the decision-makers in the scenario planning process.
6. **Summarizing in a Table:** In order to provide a concise overview, ChatGPT compiles the information into a table format, listing each factor along with its relevance and impact ranks.
7. **Ensuring Current and Actionable Analysis:** Throughout the response, the tool aims to incorporate recent trends and data where possible, to ensure the analysis is both current and actionable for the selected organization's scenario planning.

By following these steps, ChatGPT aimed to deliver a structured, comprehensive, and actionable analysis of the external factors influencing the organization's selected focal issues. The goal of the response is aid in informed decision-making and effective scenario planning.

This prompt is considered a good fit while according to the chain of thought, ChatGPT will, based on this prompt, first consider the selected focal issues and their related previous identified micro and meso factors from the local organizational environment. Next it analyzes the relevance and impact each of these factors on the focal issue and thereby organization. Based on this analysis it ranks the factors with a clear prioritization that can inform the decision makers of the scenario planning process. In doing so, this prompt provides output that matches the goal of the related step of the scenario planning process and the role AI can fulfill in it.

7.2.3 Identify driving forces that influence key factors in the local environment

The goal of this step is to identify the driving forces and their potential development directions that influence the key factors identified in step 2. This step is more focused on searching for trends compared to step 2 of this process. For this step there is made use of a single prompt:

Please conduct a detailed in-depth analysis to identify and evaluate the macro-level driving forces affecting the previous identified key external factors of our selected organization's focal issues.

For each driving force:

*1. **Identify and Describe the Driving Forces**: Clearly define and specificy the driving forces and explain its relation to the identified factors and focal issues and explain nature and current status in the context of [specific industry/sectors].*

*2. **Potential Development Directions**: Discuss the possible future directions these driving forces could take. Provide scenarios or trends that depict how these forces might evolve and the implications for our organization and industry.*

*3. **Evaluate the Relevance**: Assess and explain the relevance of each driving force in relation to the identified factors and selected focal issues. Discuss how these forces impact our strategies, operations, and decision-making processes.*

The goal of this analysis is to gain insight into the driving forces behind the identified external factors influencing our focal issues. We aim to leverage this understanding to inform our scenario planning process and decision-making, ensuring our organization is well-prepared and proactive in navigating the future.

After this create a table with the driving forces in the first collum, their related external factors in the second collum and the focal issues that are influenced by both in the third collum.

This prompt is effective due to its specificity in targeting macro influences and clearly defined focal issues, ensuring relevance to the organization's context. Its structured request for identification, potential developments, and relevance evaluation of each driving force facilitates a thorough and organized response. Additionally, it emphasizes a forward-looking perspective and practical application by discussing future trends and implications for strategy and operations, aligning well with the scenario planning needs.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. **Understanding the Organization and Focal Issues:** ChatGPT first considers the nature of Nedap b.v., its market segments, and the technology sector it operates in. Additionally, it defines and understands the selected focal issues.
2. **Reviewed Current Industry Trends**: It considers the latest trends in technology, economic climate, societal attitudes, and regulations that are widely recognized in the organization's sectors. Based on this it chooses those macro-level factors (Global Economic Shifts, Technological Innovation, etc.) that have a recognized impact on the organization's sector and are likely to affect the selected organization. Next it provides a detailed explanation of each driving force, ensuring the description relates back to your organization's focal issues and related industry.
3. **Research and Analysis:** For this the tool researches recent trends, data, and developments in the organization's sector and related markets to understand the current status and future directions of various driving forces. It considers how these trends directly or indirectly impact the selected focal issues concerning the organization business and strategic planning.
4. **Structuring the Response:** It clearly defines each macro-level driving force and described its current status and implications for the organization's industry. Additionally, it outlines possible future scenarios or trends for each driving force, explaining how they might evolve. Lastly it assesses the impact of each driving force on the identified external factors and focal issues, explaining its relevance and implications for strategy and operations.
5. **Summarization:** The tool organizes the driving forces, related external factors, and influenced focal issues into a table format for clarity and ease of understanding. Moreover, it cross-checks to make sure the driving forces, external factors, and focal issues are accurately related and represented.
6. **Review and Finalize:** Lastly it reviews the response and ensures the analysis was coherent, relevant, and aligned with the goals of informing scenario planning and decision-making.

The chain of thought shows that the prompt complies with the goal of the related step in the scenario planning process and the role AI can fulfill in it as it provides a detailed and structured analysis of macro-level driving forces, directly addressing the request to understand external influences on the organization's focal issues. The analysis includes clear descriptions, industry trends, potential development directions, and relevance evaluations of each driving force, ensuring actionable insights for scenario planning and decision-making. Lastly, it

systematically organizes the information into a summary table, aligning the driving forces with related external factors and focal issues for ease of understanding and applicability.

7.2.4 Rank by importance and uncertainty

The goal of this step is to assess and rank the previous identified key factors and driving forces based-on importance and uncertainty. These driving forces will then be explored deeper by identifying their internal predetermined elements and critical uncertainties.

For the first part, assessing and rank the previous identified factors and driving forces, there is made use of the following prompt:

Please assess and rank both the previous identified driving forces and their related external factors in terms of their importance and uncertainty as they relate to the selected focal issues and thereby to the organization. Assess and rank the external factors and driving forces for all the selected focal issues based on:

- ***Importance**: refers to the level of impact or influence each factor or force has on the focal issue*
- ***Uncertainty**: relates to the level of unpredictability associated with each factor or force.*

Include argumentation. Combine the two criteria in order to determine the most critical factors and forces for the organization in one ranking. Provide a structured evaluation that prioritizes these factors and forces based on their importance and level of uncertainty concerning the focal issues. This analysis aims to inform our scenario planning process by understanding the critical factors and forces that shape our organization's strategic considerations.

Next create a summary ranking table.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. **Understanding the Context:** ChatGPT first revisits the selected focal issues ensuring the understanding of their importance and implications for the selected organization. Then it considers the selected sector's specific context, especially the markets where the selected organization operates.
2. **Identification of Driving Forces and External Factors:** In step two it revisits the previous identified key macro-level driving forces likely to influence the selected industry and focal issues. It also reviews the previously identified micro (direct organizational environment) and meso (broader industry context) factors affecting each selected focal issue.

3. **Structured Analysis of Each Driving Force and External Factor:** ChatGPT analyzes the driving forces. Therefore, it explains how it relates to the identified factors and focal issues, it discusses possible future scenarios for each driving force and assesses the significance of each driving force in relation to the focal issues and overall organizational strategy. For both the external factors and driving forces it evaluates the level of impact (importance) and predictability (uncertainty) in relation to the selected focal issues. Additionally, it provides reasoning and examples to substantiate the rankings and evaluations.
4. **Prioritization and Ranking:** In order to prioritize and rank the external factors and driving forces, it combines the two criteria of importance and uncertainty to determine the most critical factors and forces for the organization. It creates a table summarizing the assessment, ranking each factor and driving force based on their combined priority.
5. **Structuring the Response:** Lastly it aims to present the analysis in a clear, structured, and actionable manner, suitable for informing scenario planning and strategic decision-making. Throughout the process, it ensures that the information was relevant, up-to-date, and aligned with the industry context and organizational goals.

By following these steps, it aimed to provide a detailed and prioritized overview of the macro-level driving forces and external factors affecting the selected organization's strategic considerations, helping the decisionmakers understand the critical areas to focus on for effective scenario planning and decision-making.

Looking at the chain of thought, this prompt is considered a good fit while the tool first revisits the selected focal issues and considered the selected sector's specific context. Next it revisits the previous identified external factors and driving forces. It evaluates both the external factors and driving forces both on impact and uncertainty. Based on this evaluation it prioritizes and ranks these factors. Lastly, it structures its response in a clear structured and actionable manner that is suitable for the scenario planning process. Thereby it matches the goal of the related step of the scenario planning process and the role AI can fulfill in it.

The second part of this step focuses on identifying the internal predetermined elements and critical uncertainties of the previous identified critical external factors and driving forces. Therefore, there is made use of the following prompt:
Please conduct a detailed analysis of the critical external factors and driving forces previously identified, focusing on dissecting their internal predetermined elements and critical uncertainties. For each driving force, identify and describe:

1. ***Predetermined Elements:*** *Clarify the aspects that are stable and predictable within our organization's context. Explain how these elements are expected to continue and their potential impact on our strategic environment.*
2. ***Critical Uncertainties:*** *Identify the variable and unpredictable aspects. Discuss the range of possible outcomes and their implications for our organization.*

This analysis aims to deepen our understanding of the internal and external factors shaping our strategic landscape and enhance the robustness of our scenario planning. The goal is to differentiate clearly between what we can anticipate with reasonable certainty and what we need to monitor and prepare for due to its inherent unpredictability.

Finally, compile the findings into a structured overview, categorizing the predetermined elements and critical uncertainties for each critical driving force and external factor.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. **Understanding the Request:** ChatGPT first interprets the requirement for an in-depth analysis of external factors and driving forces impacting the selected organization's focal issues. This means identifying both the stable and predictable aspects (predetermined elements) and the variable and unpredictable aspects (critical uncertainties) of each factor and force.
2. **Identifying Critical Factors and Forces:** Next it revisits the previously identified critical external factors and driving forces, focusing on those ranked highest in importance and uncertainty.
3. **Research and Synthesis:** For each identified factor and force, it draws upon general knowledge and logical inference to dissect into predetermined elements and critical uncertainties:
    - **Predetermined Elements:** the tool looks for aspects that are generally stable and have a historical precedence or a clear trend indicating their continuation.

These elements are considered relatively predictable within the context of the selected industry.

