Universiteit Leiden
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Bachelor Computer Science & Economics

How Managed Service Providers Leverage Technology Forecasting in the Age of Generative AI

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BACHELOR THESIS

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29/06/2025

Abstract

Background: Anticipating technologies may become increasingly important in today's rapidly evolving technological landscape, where innovations such as GenAI could transform industries and economies. Technology forecasting offers structured ways to prepare for such changes. However, the academic literature often emphasizes theoretical methods over their real-world applications. This potentially results in little knowledge about how companies actually conduct technology forecasting and what challenges they face in practice.

Aim: This study investigates how Dutch managed service providers conduct technology forecasting. It looks at what practices are used in the process and what organizational factors are at play. The aim is to provide empirical information on the execution of technology forecasting and its perceived effectiveness in a real-world organizational context.

Methodology: A multiple case study approach was used to combine qualitative and quantitative data methods. The qualitative analysis consisted of fourteen semi-structured interviews with key company representatives. These produced approximately 700 minutes of transcribed audio. The transcripts were thematically analyzed, resulting in 45 distinctive codes that were grouped into 8 themes. Quantitative data was collected using a follow-up survey to validate and expand the findings of the interview. The survey data was collected from participants in 26 different managed service providers.

Results: The results suggested the existence of three main archetypes of technology forecasting processes: reactive, proactive, and developed approaches. Although all organizations engaged in monitoring trends and gathering external insights, the level of internal proactivity and formal structure varied significantly. This study identified these common challenges, such as limited time, lack of ownership, and unstructured processes. Organizations also reported benefits. These included great flexibility, well-functioning tools, and the ability to act quickly on emerging trends. Most participating companies seem to be experimenting with Generative AI. However, the study found that technology forecasting practices are often not sufficiently developed to support such technologies effectively.

Conclusion: Technology forecasting appears to be actively practiced by all participating managed service providers, but often in informal or fragmented ways. The findings suggest that addressing common challenges, such as unclear roles, limited time, and unstructured processes, could improve their forecasting capabilities. A more structured and well-integrated technology forecasting process might help managed service providers better anticipate and respond to rapidly emerging technologies.

Contents

Chapter 1

Introduction

1.1 Technology Forecasting

Anticipating technological developments is increasingly believed to be important in today's rapidly evolving technological landscape, where innovations such as GenAI could transform industries and economies [28]. Technology forecasting refers to the structured and systematic process of analyzing the future potential of technological developments. This enables organizations to identify and prioritize technologies with high economic value [11]. Practices within these processes can be broadly categorized into extrapolative and normative approaches. Extrapolative methods rely on historical data, while normative approaches define a desired future state and work backward. These methods can be further grouped into five main families: monitoring, expert opinion, trend extrapolation, modeling, and scenario planning. Each of these methods provides unique strengths and limitations [23].

1.2 Problem statement

Although a wide array of forecasting tools and techniques have been developed, limited empirical studies show how they are applied in decision-making processes or strategic planning in real-world contexts. In addition, organizational barriers such as budget limitations, stakeholder resistance, and lack of internal forecasting expertise are rarely addressed in academic studies [32].

Understanding how technology forecasting is conducted is critical in IT organizations, such as managed service providers. However, there is minimal exploration of how firms or public organizations use technology forecasting tools, such as scenario planning [32, 9].

A second problem could arise from the overemphasis on forecasting tools, rather than the broader forecasting process. The literature has extensively focused on the development and comparison of Technology Forecasting methods. However, relatively little attention has been paid to the organizational, human, and contextual factors that determine their practical effectiveness [32].

In short, limited research on practical usage could form a significant barrier to making technology forecasting truly effective for IT service organizations. This research should move beyond abstract models to address this research gap. Therefore, it should investigate how technology forecasting is conducted in practice.

1.3 Research question

Taking into account the problem statement, the following research question emerges.

"How are managed service providers conducting technology forecasting to prepare for the rapid emergence of new technologies?"

To address the research question, it is essential to answer the following three sub-questions.

- What are the current practices for conducting technology forecasting within managed service providers?
- What benefits and challenges do managed service providers face when executing their technology forecasting practices?
- What changes in technology forecasting practices could optimize for new rapidly emerging technologies, such as Generative AI?

1.4 Thesis overview

First of all, this chapter forms the introduction of this paper, mentioning the problem statement together with the research questions. Secondly, chapter 2 background and related work looks at the research of technology forecasting. In the third chapter, the methodology for this research is discussed. Chapter 4 looks at the findings and results of the research. This is followed by chapter 5 Discussion, where the results are discussed and interpreted. The sixth and last chapter Conclusions summarize the findings of this paper and the answers to the research questions.

Chapter 2

Background and related work

This chapter starts with an exploration of the concept and methods of Technology Forecasting. This is followed by a look at some specific techniques that are used in research. Apart from looking at what methods are used in research, this chapter looks at how technology roadmapping is used in organizations. To finish this chapter, the most common challenges with Technology Forecasting practices are highlighted.

2.1 Technology Forecasting

Technology Forecasting is a combination of all systematic and purposeful techniques to predict and analyze technological advances in invention, innovation, adoption, and utilization [11]. It uses research to identify and select technologies that will add the most economic or social value [10]. There are various categories of methods for conducting Technology Forecasting. Each of the different categories offers unique advantages, depending on the context and objectives of the forecast. These forecasting methods are broadly classifiable as extrapolative or normative [23]. Extrapolative methods use past and present data to predict impact, whereas normative methods are tracing back from the desired future. Most of the methods are extrapolative in nature and rely on historical data [23]. This seems intuitive, but has limitations, particularly when dealing with breakthrough technologies that lack sufficient data. This results in extrapolation methods that often miss radical shifts or disruptive innovations.

There are five families in which technology forecasting practices fit in: 1. monitoring, 2. expert opinion, 3. trend extrapolation, 4. modeling, and 5. scenarios [23]. In essence, 1. Monitoring is not a dedicated practice of Technology Forecasting, but is used for accumulating data that are necessary for many forecasting practices. It has the potential to provide a lot of useful information, but is vulnerable to an information overload when used improperly. Therefore, it is important to focus on providing only useful information for the forecast. Methods that use and analyze 2. Expert Opinions are part of this second family of forecasting techniques. A common implication is that it is hard to determine who are experts in what fields while performing these practices. When done correctly, expert opinions can tap into high-quality models that are absorbed through experience and practice. These models are valuable because they help to make accurate judgments, even if the experts themselves cannot clearly explain how they arrived at their conclusion. These methods work best in scenarios where data is lacking, modeling seems impossible, and there is an identifiable expert. The data collected with monitoring could be used in 3. trend Extrapolation methods. These methods use statistical and mathematical models to extend time series data into the future, offering data-based forecasting on quantifiable parameters [5]. These are especially accurate over short time frames. In order to function, it requires proper and usable data in a significant amount.

While short term projections are likely to be quite accurate, long term projections are less accurate and can therefore be misleading. The most fitting use for trend analysis is for adoption and substitution analysis in technologies, using quantifiable parameters. 4. Modeling techniques try to understand the real world by using representation with simplified versions of structures and relations. The disadvantage of these techniques is their heavy dependency on assumptions. That means that faulty assumptions often result in poor-performing forecasts. Modeling practices are especially useful for understanding complex

systems by reducing them to certain aspect [33]. The last family of Technology Forecasting practices is 5. Scenarios. These use snapshots of the future at a specific aspect, looking to paths to the future. he weakness of scenario methods lies in the risk that they become more of a gamble than a forecast. However, scenarios can be extremely effective when combined with other technology forecasting practices, due to their contribution of complex portraits of futures to the qualitative and quantitative insight of other forecast practices. Therefore, scenarios are a great option to integrate quantitative and qualitative information in a situation where both are critical.

Technology forecasting methods can also be categorized as 1. direct, 2. correlative, or 3. structural in nature [23]. Methods such as expert opinions, trend extrapolation, and Delphi surveys are part of 1. direct category. These Technology Forecasting practices all provide a direct forecast of parameters by analyzing a certain aspect of the technology. Most direct methods do not consider the context of the potential correlations between technological, economic, sociological, and political aspects. Therefore, they heavily rely on assumptions about the contextual conditions. An exception is formed by Expert Opinions, due to the allowance of subjective consideration of contextual change by the mental model of each expert [28]. 2. Correlative techniques measure background forecasting parameters or parameters of other technologies to forecast the targeted technology. This category is often used in normative forecasting and includes methods such as scenarios, cross-impact analysis, and lead-lag indicators. For example, lead-lag practices try to identify changes in how one technology influences the target technology [23]. The last category, structural forecasting methods, involves researching cause-and-effect relationships to forecast growth. Some examples include causal models, regression analysis, and relevance trees.

2.2 Techniques used in research

In addition to understanding what Technology Forecasting is, with its families and categories, it is valuable to examine how these practices are applied and for what purposes. There is a lot of research on various techniques for forecasting technologies.

One of these techniques is the Delphi survey method, which is often used in forecasting. It systematically gathers expert opinions in iterative rounds to build future scenarios and assess their likelihood and impact. This method can be used to explore future potential or implications, such as exploring the economic and social implications of 3D printing [14]. To acquire expert opinions, it is crucial to find qualified academic and industry experts to evaluate future projections. The results of a Delphi study often consist of the most probable future scenario that was predicted by experts at the end. This could be used to provide information for other technology forecasting practices, such as strategic planning.

Another interesting method for forecasting technological developments is patent analysis. This method analyzes published patents to find information about technologies. This could be used to identify potential new technology opportunities in a certain sector or in a certain technology. This method could be used in combination with other practices, such as research analysis, to compare research trends in combination with patenting activities [31]. The primary goal is often to support the commercialization of technologies and improve the research and development efficiency. There are multiple analysis methodologies that could be used in patent analysis. An example is creating patent networks that provide information on technological opportunities. Although in a different form, the results should always provide useful information on patent data, such as insight into diseases that are not well-researched [31].

Technology forecasting practices are often integrated in an attempt to improve the chances of successfully forecasting technological developments. Scenario planning and technology roadmapping are two examples of techniques that can be used separately or together. Scenario planning exists of practices that develop scenarios to identify key drivers to form different plausible scenarios using, for example, workshops or interviews with stakeholders. The practices of Technology roadmapping tries to map out strategies in different time frames considering different aspects. A combination of these techniques is scenario-driven roadmapping [13]. This technique uses these two Technology Forecasting practices in a two-phase approach. The first phase aims to create a number of plausible scenarios. Roadmapping is used in the second phase by letting participants map out strategies across different timeframes based on outcomes of the different scenarios. This analysis could be used to explore the long-term potential of technologies and to develop possible integration strategies. The results of this analysis include a flexible unified roadmap that combines conflicting stakeholders' priorities to provide strategies under varying

conditions.

There are many different practices that account for modeling techniques. Modeling techniques can be completely different and really depend on specific domain knowledge. Various modeling techniques can also be combined to potentially create a more successful model. The innovation diffusion model is an example of a modeling practice. The goals is to create a model that examines the impact of potentially related variables, such as electricity prices to a technology. Another modeling practice is a macro-econometric model. This model captures broader socioeconomic impacts, such as GDP and market trends. The innovation diffusion and macro-econometric model can be combined to reveals if the inclusion of certain variables improves the forecasting accuracy of a technology [22].

2.3 Technology roadmapping used in organisations

Technology roadmapping is a structured method used to align technological strategies with long-term business goals. It is a framework that links technological development to market and product strategies over time. While technology forecasting is the broader concept focused on anticipating future technological developments, technology roadmapping is both a forecasting method in itself and a framework that integrates other forecasting techniques [8].

Roadmaps structure insights into uniform, time-based plans. Organizations that apply roadmapping successfully typically combine multiple foresight methods, such as scenario planning, patent analysis, and trend analysis. These combinations improve the robustness of roadmaps [7, 30].

The sources used in roadmapping processes typically include both internal and external information. For example, market analyses, supplier inputs, customer feedback, and scientific publications are commonly used to populate roadmaps. These can be categorize into market- and technology-oriented sources. Technological-oriented sources are addressing the technological state, while market-oriented sources include market information, such as customer needs and size. Sources can be further divided into primary and secondary types. Primary types include direct input from customers, suppliers, and internal experts. Meanwhile, secondary sources are indirect sources, such as market reports, patents, and academic papers [30].

Despite its potential, the use of roadmapping within organizations is often limited. Many firms apply it only to isolated domains such as product or technology planning, instead of using it as an integrated, multi-layered strategic instrument. Roadmaps are frequently updated irregularly and few organizations using structured processes for revision. Firms with limited expertise typically use roadmaps for short-term operational purposes, while more advanced organizations leverage them for long-term strategic alignment. Update processes are often ad hoc, and formal mechanisms for re-visiting roadmaps are lacking in most cases [30]. Stakeholder involvement within roadmapping efforts remains a major challenge, as many implementations are based on a narrow group of actors. For roadmap development to fully support industry-wide foresight and innovation coordination, larger and earlier engagement of stakeholders is essential [7].

2.4 Challenges with Technology Forecasting Practices

Technology forecasting faces several challenges that complicate its reliability and utility in decision-making processes. One significant issue is the fundamental uncertainty in predicting the future of technological advancements. This uncertainty is caused by the complexity of technological systems in terms of social, economic, and political factors and the unpredictable nature of scientific breakthroughs [25]. This uncertainty makes it difficult to cope with ambiguous outcomes and could cause frustration in executors who struggled to understand the iterative nature of forecasting and its reliance on incomplete data. Another cause is the unpredictable nature of future scientific discoveries or large-scale policy decisions [3].

In addition, challenges are faced due to hard definable concepts and methodologies [25, 3]. Methodological inconsistencies in the forecasting literature also pose a problem, as it is challenging to apply theoretical advances to practical applications [25]. Methodologies are often overly complex and contradictory, making it difficult for people to understand fundamental concepts. Combining with a lack of

teaching materials makes it harder to practice and learn Technology Forecasting techniques. Forecasting methods often do not align with dynamic changes and theoretical models from innovation studies [3]. Significant disagreement among experts about the timelines for breakthroughs is reflecting the complexity and unpredictability of these technological advancements.

Another challenge is the limited data used in forecasting practices. Methodologies often accumulate a dataset using specific sources to determine possible future outcomes or scenarios. Limited and incomplete data can negatively influence the quality of the forecast. An example of such an issue is the reliance on patents as a primary data source. This can be problematic due to variations in patent quality and practices between industries and regions [16]. What further complicates efforts to use patents as reliable indicators to forecast technologies is another challenge with patent data, in the lack of correlation between patent count and technological maturity [19]. Moreover, statistical analyzes, such as Granger causality tests, reinforce the notion that patents alone cannot reliably predict economic outcomes or successful commercialization without strategic governmental alignment [2].

Traditional forecasting practices are also criticized by examining their philosophical basis. Five inquiry systems were identified, including Leibnizian (model driven), Lockean (data driven), Kantian (synthetic), Hegelian (conflict-based) and Singerian (holistic) [20]. Most forecasting methods are argued to rely on oversimplified assumptions. For example, Delphi techniques (Lockean) aim to get experts to agree, but this can push aside different ideas. Meanwhile, substitution analyses (Leibnizian) assume standard growth patterns, ignoring disruptive innovations. Problems such as predicting socio-political impacts of technologies are identified as ill-structured problems. This type of problem requires dialectical (Hegelian) or Singerian approaches to incorporate ethical considerations and interdisciplinary perspectives. However, existing methods often neglect these frameworks, leading to fragmented or overly optimistic forecasts.

Chapter 3

Methodology

This chapter discusses the methodologies used to answer the research questions. It starts by introducing the qualitative multiple case study approach and why it is the best fit. This is followed by the discussion of the semi-structured interviews, their design, and how to conduct them. At the end of this chapter, the follow-up questionnaire is discussed.

3.1 Multiple case study

To answer the research question, a case study seems most suitable, due to its ability to provide an in-depth overview and consideration of the contextual background of a case. This study aims to explore the differences between the cases, with the goal of finding similarities and differences between the various cases. Therefore, this research will use a multiple case study approach. This approach is highly effective for capturing the variations in technology forecasting between the different managed service providers. Each case study forms a representation of an individual managed service provider, with each having their own circumstances. An advantage of the multiple case study is its ability to capture information about the research question in different settings and across all these settings. This allows for comparative insights into the differences and similarities in the approaches of the various organizations. One of the main advantages of this type of case study is that its results are considered robust and reliable [4].

