



*Analysing audit efficiency:  
Bridging the gap between budgeted and  
actual hours at audit companies*

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# **ANALYSING AUDIT EFFICIENCY: BRIDGING THE GAP BETWEEN BUDGETED AND ACTUAL HOURS AT AUDIT COMPANIES**

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## Preface

Dear reader,

Thank you for taking the time to read my thesis. This thesis is written as the final part of my Bachelor's degree in Industrial Engineering and Management at the University of Twente. The title of my thesis is "Analysing audit efficiency: bridging the gap between budgeted and actual hours at audit companies". This research was conducted at company X, focusing on their audit services.

I would like to express my gratitude towards everyone who supported me over the past few months. I am thankful to all the employees of company X for their valuable expertise. A special thanks to Aletta de Weerd, Silke Belshof and Brianne van der Genugten, for their insights and support.

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## Management summary

This thesis examines the discrepancies between budgeted hours and actual spent hours at audit assignments. The main research question to address this planning issue is:

*How can company X improve their resource planning for audit assignments, to align budgeted hours with actual spent hours?*

The current planning method results in a deviation between the budgeted hours and actual hours of 3,17%. However, deviations vary across different levels. In this research, the deviation on phase level, month level, group level and function level are investigated. The dataset used for this research ranges from May 2023 to April 2024, including 121 clients.

### Key findings:

The significant deviations between budgeted and actual hours are in the planning and risk assessment phase, particularly in the month May. The deviation of the planning and risk assessment phase is 15,21%, while May 2023 shows a deviation of 22,14%. Both deviations are positive, indicating that more hours are used than budgeted.

To evaluate discrepancies based on the size of engagements, clients are categorized into eleven different groups, based on actual hours used to complete the engagement. To ensure representable results, each group involves at least 10 clients. The highest negative deviations are identified in group 1 (0-250 actual hours) and group 2 (250-300 actual hours), with deviations of -26,02% and -26,52% respectively. The highest positive deviation is in group 10 (1600-2000 actual hours), with a deviation of 10,69%.

A cross-level analysis is conducted to identify the contributing factors to the observed discrepancies. The results are summarized in Table 1:

Highest deviation	Planning and risk assessment	May 2023	Group 2	Group 10
<b>Phase level</b>	X	Planning and risk assessment	Planning and risk assessment	Planning and risk assessment
<b>Month level</b>	May 2023	X	May 2023	May 2023
<b>Group level</b>	Group 2 + group 10	Group 1 + group 10	X	X
<b>Function level</b>	Manager	Manager	Partner	Partner

*Table 1, Results cross-level analysis*

### Root causes:

Combining the knowledge gained from the data analysis with information gained from consulting experts, two theoretical root causes are identified:

- 1 Lack of understanding client's risk
- 2 Challenging realisation rate

### Recommendations:

To address the root cause "lack of understanding client's risk", company X could make more use of the initial risk assessment and incorporate benchmarking. The initial risk assessment can even be expanded with additional questions to provide deeper insight into a client's risks before the planning process begins. The use of benchmarking can help identify risks attached to a specific client type. To address the root cause "challenging realisation rate", the realisation rate target could be adjusted, including the costs of more hours used than budgeted. This results in a realistic view of the financial profitability of the assignment, with a smaller gap between budgeted and actual hours.

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# 1. Research methodology

In this Chapter, an introduction of my research is provided. Section 1.1 gives an introduction of this research. Section 1.2 describes the research design and the problem-solving approach used. Section 1.3 states the norm versus reality. Section 1.4. shows a list of deliverables resulting from this research. Section 1.5. shows which data gathering methods are used to collect the information needed. Section 1.6. focuses on the analysis method of the retrieved data. Section 1.7. lists the limitations and assumptions relevant for this research. To conclude, section 1.8. discusses the validity and reliability of the research.

## 1.1 Introduction

Auditors play an essential role in the functioning of the global market. However, as the global market keeps changing, they are facing increasing challenges, issues and risks. This makes the job of an auditor more demanding. Auditors are responsible for evaluating financial statements and asses the effectiveness of the internal control of their clients (Kueppers & Sullivan, 2010). Auditors provide assurance regarding a company's financial position, which is crucial for external parties like investors, suppliers and clients, who rely on accurate financial information for decision-making.

### 1.1.1. Company introduction

Company X is a leading firm providing Audit, Tax and Advisory services. The company was formed through the fusion of two companies, and quickly it became an internationally known firm. Audit professionals at company X provide an independent examination of their client's financial records, transactions, and systems. They check if their client's financial statements are in line with the relevant accounting standards and regulations. At the same time, tax professionals have a role in ensuring compliance with the new laws and regulations and provide help filling in the taxes of their clients. Moreover, the advisory professionals provide strategic guidance and support to their clients. Their knowledge enables them to help clients address challenges, seize opportunities, and achieve their goals.

### 1.1.2. Problem context

Efficient resource planning (i.e., the allocation of staff hours) is crucial for an audit company to carry out assignments with success. The main goal of resource planning is getting the right people, with the right skills, to the right job. It also contains calculating how much time and effort will be needed to complete each assignment. Nonetheless, audit companies face a lot of challenges when it comes to forecasting and managing their resource planning.

There are numerous reasons audit resource planning is complicated. Firstly, audit assignments vary in scale and complexity (Christ, 1993). As result, a good understanding of each audit assignment's requirements is needed. Secondly, regulations reporting requirements are constantly changing (Hayes et al., 2005). Therefore, the planning must be dynamic, in order to respond easily to changes.