- **Critical Uncertainties:** Next it identifies the aspects that are highly variable or unpredictable. These include areas where there is a lack of clear historical data, rapid changes are occurring, or the factor is influenced by a wide variety of external variables.

4. **Structured Analysis:** it provides a brief description of each factor and force to establish a baseline understanding. For each factor or force, it articulates the elements or aspects that can be reasonably anticipated based on current trends and historical patterns (predetermined elements) and those that are subject to change and could vary widely in outcome (critical uncertainties). It considers the implications of each aspect for the selected organization's strategic environment, focusing on how they might impact the selected focal issues.
5. **Compilation into Summary Table:** It organizes the findings into a structured overview table, categorizing the predetermined elements and critical uncertainties for each critical driving force and external factor. This format was chosen to provide clarity and ease of understanding, ensuring the information is actionable for scenario planning.
6. **Review and Finalize:** Lastly, it reviews the response for coherence, relevance, and completeness to ensure it aligns with the request and provides a comprehensive analysis to inform the selected organization's strategic considerations and scenario planning process.

This chain of thought shows that based on the prompt the tool uses the previous selected focal issues, also considering the selected organizational context. Moreover, it uses the critical factors and driving forces which were previously identified, while these form the basis of this step in the scenario planning process. For these critical factors and driving forces it identifies both the predetermined elements and critical uncertainties based on historical data and knowledge. Lastly, the tool makes sure the response is cohere, relevant, and complete in order to inform the selected organization's strategic considerations and scenario planning process. This chain of thought and related response match the goal of this step in the scenario planning process and role AI can fulfill in it and is therefore considered a good fit.

7.2.5 Select scenario logics

The goal of this step is to develop 4 scenario logics or themes that present potential futures based on previous identified top 2 driving forces/external factors. This top 2 driving forces/external factors will be used to name the axes of a 2-by-2 matrix. This matrix will then be used to develop 4 scenario logics or themes that present potential futures. These logics represent different potential futures based on combinations of the previous identified critical external factors and driving forces. For this there is made use of a single prompt:

Please perform the following steps to generate robust scenario logics or themes for our scenario planning:

1. ***Selection of Driving Forces or External Factors**: Identify the top two driving forces or external factors previously determined as most impactful and uncertain. These will form the axes of a 2-by-2 matrix.*
2. ***Defining Extreme Variants**: For each of the selected driving forces or factors, define two distinct and extreme variants. These will represent the ends of each axis, creating a spectrum of possibilities.*
3. ***Developing Scenario Logics**: Create and name four unique scenario logics or themes. Each should represent a plausible future emerging from different combinations of the extreme variants of the identified driving forces or factors. Ensure consistency and plausibility in the narratives.*
4. ***Analyzing Overlaps**: Examine the potential overlap between these themes to determine the most distinct and valuable futures worth developing into detailed scenarios.*
5. ***Visualization**: Construct a 2-by-2 matrix, with the selected driving forces or factors as axes and the developed scenario logics at each quadrant, to visualize the relationship and potential transitions between these futures.*
6. ***Evaluate**: Conduct a thorough analysis and review of the developed logics to determine the likelihood and relevance of each future. This step ensures the scenarios are aligned with current understandings and plausible developments.*

This structured and iterative approach will allow us to visualize and comprehend a range of potential futures, directing our strategic decisions and planning efforts. The objective is to craft a set of diverse, challenging, and plausible scenarios that provide deep insights for navigating future uncertainties and enhancing organizational resilience.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. Understanding the Task: It first understands that the goal is to create relevant, plausible and challenging scenarios based on the identified critical driving forces or external factors. The aim is to enhance organizational resilience by understanding potential future uncertainties.

2. Selection of Driving Forces or External Factors: It revisits the previous analysis to identify the most impactful and uncertain driving forces or external factors. This involves considering the importance and uncertainty of each factor and driving force. Based on this analysis, it chooses the critical driving forces or external factors for their high impact and uncertainty, making them suitable axes for scenario planning.

3. Defining Extreme Variants It then considers the nature of each selected force or factor and defined two extreme ends of the spectrum for each. The goal is to create distinct, plausible poles that represent a wide range of possibilities. It describes each extreme variant in a way that clearly contrasts one from the other, setting the stage for diverse scenario creation.

4. Developing Scenario Logics: Using a 2-by-2 matrix approach, it identifies the intersections of the extreme variants of the chosen forces, creating four quadrants. It develops challenging, relevant, and plausible narrative logics for each quadrant, ensuring they represent distinct futures that could plausibly emerge from the combination of extreme variants.

5. Analyzing Overlap: It examines the developed scenario logics for potential overlaps to ensure each represents a unique and distinct future. The tool considers the value of each scenario in providing insight and guiding strategic decisions, ensuring they cover a broad range of possibilities without redundant overlaps.

6. Visualization: Based on this it constructs a 2-by-2 matrix visualizing the relationship between the selected forces or factors (axes) and the developed scenario logics (quadrants). The visualization aims to clearly depict how different combinations of extreme variants result in different futures, making the relationships and transitions understandable.

7. Evaluation: Lastly, it evaluates each developed scenario logic for its likelihood and relevance, considering the current understanding of trends and plausible developments.
It critically reviews each scenario logic to ensure they are aligned with the organization's context and provide valuable insights for scenario planning and decision-making.

By methodically following these steps, it ensures that the generated scenarios are plausible, challenging, and relevant, providing valuable insights for the selected organization’s strategic

planning and future preparedness. Each step builds upon the previous, ensuring a coherent and comprehensive approach to scenario planning.

This prompt is considered good while it uses the previous identified most impactful and uncertain driving forces or external factors in order to define extremes. These extremes are used to name the axes of the 2-by-2 matrix. Based on this 2-by-2 matrix it identifies scenario logics which are challenging, relevant, and plausible and thereby matches the scenario criteria of Van der Merwe (2008). It examined the developed scenario logics for potential overlaps to ensure each represents a unique and distinct future. Lastly, it evaluated each developed scenario logic for its likelihood and relevance, considering the current understanding of trends and plausible developments. Thereby, it matches the goal of the related step of the scenario planning process and the role AI can fulfil in it.

7.2.6 Flesh out scenario's

The goal of this step is to develop consistent scenarios that provide a comprehensive picture of the potential future. Therefore, the identified scenario logics will be developed into detailed scenarios. The trends and developments that lead to the scenario will be described. Therefore, there is made use of the following prompt:

Utilizing the scenario logics identified through our 2x2 matrix of the most impactful and uncertain driving forces and external factors, please develop four detailed and extensive scenarios representing potential futures for our organization.

For each scenario:

1. ***Detail the Scenario Extensively:*** *Elaborate on the envisioned future by describing how trends, developments, and interactions between the driving forces and external factors culminate in this specific scenario. Provide a rich, detailed narrative that includes economic, technological, social, and regulatory dimensions, referencing the extreme variants defined for each axis in our scenario matrix.*
2. ***Integrate Deep Insights:*** *Draw upon the in-depth analysis of predetermined elements and critical uncertainties associated with each driving force and external factor. Use the importance and uncertainty rankings to underscore why these scenarios are critical for our organization. Include statistical forecasts, expert opinions, and recent industry-specific studies to enrich the scenarios with concrete, relevant insights.*
3. ***Ensure Sector-Specific Relevance and Challenge:*** *Tailor each scenario to be directly relevant to the [specify sector], specifically addressing areas where our organization operates. Dive into sector-specific trends, challenges, and opportunities, ensuring that*

each scenario encourages proactive and strategic thinking. Highlight potential disruptors, market shifts, and emerging opportunities that would require strategic agility and innovation.

4. ***Maintain Enhanced Plausibility:*** *Construct each narrative based on plausible extensions of current and forecasted trends, informed by up-to-date industry reports, market analyses, and scientific projections. Include potential policy changes, technological breakthroughs, and global economic factors that could realistically shape the future. Ensure that all elements are coherent and build upon established trends and known variables.*
5. ***Provide a Comprehensive Overview:*** *Summarize each scenario in a detailed table, clearly delineating how the findings from previous steps (identification of driving forces and external factors, the development of the 2x2 matrix, and the assessment of importance and uncertainty) are integrated to form each detailed and extensive scenario. This table should logically connect the abstract elements of scenario planning to concrete, actionable futures, ensuring traceability and clarity in the narratives.*

Ensure that the scenarios are not only relevant and extensive but also present challenging and thought-provoking narratives that compel our organization to think critically and prepare strategically. The goal is to provide a comprehensive and advanced toolkit for anticipating and navigating potential futures, enhancing decision-making and organizational resilience.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

3 **Detail the Scenario Extensively:** ChatGPT first crafts a detailed narrative for each scenario, considering economic, technological, social, and regulatory aspects. This includes elaborating on how the interactions between various trends and developments lead to the envisioned future. In order to do so it aligns the narrative with the extreme variants defined in the 2x2 matrix, ensuring each scenario is grounded in the previously identified driving forces and external factors.

4 **Integrate Deep Insights:** The tool utilizes the analysis of predetermined elements and critical uncertainties to deepen the understanding of each scenario. Moreover, it uses the importance and uncertainty rankings to emphasize the significance of each scenario for

the organization. It also includes relevant statistical forecasts, expert opinions, and industry-specific studies to provide a well-informed basis for each scenario.

5 **Ensure Sector-Specific Relevance and Challenge:** It customizes scenarios to be directly relevant to the specified sector, focusing on areas of operation for the organization. Based on this it will identify and discuss sector-specific trends, potential disruptors, and emerging opportunities. Additionally, it highlights aspects of each scenario that would require strategic agility and innovation from the organization.