3.2 Data collection

In this research, qualitative data are used for this multiple case study to show in-depth details and nuances within the cases. To gather these qualitative data, semi-structured interviews are selected. To answer the research questions, some open questions are needed to gather information on the current practices used in these cases. In addition, flexibility is needed to ask ad hoc questions that examine the unknown territory on the benefits and challenges they face, and their perception on the process in general. Therefore, a flexible qualitative technique is necessary. Semi-structured interviews are well suited to ask a set of open questions while also capturing independent thoughts and having the freedom to pursue potential unexpected insights [1]. One semi-structured interview is conducted per case company. Each interview will last approximately 45–60 minutes. Although conducting multiple interviews in each company would enhance the objectivity of the data, the choice to conduct a single in-depth interview for each case was made due to the scope and time constraints. This approach was chosen for an exploratory study as it allowed a broad range of fourteen different companies within the available resources. Future research could build on this by including several interviews per case to gain deeper insight within each organization.

To validate the data from the interviews, a survey is used in all 26 companies. The purpose of the survey is to gather both qualitative and quantitative data. The questions will mainly be closed questions with some optional open questions. The closed questions will be based on the interview results, in order to see to what extent those findings are consistent across all 26 companies. The quantitative data from these closed questions help to support the findings in the interviews. Secondly, the additional open questions from the survey aim to complement the qualitative findings of the interviews. The qualitative

data from these open questions will be used to expand the findings of this research, in addition to the results of the interviews.

3.3 Interview guide Design

The semi-structured interview should create a funnel from more general questions to more specific questions about technology forecasting practices. This should minimize the influence of the question format on the participants. The first part of the interview is the introduction consisting of questions about the background of the participant and the company. This is followed by questions about how the general long-term strategy is determined within the company and if anticipating technological developments is a part of it. In the next phase of the interview, participants are asked what steps are used to anticipate technological developments. To minimize influencing the interviewees, the use of uncommon and hard scientific terms is avoided in the interview guide. During interviews, the interviewer will draw on the screen based on the input of the interviewee to create a process model. The screen is shared with the interviewee, and the interviewee monitors the progress and verifies if the image is a realistic representation at the end. This model is used to better understand and compare the different companies. The last phase of the interviews includes questions about the advantages and disadvantages of the steps taken and what steps are used to anticipate the technological advances in GenAI. For details of the exact questions, see A.

3.4 Survey Design

The survey consists of the following three categories: 1) Technology Forecasting activities, 2) Formal role definitions, and 3) Perceptions of current practices. See B for the complete survey and all included questions. The survey begins with a brief introduction explaining the context and confidentiality of participation.

In the first category, participants are presented with statements that describe proactive and reactive activities of the Technology Forecasting process. For each statement, participants are first asked whether it occurs *Ad hoc*, *Structurally planned*, or *Never*. If the activity is conducted ad hoc or structurally planned, participants are asked to indicate how frequently it occurs on a scale from 1 (Yearly) to 5 (Daily). This section ends with two open-ended questions asking participants to describe what specific activities their team undertakes for Technology Forecasting, and what sources of information they use to stay informed about technological trends.

The second category includes closed-ended questions about formal role definitions and approval processes, investigating the formal status and documentation of employee practices.

In the final category, participants are shown a series of statements that reflect current practices, organizational capabilities, and perceived benefits and challenges related to anticipating technological developments. These statements are based on themes that emerged during previous interviews. Participants indicate their level of agreement with each statement on a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree). This section ends with two open-ended questions asking participants to reflect on the main benefits of their current anticipation process and the challenges their team faces.

3.5 Distribution

The goal is to have one employee from 14 different managed service providers participating in the interviews. This group of 14 companies should be diverse in the total amount of employees, as well as the solutions they provide. The participants in each company will be selected to ensure that they are all deeply involved in the direction and decision-making of technology forecasting practices. Therefore, participants' functions should range from technology officers to managers of technology teams, with possibly some managing directors from smaller companies. To keep as many factors constant,the chosen companies and their participants will be Dutch. The interviews are also held in Dutch to prevent potential limitations due to language barriers from the participants and the interviewer. Each interview lasts approximately 45-60 minutes. The interviews are recorded in audio and will be conducted in a digital

meeting or in person, depending on the availability of the participant.

The survey will be targeted at all 26 managed service providers. See Table 4.1 for more details about the 26 managed service providers. To collect data from all of these companies, this survey will be distributed to three employees of each organization. Each of these employees should be partially responsible for the execution of technology forecasting practices. The head of technology of each company will determine which three employees are the best fit to participate in this survey. To distribute the surveys, email is used. After sending the emails, participation is encouraged by a contact person within the managed service provider group and the head of technology of each company.

3.6 Data analysis

To analyze the data collected in the interviews, the audio is first transcribed into text using a custom transcribe tool. This tool is a locally run Python script using a whisper tool to convert all audio into text, and a diarization tool to identify who was speaking at what moment. Combining the outcomes of the two processes provides a complete transcription of the audio recordings in pdf form to use in the coding analysis. To analyze these text documents, coding is used to systematically collect, order, and compare answers to retrieve insights. Coding involves identifying and recording one or more sentences of text that share the same theoretical or descriptive meaning. Thematic analysis aims to make values and theoretical concepts emerge from text in a flexible and systematic way [15]. Thematic coding starts with open coding where meaningful features are connected to a code. After open coding, the created codes are analyzed for potential themes that are relevant to answer the research question. Then these themes are reviewed, defined, and named to ensure their contribution to the analysis. The findings include the frequency, definition, and example of the theme. Afterwards, these findings will be interpreted in the discussion. This approach is chosen to enable structured interpretation and identify emerging patterns. The systematic organization of the findings allows researchers to draw meaningful conclusions in this research [6].

The survey consists mainly of closed questions with some open-ended questions. The quantitative data from the closed questions will be analyzed using descriptive statistics. For each item, frequency distributions will be calculated and visualized, particularly for:

- Structured activity ratings (ad hoc / planned / never),
- Frequency scales (e.g., yearly to daily),
- Agreement scales (1 = Strongly disagree to 5 = Strongly agree).

These distributions will be presented in the form of bar charts and/or stacked Likert plots to show how frequently various anticipation practices occur and how perceptions differ across respondents. The qualitative data from the open-ended survey questions will be analyzed using light-thematic coding. Although not as detailed as interview coding, the responses will be grouped by similar ideas to identify common practices, perceived benefits, and challenges. These results can be used as an addition to the interview results. In conclusion, the analysis combines frequency-based quantitative analysis with targeted qualitative coding to validate and supplement the interview data.

Chapter 4

Results

This chapter starts by introducing the multiple cases. This is followed by showing the results of the business process models created in the interviews. After this evaluation, an overview of each theme is shown and discussed. This will provide insight into the codes that belong to each theme, their meaning, and their distribution.

4.1 Introduction cases

This study examines how 25 Dutch managed service providers conduct technology forecasting to prepare and respond to rapidly emerging technologies. All of these different managed service providers are part of a managed service provider group. This means that all companies are owned by an investment company. These companies range from smaller organizations with 14 employees to larger enterprises with 250 employees. See Table 4.1 for all details about the organizations.

Company	**Employees**	**Markets**
Company 1	40	SME
Company 2	60	Healthcare
Company 3	15	SME and Non-profit
Company 4	20	Government, Education, Industry, and Healthcare
Company 5	80	Education, Healthcare, Research, IT, and Government
Company 6	80	Housing associations
Company 7	80	Healthcare and Business services
Company 8	250	SME
Company 9	40	SME
Company 10	40	Financial services
Company 11	60	SME
Company 12	20	Legal services
Company 13	40	Hospitality
Company 14	80	SME
Company 15	250	Medium-sized companies
Company 16	80	Legal professionals
Company 17	50	Education, Pharmacy, SME, and Non-profit
Company 18	50	Notary, SME, Automotive, Health, and Wholesale
Company 19	50	Industry, Transport/Logistics, Business, and Financial
Company 20	40	SME
Company 21	30	Accountancy
Company 22	30	SME and Large corporate
Company 23	30	Hospitality and Administration/Accountants
Company 24	30	Healthcare and SME
Company 25	20	SME
Company 26	15	SME

Table 4.1: Overview of Companies

4.2 Interviewees

Companies 1 to 14 have participated in the interviews; for more details, see Table 4.2. These 14 participants include technology leaders, chief technology officers, managing directors, and innovation managers who are directly involved and responsible for technology forecasting decisions within their organizations.

Participant	Company	Job Title	Date	Time
Participant 1	Company 1	Tech lead	23/04/2025	11:00
Participant 2	Company 2	Programma Manager	23/04/2025	12:30
Participant 3	Company 3	CEO	23/04/2025	14:00
Participant 4	Company 4	Operationsmanager	24/04/2025	11:00
Participant 5	Company 5	Tech lead	24/04/2025	13:00
Participant 6	Company 6	Tech lead	24/04/2025	15:00
Participant 7	Company 7	Tech lead	28/04/2025	10:00
Participant 8	Company 8	Tech innovation	28/04/2025	13:00
Participant 9	Company 9	Tech lead	01/05/2025	11:00
Participant 10	Company 10	CTO	01/05/2025	13:30
Participant 11	Company 11	Technology Officer	01/05/2025	15:00
Participant 12	Company 12	Managing Director	02/05/2025	10:00
Participant 13	Company 13	CEO	07/05/2025	11:30
Participant 14	Company 14	CTO	08/05/2025	10:00

Table 4.2: Interview Schedule with Company Representatives

4.3 Interview BPM models results

The business process models created within the interviews were transformed into a uniform process model, listing all 14 participating companies. There are three main archetypes that group the models based on their similarities: 1. The reactive approach, 2. The proactive approach, and 3. The developed approach. See Figure 4.1, for a summary of the business process model for each approach.

The reactive approach is characterized by having no internal triggers and efforts to identify and forecast new technological developments. These companies mostly follow customers or companies such as vendors and partners. Company 2, 4 and 5 although having slightly different processes, share these characteristics; see Figure C.1. They all receive information about technological developments from companies, such as partners and vendors. In addition, two of the three companies also receive or discuss customer wants about new technological development. All three companies reach out to experts or other companies and collect information to identify trends in technological developments. The differences are mainly in who decides what technological developments are interesting and what assessment practices they use.

The second approach is the proactive approach. This group is formed by companies 1, 3, 9 and 12; see Figure C.2. These companies rely largely on their internal capabilities to forecast technological developments. They show to be triggered by internal ideas as well as information of other companies, such as partners and vendors. Three of the four companies also actively engage and brainstorm with their employees in their attempt to forecast technological developments. There are some differences between these companies, such as who decides whether further research is required during the process. In company 1 new insights are first discussed in the team lead meeting, while the management team has the final decision. The management team is involved during the whole process in Company 12 to decide what is further investigated. In contrast, Company 2 shows to have no need for approval when forecasting and implementing technological developments. Within the proactive group, the only organization that has a dedicated innovation team is company 9. This team is first involved, and before it is discussed in the management team meeting.

The developed approach distinguishes itself by utilizing most sources. They indicate receiving triggers from customers, other companies, as well as from their own employees. They differ from the other categories because of their broader collection of practices. Five of the seven companies show an interest in engaging and brainstorming with other employees as part of their technology forecasting practices. The seven companies all reach out to experts or other companies, collect information, and try to identify

trends within technological developments. These seven companies using the develop approach can be divided into two subcategories looking at the teams that are involved in the technology forecasting process.

The first subcategory includes companies 6, 7, 8 and 13; see Figure C.3. These four organizations show to have a broad collection of practices, with their generic teams mostly involved. In addition, all of these companies involved their management team in the last stage of the investigation. The management team is involved in the whole process in company 6. Both companies 7 and 13 first discuss new insights in the team lead meeting with the team leaders of the generic teams. The team lead is also involved in company 8 but this is only after the regular team meeting. These companies also show differences in the assessment practices they use.

The developed approach has its second subcategory, which is characterized by the presence of a specialized team for technology forecasting practices. This group exists of company 10, 11 and 14; see Figure C.4. All of these organizations combine a broad range of technology forecasting practices with a specialized team where these practices are discussed. Both companies 11 and 12 have a specialized team called the innovation team, while company 14 uses a different name for their team focused on innovation. An exception is company 10, due to also having a deployment team, which is also involved during the decision-making on the technology forecasting practices. Furthermore, these companies have other differences, mostly in the practices for assessing used in the process.

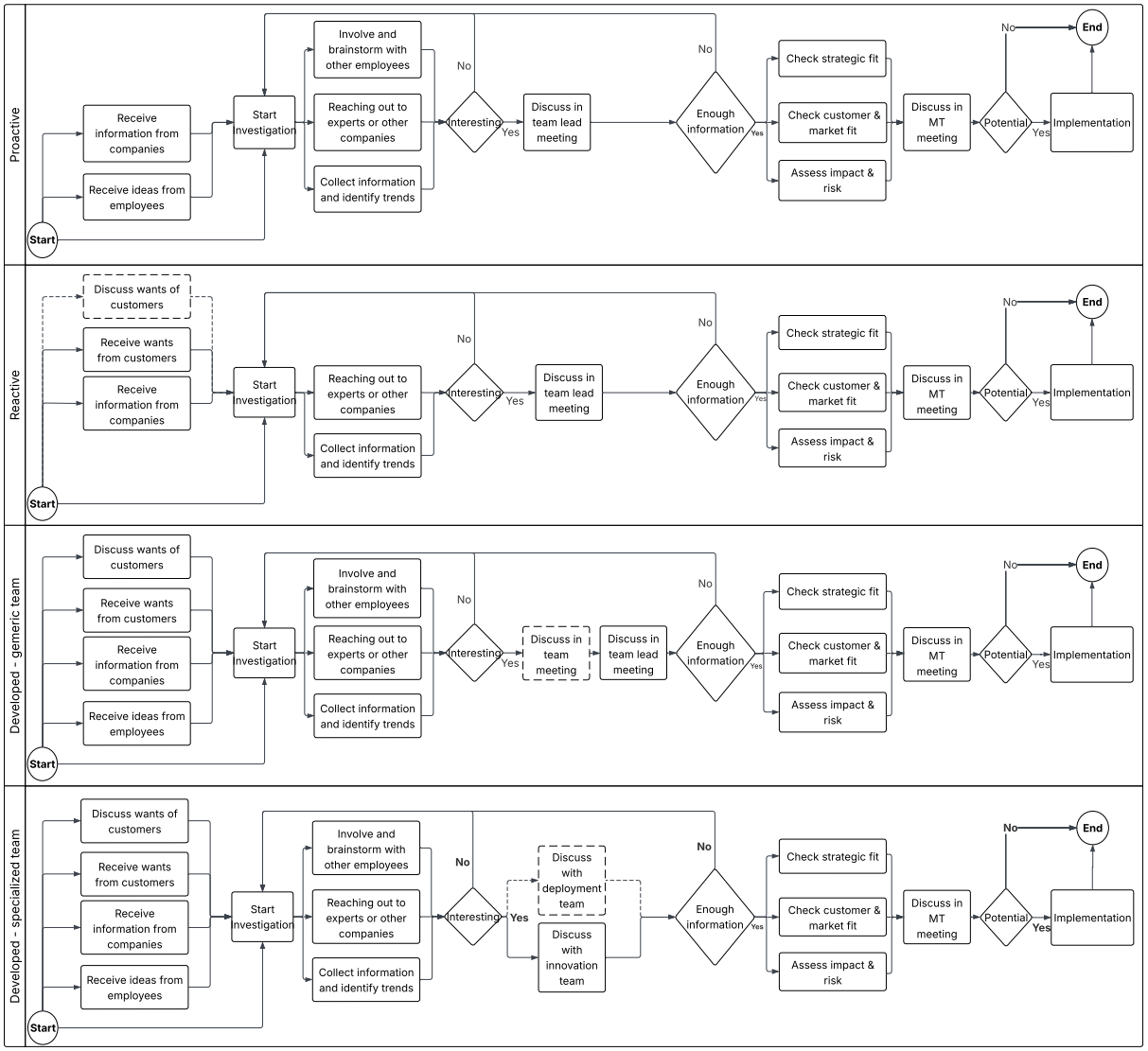

Figure 4.1: Combined business process models of groups

4.4 Interview results

The interviews aimed to capture current practices, perceived benefits and challenges, and organizational readiness to answer the research questions of this study. Thematic analysis was applied to the transcribed interview data by systematically coding the responses of the interviewees. Eventually, eight themes were identified after clustering 45 codes of the coded statements from the interviews; see Table 4.3.