6 **Maintain Enhanced Plausibility:** The tool ensures that each scenario is a plausible extension of current and forecasted trends, using up-to-date industry reports and market analyses. Moreover, it includes potential policy changes, technological advancements, and economic factors that could realistically influence the future.

7 **Provide a Comprehensive Overview:** Lastly it will summarize each scenario in a table format, showing how the outputs from the previous steps are integrated to form each scenario. Thereby the tool makes sure the table demonstrates a clear and logical path from the abstract elements of scenario planning to concrete, actionable futures.

Looking at the chain of thought this prompt is considered good while it matches the goal of the related step of the scenario planning process and the role AI can fulfill in it. In doing so. it develops extensive scenarios based on the previous identified scenario logics. It integrates predetermined elements and critical uncertainties to deepen the understanding of each scenario. Moreover, it customizes scenarios to be directly relevant to the specified sector, focusing on areas of operation for the organization. This structured approach will ensure that each scenario is not only relevant and plausible but also extensive and challenging, and thereby meets the scenario criteria of Van der Merwe (2008). In doing so it ensures it uses the previous output in order to construct these scenarios. Thereby the output of this prompt provides the organization with a comprehensive toolkit for strategic planning and decision-making.

While AI can also be used to visualize text, the next part of this step will be focused on visualizing the created scenarios into an image. ChatGPT Plus can provide its users with prompts in order to visualize the previously by the tool provided output. These prompts can then be used to visualize these outputs. In order to get these prompts, there is made use of the following prompt:

Develop comprehensive visualization prompts for the four detailed scenarios, representing potential futures for our organization. Each prompt should distill the core essence of its respective scenario, weaving together economic trends, technological advancements, sector-specific nuances, and overarching strategic influences. Aim to vividly illustrate the narrative of each scenario, highlighting its focal issues, external factors, and driving forces. The visuals should effectively convey the depth, nuances, and complexity of each future environment. In your descriptions, accentuate the distinctive features and pivotal elements of each scenario, ensuring a clear and impactful representation of the potential futures.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. Understanding the Request: It first reviews the request to ensure understanding of the need for visualization prompts for each scenario, focusing on economic trends, technological advancements, sector-specific nuances, and overarching strategic influences. It references the prior detailed scenarios developed based on the 2x2 matrix of driving forces and external factors, ensuring continuity and relevance in the visualization prompts.

2. Scenario Review: It revisits each of the four scenarios to understand their unique narratives, focusing on their economic, technological, social, and regulatory dimensions. For each scenario, it identifies the key elements that needed to be highlighted, such as economic conditions, technological status, and sector-specific trends.

3. Creative Development of Visualization Prompts: It constructs a vivid narrative for each scenario, aiming to capture the essence and project into a visual story that reflects the specified conditions and trends. It integrates the critical aspects of each scenario into the prompts, ensuring that economic trends, technological advancements, and sector-specific nuances are all reflected. Moreover, it highlights the focal issues, external factors, and driving forces. It made sure that each visualization prompt was distinct and clearly represented the unique attributes and outcomes of its respective scenario.

4. Structuring the Response: It structures the response to present each scenario's visualization prompt separately, maintaining clear differentiation and focus. It uses vivid and descriptive language to paint a picture of each potential future, making the scenarios easy to visualize and understand.

5. Review and Refinement: It reviews each visualization prompt to ensure it was comprehensive, plausible, and aligned with the core aspects of each scenario. Additionally, it

ensures that all elements are coherent and plausible, reflecting current and forecasted trends known in the sectors relevant to the selected organization.

6. Finalizing the Response: Finally, it provides a summary of the steps taken to assure the user of the methodical approach and thoroughness in the development of the visualization prompts. It conducts a final quality check to ensure clarity, coherence, and that the response fully addressed your request.

By following these steps, it aimed to deliver a well-constructed and meaningful set of visualization prompts that accurately represent the potential futures for the selected organization, providing a useful tool for strategic thinking and planning.

The prompt is considered a good fit while according to the chain of thought ChatGPT will, based on this prompt formulate prompts to visualize the generates scenarios. Therefore, it will revisit each of the four scenarios in order to understand them. Based on this it constructs a vivid narrative for each scenario, aiming to capture the essence and project into a visual story. It integrates the critical aspects of each scenario into the prompts. In doing so it makes sure that each visualization prompt is distinct and clearly represents the unique attributes and outcomes of its respective scenario. Lastly, it reviews each visualization prompt to ensure it is comprehensive, plausible, and aligned with the core aspects of each scenario. This prompt thereby matches the goal of this step of the scenario planning process and related role AI can fulfill in it.

7.2.7 Formulate implications

The goal of this step is to formulate implications based on the developed scenarios. These implications for the scenarios have to be relevant for the issue or decision. Moreover, the risks, opportunities, challenges, and trade-offs associated with each scenario have to be assessed. For this there is made use of a single prompt:

Identify and define, for my organization, the organizational implications of each developed scenarios relevant for the related focal issue or decision. Additionally, assess and define the risks, opportunities, challenges, and trade-offs inherent in each scenario. This will facilitate a deeper understanding of the potential consequences and variations in future landscapes, aiding our strategic decision-making process.

Provide recommended strategies or mechanisms to effectively address or capitalize on these implications, considering the organization's capabilities and goals. Identify key challenges and focus areas, particularly those arising from overlaps between different scenarios, and discuss how they might influence organizational readiness and response.

Lastly, compile a summary table outlining which challenges are associated with each scenario and the anticipated effectiveness of current strategies under different future conditions. This table should serve as a concise reference for aligning our strategic planning efforts with potential future environments.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. Understanding and Defining Scenarios: It starts by revisiting the four detailed scenarios and related focal issues or decision. For each scenario, it details its characteristics based on the extremes of the driving forces and external factors, considering economic trends, technological advancements, and sector-specific nuances.

2. Dissecting Organizational Implications: It identifies how each scenario's particular combination of economic and technological conditions will affect an organization in the selected organization’s industry. It determines the organizational implications, considering how changes will affect operations, strategy, market positioning, and innovation needs.

3. Assessing Risks, Opportunities, and Challenges: It evaluates the potential risks (threats to current operations or market position) and opportunities (areas for growth, innovation, or competitive advantage) inherent in each scenario. Additionally, it identifies the challenges each scenario would present to the selected organization and the trade-offs that might need to be made between competing priorities, such as innovation vs. stability or expansion vs. consolidation.

4. Formulating Recommended Strategies: Based on the implications, risks, opportunities, and challenges, it proposes strategies or mechanisms that the organization could employ to address or capitalize on these factors. It ensures that the strategies are relevant to the specific sectors in which the selected organization operates and focuses on areas of overlap and distinction between scenarios.

5. Creating a Summary Table: Finally, it compiles all the findings into a summary table that outlines the challenges, opportunities, risks, and recommends strategies for each scenario, along with an assessment of the anticipated effectiveness of current strategies under different

future conditions. It makes sure that the table logically connects the abstract elements of scenario planning to concrete, actionable futures, providing a concise reference for strategic planning efforts.

Throughout the process, it aimed to provide a comprehensive and advanced toolkit for anticipating and navigating potential futures, enhancing decision-making and organizational resilience by compelling the organization to think critically and prepare strategically for a range of possible futures. Thereby this prompt matches the goal of the related step of the scenario planning process and identified role AI can fulfill in it. For this, the prompt first revisits the 4 scenarios. For each scenario it identifies it's influence on the organization in order to formulate organizational implications. Next it evaluates risk, opportunities and challenges related to each scenario. Based on this it proposes strategies or mechanisms that the organization cab employ to address or capitalize on these factors with a focus on areas of overlap between the different scenarios.

7.2.8 Select the leading indicators and signposts

The goal of this last step is to select indicators and signposts that can be used to monitor and assess the scenarios. These indicators serve as early warning signals and help assessing the likelihood of the different scenarios. Therefore, there is made use of the following prompt: *Identify and define key leading indicators and signposts for each scenario that will enable the organization to monitor evolving trends and potential pivot points. These indicators should be specific, measurable, and relevant to the scenarios' focal issues and external factors. For each indicator, provide potential implications for the organization based on the observed developments. This will allow us to not only track but also understand the significance of changes in these indicators, enabling proactive adaptation of our strategies. The objective is to establish a robust set of indicators and signposts that effectively monitor and assess the scenarios, facilitating timely decision-making and strategic agility.*

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. **Understanding the Scenarios:** It revisits the four detailed scenarios ensuring a clear understanding of each scenario's narrative and core elements. It identifies the focal issues, external factors, and driving forces unique to each scenario.

2. **Defining the Purpose of Indicators:** It clarifies the objective of the indicators: to monitor evolving trends and potential pivot points. Next it defines the characteristics of effective indicators: specific, measurable, and relevant to the scenarios.
3. **Identifying Key Leading Indicators:** For each scenario, it identifies specific indicators related to the key driving forces and external factors that will signal changes aligned with the scenario's narrative. It ensures that these indicators are observable and measurable to allow for actual monitoring.
4. **Defining Signposts:** It distinguishes signposts as specific events or trends that can indicate the direction a scenario is heading. It ensures that these signposts are relevant and directly tied to the focal issues of each scenario.
5. **Determining Potential Implications:** For each indicator and signpost, it assesses the potential implications for the organization, considering how an observed change could affect strategic decisions and operations. It aims to provide actionable insights that would allow the organization to adapt its strategies proactively.
6. **Structuring the Response:** ChatGPT organizes the response to clearly delineate between the scenarios, with separate sections for each scenario's indicators, signposts, and implications. It ensures clarity and coherence in presenting the information, making it accessible and actionable for strategic planning.
7. **Reviewing and Refining:** Finally, it reviews the entire response to ensure alignment with the original request and scenarios. It refines the language and structures where necessary to enhance clarity and impact.