Theme	**Number of codes**
Challenges executing technology forecasting practices	9
Benefits executing technology forecasting practices	7
Roles and responsibilities	7
Strategic Planning	6
Perception of technology forecasting practices	5
Progress on Generative AI	4
Technology forecasting practices	4
Assessment practices	3
Grand Total	**45**

Table 4.3: Overview of the identified themes with number of related codes

4.5 Survey results

The purpose of the survey is to validate the interview results. In total, 49 employees from all 26 companies participated in the survey; see Table 4.1. The survey consisted of 21 questions, including four open questions. The topics of the questions align with the themes found in the interviews; see B for more details on the exact questions. The results of the questions will be shown in the corresponding theme together with the interview results.

4.6 Strategic Planning

This first theme, Strategic planning, shows what formal practices the various organizations use for strategic planning and who execute these. This theme consists of six different codes; see D.1 for more details.

The analysis reveals that most managed service providers have established a formal strategic planning process. Annual strategic planning is identified in seven different organizations. In Table 4.4, a multiyear vision and road mapping are also found in seven different companies. Some have both a one-year and a multi-year strategy. As participant 6 explained: “At the moment, we have a three-year vision in place. A three-year journey has been described. We are here now, we want to go there. We have allocated three years to bridge the gap”. Participant 12 noted: “And that strategy. I do that once every three years”.

The management team defines the strategy for all 14 participants that use a long-term strategy. As Particpant 13 stated: ’The full management team’. Similarly, Participant 14 emphasized: “The entire annual plan and the quarterly meetings are all made by the full management team of our company.”

Participant 3 mentioned an ad hoc planning approach determined by a small team. Seven of the 14 participants who used a long-term strategy mentioned a recurring quarterly meeting to review their progress. Two of the 14 also mention a monthly recurring meeting to discuss their progress.

Strategic Planning Activity	**Number of Participants (n=14)**
Strategy defined by management team	11
Multi-year vision and roadmapping (2–3 years)	7
Annual strategic planning process	7
Quarterly progress review meetings	7
Monthly monitoring and planning evaluations	2
Ad hoc planning in small teams	1

Table 4.4: Code overview of strategic planning practices by particpants

4.7 Technology forecasting

The second theme Technology forecasting practices exists out of four codes, that shows what types of practices the organization indicates to use that were mentioned in the interviews. See codebook D.2 for more details on codes and meanings.

External insights from experts and industry peers is one of the codes of this theme. This code represents actions and practices executed to gather knowledge from other organizations, such as vendors or other companies. As seen in graph 4.2, this code is most frequently mentioned with 43.8% of all quotes. This code can be divided into three subcodes: 1. Insights from vendors and partners, 2. Industry events & platforms and 3. Peer knowledge sharing. The first subcategory accounts for 18.0% of all the mentioned practices, which involves the request or receiving of information from vendors and partners. As Participant 12 stated: "We also let ourselves be informed by Microsoft itself, so by partners." Another example of peer knowledge sharing was given by Participant 8: "A request was made within other MSP Group X companies."

Monitoring of industry and tech trends is another aspect that has often been mentioned. It represented 31.5% of the total practices and was mentioned by every organization. This suggests that organizations are following the technological news and developments and are looking for recurring topics to identify possible trends. As Participant 6 put it: "Trend detection is done. So you start collecting signals. That comes from following the news." Participant 12 added: "So we actively and proactively seek information ourselves, but also from third parties, we look up to see what's going on."

Nine of the 14 participants mentioned activities related to receiving or gathering customer information about their needs about technological developments. These quotes show that customer input is monitored within these organizations. Companies also implement practices that encourage the discovery of internal needs or opportunities related to technological developments. These kinds of activities are part of the code triggered based on observed needs, which is mentioned within seven different organizations.

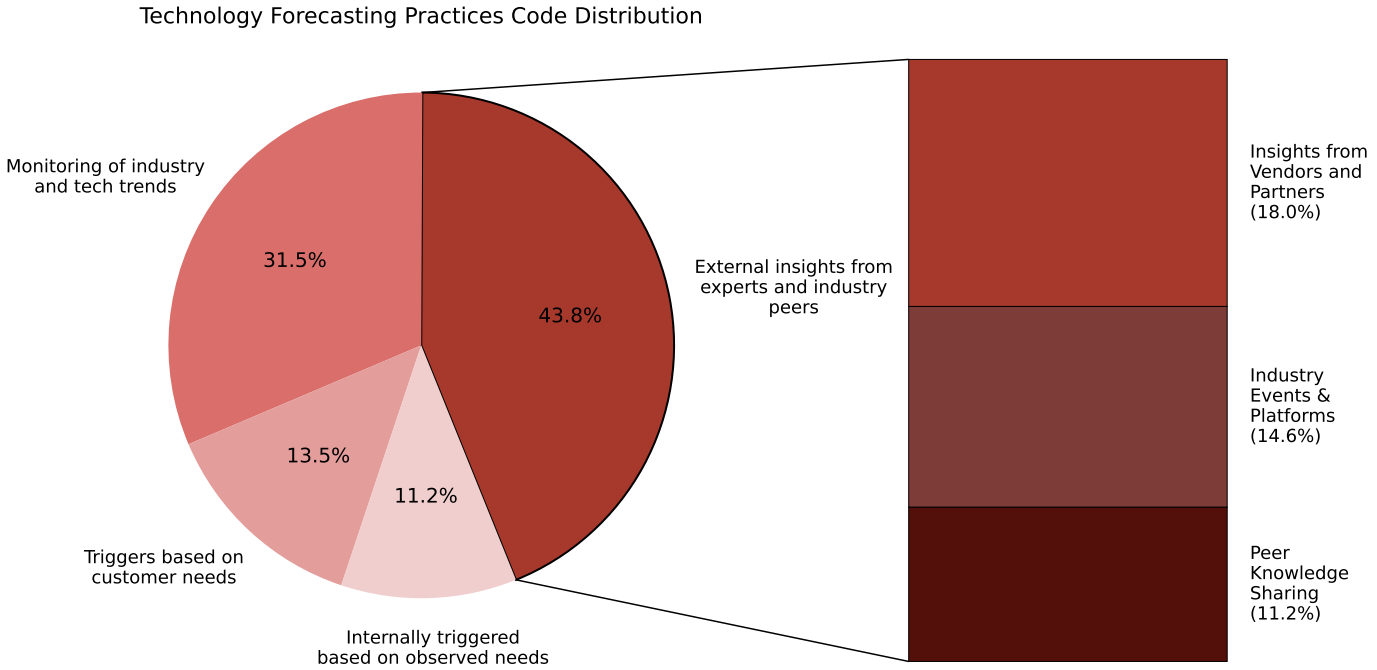

Figure 4.2: Code distributions of 87 quotes related to technology forecasting practices

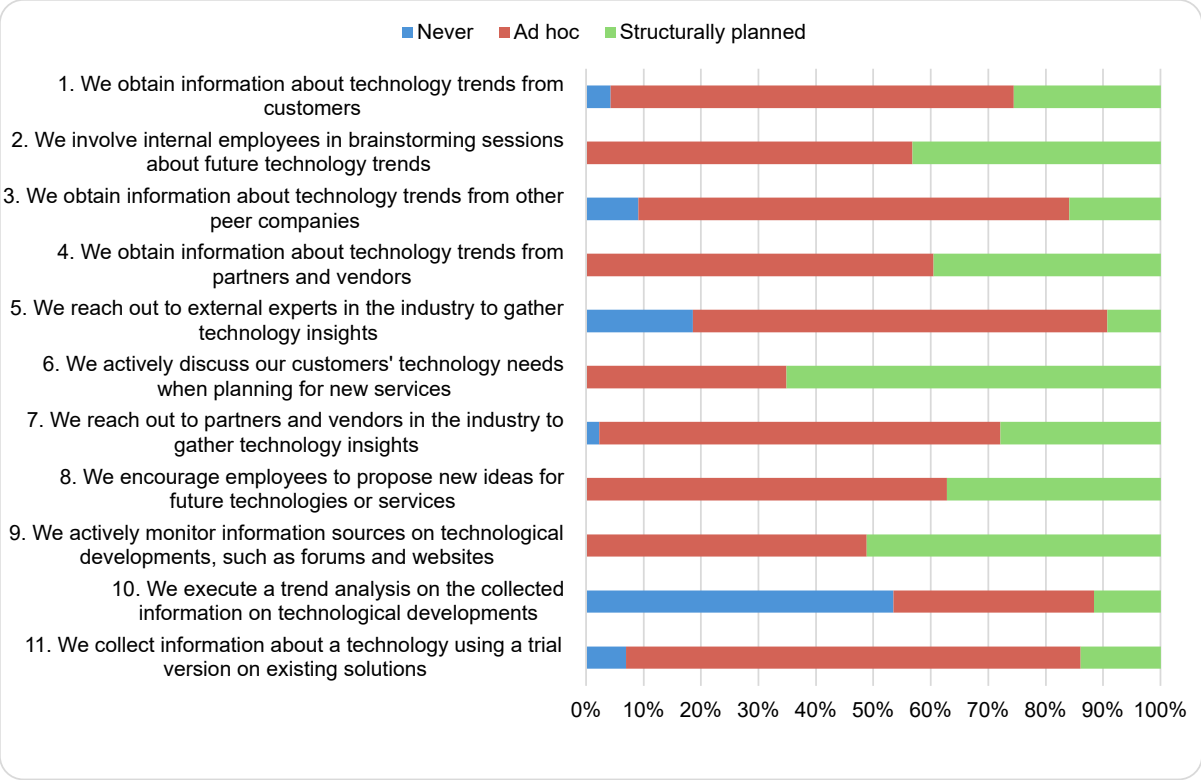

Figure 4.3: Distributions of performed technology forecasting practices survey statements

Figure 4.3 shows 11 statements on the use of specific technology forecasting practices. These statements were questioned twice in the survey, looking at how organizations use them, if they use it at all. If they used them, they got a follow-up question about the frequency of the action performed in the statement. It seems that virtually all participating managed service providers engage in Monitoring of industry and tech trends, looking at statements 7, 9 and 11. However, more than half of respondents indicated they never conduct a formal trend analysis of collected information.

Looking at *External insights from experts and industry peers*, it seems that almost all are using the practices in statements 3 and 4. Not a single respondent reported 'never' in statements 4, 6 and 9, suggesting that they are performed at least on an ad hoc basis everywhere. However, only a minority seem to have formalized these practices as a structural routine for all statements except the statement *6. We actively discuss our customers' technology needs when planning for new services.*

Triggers based on customer needs are seen in statements 1 and 6. Most companies use the practices in these statements, with less than 5% never obtaining information about technology trends from customers.

Looking at statements 2 and 8 on the theme internally triggered based on observed needs, it appears that all companies are using the practices from the statements.

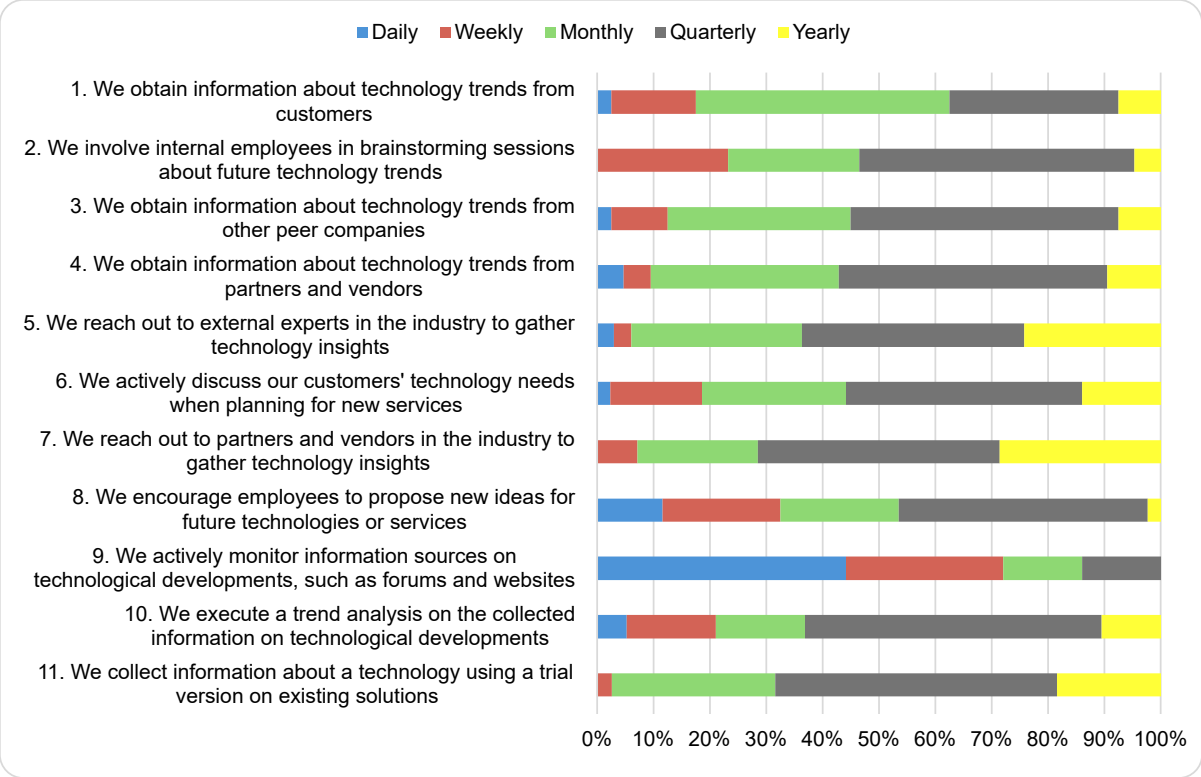

Figure 4.4: Distributions of frequency on technology forecasting practices survey statements

4.8 Roles and responsibilities

The organizational structure for technology forecasting reveals significant diversity in defining roles and responsibilities among the managed service providers studied. The third theme Roles and responsibilities show how these roles are divided within the different organizations. This theme consists of seven codes; see D.3. The informal and unfixed practices represent the most common approach within 12 companies as seen In Table 4.5. This implies that 12 of the 14 organizations operate without formal processes or documented processes for technology forecasting practices. As Participant 2 explained: “I think at the moment there is no process where we have really aligned that in a complete cycle.” Participant 6 similarly remarked: “No, there is no fixed process for it.”

Two organizations seem to have partially structured these practices, as seen in the code ’Practices are semi-structured and documented’. Practices that are executed by dedicating innovation teams occurred in four different companies. This shows that these four organizations have formalized a specialized team for part of their innovation responsibilities. Participant 9 described this setup as: “At company 9, we have a team called Innovation & Adoption, of which I am the manager.” Likewise, Participant 11 stated: “I have my own team that literally deals with innovation.”

In some organizations, practices are largely executed by individuals. These could be the main individual who is responsible for the most technological aspect, such as a tech lead or a CTO. This appeared in 3 different companies. In other cases, execution was divided among a few individuals, who are the team leaders, where each individual is responsible for their own specialty. The code "executed by department heads" is also seen in two different organizations. Instead of only the team leader, the entire team could execute the practices. This variation is seen in three different organizations.

Roles and Responsibilities Activity	Number of Participants (n=14)
Practices are informal, and unfixed	12
Practices executed by dedicated innovation team	4
Practices are executed voluntarily	4
Practices are separately executed by all teams	3
Single responsible role for all practices	3
Practices are semi-structured and documented	4
Practices executed by department heads	2

Table 4.5: Overview of codes in the code category Roles and Responsibilities by Participant

In Figure 4.5, two statements were tested in the survey. The results show that only a small fraction of respondents believe that their forecasting process is formally structured. In fact, just around 11% of respondents agreed that "our anticipation of technological developments process is well-structured and documented." A large portion of 42% actively disagreed with that statement, and the rest were non-committal. This suggests that many companies do not have a documented clear process. Similarly, fewer than 40% of respondents agreed that "all team members have clearly defined roles in our innovation process." Approximately one third disagreed, and one third neither agreed nor disagreed.

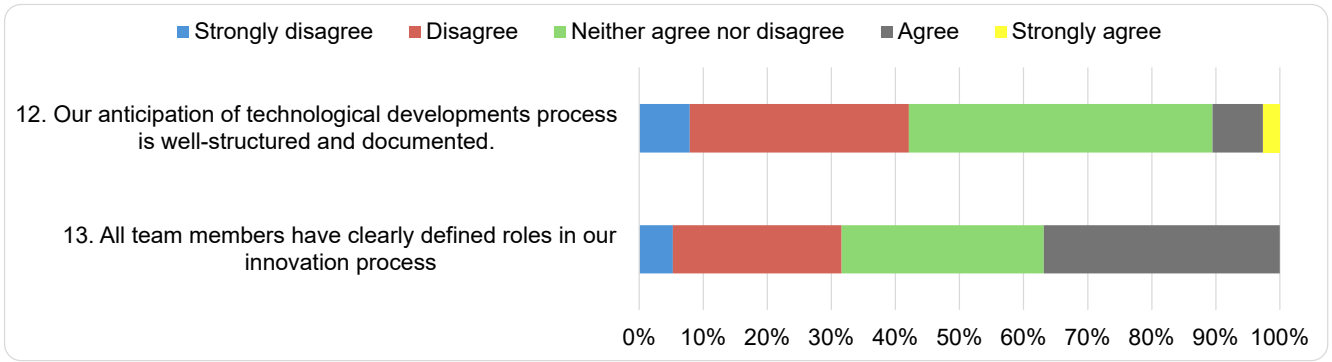

Figure 4.5: Distributions of survey statements on responsibilities

Additional survey statements look how official these responsibilities are in day-to-day job structures in Figure 4.6. 48% of respondents reported that technology forecasting tasks are formally part of their job function. The other half of approximately 52% answered that such practices are not defined duties in their role descriptions. A vast majority of 88% indicated that no dedicated time is set aside in their schedule for researching new technological developments in statement 13. Only 12% of the respondents appear to have explicitly reserved time for this purpose.

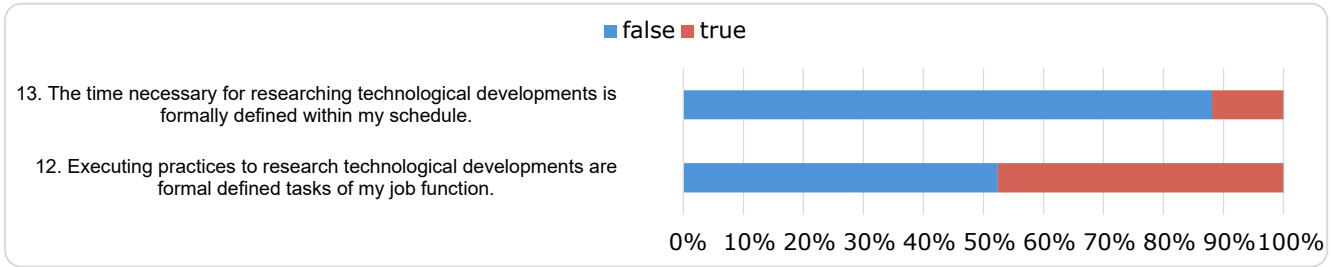

Figure 4.6: Distributions of survey statements on formality

The survey also included a multi-select question on who holds decision-making authority or must grant approval in the forecasting process. As seen in Figure 4.7, the majority of respondents seem to indicate that oversight is concentrated at high levels of the organization. When asked which parties must approve

further research into a new technology, about 76% of the respondents selected 'management team'. 29% of the participants also indicated that the approval of the team leader is required. Meanwhile, 19% reported the need for approval from a dedicated "specialized team", such as an innovation or platform team. A small minority, 17% of respondents, said that "no approval is necessary". This suggests they can proceed with researching a technological innovation without formal approval. Likewise, the minority with 12% indicated that "all team leads" collectively must approve.

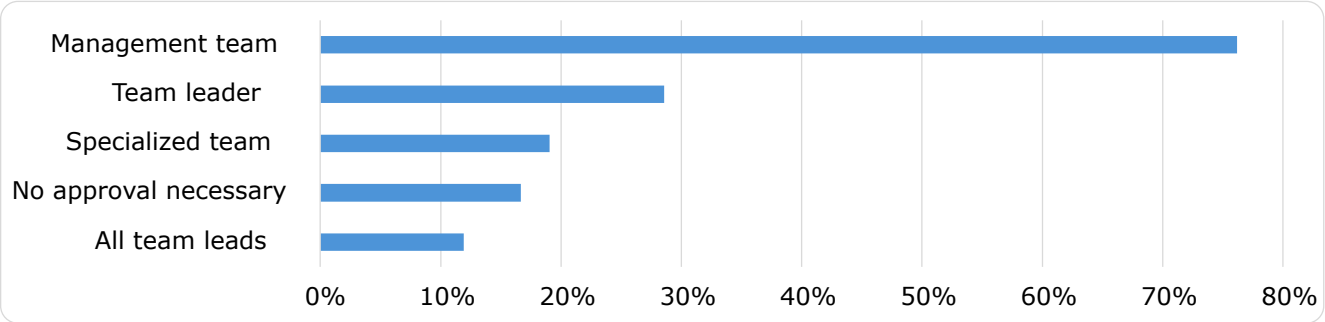

Figure 4.7: Distributions of results on "Which of the following parties must approve before further research on a technological development can be conducted? (Select all that apply)"

4.9 Assessment practices

The fourth theme of opportunity assessment practices looks at the types of activities that the organizations mentioned about how they assess technological developments. There are three different codes, which were identified at the beginning or end of their technological investigation; see D.4 for more details.

Looking at Table 4.8, 52.4% of recorded occurrences are in the code Evaluation cost, benefit, and risks. This code can be divided by the following three subcodes: 1. Cost-benefit analysis, 2. Proof of concept & testing, and 3. Risk assessment and mitigation. These evaluations typically consider all implementation and maintenance costs, expected benefits, and potential risks. As Participant 14 summarized: "What are the costs? What are the savings?" Participant 4 added: "If you have really decided that you want to proceed with this, you will move forward with trials to see if it really is something."

Evaluating practices on the strategy, vision and resources accounts for 23.8% of all mentioned practices. As Participant 9 described: "So we actually determine, is it relevant for us? How does it work and how does it fit into our organization?" Similarly, Participant 2 reflected: "Do we have resources for that, competencies, people? Maybe we need to work with third parties to hire them?"

Another method of assessment mentioned is the practice of assessing the alignment of technological developments with customers and market developments. This represents the effort of companies to take into account the wants of the customers. This also accounts for 23.8% of all the practices mentioned within the various organizations. As Participant 12 noted: "We may find it very interesting for our customers, but your customer must also understand it themselves." Participant 2 asked critically: "So how well do our services still align with what the customer wants? And what developments are being considered?"

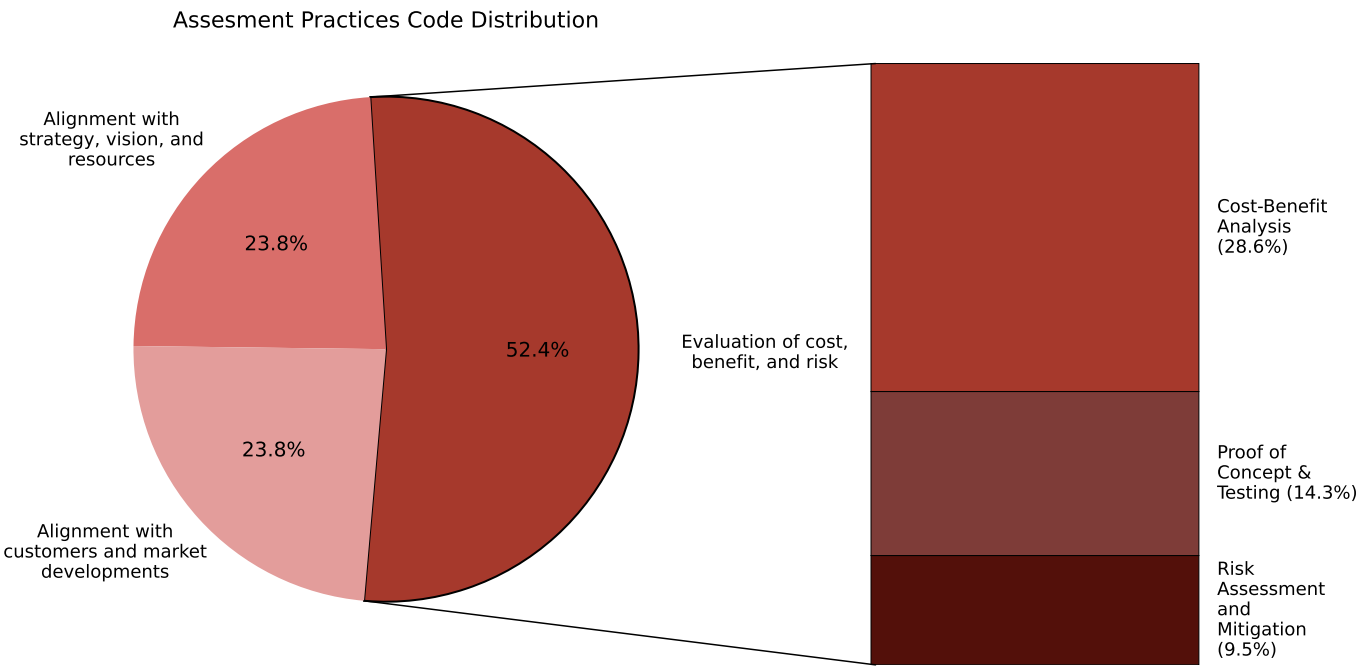

Figure 4.8: Code distributions of 40 codes related to assessment practices

4.10 Challenges executing technology forecasting practices

The challenges of executing technology forecasting practices form the fifth theme with nine representative codes; see D.5 for more details.

Companies show difficulties in reserving time to execute technology forecasting practices, due to competing business priorities and a lack of dedicated time. These challenges were identified in eight of the 14 organizations. This challenges emerges as the most common challenge. Participant 8 summarized: "The biggest challenge is often time, that's the biggest challenge, and why your agenda is usually already quite full." Participant 12 added: "My challenge is at that project point. Exactly what you said, figure it out. We are a small team and already quite busy with work, so this has to be added on top."

In addition, Unstructured processes and missing ownership emerge as the second most occurring challenges, mentioned in seven participants. These quotes show issues in executing technology forecasting practices, due to processes, structure, and ownership being informal within the organization. As Participant 1 explained: "The difficulty in the whole story is that we don't really have a clear process. We don't follow a process." Participant 8 further elaborated: "Is time officially made for this? No, people are not yet structurally freed up or in the plan to really look for innovations, and this is an issue currently being addressed by management."

In six of 14 interviews, poor cross-team communications and unclear goals were identified. This represents difficulties for various teams when working together, for example, because the goals are unclear between teams.

As seen in Table 4.6, a shortage of staff and internal expertise accounted for five instances among the 15 companies. These associated quotes suggest that companies lack sufficient and skilled employees, limiting the execution of technology forecasting practices. Participant 9 acknowledged: "Yes. In some cases, maybe also a lack of expertise." Similarly, Participant 14 stated: "The only challenge we have is personnel. We have too little personnel to develop faster than we would like. But I actually don't think that's a valid concern anymore, because everyone has the same problem. I think if we had more personnel, but with the right technical background, we could implement much more."

Challenges Executing Technology Forecasting Practices	Number of Participants (n=14)
Limited time and competing business priorities	8
Unstructured processes and missing ownership	7
Poor cross-team communication and unclear goals	6
Shortage of staff and internal expertise	5
Struggles to find fitting use cases	5
Difficulties gathering and filtering information	5
Hard time dealing with uncertainties	2
Struggles with monitoring and evaluating	2
Customer or market misalignment	2

Table 4.6: Overview of codes in the code category Challenges Executing Technology Forecasting Practices by Participant

In the survey, three statements were created to test some of the recurring challenges found in the interviews. Closed-ended statements in Figure 4.9 suggests an agreement regarding workload and time issues: 71% of respondents agreed or strongly agreed that "balancing forecasting activities with daily operations is challenging for our team." Less than 5% of respondents disagreed with this statement. In contrast, the perceived impact of structural and coordination issues is more mixed. Approximately 47% of the respondents agreed that "communication and coordination around the anticipation of technological developments are effective" in their organization. However, only 16% disagreed and the remaining 37% selected a neutral position.

Interestingly, fewer respondents identified process shortcomings as an active challenge: only 21% agreed that "our process structure limits effective anticipation of technological developments". 34%, A larger share, actually disagreed with that notion. The majority neither agree nor disagree, with 45%.

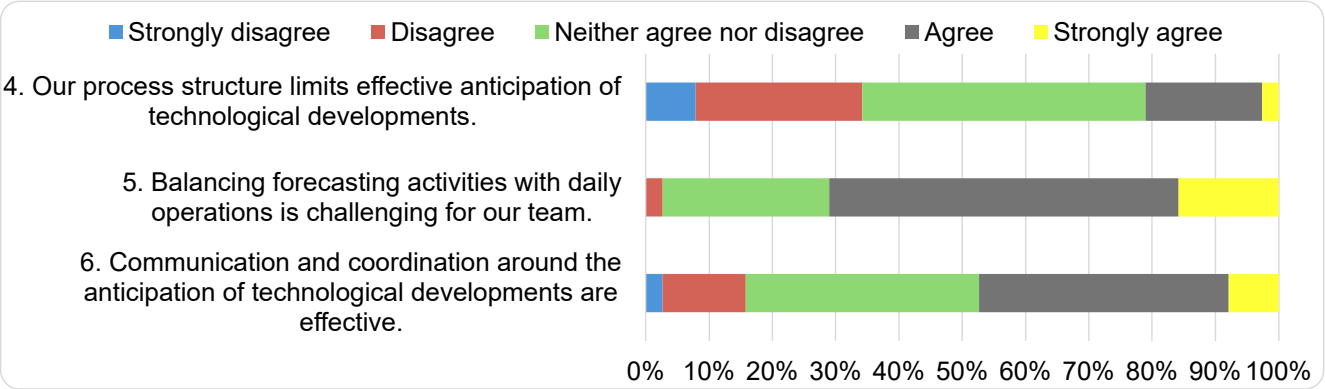

Figure 4.9: Distributions of survey statements on challenges

In Figure 4.10, the results encoded in the open survey question are shown, which addresses the challenges facing organizations. Approximately 65% of the respondents who provided a written answer mentioned 'limited time and competing business priorities' as a challenge to arise. The next most common challenge, observed by about 16% of the respondents, was a "shortage of staff and internal expertise". A slightly smaller group of 13% of respondents raised the issue of 'hard time dealing with uncertainties'. About 6% of the respondents mentioned unstructured processes or missing ownership, 6% raised difficulties in gathering and filtering information, and similarly 6% referenced misalignment with customer needs/market. Furthermore, 3% explicitly mentioned poor cross-team communication or unclear goals as an issue in their answer.

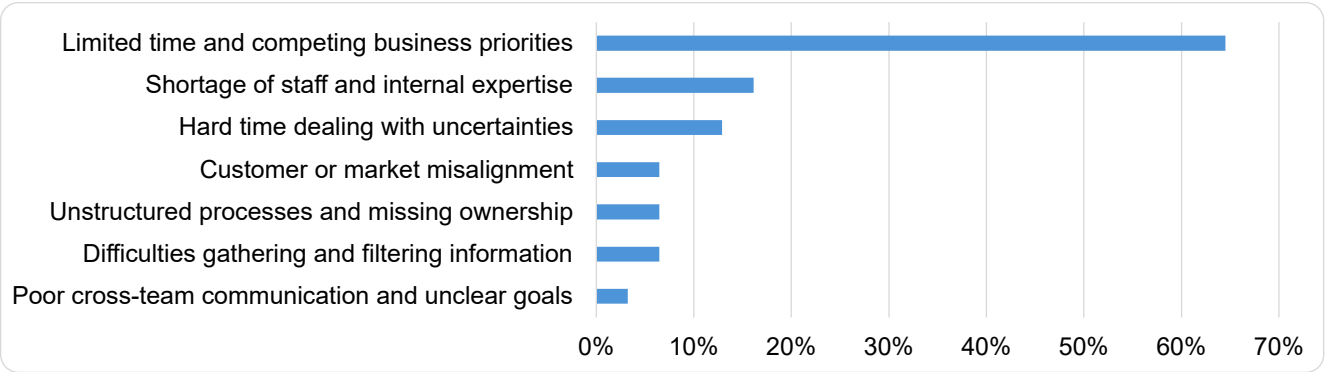

Figure 4.10: Distributions of results on "What challenges does your team face when anticipating technological developments?"

4.11 Benefits executing technology forecasting practices

Despite the challenges identified, managed service providers mentioned significant benefits in the sixth theme called benefits executing technology forecasting practices. Seven codes are included in this theme; see D.6 for more details.