By following these steps, ChatGPT aimed to provide a detailed, structured, and actionable set of leading indicators and signposts for each scenario, facilitating robust and strategic scenario planning for the selected organization. Based on the chain of thought there can be stated that this prompt is a good fit while it complies with the goal of the related step of the scenario planning process and identified role AI can fulfill in it. In doing so the tool first considers the four detailed scenarios and their related components. For these scenarios it identifies signposts and indicators which can be used to monitor the progress of each scenario. Based on these signposts and indicators it formulates potential implications considering changes and their effect on the organization. By doing so it provides the organization with information that is accessible and actionable for strategic planning.

In order to provide an overview of the scenario planning process and thereby of each scenario including all the input used to create the scenario there is made use of the following prompt: *Please provide an overview that synthesizes the key elements of each scenario developed earlier. For each scenario, break down the following components:*

1. ***Focal Issue**: Associate each scenario with the selected relevant focal issue it addresses within the organization.*
2. ***External Factors**: Discuss the previous identified key external factors from the micro and meso levels that influence each scenario, considering the industry and market segment.*
3. ***Driving Forces**: Discuss the previous identified driving forces that underpin each scenario and explain their nature and current status in the context of the industry.*
4. ***Critical Uncertainties**: Highlight the previous identified critical uncertainties that may affect the trajectory of each scenario and the organization's ability to adapt.*
5. ***Scenario overview**: Describe the scenario including its impact on my organization.*
6. ***Implications**: Describe the previous identified implications of each scenario, including its scope, timeframe, and impact on the organization's focal issues.*
7. ***Signposts and indicators**: Discuss the previous identified the leading indicators and early warning signals that can be used to track the progress and likelihood of each scenario.*

By breaking down each scenario into these elements, we aim to provide a comprehensive overview that allows for a deeper understanding of the potential future landscapes and their implications for my organization.

According to the by ChatGPT provided chain of thought it generates the response in the following steps:

1. **Review of Scenarios:** ChatGPT starts by revisiting the four detailed scenarios to understand their narratives, focal issues, and the economic and technological contexts. It ensures a deep understanding of the specific industry context, including the related sectors, and how each scenario would particularly impact these areas.
2. **Associating Focal Issues:** Next, it matches each scenario with the relevant focal issue or decision that was selected and it primarily addresses, considering the implications for the organization in terms of strategy, market position, and operational efficiency.
3. **Identifying External Factors:** It then revisits the previously identified key external factors at the micro and meso levels that influence each scenario. This step involves

mapping these factors to their respective scenarios based on their influence on the industry and market segment.

4. **Discussing Driving Forces:** It outlines the driving forces underpinning each scenario, considering their nature and current status in the context of the industry. This involves understanding how these broader trends and conditions shape the scenarios' landscapes.
5. **Highlighting Critical Uncertainties:** ChatGPT identifies the critical uncertainties for each scenario — these are the aspects with high levels of unpredictability that significantly affect the scenario's trajectory and the organization's ability to adapt.
6. **Describing Scenario Overview:** For each scenario, it provides a concise but descriptive overview, highlighting how it unfolds and its impact on the organization. This includes summarizing the scenario's essence and its economic, technological, and regulatory dimensions.
7. **Detailing Implications:** The tool delves into the previously identified implications for each scenario, including its scope, timeframe, and impact on the organization's focal issues. This involved analyzing how each scenario would affect the organization's strategies and operations.
8. **Identifying Signposts and Indicators:** It discusses the leading indicators and signposts previously identified for each scenario. This includes explaining how these indicators can be used to track the progress and likelihood of each scenario unfolding, aiding in the organization's strategic agility.
9. **Structuring the Response:** The tool organizes the information into a clear and coherent format, ensuring each scenario was broken down into the specified components: Focal Issue, External Factors, Driving Forces, Critical Uncertainties, Scenario Overview, Implications, and Signposts and Indicators.
10. **Reviewing and Ensuring Coherence:** Finally, it reviews the entire response, ensuring that it provides a coherent and comprehensive overview. It checks for clarity, relevance, and the logical flow of information, ensuring that each component was clearly defined and discussed in the context of the scenarios.

By systematically following these steps, it aimed to provide a synthesized yet detailed overview of each scenario, helping the selected organization understand and navigate potential future landscapes. The approach was designed to ensure that the scenarios are not only theoretically sound but also practically relevant and actionable for strategic planning and decision-making.

Appendix 8: Navigating the Future: A Guide to Leveraging Artificial intelligence in Scenario Planning

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This guide is part of the Master thesis *"How can AI tool(s) support the scenario planning process? A systematic guide".* This guide contains 6 sections. The first section contains a short introduction of the problem and the role the guide aims to fulfill. The second section gives a short description of Artificial intelligence (AI) and the for this guide selected AI tool(s) to give the user a good insight in how the tool(s) works. The third section describes the selected scenario planning model with an in-depth description of each step. The fourth section describes how the quality of the process related to this guide is maintained. The fifth section of the guide contains the quality criteria that should be used to assess the by AI provided output and developed scenarios. The last and final section describes how the selected AI tool(s) can support the different steps of the scenario planning model.

The guide is made by Maxim Wielens, student of the Master of Business Administration at the University of Twente.

1. Introduction

The emergence of AI-based applications like ChatGPT and their widespread adoption globally has significantly raised awareness of AI across society. AI is perceived as a disruptive force in various sectors, prompting organizations to recognize its importance. Consequently, organizations have begun to focus on exploring the business opportunities stemming from AI adoption. However, despite the increasing interest in AI, companies are encountering challenges in realizing its full potential. A key obstacle is the lack of knowledge and skills related to AI adoption and utilization. Missing the relevant AI related knowledge and skills is currently forming a barrier for organizations which they must overcome in order to gain the potential benefits AI has.

Organizations also struggle with the increasing market uncertainty due to rapid technological innovations and volatile market environments with diversified customer needs. Scenario planning is an often by organizations used technique in order to cope with this uncertainty. However, the traditional scenario planning techniques have a number of weaknesses, as these approaches often take a lot of a time and resources because they lack standardized processes and tools for developing the scenarios. Organizations therefore struggle with finding the most efficient way of using the traditional scenario planning techniques.

Artificial intelligence applications have shown that AI can decrease the time and cost of making predictions about potential futures, decreasing the number of uncertainties in an efficient way. Therefore, Artificial intelligence might be a solution to overcome the traditional scenario planning weaknesses, decreasing the needed resources and time, by taking the role of a supportive tool. Thereby, organizations can use AI in a way that it produces organizational value, overcoming their struggle related to AI.

The goal of this guide is offering a systematic step-by-step manual how to adopt, use and leverage AI in the different steps of the scenario planning process, overcoming the scenario planning weaknesses and organizational struggle regarding AI.

2. Artificial intelligence tool(s)

This section starts with a short description of Artificial intelligence and what it entails. The second part describes the selected Artificial intelligence tools used in this guide.

2.1 What is Artificial Intelligence?

To get a good understanding of the definition of AI, it is key to first understand both internal concepts *"artificial"* and *"intelligence"* separately (Enholm et al., 2022; Wirtz et al., 2019). According to Cambridge Dictionary (2024) *"artificial"* is a human-made creation that mimics or replicates something natural. *"Intelligence"*, on the other hand, refers to cognitive processes, encompassing activities like learning, reasoning, and understanding (Lichtenthaler, 2019). Combining these two concepts, artificial intelligence can be defined as the creation of technological systems capable of emulating intelligence (Wamba-Taguimdje et al., 2020). This implies that computers can undertake tasks typically associated with human intelligence, such as understanding, learning, reasoning, and problem-solving. While there are several ways to define AI, this guide defines AI as "*a technology that aims to enable systems to identify, interpret, make inferences, and learn from data to achieve predetermined organizational and societal goals*."

2.2 Selected Artificial intelligence tool(s)

ChatGPT Plus and DALLE-3 are the two AI tools used in this guide. ChatGPT, short for Chat Generative Pre-Trained Transformer, is a language model developed by OpenAI. It belongs to the GPT (Generative Pre-trained Transformer) series of models and is built on the GPT-3.5 architecture.

The GPT models, including ChatGPT, are designed to generate human-like text based on the input provided. They are pre-trained on a large corpus of text data from the internet, allowing them to understand and produce coherent responses in a conversational manner. This makes them suitable for various natural language processing tasks, including chatbot interactions.

ChatGPT leverages deep learning techniques, specifically transformer neural networks, to process and generate text. Deep learning enables the model to learn complex patterns and representations from the vast amounts of text data it is trained on, enhancing its ability to generate human-like responses.

ChatGPT Plus is the Plus version of ChatGPT and offers some additional features such as access to the web and thereby real time data and it has an integrated image generator called DALLE-3. DALLE-3 is a variant of the DALL-E model developed by OpenAI, which is designed to generate images from textual descriptions. DALLE-3 builds upon this capability, allowing users to generate high-quality images based on textual prompts. DALL·E 3 is an iteration of the DALL·E series, a neural network-based image generation system also created by OpenAI. DALLE-3 is a text-to-image generation model that can be used to generate tailor made images based on text. ChatGPT Plus can be instructed to visualize a certain prompt and it will use DALLE-3 to do so.