Well-functioning tools and planning processes emerge as the most cited benefit. As seen in Table D.6, eight different organizations were identified with this code. Participant 2 explained: “Look, I think that in terms of systems and what people know they need to do, that is well organized. So let’s say in terms of ownership and responsibility, the division of work, I think all of that is going well.” Participant 6 added: “They really appreciate that I take the time to do such a Moscow analysis with them, and look at the ist sol gap analysis, and what do you really want to achieve?”

The freedom to act and experiment quickly was also identified in eight organizations. Each of these eight participants suggested that there is a lot of freedom within technology forecasting practices to act and experiment quickly. As Participant 1 stated: “When we see something new in the market, we immediately start working on it. If it fits within our organization, we want to do something with it. And I think we are open to new technologies. We’re really working on them and taking action.” Likewise, Participant 8 noted: “What we are very satisfied with is that employees have a lot of freedom to bring in their own ideas.”

Half of the participants mentioned the benefit of effective knowledge sharing internally. This means success in practices where knowledge is shared within the company. As Participant 8 explained: “The communication with other MSP Group X companies for knowledge sharing.” Participant 14 illustrated this further: “These are usually two or three sessions at our office. In the cafeteria, we have a big screen and we just dive deep into the product, they can ask any questions, and then they also get the documentation. So I think we try to make the product as understandable as possible from A to Z for all departments.”

Benefits Executing Technology Forecasting Practices	**Number of Participants (n=14)**
Well-functioning tools and planning	9
Freedom to quickly act and experiment	8
Effective internal knowledge sharing	7
Ability to act and implement quickly	4
Active customer involvement in the process	3
Adoption strategy performs great	2
Great employee skills and capacities	2

Table 4.7: Overview of codes in the code category Benefits Executing Technology Forecasting Practices by Participant

In the closed-ended statements of Figure 4.11, respondents stated that 'our team has the necessary skills to evaluate new technologies'. This is showed by a solid majority of 71% in agreement. Likewise, 63% of respondents seem to agree that "we can effectively evaluate and test new technologies before adopting them". However, the survey responses were more mixed regarding structural or strategic strengths. Only about 37% of participants agreed that "we have effective tools and processes in place to support the anticipation of technological developments." While an almost equal proportion of 34% outright disagreed with that statement.

A similarly result appeared for the statement "our organization quickly responds to emerging technologies and market trends." Only 37% agreed that their organization is very quick to respond, while about one-third disagreed and the rest neither agreed nor disagreed.

Furthermore, alignment with market needs is an area of uncertainty: 47% chose a neutral position on "our forecasting activities are well aligned with actual market needs". However, 39% agreed and 13% disagreed outright. The large neutral contingent implies that many are unsure or have only partial evidence of how well their tech-forecasting efforts translate into meeting customer demands.

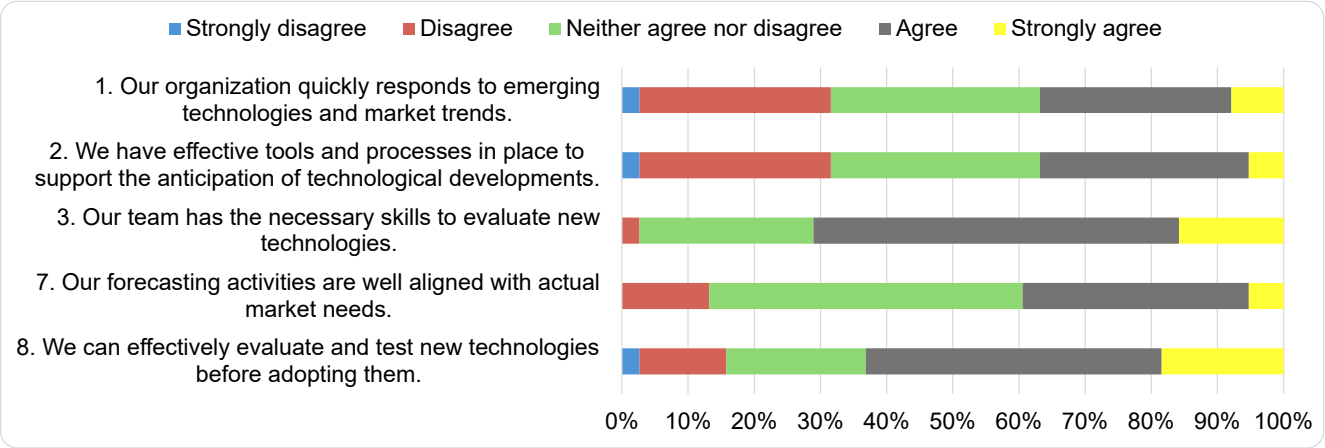

Figure 4.11: Distributions of the benefits survey statements

The results of the open-ended survey question are shown in Figure 4.12. Among the respondents who described the benefits in their own words, the most frequently mentioned advantages were having well-functioning tools/processes, skilled people, and the ability to act quickly. Each of these three categories was cited by about 27% of respondents who answered the question. Customer-focused and strategic advantages were less frequently mentioned but still present. Approximately 18% of respondents noted "active customer involvement in the process" as a benefit. Similarly, about 18% mentioned that their "adoption strategy performs great". Internal knowledge sharing, which was highlighted by half of the interviewees as a benefit, was explicitly cited by 14% of the survey respondents.

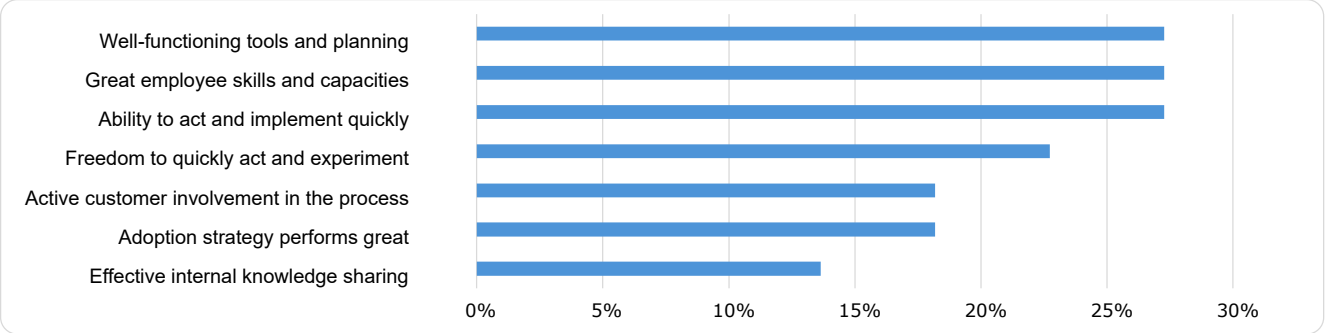

Figure 4.12: Distributions of results on "What do you consider the main benefits of your current process for anticipating technological developments?"

4.12 Progress of Generative AI

Four codes were identified that belong to the seventh theme Progress of Generative AI. Examining the adoption of generative AI reveals varying stages of implementation among participants.

In six instances, the participant mentioned their company is still exploring use cases and strategic fits. These companies have finished their investigation and try to use the gathered insights to find valid use cases within their organization. As Participant 5 explained: "So I often find myself reasoning, analyzing, and worrying about what it can mean for Company 5. But so far, based on what the other MDs have thought of, I've never had, okay, this is really relevant." Similarly, Participant 4 mentioned: "Then, as discussed with you, in this case, I went on research, and I have the model that we are using in the MSP Group X group where it is already being used, and I know that some sister companies are working on the implementation, so I will just wait."

Three participants indicated that they are currently in the phase of conducting their investigation, collecting information and insights. Looking at Table 4.8, one participant mentioned being close to finishing their first implemented solution using GenAI.

In addition, four companies have fully implemented solutions with GenAI that are actively being used. As Participant 3 stated: "We have fully implemented it in our processes, at least where it helps. So there are parts of your processes where it adds nothing, so you should especially stay away from LLM there." Participant 11 added: "Yes, that has already been delivered. There have already been 4 or 5 iterations on it. So it's going pretty well."

Progress on Generative AI	**Number of Participants (n=14)**
Still exploring use cases and strategic fit	6
1 or more fully implemented solution	4
Information and idea gathering phase	3
Actively implementing initial GenAI solutions	1

Table 4.8: Overview of codes in the code category Progress on Generative AI by Participant

4.13 Perception of current technology forecasting practices

This last theme looks at the companies' meaningful judgments on their current technology forecasting practices. This seventh theme exists of five different codes, see D.7.

There are eight instances in which a quote was identified to describe the existing approach as being considered suitable to anticipate the technological development of GenAI. These eight quotes suggest that half of the participants feel confident that their approach is suitable for the anticipation of GenAI. As Participant 6 put it: "Yes. I think so, I think so." Likewise, Participant 10 agreed: "I think so."

On the other hand, there are six participants that each mentioned one quote indicating that their current practices are considered insufficient. As Participant 11 admitted: “No, to be honest, not good enough at this moment. Despite the improvements.” Similarly, Participant 7 remarked: “Oh no. It happens to us too often.”

Perception of Technology Forecasting Practices	**Number of Participants (n=14)**
Existing approach considered suitable for anticipation genAI	7
Current practices are considered insufficient	6
Satisfied with current practices	3
Not aiming to be a first adopter	2
Aims to be an early adopter	1

Table 4.9: Overview of codes in the code category Perception of Technology Forecasting Practices by Participant

The survey also looked at participants’ overall perception of their current forecasting approach, particularly in the context of rapidly emerging technologies like generative AI. The results in Figure 4.13, shows a considerable segment of respondents is cautious or critical about their readiness, with only about 24% agreed that “our organization is prepared to implement technologies like Generative AI". In addition, 37% disagreed with that statement and the remaining 39% neither agreed nor disagreed, suggesting uncertainty. About 34% agreed that “we prefer to be early adopters of promising new technologies”. However, a larger proportion of 45% did not see their organization as an early adopter. In response to the complementary item, 39% of respondents agreed on “we tend to wait until a technology is widely adopted by others before we implement it”. Compared to 37% who disagreed and about 24% neutral.

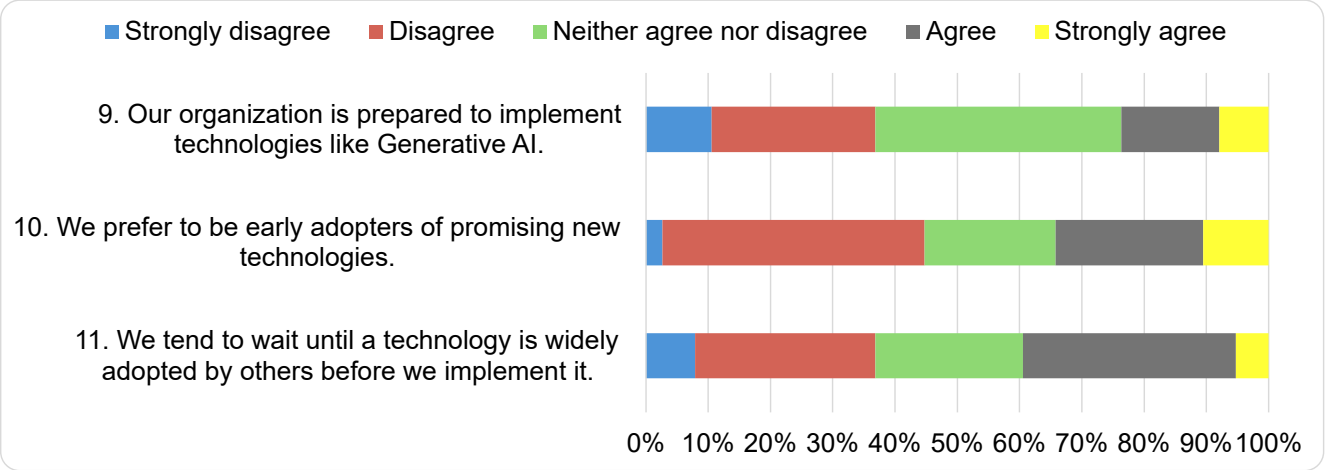

Figure 4.13: Distributions of the survey statements on the perception of current practices

Chapter 5

Discussion

This chapter will interpret the results, trying to answer the sub-question and main research question as stated in the Introduction. It starts by looking at what the technology forecasting process looks like, what practices they use, and how roles and responsibilities are divided. This is followed by a discussion of the most significant challenges and benefits that were found in the analysis. The last sub-question is then answered by discussing how the process can be improved for emerging technologies. This chapter ends with a discussion of future research and limitations of this research paper.

5.1 How the technology forecasting process looks like

Looking at the results of this research, interviewees and survey participants seem to indicate mainly that there is no formally structured technology forecasting process. However, based on the information collected, it appears that the process is a technological (competitive) intelligence. Technology intelligence is a collection of practices that collect and analyze information to create insight on technological trends and opportunities [29]. The practices of technological intelligence should be executed formally and systematically. In contrast, most of the participants seem to execute their practices informally. Although the informal approach of method selection could decrease forecasting performance, it seems that this unsystematic manner is a dominant occurrence [27].

5.1.1 General identified approaches

The findings suggest that Dutch managed service providers engage in technology forecasting through a spectrum of approaches. These approaches can be categorized into three archetypes: reactive, proactive, and developed. In all cases, organizations actively monitor external technology trends and sources, but it seems that the degree of internal initiative and formalization of the process vary quite a bit. In the reactive approach, organizations believe that they have no internal triggers for innovation. They respond primarily to external triggers, such as customer requests or vendor updates. As a result, reactive firms tend to follow customers or companies, such as vendors and partners, gathering information from these external parties and experts to identify trends, but rarely initiating forecasting activities from within.

In contrast, proactive organizations seem to rely more on internal efforts. Companies in this category supplement external insights with internal idea generation and brainstorming sessions involving their employees. For example, company 3's process involves team-wide brainstorming and does not require top management approval at every step see C.2. This appears to be a culture that encourages employees to explore new technological developments themselves.

The developed approach is identified in organizations that employ the broadest range of forecasting practices and information sources. These companies include multiple triggers, such as obtaining trend insights from customers, vendors, partners, and also from their staff. Companies with developed approaches often have more structured processes. In participating companies, a subset of the developed group created specialized innovation teams dedicated to technology forecasting and innovation management.

The other subset in this group involves a wide range of employees (across departments) in forecasting activities, without a dedicated team. This more developed process indicates a possible higher level of maturity, suggesting that forecasting is not left to chance but rather is an ongoing, organization-wide effort.

Looking at the results on the perception of current technology forecasting practices, two participants explicitly pointed out that their company was not aiming to be an early adopter of new technologies. Of the 14 participating companies, one organization noted that they are aiming to be an early adopter. It is important to note that this was not a question in the interview guideline. Therefore, this statement was included in the survey. The survey data implies a division of companies. 45% of the respondents did not see their organization as an early adopter, whereas 34% do. Approximately 21% of the respondents identified their company as neutral.

5.1.2 The technology forecasting practices used

Some categories of practices were found in the interviews and the survey. These are mainly identified with codes from the theme Technology forecasting practices. The same categories of practices are also found in the business process models that were created during the interview.

Obtaining External Insights from experts and industry peers is the most commonly occurring practice during the interviews. We can also see these practices in the business process models in the reactive action 'Receive information from companies' and the proactive action 'Reaching out to experts or other companies'. These seem to be identified in all but one company. This also aligns with the results of the surveys Statements 3-5 and 7 in Figure 4.3, with all these practices being performed in more than 80% of the participating companies.

Virtually all surveyed managed service providers seem to report that they monitor industry trends. In fact, in the survey none of the respondents indicated 'never' for the ninth statement. This suggests that all participating organizations do this at least informally. These practices also accounted for 23.8% of practices found during the interviews; as seen in Figure 4.2. Looking at business process models, all companies seem to collect information and identify trends. Notably, 53% of surveyed companies admitted they never conduct a formal trend analysis on the information they collect. This suggests that trends are recognized, but formal trend analysis is not being employed as a standard practice. It seems like turning those observations into structured forecasts or analyses is far less common. In other words, most organizations are watching, but not systematically connecting the dots.

Triggers based on customer needs account for 13.5% of practices identified in the interviews. Looking at the results of the business process models, 5 of the 14 companies did not name these triggers as part of their process. In contrast, almost all companies take customer input as a trigger when looking at the survey results. Fewer than 5% said that they never collect technology trend information from customers in statement 3. Interestingly, the interviews appear to show different results compared to the survey data. The survey details also show that 74% of the respondents do not seem to obtain structurally information on technology trends from the customers. This could be why these differences occurred. It looks like companies are doing it, but not in a structured way. Therefore, that is probably why they did not include this practice in their process model.

During the interviews, internal idea generation appeared to play a more limited role. It was the last frequently coded practice from the interviews, with only 11%. 11 of the 14 companies pointed out this, in the business process models as seen in C. The survey painted a slightly different picture. Its results show that all the companies claimed to involve employees in the ideating of future technologies. Only a minority of respondents indicated that they had structured routines for internal ideation, looking at Statements 2 and 8. Thus, while all organizations recognize the value of employee input, execution seems to be often informal. Furthermore, the extent and formality of these internal practices differ.

Looking at the results of the technology forecasting process, it seems that most of the participants are monitoring technological developments but not formally using technology forecasting in a rigorous way. 53% of the companies surveyed indicated that they have never performed a formal trend analysis on the

information gathered; as seen in 4.3. In other words, monitoring is frequent, but converting observations into explicit future projections is much less common. In interviews, many participants seem to be aware of trends, but are less developed in modeling technology trajectories. Essentially, technology forecasting is probably mostly being done in an informal, ad hoc manner at most firms, rather than through formal methodologies. Figure 4.3 reinforces this by showing that for most practices, most companies perform it on an 'ad hoc' basis rather than as a scheduled and 'structurally planned' activity.

When relating these findings to the five families of forecasting methods described in the Background, it appears that some families are more common than others. These families consist of monitoring, expert opinion, trend extrapolation, modeling, and scenario planning. The dominant practices observed correspond to the first two families. Almost all companies seem to monitor external sources for signals and use expert opinion as part of their forecasting efforts. Some organizations appear to use trend extrapolation. Modeling and scenario planning seem to be rare as none of the participants mentioned any of these methods. In general, while every managed service provider in the study participates in technology forecasting to some extent, the process mostly involves informal scanning and external sensing. It is presumably not typical to use more structured forecasting tools, such as trend analysis or scenario planning. As discussed earlier, this dominant presence of informal practices seems to align with the literature on technological intelligence. The results on these practices appears to be close to informal scanning and informal monitoring, which are part of informal technology intelligence activities [17].

5.1.3 Roles and responsibilities

The data seem to show quite some diversity in the way that roles and responsibilities for technology forecasting are defined within organizations. As shown in Table 4.5, 12 of 14 companies indicated that their technology forecasting practices are informal and unfixed. Looking at the survey results form 4.5, about 11% of the respondents agree that their anticipation of technological developments process is well-structured and documented. Interestingly, 88% of the survey participants noted 'false' in the statement: 'The time necessary for researching technological developments is formally defined within my schedule'. All of these results strongly suggest that, in the vast majority of cases, these practices are carried out in an informal and unfixed manner.

Only a few organizations seem to formalize their roles or create structures for technology forecasting. Two of the 14 companies were coded as having "semi-structured and documented" forecasting practices. This implies that they have started to put some process descriptions or guidelines in place. More notably, four out of 14 companies have gone so far as establishing a dedicated innovation team responsible for technology scouting and innovation management. Where there is no dedicated team, the responsibility tends to fall on departments, loose groups, or certain individuals. In some organizations, a single role effectively executes most forecasting activities. Three companies described this kind of setup where one person is the go-to. In other cases, the responsibility is distributed among several leaders or teams. The survey results show that fewer than 40% of the respondents agreed that 'all team members have clearly defined roles in our innovation process'. About one third outright disagreed that roles are clearly defined, and another one-third neither agreed nor disagreed. In other words, only a minority seem to perceive clear role definitions.

The distribution of tasks seems to differ significantly. These differences could be due to the three forms of coordination [17]. The three forms are: 1. Structural coordination, 2. Hybrid coordination and 3 Informal coordination. All three of these forms can be present in parallel. Most organizations seem to use informal monitoring and informal scanning practices, using mostly informal coordination, and some participants use structural or hybrid coordination at certain points.

The results in Figure 4.7 of the survey asked which parties must approve further research on a new technology. The results show that in 76% of the cases, the approval of the management team is needed. Furthermore, 29% indicated a requirement for the approval of the team leader. About 19% said a specialized team. Therefore, decision-making in the forecasting process seems to be generally concentrated at higher organizational levels.

5.2 Challenges faced in the technology forecasting process

Participants in this study reported on several challenges that hinder the effectiveness of these practices. The challenges are both organizational and practical in nature. They help explain why current forecasting efforts sometimes fall short of ideal outcomes. The key challenges identified include limited time and competing priorities, unstructured processes with unclear ownership, and shortages of skilled staff. These factors could negatively impact both the effectiveness of the process. One of the issues is limited time and competing priorities. Employees and managers often struggle to find time to work on technology forecasting practices because their schedules are dominated by other operational tasks. This challenge was mentioned in eight of 14 interview cases, making it the most common. The frequency of this issue could be expected since the organizations do not seem to have allocated dedicated time as seen earlier. The survey data shows that 71% of respondents agreed that "balancing forecasting activities with daily operations is challenging for our team". Less than 5% disagreed with that statement. This strongly suggests that time scarcity is a frequently occurring challenge.

Another major challenge likely lies in the fact that the process itself is unstructured and lacks clear ownership. This was the second most cited challenge in the interviews. In total, this was mentioned by seven of 14 organizations; see Table 4.6. Looking back at the roles, many managed service providers have no single person or team responsible. This informal and ad hoc way can be inconsistent. The survey gives an interesting perspective. When asked if "our process structure limits effective anticipation of technological developments," only 21% of respondents agreed. Meanwhile, 34% actively disagreed and 45% were neutral. This mixed response suggests that some employees feel that the absence of structure obstructs them, but many are unsure or do not see it as the main bottleneck. It could be that they have adapted to working without a formal process, or they are not sure if a formal process will improve their current performance. However, the presence of neutral responses might indicate latent issues. In any case, unstructured processes and unclear ownership remain a prominent theme in the qualitative data, even though they are less supported in the survey data. In addition, traditional monitoring processes in most companies seem to be ad hoc and spontaneous. However, these informal processes appear to be hardly sufficient to monitor technological changes [26]

Poor communication between employees is considered one of the obstacles, cited in 6 of the 14 interviews. This indicates that even when there are multiple people or departments, they often do not work effectively together. Although probably not the main challenge, this can further diminish the efficiency of forecasting practices. This challenge could possibly be caused by the unclear responsibilities as discussed previously, due to teams not exactly knowing each other's roles. The survey statement: "communication and coordination around the anticipation of technological developments are effective" looks at this issue. About 47% agreed that their communication is effective, 16% disagreed and 37% were neutral. So, roughly half seems to feel positive about their internal communication on these topics, but the rest either see issues or are not sure. In an organization, communication incompetence between different employees is considered one of the obstacles in technology intelligence [18].

Resource constraints, especially a shortage of skilled staff or expertise, could be another critical challenge. Five companies indicated their lack of sufficient and capable personnel to dedicate themselves to technology forecasting tasks, as shown in Table 4.6. Some participants said that they simply do not have people with the right technical background or that the teams are too small. If a company does not have people who deeply understand certain technological developments or simply does not have enough staff, it could be hard to devote efforts to exploring new tech. The survey responses to the open question seem to support this; see Figure 4.10. About 16% of the respondents mentioned the shortage of personnel and internal expertise as a challenge. This challenge is the second most common theme in open-ended survey data. Furthermore, this issue could be the reason why more sophisticated forecasting methods are not used. Human capital for using those methods might be lacking. Successfully executing these practices requires enough resources, competences, and capabilities that not all firms have [18].

Participants also noted several other challenges with slightly lower frequency. Struggles to find suitable use cases for new technologies were mentioned in 5 companies. This suggests that organizations have trouble envisioning or validating how new technologies could be applied in their organizations. Without clear use cases, momentum can stall. Another challenge, raised in five interviews, is the difficulty in gathering and filtering information. Given the flood of tech news and hype, knowing what

information to trust and focus on can be hard. Employees can be overwhelmed by information overload. In summary, the key challenges are believed to be: 1. lack of time and priority, 2. lack of formal process/ownership, 3. limited expertise and resources, and 4. coordination and information-related difficulties. These challenges could very well be interrelated, and together they help explain the difficulties that organizations face. An example could be that no one ensures that time is allocated or that different teams share insights because there is no formal process.

5.3 Benefits derived from the technology forecasting process

In addition to challenges, the study also appears to encounter several benefits that organizations gain from their current technology forecasting practices. Participants reported that participating in forecasting activities has yielded positives such as greater organizational flexibility, an experimentation culture, and improved knowledge sharing. The most cited benefit is having well-functioning tools and planning processes in place. In eight of the companies, participants noted that certain systems or frameworks they use work well to guide the exploration of new technologies. In the open survey question on the main benefits of their current process, 33% of the answers were about well-functioning tools and planning; see 4.12. This indicates that some organizations have established effective internal processes, such as defined stages, checklists, or tools. Participant 6 mentioned using analyses such as MoSCoW prioritization and gap analysis, implying that structured planning techniques are appreciated. In fact, nine companies in total were coded with the benefit 'well-functioning tools and planning'; see Table 4.7. Looking at the survey results of the statement about effective tools and processes, it seems quite mixed. Although 37% agreed with the statement, about one-third disagreed and the other 30% neither agreed nor disagreed.

Another strong benefit that seems to emerge is the freedom to act and experiment quickly with new technologies. In total, eight interviewees cited 'freedom to act quickly and experiment'; see Table 4.7. This includes companies that do not have formal processes. Looking at Figure 4.12, about 33% also included a benefit in the ability to act and implement quickly at the open question on the main benefits of their current process. Participant 1 illustrated this by saying: 'When we see something new in the market, we immediately start working on it'. This reflects a proactive mindset and agility. It also seems that an informal approach, while perhaps challenged in consistency, can excel in flexibility. It could be beneficial for some small or proactive companies to have a less formal process. Four companies mentioned the ability to act quickly and implement new developments as a benefit. This is closely related to 'freedom to act' but emphasizes not just experimentation, but actually implementing solutions. These benefits seen with informal activities may be caused by the specialized teams composed of some of the participating organizations. Informal monitoring and informal scouting can be complemented by hybrid coordination [17]. This form of coordination can be achieved by creating a specialized team. It appears that some of the participants, with a specialized team, are indeed benefiting from this.

A third significant benefit is having great employee skills and capacities as a benefit. This was mentioned in two companies during the interviews; see Table 4.7. Essentially, they credit their talented staff as a strength in forecasting. This aligns with the survey finding that 71% of the respondents agreed that 'our team has the necessary skills to evaluate new technologies'. Many MSPs evidently feel that their people are capable and tech-savvy. This is such a large share that agrees with this statement that it contradicts the results of the challenge:'shortage of staff and internal expertise'. This suggests that the participants are mostly agreeing on the shortage of staff, with less emphasis on the shortage of internal expertise.

In addition, other benefits were also noted. Seven out of the 14 companies said that their forecasting activities use effective internal knowledge sharing within the organization. This means that as they explore new technologies, they are also building knowledge among employees. Participant 14 described how they run an internal deep-dive session. The benefit is a more informed workforce and the stimulation of ideas. It is worth noting that not all companies seem to actively do this. It appears that more proactive cultures or larger groups share information like this. In Figure 4.12, 15% of the participants noted effective internal knowledge sharing in the open survey question on the main benefits of their current process.

In conclusion, companies seem to experience benefits even if their process is informal. These include improved ability to notice and respond to technological developments, excellent employee skills and ca-

pabilities, and effective internal knowledge sharing. The survey responses also reveal that not all these potential benefits are probably universally present. Interestingly, some challenges and benefits seem to be in the same aspects, such as formality, communication, tools and planning, and human capital. This suggests that these aspects could be key aspects for the technology forecasting process. Although they can present great challenges, they also become key strengths when effectively managed.

5.4 Improving the process for emerging technologies

The findings of this study highlight a potential gap in the way current technology forecasting practices can handle rapidly emerging technologies, such as generative AI. The interviewees were divided on whether their existing processes could anticipate innovations such as GenAI. About half of the participants seem to think that their approach is suitable. Others admitted that their practices were not good enough. This split perception seems to align when looking at the survey results. Only about 24% of the survey respondents agreed that their organization is prepared to implement technologies such as GenAI. Meanwhile, 37% disagreed and 39% was uncertain. Similarly, a majority of the respondents did not view their organization as an early adopter. Looking at Figure 4.13, 40% of the participants agreed that they would prefer to wait until a technology is widely adopted by others before implementing it. It seems like many participants are experimenting with GenAI. However, they appear to lack confidence that their current informal forecasting efforts can fully support such disruptive technologies. This suggests that improvements are needed in the forecasting process to better anticipate and forecast technologies.

Emerging technologies such as Generative AI can be characterized by high complexity and challenges in assessing technological maturity [12]. Therefore, forecasting these technologies is believed to be more complicated than traditional technology forecasting approaches. This study cannot state exactly what would enable accurate forecasting of these technologies, as the rapidly evolving nature can be unpredictable. However, to improve the process for emerging technologies, it seems best to minimize and eliminate current common challenges and pitfalls identified in both the literature and this research. To counter these challenges, managed service providers should strengthen the three aspects of their forecasting process: 1. formality, 2. practices and tool, and 2. communication. By strengthening these areas, managed service providers can improve their ability to anticipate and take advantage of new breakthroughs.

The lack of formal processes and unclear ownership is a recurring challenge in this study. This has been a common area of improvement in the literature over the years. Companies in the third generation of technology foresight seem to establish systematic organizational processes in order to enhance their technology foresight activities [24]. To address these identified challenges, managed service providers should establish structured technology intelligence activities. To realize this, organizations could shift from 'informal technology scouting' to 'a structured process that includes four important steps' [21]. These important steps are: 1. planning, 2. collecting, 3. analyzing and 4. disseminating intelligence. These structured steps could be established by using a governance document. Using such a document can provide immediate benefits in clarity of roles and shared memory to prevent loss of important information during staff turnover.

The complexity of emerging technologies appears to benefit from a multi-method approach to forecasting [10]. As discussed, the participants seem to use just a few informal practices of the technology forecasting families. There are many tools and practices to expand the current repertoire of forecasting techniques. Scenario planning is one valuable method for emerging technologies, with crucial uncertainties [26]. This method creates alternative images of the future development of external factors.

Collecting insights from partners and industry peers is a fairly common practice within participating organizations. Extending this insight with expert-based forecasting could be valuable. Especially, where historical data may be limited [10]. Professional consultation could be implemented through interviews or can be combined within a Delphi method.

In addition, patent analysis could provide crucial information about the development of emerging technologies [26]. Patents often contain forward-looking information about research and development activities. By systematically analyzing these patent trends, an organization can gauge insights such as technological maturity. In practice, managed service providers could monitor patent data to track areas

relevant to their industry. For example, a spike in patents on a certain type of cybersecurity algorithm might alert a managed security provider to an important trend. This could be done by the organization itself, but also by accumulating information from subscriptions to patent-analytics.

In our study, communication issues seem to become a notable challenge. Several interviewees pointed out poor cross-team communication as factors that hinder the forecasting process. The third area for improvement is to improve communication and knowledge sharing around technology forecasting. Even if an organization adopts formal processes and advanced tools, their impact could be limited unless the insights are effectively acted upon internally. Looking at the results, organizations could strive for an open culture where information about new technologies flows freely and curiosity is encouraged. Putting emphasis on the strategic importance of anticipating technological change can motivate employees to share ideas and information. Some managed services in our study cited internal knowledge sharing as a benefit of their current process. This suggests that adjustments to this challenge can potentially transform it into a strength. This is in line with the third generation of technology foresight, where companies are encouraging direct and efficient communication, ensuring that the information is delivered to all necessary stakeholders, in order to improve their forecast performance [24].

5.5 Future Work

Future research opportunities may be conducting longitudinal studies on technology forecasting in organizations. The results of this study were essentially a snapshot in time. A longitudinal approach could follow the same managed service providers for multiple years. Potentially capture how their maturity evolves and monitor, for example, changes in reactive, proactive, and developed approaches.

The impact of structured versus informal forecasting could be another opportunity for future work. One way to do this is through a comparative case study. This could include organizations that are known for structured forecasting versus those that operate mainly in an informal way. This could examine how each performs in identifying and adopting emerging technologies and if structured ones consistently perform better.