ChatGPT and DALLE-3 work in the same interface which is accessible on https://chat.openai.com/. In order to use ChatGPT you need an account, which you can create for free. However, in order to access ChatGPT Plus and DALLE-3 you need a Plus account which costs $20 a month. Once you created an account and logged in with it, you can send a text request to ChatGPT, by putting it in the text box and clicking  . These requests can be in the form of a question, a statement, or any text input. These text requests are better known as “prompts”.
An example of a prompt is:
What are 5 creative things I can do with my bike?
Once you send a prompt, ChatGPT will analyze that prompt and generate a text response based on its training. In doing so it aims to provide relevant and coherent answers.

DALLE-3 can be used through ChatGPT Plus. In order to use DALLE-3 you have to make clear to ChatGPT Plus that the output should be visualized in an image instead of text. Therefore, you should clearly describe the image you want to generate. Once you've described the image, ChatGPT Plus will translate your description into a prompt for DALL·E. It will then submit the prompt to DALL·E, which will generate the image based on your description.

So, both tools work in the same interface with so called prompts. Just instruct the tool what you want it to do with a prompt and it will do the work for you.

3. Scenario planning process

This guide uses the scenario planning model of Schwartz. This model consists of eight steps (see figure 1). The model suggests plotting scenario drivers to develop various scenarios.

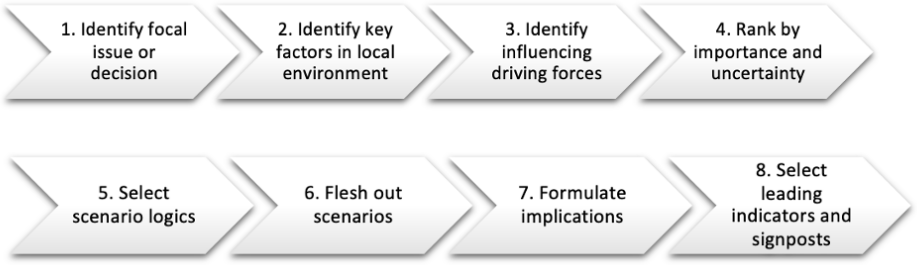


Figure 6 Scenario planning model Schwartz

3.1 Scenario planning model Schwartz

1. **Identify focal issue or decision:**

The goal of first step of the model is to identify focal issues or decisions relevant for the organization that require analysis. The organization should determine what issues or decisions are relevant for them and define the scope and timespan in which this will happen. Examples are “Should we invest in technology X?” or “What are factors that could disrupt our current strategy?”. The key thing to remember when selecting a focal issue or decision is that it needs to help you focus on the uncertainty for which you want to prepare. It is also important to choose a time horizon that isn’t to short and thereby discourages research and preparation for potential surprises, nor to long and thereby leads to vague, unrelatable scenarios.

2. **Identify key factors in the local environment which influence the decision:**

In step 2 the key factors that might have a direct or indirect influence on the selected focal issues or decisions have to be identified. The goal is to identify external factors from the local organizational environment which influence the in step 1 selected focal issues/decisions. Many of these factors are obvious as they are part of the organization’s business plan for example demand, competition, technology developments or supply chain changes. After identifying these key factors, they have to be evaluated to make sure they are relevant for the in step 1 selected issues/decisions.

3. **Identify driving forces that influence key factors in the local environment**:

The driving forces with their potential development directions, that might influence the identified key factors have to be identified in step 3. This step is more focused on searching for trends compared to step 2 of this process. These driving forces are typically external forces that might impact the key factors and thereby the selected issues or decisions. These

driving forces can be political, economic, social, technological, and regulatory. These are often bigger forces outside the direct environment of the organization, for example war, currency fluctuation or cultural barriers. The goal of this step is to identify the driving forces and their potential development directions, that influence the key factors identified in step 2 and focal issues/decisions selected in step 1. While these driving forces are often viewed as risks, they can also form opportunities. It is important to be realistic.

4. **Rank by importance and uncertainty:**

Next, the identified key factors and driving forces have to be assessed on importance and uncertainty. Importance refers to the level of impact or influence it will have on the in step 1 selected focal issue(s) while uncertainty relates to the level of unpredictability associated with the factor or driving force. The identified key factors and driving forces have to be ranked based on this assessment. This will lead to a number of critical key factors and driving forces. These key factors and driving forces will then be explored deeper by identifying their internal predetermined elements and critical uncertainties. In order to understand their underlying elements.

5. **Select scenario logics:**

The goal of step 5 is to determine which futures are worth developing as detailed scenarios. Therefore, the top 2 key factors/driving forces identified in step 4 will be used to name the axes of a 2-by-2 matrix (see figure 2). This matrix will then be used to develop 4 scenario logics or themes that present potential futures. These logics represent different potential futures based on combinations of the top 2 key factors/driving forces.

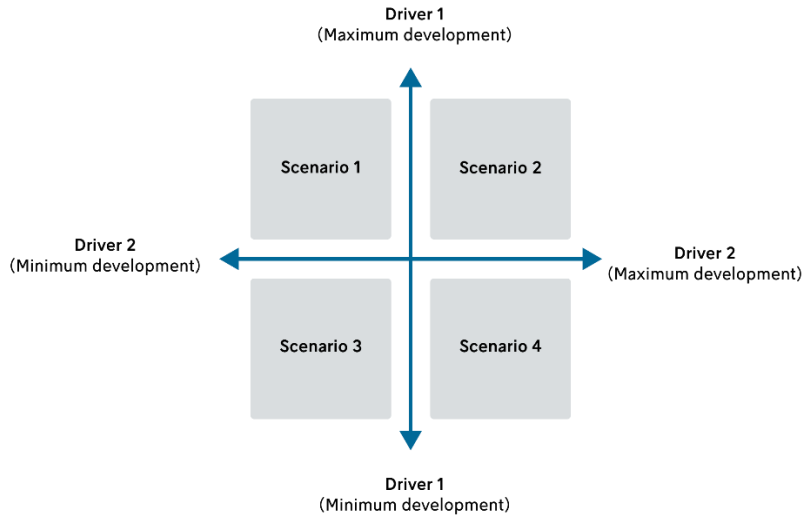


Figure 7 Scenario matrix

6. **Flesh out scenarios:**

The in step 5 identified scenario logics will be developed into detailed scenarios in step 6. The trends and developments that lead to the scenario will be described. The goal of this step is to develop the scenarios themes/logics into consistent scenarios that provide a comprehensive picture of the potential future. The outputs of the previous steps should be combined in order to do this.

7. **Formulate implications**:

The goal of step 7 is to formulate implications based on the developed scenarios. These implications for the scenarios have to be relevant for the in step 1 selected issue or decision. Moreover, the risks, opportunities, challenges, and trade-offs associated with each scenario have to be assessed. This helps understanding the potential consequences of the different futures and supports the decision-making process. While there are some implications that are related to every scenario these should be prioritized.

8. **Select the leading indicators and signposts:**

Lastly, in step 8 the leading indicators and signposts that can be monitored to track the progress of each scenario will be identified. These indicators serve as early warning signals and help assessing the likelihood of the different scenarios. Monitoring these indicators enables organizations to adapt their strategies accordingly. The goal of this last step is to select indicators and signposts that can be used to monitor and assess the scenarios. Examples of potential indicators are news publishers or technological development progress.

4. Process quality control

Process quality control is a long-used technique to maintain the quality of a process.
The primary goal of process quality control is to achieve consistent and reliable outcomes by reducing variations and errors. Process quality control plays a crucial role in ensuring process quality and thereby ensuring the productivity, efficiency and consistency of a process. It is therefore of great importance to every process and every organization.

This guide uses the Input-Process-Output model, which is also known as the IPO model to control the quality of the process. The IPO model provides a structured way to analyze and optimize the flow of resources, activities, and information throughout a process, aiming to enhance efficiency, consistency, and ultimately the quality of the produced output. The IPO model breaks a process down into three essential components:

1. **Input:** This represents the resources, materials, data, and information required to initiate and execute a particular process. The inputs used in this process are the prompts displayed in section 6. These prompts are based on the goal of the related step of the scenario planning process in order to ensure their relevance and quality. These prompts are fixed in order to enhance efficiency, consistency, and ultimately the quality of the produced output.
2. **Process:** This includes the series of activities, tasks, and steps performed to transform the inputs into desired outputs. The process related to this guide is the use of ChatGPT Plus and DALLE-3 combined with the guide itself in order to transform the inputs into the desired outputs. ChatGPT Plus and DALLE-3 are selected based on a critical review in which they scored the best on the Artificial intelligence evaluation criteria from the literature. The guide is based on academic literature and research in order to ensure its quality. Moreover, the guide offers a systematic approach which aims to enhance the efficiency, consistency, and ultimately the quality of the produced output.
3. **Output**: The output component of the IPO model represents the result or deliverables generated from the process. The quality of the output reflects the effectiveness of the inputs and the efficiency of the processes. The output quality should be evaluated by using the quality criteria discussed in section 5.

5. Output evaluation

Three quality criteria will be used to assess the output and scenarios provided by the process. These criteria are:

- **Relevance**: Each scenario should address current organizational concerns but also think beyond the current assumptions. By meeting this criterion, decision makers will recognize their specific concerns immediately within the scenarios. The relevance of the output should be assessed by linking the provided output and scenario to current organizational concerns and evaluate if and to what extent these match.
- **Challenging**: Each scenario must provide a new view which differs from the current one. There should be a good balance in the amount of challenge, as too challenging scenarios or not challenging scenarios won't be taken seriously by the decision maker. The evaluation of this criterium is based on the knowledge and opinion of the users.
- **Plausible**: The scenarios should be internally consistent and realistic so that the scenario is possible of happening. This is based on in-depth analysis and research. Therefore, scenarios should be supported by data. In order to evaluate the plausibility users should search for credible data that support the provided output and thereby the scenarios.

In short, scenarios must be relevant by addressing organizational concerns, challenging by expanding the thinking of the organization and its decision makers and plausible by being well analyzed, researched and supported by data.

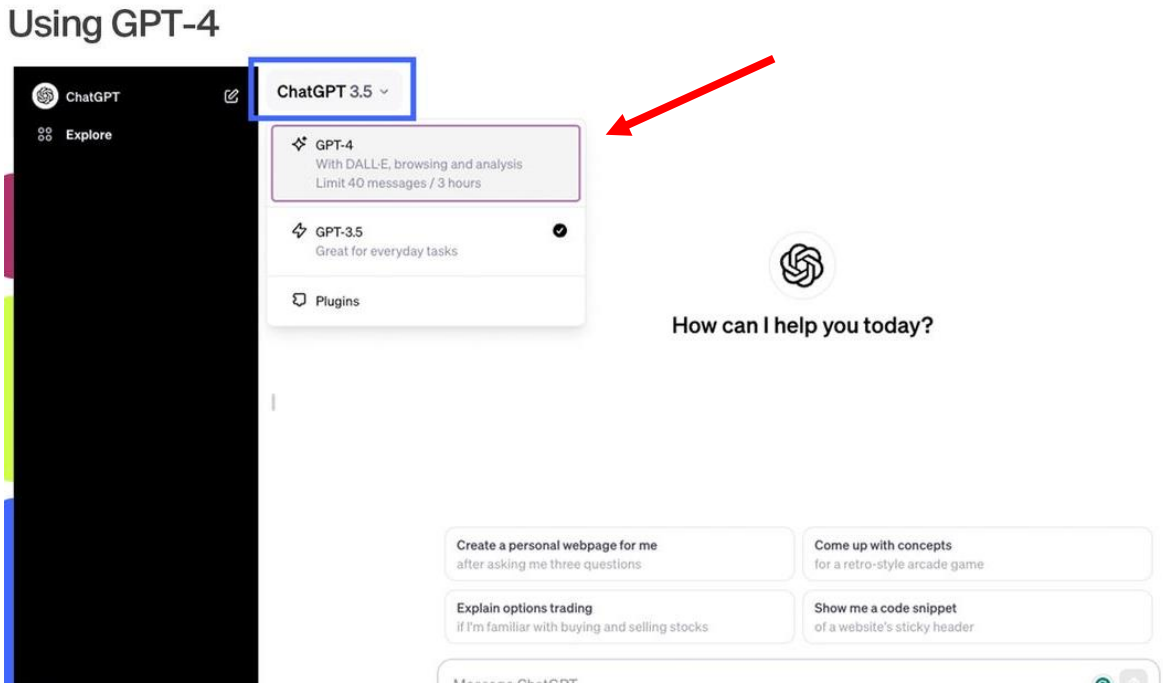
6. AI in the scenario planning process

ChatGPT plus and DALLE-3 are selected as the best combination of AI tools to support the scenario planning process. This section contains prompts related to each step of the scenario planning process. These prompts are used in ChatGPT Plus in order to transform the inputs into the desired outputs. The outputs should be evaluated on the quality criteria discussed in section 5. Moreover, the outputs should be combined with human knowledge, since the human thinking aspect plays an important role in the scenario planning process.

Please follow all the steps carefully in order to enhance the efficiency, consistency, and ultimately the quality of the produced output.

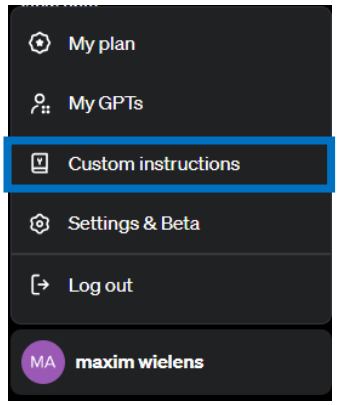
6.1 Login/Create an account

1. **Go to: https://chat.openai.com/auth/login**
2. **Already have an account? Click login and login with your account information**
3. **Don't have an account? Click sign up, create an account and login**
4. **Make sure you have a ChatGPT Plus subscription**
5. **Click on the top left in the ChatGPT window to switch between models from the default GPT-3.5 to GPT-4 (see image)**



6.2 Set custom instructions

1. **Click in the left bottom on your account name**
2. **Click on “custom instructions” (see image)**



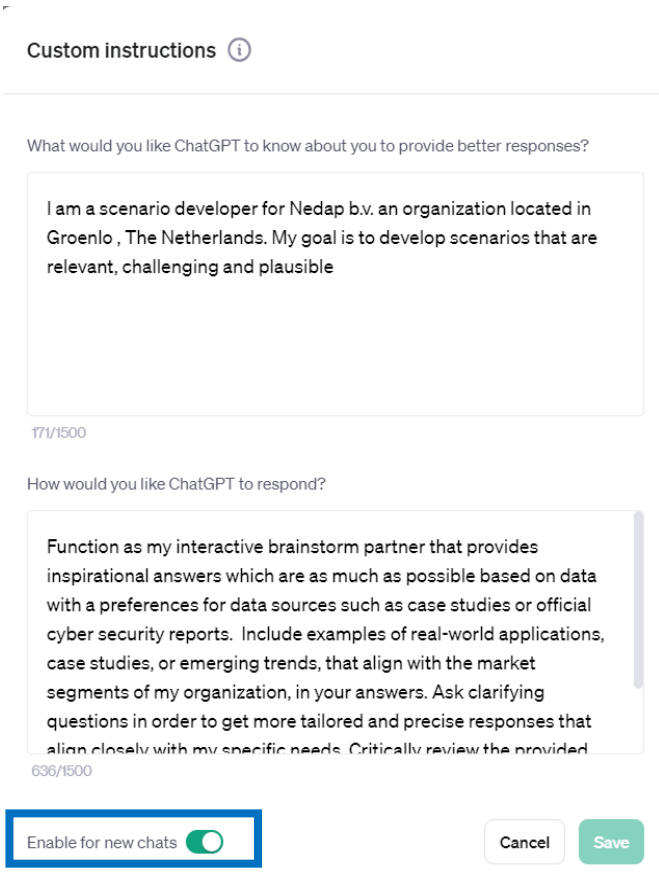
3. **Make sure you have the custom instructions enabled for new chats (see image)**
4. **Set the custom instructions like the following by copying the *italic* text (see image):**

1. What would you like ChatGPT to know about you to provide better responses?

I am a scenario developer for [organization name] an organization located in [name city], [name country]. My goal is to develop scenarios that are relevant, challenging and plausible.

2. How would you like ChatGPT to respond?

Function as my interactive brainstorm partner that provides inspirational answers which are as much as possible based on data with a preference for data sources such as case studies or official reports. Include examples of real-world applications, case studies, or emerging trends, that align with the market segments of my organization, in your answers. Ask clarifying questions if needed in order to get more tailored and precise responses that align closely with my specific needs. Critically review the provided answers and rewrite based on this review. Make sure the provided answers are relevant, challenging and plausible.



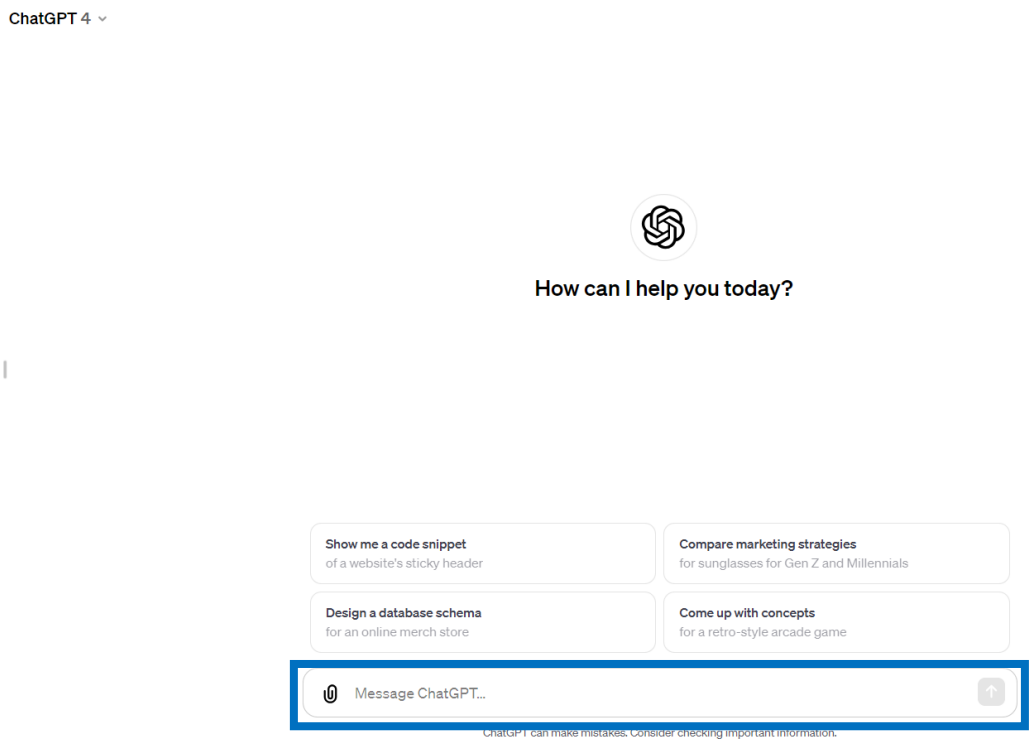
5. **Make sure to fill the brackets [] with your exact organizational information**

6. **Save the custom instructions by clicking on** 

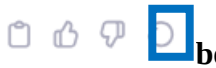
6.3 Identify focal issue or decision

7. **Identify focal issues or decisions relevant for your organization. Therefore, put the following prompt in the text box:**

Provide me a list of 10 focal issues or strategic decisions that are relevant for my organization and in particular for our industry [specify industry, e.g., technology, healthcare, etc.] and require thorough analysis. These should be pertinent to our organization's current context, including aspects like technology adoption, market expansion, and operational strategies. Examples are "Should we invest in technology X?" or "What are factors that could disrupt our current strategy?" The focal issues and decisions should help me focus on the uncertainty for which I want to prepare. Please ensure these focal issues are relevant to the unique aspects of our sector and organizational goals.