5.6 Limitations

It is important to recognize the limitations of this study when interpreting the results. Similarly to most multi-case study designs, this study has a number of common limitations that impact the depth and generalizability of the findings.

First, the sample has Limited Generalizability, due to the geographic and sector being mostly confined to Dutch managed service providers. Furthermore, all interviewees were from the Netherlands. The participating managed service providers are all closely related due to their common parent company. As a result, the results may not apply directly to different geographical areas, business sectors, or organizational structures.

In addition, there are certain transferability limitations with the sample size. In total, 26 organizations were surveyed and 14 people were interviewed. This sample size seems to remain relatively small in the broader context of the Dutch IT sector. The limited number of participants might restrict the depth of analysis within each organization, as only one interview per case was conducted. This could make it difficult to fully capture internal variation or conflicting perspectives within each company.

The third limitation is the potential selection bias. For this research, participants were selected through internal contacts within the managed service provider group. This way of sampling could possibly lead to selection bias. Participants who are more engaged or confident in their technology forecasting practices may have been more willing to participate. As a result, the study might struggle to represent the distribution of all different groups correctly.

Chapter 6

Conclusions

This research aimed to explore how managed service providers conduct technology forecasting to prepare for the rapid emergence of new technologies. A multiple case study design was used that combined qualitative and quantitative data collection. Fourteen semi-structured interviews were conducted with representatives from managed service providers. The transcriptions of these interviews were then analyzed using thematic coding. A follow-up survey was used in 26 organizations to validate and expand the interview findings. This approach aimed to provide a broad and detailed data set on current practices, challenges, benefits, and perceptions of the technology forecasting process in the participants.

Key findings: Several insights emerged from the study. First, the participating organizations appear to have three broad approaches to technology forecasting, including a reactive, a proactive, and a more developed approach. These approaches reflect varying levels of formality and internal initiative in their forecasting processes. Second, all participating companies seem to engage in basic forecasting activities, such as trend monitoring and expert opinion. However, most practices appear to be unstructured and informal. Third, common challenges are identified in the lack of time and priority, unclear ownership, and unstructured practices within the process. Fourth, respondents also identified clear benefits to their current practices, including organizational flexibility, well-functioning tools, and the ability to respond quickly to new technological trends. Finally, most of the participants were already experimenting with Generative AI, yet they seem to lack confidence about their technology forecasting ability.

In conclusion, this study finds that all participating managed service providers engage in technology forecasting, but their approaches vary significantly in structure. Most are based on informal practices, and only a minority use structured forecasting practices or a dedicated innovation team. These findings suggest that addressing common challenges by formalizing roles,allocating dedicated time, and expanding current practices may help managed service providers better anticipate and adapt to rapidly evolving technologies.

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Appendix A

Interview Guide

Goedemiddag en welkom, bedankt dat u de tijd neemt voor dit interview.
Mijn naam is Diego Sourbag. Op dit moment ben ik derdejaarsstudent informatica en economie, en doe ik een scriptiestage bij Your.Cloud. Daarnaast ben ik ook parttime data-analist bij een van de zusterbedrijven, Vancis.

Dit interview maakt deel uit van mijn bacheloronderzoek, waarin ik onderzoek doe naar hoe organisaties zich voorbereiden op technologische ontwikkelingen, in een wereld van snelle technologische vooruitgang.

Het gesprek zal ongeveer 45 tot 60 minuten duren en wordt opgenomen, uitsluitend voor analyse- en onderzoeksdoeleinden. Alle antwoorden worden vertrouwelijk behandeld conform het beleid van de universiteit en geanonimiseerd in het uiteindelijke onderzoek.

Uw deelname aan dit interview is vrijwillig en u mag elk moment aangeven als u wilt stoppen met dit interview, of als u een vraag liever niet wilt beantwoorden. Daarnaast mag u tot 1 maand na dit interview aangeven als u niet wilt dat ik uw antwoorden gebruik in mijn onderzoek.

Als u akkoord gaat, zal ik de opname starten. Hierbij zal ik mijn praatje even kort opnieuw doen om de opname compleet te maken.

1. Gaat u akkoord met de opname van dit interview?
2. Zou u zichzelf kort willen voorstellen: wie bent u en wat is uw rol binnen de organisatie?
3. Kan u een korte introductie geven over de organisatie?
4. Op welke wijze stellen jullie een lange termijn strategie op?
    (a) Hoevaak wordt deze strategie vernieuwd of aangepast en voor welke periode wordt het opgesteld (bijv: 1 jaar, 3 jaren of 5 jaren)?
    (b) Welke interne functies en afdelingen zijn betrokken bij het opstellen van de strategie, en in hoeverre spelen externe partijen zoals consultants, leveranciers hierin een rol?
    (c) Wordt hiervoor altijd dezelfde werkwijze voor gebruikt?

Voor veel organisaties zijn technologische ontwikkelingen en de relevantie daarvan onderdeel van het lange termijnperspectief. In dit deel van het interview ga ik graag in op hoe binnen jullie organisatie wordt omgegaan met deze ontwikkelingen.

5. In hoeverre wordt het anticiperen op technologische ontwikkelingen meegenomen in het lange termijnperspectief van jullie organisatie?
6. Hoe belangrijk is het anticiperen op technologische ontwikkelingen in jullie organisatie?

Bij de volgende vragen zal u gevraagd worden om stappen te beschrijven. Deze stappen ga ik live uittekenen in een tijdlijn, om zo een compleet beeld te krijgen. Graag vraag ik u om mee te kijken, zodat u de tekening kunt controleren.

7. Welke stappen worden binnen de organisatie gezet om te anticiperen op technologische ontwikkelingen? Licht dit toe aan de hand van een typische doorloop van een jaar?
   (a) Welke stappen worden wanneer in het jaar gezet?
   (b) Hoevaak worden de stappen uitgevoerd en voor welke periode wordt dit uitgevoerd? (bijv: half jaar of 1 jaar)?
   (c) Welke functies of afdelingen binnen de organisatie zijn betrokken bij het uitvoeren van de stappen?
   (d) Welke externe bronnen (zoals trend rapporten) en partijen (zoals consultants) worden gebruikt in het beschreven stappen?
   (e) Hoe bepalen jullie welke technologische ontwikkelingen mogelijk relevant zijn om verder te onderzoeken?
8. Worden er specifieke methodes, zoals scenario planning, gebruikt tijdens deze stappen? Zo ja, welke methodes?
9. Welke uitdagingen ervaren jullie tijdens het uitvoeren van de benoemde stappen?
10. Wat werkt juist goed in deze stappen? Zijn jullie hier allemaal tevreden over?
11. Denkt u dat jullie organisatie over het algemeen goed is in het anticiperen op technologische ontwikkelingen? Leg uit waarom (niet)?
12. In hoeverre zijn de beschreven stappen uitgevoerd voor het anticiperen van de technologische ontwikkeling Generative AI.
13. In hoeverre is de huidige werkwijze geschikt bij het anticiperen op de technologische ontwikkeling Generative AI?
14. Hoe leren jullie als organisatie van eerdere ervaringen met technologische ontwikkelingen?
15. Is er nog iets wat u graag zou willen toevoegen, waarvan u denkt dat we het misschien gemist hebben of waar u nog op wilt terugkomen?

Appendix B

Survey questions

Introduction

Thank you for participating in this survey on anticipation of technological developments within managed service providers (MSPs). Please answer each statement based on your own experience. All data will be treated confidentially and anonymized. The survey will take approximately 7–10 minutes. Open-ended questions can be answered in English or Dutch.

Q1. What is the name of the company you work for?

Statements with Dual Scales

Instructions: For each of the following statements, first indicate how structurally this activity is performed:

- ☐ Ad hoc
- ☐ Structurally planned
- ☐ Never

If your answer is "Ad hoc" or "Structurally planned", then indicate the frequency:

- ☐ Yearly
- ☐ Quarterly
- ☐ Monthly
- ☐ Weekly
- ☐ Daily

Statements:

1. We obtain information about technology trends from customers.
2. We involve internal employees in brainstorming sessions about future technology trends.
3. We obtain information about technology trends from other peer companies.
4. We obtain information about technology trends from partners and vendors.
5. We reach out to external experts in the industry to gather technology insights.

6. We actively discuss our customers' technology needs when planning for new services.
7. We reach out to partners and vendors in the industry to gather technology insights.
8. We encourage employees to propose new ideas for future technologies or services.
9. We actively monitor information sources on technological developments (e.g. forums, websites).
10. We execute a trend analysis on the collected information on technological developments.
11. We collect information about a technology using a trial version of existing solutions.

Job Function and Time Allocation

Q14. Executing practices to research technological developments are formally defined tasks of my job function.

☐ True

☐ False

Q16. The time necessary for researching technological developments is formally defined within my schedule.

☐ True

☐ False

Approval for Further Research

Q17. Which of the following parties must approve further research on a technological development? (Select all that apply)

☐ Management team

☐ Team leader

☐ All team leads

☐ No approval necessary

☐ Other: _____

Open Questions – Activities and Sources

Q18. What specific activities does your team undertake to anticipate technological developments?

Q19. What sources of information does your team use to stay informed about future technology trends?

Perceptions on Current Practices

Q20. Indicate your agreement with the following statements:

☐ Strongly disagree

☐ Disagree

☐ Neither agree nor disagree

☐ Agree

☐ Strongly agree

1. Our organization quickly responds to emerging technologies and market trends.
2. We have effective tools and processes to support anticipation of technological developments.
3. Our team has the necessary skills to evaluate new technologies.
4. Our process structure limits effective anticipation of technological developments.
5. Balancing forecasting activities with daily operations is challenging for our team.
6. Communication and coordination around technological anticipation are effective.
7. Our forecasting activities align with actual market needs.
8. We can effectively evaluate and test new technologies before adoption.
9. Our organization is prepared to implement technologies like Generative AI.
10. We prefer to be early adopters of promising new technologies.
11. We tend to wait until a technology is widely adopted before implementing it.
12. Our technological anticipation process is well-structured and documented.
13. All team members have clearly defined roles in the innovation process.

Open Questions – Reflection

Q21. What do you consider the main benefits of your current process for anticipating technological developments?

Q22. What challenges does your team face when anticipating technological developments?