8. **Fill the brackets [] with the industry/sector you want to focus on**
9. (Not required) **change the examples in the prompt to examples specified to your organization**
10. **Click on** 

11. **Critically evaluate the provided focal issues based on your personal knowledge. If you are not satisfied, click**  **below the by ChatGPT provided response**
12. (Not required) **add own focal issues or decisions to the list, therefore put the following prompt in the text box:**

Please add the focal issue of [specify the issue] to the list of strategic decisions and focal issues.

13. (Not required) **fill the brackets [] with the focal issue you want to add.**
14. (Not required) **click on** 
15. **Critically evaluate the provided focal issues based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:**

- *Please elaborate [specify focal issue].*
- *Please include [XXX] in your answer.*
- *Make the focal issues more [e.g. financially focused].*

16. **Select the focal issue(s) from the list provided by ChatGPT that you want to focus on. Therefore, put the following prompt in the text box:**

For the rest of this conversation focus on focal issues or decisions [specify focal issues or decisions].

17. **Fill the brackets [] with the focal issue(s) (number or name) you want to focus on.**
18. **Click on** 
19. (Not required) **create a Word document that will be used to create an overview of the by ChatGPT and DALLE-3 provided outputs**
20. (Not required) **copy the output of the selected focal issue to the Word document in order to create an overview.**
21. **Define a potential scope and timespan for the selected focal issues. Therefore, put the following prompt in the text box:**

Please provide a detailed scope and timeframe, in months, for each of the selected focal issues or strategic decisions relevant to my organization. For each issue or decision:

5. ***Define the Scope**: Describe the specific aspects, areas, or elements of our organization that the issue or decision will impact. Include any relevant market segments, technologies, or operational areas.*
6. ***Estimate the Timeframe**: Provide an estimated timeframe, in months, for addressing or implementing the issue or decision. Indicate whether this is for initial impact, full implementation, or another specific milestone.*
7. ***Substantiate with Data**: Offer substantiation for each scope and timeframe estimation using relevant, real-time data, case studies, or industry benchmarks. Include sources where possible for data validation.*
8. ***Describe Trade-offs**: Explain the trade-offs considered in defining the scope and timeframe. This might include resource allocation, market conditions, technological feasibility, or other strategic priorities.*

The goal is to have a clear understanding of the scope and timespan for each focal issue or decision to better prepare for and address these strategic considerations.

Next combine these factors in one table to provide a clear overview.

22. click on 

23. Critically evaluate the provided scope and timespan based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:

- *Please elaborate [specify focal issue].*
- *Please include [XXX] in your answer.*
- *Make the focal issues more [e.g. strategic].*

6.4 Identify key factors in the local environment which influence the decision

24. **Identify key factors in the local environment which influence the selected focal issue(s) or decisions. Therefore, put the following prompt in the text box:**

Identify and analyze the key external factors from the local organizational environment that directly or indirectly influence our chosen focal issues: [Selected focal issues]. In your analysis, clearly distinguish between micro factors (specific to our direct organizational environment) and meso factors (related to the broader industry and market context) for each focal issue. Additionally, consider the interplay among the focal issues. Provide a structured breakdown for each focal issue, citing current and relevant examples specific to [specify industry or market segment]. This analysis should inform our scenario planning by elucidating these influences and proposing potential strategies to either leverage or mitigate them. Focus on incorporating recent trends and up-to-date data to ensure that the analysis is both current and actionable. Finally, create a summarized overview table of each selected focal issue alongside its related micro and meso external factors.

25. **Fill the brackets [] with the focal issues (name) you selected**
26. **Fill the brackets [] with the industry or market segment you want to focus on**
27. **Click on** 
28. **Critically evaluate the identified external factors from the local environment based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:**

- *Please elaborate [specify external factor].*
- *Please include [specify external factor] in your answer.*
- *Make the external factors more [e.g. financially focused].*

29. (Not required) **copy the provided summarized overview table to the Word document in order to create an overview.**
30. **Evaluate the identified key external factors to make sure they are relevant for the selected focal issues or decisions. Therefore, put the following prompt in the text box:**

Please conduct an evaluation of the identified external factors from both the micro (direct organizational environment) and meso (broader industry and market context) levels that directly or indirectly influence our organization's selected focal issues. Provide a structured analysis distinguishing between micro factors, which pertain to the immediate business

environment, and meso factors, which encompass the broader industry and market trends affecting our sectors. Include current, relevant examples pertinent to these industry segments. The goal is to inform the decision makers of the scenario planning process by understanding these external influences and suggesting potential strategies for either leveraging or mitigating these factors. Please ensure the analysis is up-to-date, actionable, and prioritizes each identified factor based on its relevance and impact on the focal issues and the organization as a whole. Include argumentation.

Next, create a ranking of all these factors based on their relevance and impact.

31. **Click on** 
32. **Critically evaluate the provided evaluation of the identified external factors based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:**

- *Please re-evaluate [specify external factor].*
- *Please include [XXX] in your evaluation.*
- *Make the evaluation more [e.g. financially focused].*

33. (Not required) **copy the provided ranking to the Word document in order to create an overview.**

6.5 Identify driving forces that influence key factors in the local environment

34. **Identify the driving forces and their potential development directions that influence the previous identified key factors. Therefore, put the following prompt in the text box:**

Please conduct a detailed in-depth analysis to identify and evaluate the macro-level driving forces affecting the previous identified key external factors of our selected organization's focal issues.

For each driving force:

1. ***Identify and Describe the Driving Forces****: Clearly define and specify the driving forces and explain its relation to the identified factors and focal issues and explain nature and current status in the context of [specific industry/sectors].*

2. ***Potential Development Directions****: Discuss the possible future directions these driving forces could take. Provide scenarios or trends that depict how these forces might evolve and the implications for our organization and industry.*

3. ***Evaluate the Relevance****: Assess and explain the relevance of each driving force in relation to the identified factors and selected focal issues. Discuss how these forces impact our strategies, operations, and decision-making processes.*
The goal of this analysis is to gain insight into the driving forces behind the identified external factors influencing our focal issues. We aim to leverage this understanding to inform our scenario planning process and decision-making, ensuring our organization is well-prepared and proactive in navigating the future.
After this create a table with the driving forces in the first column, their related external factors in the second collum and the focal issues that are influenced by both in the third column.

35. **Fill the brackets [] with the specific industry or sector you want to focus on.**
36. **Click on** 
37. **Critically evaluate the identified driving forces based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:**

- *Please elaborate [specify driving force].*
- *Please include [specify driving force] in your answer.*
- *Make the driving forces more [e.g. financially focused].*

38. (Not required) **copy the provided table to the Word document in order to create an overview.**

6.6 Rank by importance and uncertainty

39. **Assess and rank the previous identified key factors and driving forces based-on importance and uncertainty. Therefore, put the following prompt in the text box:**

Please assess and rank both the previous identified driving forces and their related external factors in terms of their importance and uncertainty as they relate to the selected focal issues and thereby to the organization. Assess and rank the external factors and driving forces for all the selected focal issues based on:

- ***Importance****: refers to the level of impact or influence each factor or force has on the focal issue*
- ***Uncertainty****: relates to the level of unpredictability associated with each factor or force.*

Include argumentation. Combine the two criteria in order to determine the most critical factors and forces for the organization in one ranking. Provide a structured evaluation that

prioritizes these factors and forces based on their importance and level of uncertainty concerning the focal issues. This analysis aims to inform our scenario planning process by understanding the critical factors and forces that shape our organization's strategic considerations.

Next create a summary ranking table.

40. **Click on** 
41. **Critically evaluate the provided ranking of the identified external factors and driving forces based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:**

- *Please elaborate the evaluation of [specify external factor/driving force].*
- *Please include [XXX] in your answer.*
- *Make the ranking more [e.g. financially focused].*

42. (Not required) **copy the provided ranking table to the Word document in order to create an overview.**
43. **Identify the internal predetermined elements and critical uncertainties of the previous identified critical external factors and driving forces. Therefore, put the following prompt in the text box:**

Please conduct a detailed analysis of the critical external factors and driving forces previously identified, focusing on dissecting their internal predetermined elements and critical uncertainties. For each driving force, identify and describe:

1. ***Predetermined Elements:*** *Clarify the aspects that are stable and predictable within our organization's context. Explain how these elements are expected to continue and their potential impact on our strategic environment.*
2. ***Critical Uncertainties:*** *Identify the variable and unpredictable aspects. Discuss the range of possible outcomes and their implications for our organization.*

This analysis aims to deepen our understanding of the internal and external factors shaping our strategic landscape and enhance the robustness of our scenario planning. The goal is to differentiate clearly between what we can anticipate with reasonable certainty and what we need to monitor and prepare for due to its inherent unpredictability.

Finally, compile the findings into a structured overview, categorizing the predetermined elements and critical uncertainties for each critical driving force and external factor.

44. **Click on** 
45. **Critically evaluate the provided internal predetermined elements and critical uncertainties based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:**

- *Please elaborate [specify predetermined element/critical uncertainty].*
- *Please include [XXX] in your answer.*
- *Make the predetermined elements more [e.g. financially focused].*

46. (Not required) **copy the provided overview to the Word document in order to create an overview.**

6.7 Select scenario logics

47. **Develop 4 scenario logics or themes that present potential futures based on previous identified top 2 external factors/driving forces. Therefore, put the following prompt in the text box:**

Please perform the following steps to generate robust scenario logics or themes for our scenario planning:

1. ***Selection of Driving Forces or External Factors**: Identify the top two driving forces or external factors previously determined as most impactful and uncertain. These will form the axes of a 2-by-2 matrix.*
2. ***Defining Extreme Variants**: For each of the selected driving forces or factors, define two distinct and extreme variants. These will represent the ends of each axis, creating a spectrum of possibilities.*
3. ***Developing Scenario Logics**: Create and name four unique scenario logics or themes. Each should represent a plausible future emerging from different combinations of the extreme variants of the identified driving forces or factors. Ensure consistency and plausibility in the narratives.*
4. ***Analyzing Overlaps**: Examine the potential overlap between these themes to determine the most distinct and valuable futures worth developing into detailed scenarios.*
5. ***Visualization**: Construct a 2-by-2 matrix, with the selected driving forces or factors as axes and the developed scenario logics at each quadrant, to visualize the relationship and potential transitions between these futures.*

6. ***Evaluate****: Conduct a thorough analysis and review of the developed logics to determine the likelihood and relevance of each future. This step ensures the scenarios are aligned with current understandings and plausible developments.*

This structured and iterative approach will allow us to visualize and comprehend a range of potential futures, directing our strategic decisions and planning efforts. The objective is to craft a set of diverse, challenging, and plausible scenarios that provide deep insights for navigating future uncertainties and enhancing organizational resilience.

48. **Click on** 
49. **Critically evaluate the provided scenario logics based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:**

- *Please elaborate [specify scenario logic].*
- *Please include [XXX] in your answer.*
- *Make the scenario logics more [e.g. financially focused].*

50. (Not required) **copy the provided 2-by-2 matrix to the Word document in order to create an overview.**

6.8 Flesh out scenarios

51. **Develop the scenario logics into consistent scenarios that provide a comprehensive picture of the potential future. Therefore, put the following prompt in the text box:**

Utilizing the scenario logics identified through our 2x2 matrix of the most impactful and uncertain driving forces and external factors, please develop four detailed and extensive scenarios representing potential futures for our organization.
For each scenario:

1. ***Detail the Scenario Extensively:*** *Elaborate on the envisioned future by describing how trends, developments, and interactions between the driving forces and external factors culminate in this specific scenario. Provide a rich, detailed narrative that includes economic, technological, social, and regulatory dimensions, referencing the extreme variants defined for each axis in our scenario matrix.*
2. ***Integrate Deep Insights:*** *Draw upon the in-depth analysis of predetermined elements and critical uncertainties associated with each driving force and external factor. Use the importance and uncertainty rankings to underscore why these scenarios are*

critical for our organization. Include statistical forecasts, expert opinions, and recent industry-specific studies to enrich the scenarios with concrete, relevant insights.

3. ***Ensure Sector-Specific Relevance and Challenge:*** *Tailor each scenario to be directly relevant to the [specify sector], specifically addressing areas where our organization operates. Dive into sector-specific trends, challenges, and opportunities, ensuring that each scenario encourages proactive and strategic thinking. Highlight potential disruptors, market shifts, and emerging opportunities that would require strategic agility and innovation.*
4. ***Maintain Enhanced Plausibility:*** *Construct each narrative based on plausible extensions of current and forecasted trends, informed by up-to-date industry reports, market analyses, and scientific projections. Include potential policy changes, technological breakthroughs, and global economic factors that could realistically shape the future. Ensure that all elements are coherent and build upon established trends and known variables.*
5. ***Provide a Comprehensive Overview:*** *Summarize each scenario in a detailed table, clearly delineating how the findings from previous steps (identification of driving forces and external factors, the development of the 2x2 matrix, and the assessment of importance and uncertainty) are integrated to form each detailed and extensive scenario. This table should logically connect the abstract elements of scenario planning to concrete, actionable futures, ensuring traceability and clarity in the narratives.*

Ensure that the scenarios are not only relevant and extensive but also present challenging and thought-provoking narratives that compel our organization to think critically and prepare strategically. The goal is to provide a comprehensive and advanced toolkit for anticipating and navigating potential futures, enhancing decision-making and organizational resilience.

52. **Click on** 
53. **Critically evaluate the provided scenarios based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:**

- *Please elaborate [specify scenario].*
- *Please include [XXX] in your answer.*
- *Make the scenarios more [e.g. financially focused].*

54. (Not required) **copy the provided overview to the Word document in order to create an overview.**
55. **Develop visualization prompts. Therefore, put the following prompt in the text box:**

Develop comprehensive visualization prompts for the four detailed scenarios, representing potential futures for our organization. Each prompt should distill the core essence of its respective scenario, weaving together economic trends, technological advancements, sector-specific nuances, and overarching strategic influences. Aim to vividly illustrate the narrative of each scenario, highlighting its focal issues, external factors, and driving forces. The visuals should effectively convey the depth, nuances, and complexity of each future environment. In your descriptions, accentuate the distinctive features and pivotal elements of each scenario, ensuring a clear and impactful representation of the potential futures.

56. **Click on** 
57. **Copy and paste the provided visualization prompts for each scenario in the text box (one at a time)**
58. **Click on**  **(one at a time)**
59. (Not required) **copy the provided images to the Word document in order to create an overview.**

6.9 Formulate implications

60. **Formulate implications, risks, opportunities, challenges, and trade-offs that are relevant for the organization and focal issue or decision based on the developed scenarios. Therefore, put the following prompt in the text box:**

Identify and define, for my organization, the organizational implications of each developed scenarios relevant for the related focal issue or decision. Additionally, assess and define the risks, opportunities, challenges, and trade-offs inherent in each scenario. This will facilitate a deeper understanding of the potential consequences and variations in future landscapes, aiding our strategic decision-making process.

Provide recommended strategies or mechanisms to effectively address or capitalize on these implications, considering the organization's capabilities and goals. Identify key challenges

and focus areas, particularly those arising from overlaps between different scenarios, and discuss how they might influence organizational readiness and response.

Lastly, compile a summary table outlining which challenges are associated with each scenario and the anticipated effectiveness of current strategies under different future conditions. This table should serve as a concise reference for aligning our strategic planning efforts with potential future environments.

61. **Click on** 
62. **Critically evaluate the provided implications, risks, opportunities, challenges, and trade-offs based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:**

- *Please elaborate [specify implication].*
- *Please include [specify implication] in your answer.*
- *Make the implications more [e.g. financially focused].*

63. (Not required) **copy the provided table to the Word document in order to create an overview.**

6.10 Select the leading indicators and signposts

64. **Select indicators and signposts that can be used to monitor and assess the scenarios. Therefore, put the following prompt in the text box:**

Identify and define key leading indicators and signposts for each scenario that will enable the organization to monitor evolving trends and potential pivot points. These indicators should be specific, measurable, and relevant to the scenarios' focal issues and external factors. For each indicator, provide potential implications for the organization based on the observed developments. This will allow us to not only track but also understand the significance of changes in these indicators, enabling proactive adaptation of our strategies. The objective is to establish a robust set of indicators and signposts that effectively monitor and assess the scenarios, facilitating timely decision-making and strategic agility.

65. **Click on** 
66. **Critically evaluate the provided indicators and signposts based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, examples of prompts to do so are:**

- *Please elaborate [specify indicator/signpost].*
- *Please include [specify indicator/signpost] in your answer.*
- *Make the indicators/signposts more [e.g. financially focused].*

67. (Not required) **copy the provided indicators and signposts to the Word document in order to create an overview.**

6.11 Create an overview the scenarios including their inputs

68. Create an overview of the scenario planning process and thereby of each scenario including all the input used to create the scenario. Therefore, put the following prompt in the text box:

Please provide an overview that synthesizes the key elements of each scenario developed earlier. For each scenario, break down the following components:

1. ***Focal Issue**: Associate each scenario with the selected relevant focal issue it addresses within the organization.*
2. ***External Factors**: Discuss the previous identified key external factors from the micro and meso levels that influence each scenario, considering the industry and market segment.*
3. ***Driving Forces**: Discuss the previous identified driving forces that underpin each scenario and explain their nature and current status in the context of the industry.*
4. ***Critical Uncertainties**: Highlight the previous identified critical uncertainties that may affect the trajectory of each scenario and the organization's ability to adapt.*
5. ***Scenario overview**: Describe the scenario including its impact on my organization.*
6. ***Implications**: Describe the previous identified implications of each scenario, including its scope, timeframe, and impact on the organization's focal issues.*
7. ***Signposts and indicators**: Discuss the previous identified the leading indicators and early warning signals that can be used to track the progress and likelihood of each scenario.*

By breaking down each scenario into these elements, we aim to provide a comprehensive overview that allows for a deeper understanding of the potential future landscapes and their implications for my organization.

69. Click on 

70. Critically evaluate the provided overview based on your personal knowledge. In case you are <u>not</u> satisfied with the provided output make changes, example of prompts to do so are:

- *Please elaborate [XXX].*
- *Please include [XXX] in your answer.*
- *Make the overview more [XXX].*

71. (Not required) **copy the provided overview to the Word document in order to create an overview.**

6.12 Evaluate the outputs

72. Evaluate with your personal knowledge all the provided outputs and created scenarios on the criteria: relevance, plausible and challenging as described in section 5.

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