Appendix C

Business process models

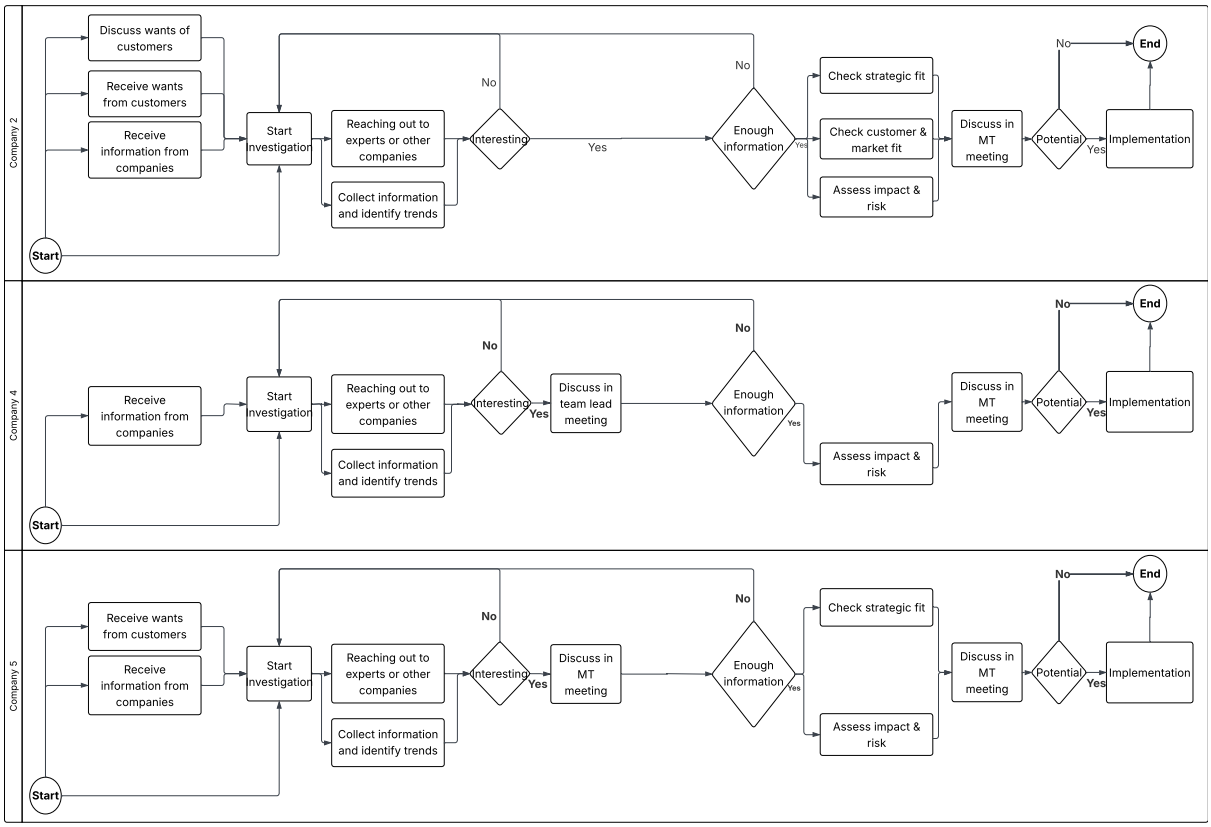

Figure C.1: Business process models of reactive companies

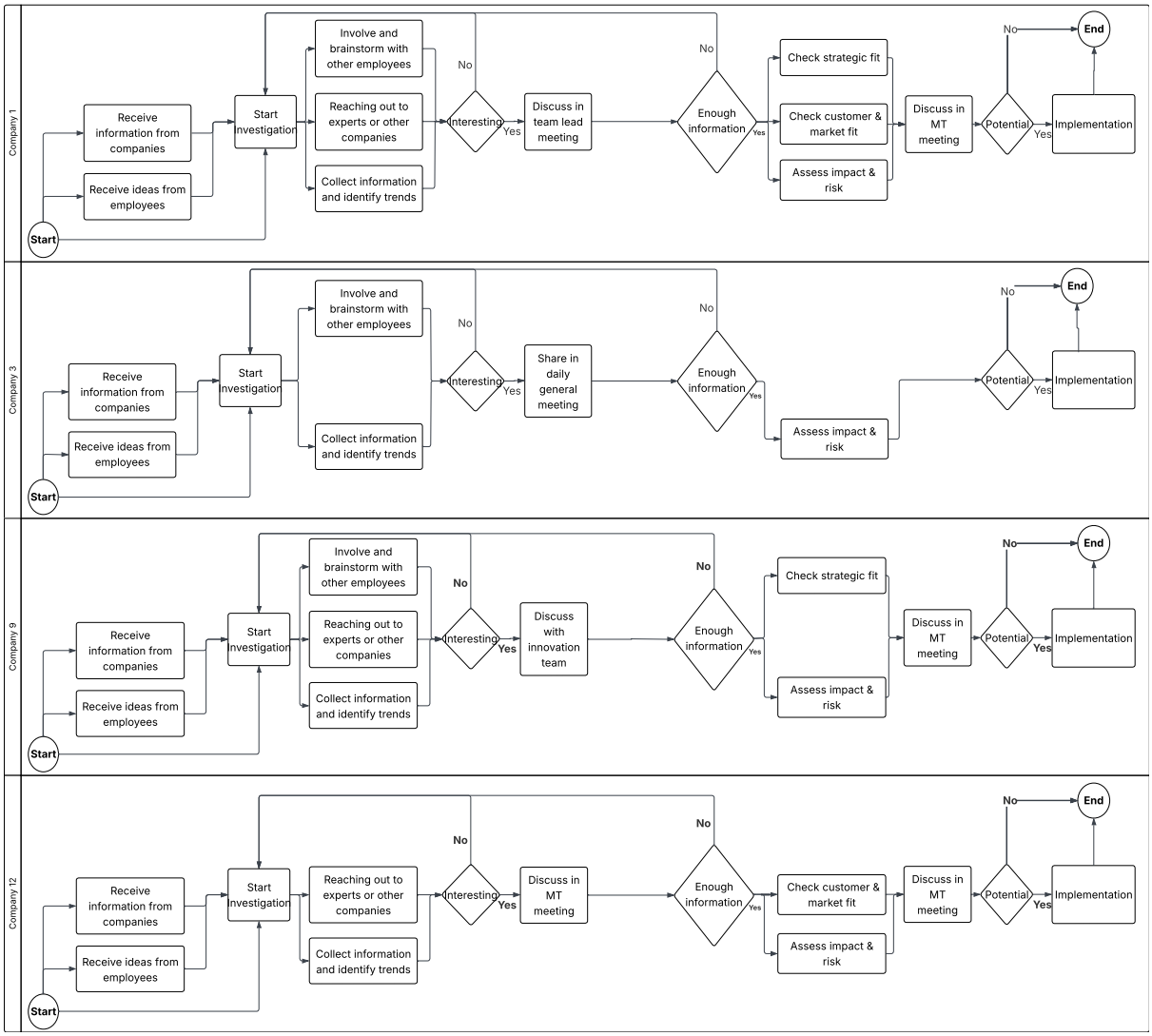

Figure C.2: Business process models of proactive companies

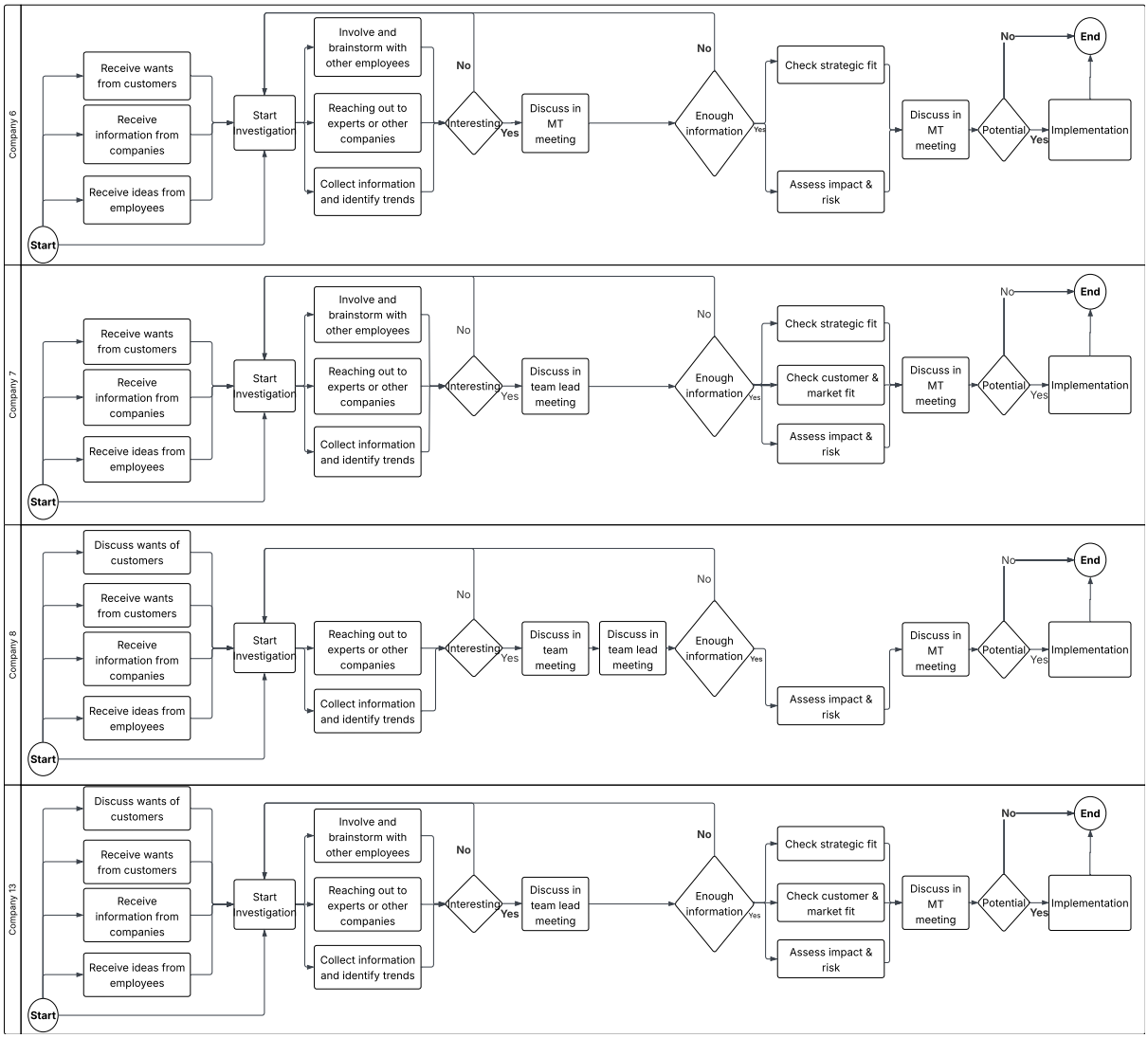

Figure C.3: Business process models of developed companies by generic teams

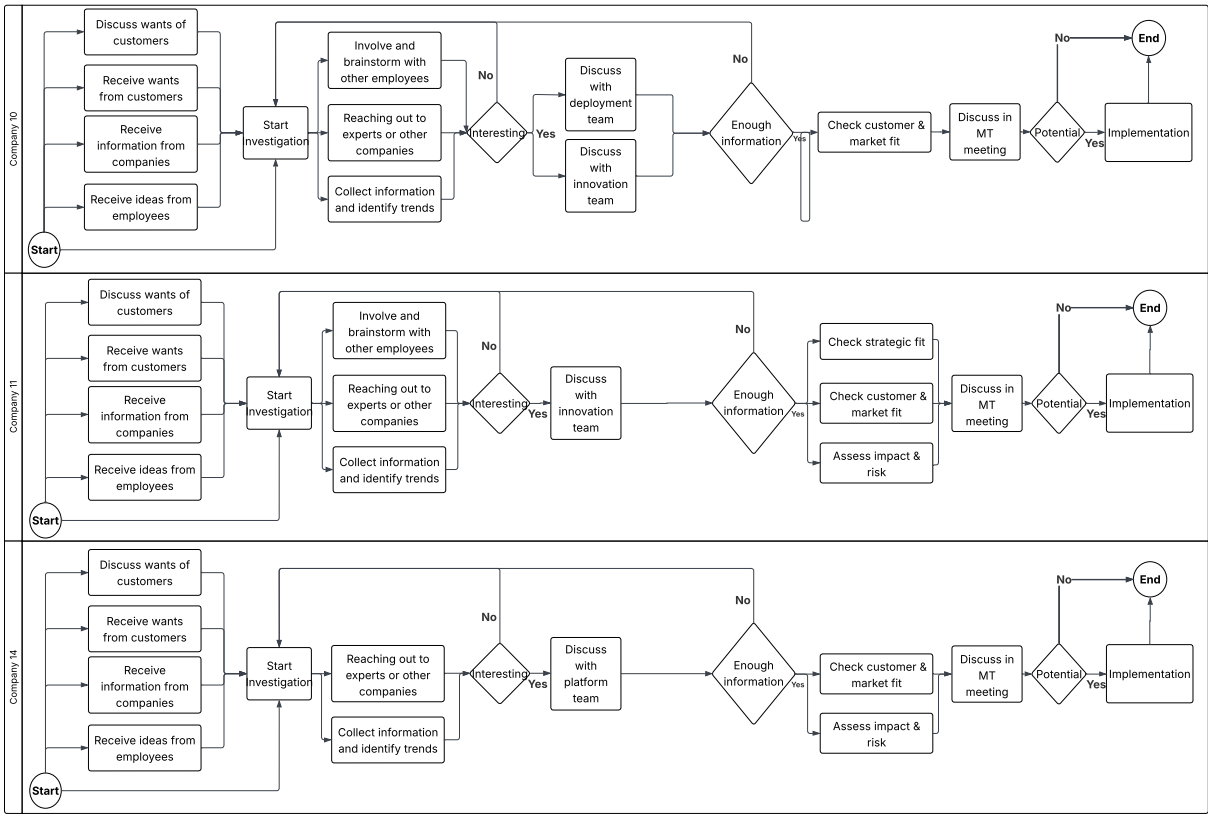

Figure C.4: Business process models of developed companies by specialized teams

Appendix D

Codebooks

Table D.1: Codebook: Strategic planning practices

Code	Comment	Quote (translated)
Ad hoc planning in small teams	In smaller organizations or teams, planning for new technology adoption is handled on an as-needed, ad hoc basis.	If you're a small company it's not set up as structured as an enterprise. So we don't really have a monthly meeting for that.
Annual strategic planning process	A structured yearly exercise in which the company develops a business or strategy plan for the year ahead.	Yes, and then we usually try to work on the annual plan for the next year towards the end of the current year.
Monthly monitoring and planning evaluations	The company holds check-in meetings or evaluations on a monthly basis to monitor progress and plans.	Well yes, monthly and quarterly we prepare a meeting to inform our colleagues, and from that you just know whether you're on course or not.
Multi-year vision and roadmapping (2–3 years)	The organization sets out a longer-term vision for the next few years and creates a roadmap.	At the moment, for example, we have a three-year vision. A three-year roadmap has actually been established.
Quarterly progress review meetings	The organization meets every quarter to review how projects and initiatives are progressing relative to goals.	So the propositions are reviewed every quarter.
Strategy defined by management team	The high-level strategy, including directions for technology and innovation, is determined by the company's top management or leadership team.	The entire annual plan and the quarterly meetings – the annual plan is made by the full MT (management team) of our company.

Table D.2: Codebook: Technology forecasting practices

Code	Comment	Quote (translated)
External insights from experts and industry peers	The company looks outside its own walls for knowledge. It gathers input from industry experts, vendors, partner networks, and peers.	We are now in a position where we can look at what is happening in sister organizations.
Internally triggered based on observed needs	New innovation initiatives often start because someone inside the organization notices a need or opportunity.	For example, you have brainstorming sessions with colleagues... or simply the conversations that are held...
Monitoring of industry and tech trends	Continuously keeping an eye on industry news and emerging technology trends. The team follows sources like tech news.	So in this case, say Microsoft is really emphasizing this topic in their emails and partner meetings. Then you intuitively sense — hey, they're actively working on this. Maybe we should also look at what they're doing.
Triggers based on customer needs	Many innovation efforts start reactively, triggered by customer input.	You have customer input. Yes. Where customers have questions or a problem, and from that a demand arises. It's a piece of the market. Customers are, of course, part of the market.

Table D.3: Codebook: Roles and Responsibilities

Code	Description	Example Quote (translated)
Practices are executed voluntarily	It is left to personal initiative, because there is no formal mandate or program, participation in forecasting activities.	a few tech nerds and they basically read the same information. So we regularly send each other messages like: have you seen this already?
Practices are informal, and unfixed	The company's forecasting and innovation efforts are not governed by any formal process or written procedure.	This isn't documented. No. It just kind of happens naturally.
Practices are semi-structured and documented	The organization has made some progress in formalizing its innovation process. There are partially set procedures and documentation in place.	So it's also not entirely fixed... It's partly for yourself and partly for work.
Practices are separately executed by all teams	Each department or team carries out its own innovation and tech scouting activities independently.	Developments — that basically starts with the internal teams I mentioned earlier, who mainly look within their own field at what's going on or what's changing.
Practices executed by dedicated innovation team	The company assigns innovation duties to a specific, dedicated team.	We have a team, currently called Innovation & Adoption, which I manage.
Practices executed by department heads	Responsibility for innovation and forecasting lies with individual department heads.	The head of the department is usually the one who does the research, yes.
Single responsible role for all practices	A single person (such as a CTO, tech lead, or innovation officer) is largely in charge of all the innovation activities.	Yes, for a small organization like ours, that mainly falls to me as tech lead.

Table D.4: Codebook: Assessment practices

Code	Comment	Quote (translated)
Alignment with customers and market developments	The company checks that its new services and innovation efforts align with what customers want.	Everything new that comes out there, we start working on it and look for value for the customer.
Alignment with strategy, vision, and resources	The company checks that its new services and innovation efforts are chosen and shaped to fit the company's overall strategic goals and vision.	So we actually determine, is it relevant for us? How does it work and how does it fit in our organization?
Evaluation of cost, benefit, and risk	Before committing to a new idea, the company elaborately analyzes its potential value, risks and downsides.	Further elaborating on how much time this will cost, which problem exactly we are solving, and what time savings we may achieve with this.

Table D.5: Codebook: challenges executing technology forecasting practices

Code	Description	Example quotes (translated)
Customer or market misalignment	Occurs when a new product or technology is available but does not fit what customers currently want or are ready for.	But the customer... in the end just doesn't... isn't ready yet... or doesn't find it relevant.
Difficulties gathering and filtering information	The team faces challenges in collecting and sifting through the vast amount of information on new technologies.	When we talk about products, services, tools you can use to reach your goals, there's just so much on the market. So the selection process itself can be quite challenging. Precisely because you can't see the forest for the trees.
Hard time dealing with uncertainties	The company struggles with the inherent uncertainties of emerging technologies.	And with some new technologies... you're at the point of implementing them... and then some legislation pops up... that hinders things again.
Limited time and competing business priorities	One of the biggest issues is the lack of dedicated time for practices, due to day-to-day operations and immediate business priorities.	Exactly what you said, right? Just figure it out. We're a small team and already quite full with work, so this has to be squeezed in.
Poor cross-team communication and unclear goals	When pursuing new or innovative projects (especially those not yet concrete), the organization encounters communication struggles between departments.	You do have challenges, but that's often a piece of miscommunication between departments.
Shortage of staff and internal expertise	A lack of sufficient and skilled personnel is hindering the execution of practices.	Yes. In some cases, maybe also a lack of expertise.
Struggles to find fitting use cases	Despite learning about a new technology, the team has difficulty finding clear, valuable applications for it in their own business context.	But the use cases, they're not really there for us. Maybe they exist, but in this case they haven't been defined.
Struggles with monitoring and evaluating	Participants express uncertainty about whether current efforts are successful or impactful, often due to the lack of clear indicators or feedback mechanisms.	The question is, you know, whether it's going well or not. In the land of the blind, everything goes well.
Unstructured processes and missing ownership	Participants describe difficulties in executing innovation practices due to unclear processes, lack of structure, and missing ownership within the organization.	Those are the things we struggle with. Where does that belong? Who do you give which responsibility in that?

Table D.6: Codebook: Benefits executing technology forecasting practices

Code	Comment	Quote (translated)
Ability to act and implement quickly	Once a promising idea or need is identified and validated, the company can move swiftly to test and roll it out.	And if that is successful and we can build a business case around it, then we can introduce it to our customers. And that can go really fast.
Active customer involvement in the process	Customers are kept closely involved during innovation efforts.	I think customer contact goes quite well, that we stay in touch with the customer.
Adoption strategy performs great	The company's approach to adopting new technologies is highly successful.	We are currently far ahead of the rest of the group.
Effective internal knowledge sharing	The organization excels at sharing knowledge internally.	Those are usually two or three sessions at our office... So I think we try as best as possible to make everything understandable from A to Z for all departments.
Freedom to quickly act and experiment	People who spot opportunities have the freedom to pursue them without excessive formal hurdles.	What we are very satisfied with is that employees have a lot of freedom to bring in their own ideas.
Great employee skills and capacities	Employees have the necessary knowledge and competencies.	The people working on it – they have the skills. And the knowledge.
Well-functioning tools and planning	The company has effective tools and planning practices that aid their innovation process.	I think in terms of systems and people knowing what they have to do, things are well arranged.

Table D.7: Codebook: Perceptions of current technology forecasting practices

Code	Comment	Quotes (transcription)
Aims to be an early adopter	The organization deliberately strives to be among the first to experiment with and adopt emerging technologies.	Ja, eigenlijk zijn wij early adopters. Dus nieuwe technologieën, dat kan ook als heel kleine organisatie.
Current practices are considered insufficient	A recognition that the existing approach to forecasting and innovation is not adequate or well-structured enough.	Nee, als ik heel eerlijk ben op dit moment nog niet goed genoeg. Ondanks dat de verbeterslag,
Existing approach considered suitable for anticipation genAI	Participants believe their current method of technology forecasting is well-suited for handling emerging tech like generative AI.	En zou je zeggen dat het geschikt is om het te doen voor AI, generatieve AI? Ja.
Not aiming to be a first adopter	The company intentionally avoids being the very first to jump on new technologies. They prefer to wait and observe.	Dus als er vandaag iets nieuws komt. Dat betekent niet. Dat je dat morgen gelijk moet. Introduceren en doen. Soms is het ook goed. Om je heen te kijken. Wat doet de markt daarin.
Satisfied with current practices	Team members feel that their existing process for technology forecasting works well and are happy with it.	naar mijn mening gaat het goed.