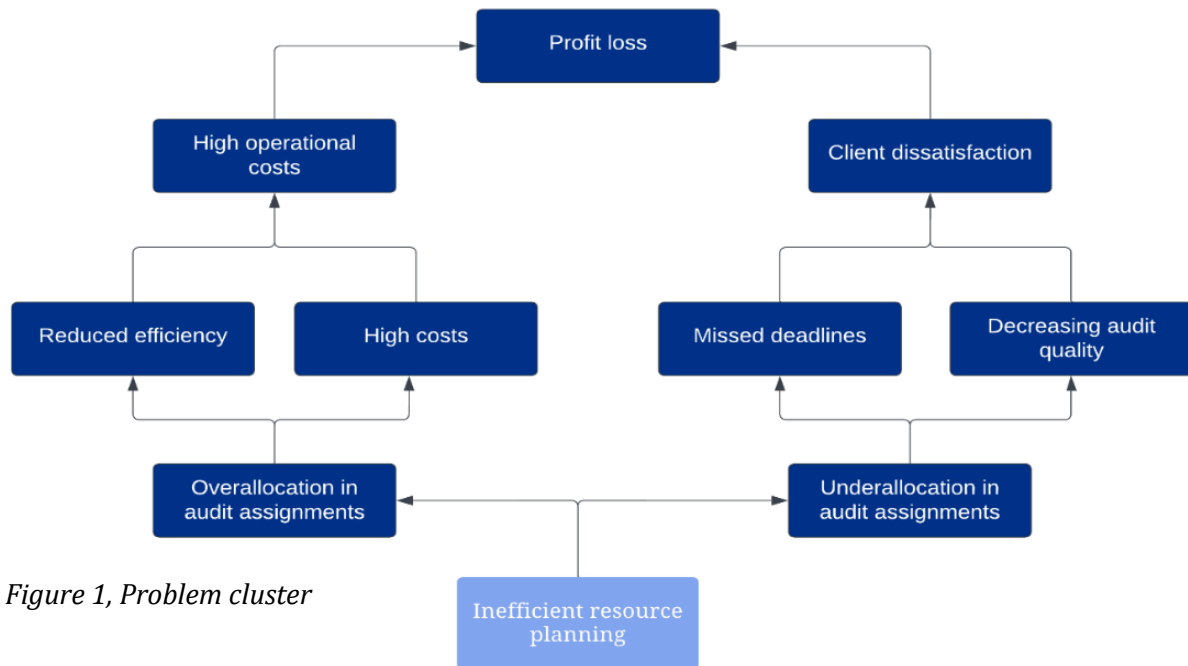


Figure 1, Problem cluster

### 1.1.3. Action problem

An action problem is any situation that differs from how you want it to be, so where reality deviates from its norm as perceived by the problem owner (Heerkens et al., 2017). After looking into the problem context and problem cluster in Figure 1 it can be concluded that our action problem is profit loss. Inefficient resource planning can have significant consequences for an audit firm. It may lead to under allocation of assignments, which leads to missed deadlines and decreased audit quality. This has as a consequence a decrease of a client's trusts and satisfaction. They expect auditors to be efficient, work on time, and deliver high quality work. Failure to meet these expectations will cause dissatisfaction and will put client relationships in danger. Conversely, over allocation can result in reduced efficiency and high costs, which leads to high operational costs. Both under- and over allocation will eventually have profit loss as result.

### 1.1.4. Core problem

The core problem becomes clear from the problem cluster in Figure 1, "inefficient resource planning". For audit firms, resource planning is a difficult task. When the planning for a specific client is made, not all information is provided by the client. The information can be incomplete or inaccurate, which makes it difficult to estimate the risk of an audit assignment. Moreover, there is a strict hierarchy in the audit team, where all people have a different level of skills (Hayes et al., 2005). There are numerous different tasks within one assignment, which all require a specific level of skills to complete the task. The audit resource planning has to meet all these demands, while remaining efficient, which can be a challenge.

### 1.1.5. Research questions

To solve the core problem, inefficient resource planning, the research question and its sub-questions will have to be formulated. Below, a description of the main research question, followed by its sub-questions and the goal of each sub-question is given. The main research question is:

***How can company X improve their resource planning for audit assignments, to align budgeted hours with actual spent hours?***

To answer this question, this research will be divided into multiple sub-questions. The first sub-question will provide us with an insight about the way company X currently allocates its hours. To improve the resource planning at company X, we first have to understand the current situation regarding the planning process. The sub-question designed for this is as follows:

**1. *What is the current situation at company X, regarding their resource planning?***

Next, a closer look at different assignments will be taken. We will investigate the assignments on phase level, month level, group level and function level. Company X has all this data stored, and visualizing this data will help us to find where discrepancies are between budgeted and actual hours. The sub-question for this is:

**2. *Where are the discrepancies between budgeted and actual hours located within audit assignments?***

With the information we gained from the last sub-question, it is easier to identify the root causes of the inefficient resource planning. Before we can identify what the root causes are, a root cause analysis method should be used. A literature study will be performed to find out which root cause analysis methods are being discussed in literature. After identifying the existing methods, we select the most appropriate method for this research.

**3. *What root cause analysis methods are described in literature, and which is the most fitting for this research?***

After answering this question, the findings in discrepancies from sub-question 2 and the root cause analysis method from sub-question 3 can be combined to identify the possible root causes of inefficient resource planning at company X. Identifying the causes of inefficient resource planning will help providing recommendations on how the planning process could be more efficient. In the next sub-question, we will use a root cause method to identify the possible root causes of inefficient resource planning:

**4. *What are possible root causes of inefficient resource planning at company X?***

For the last step, recommendations for company X will be given. These recommendations could help them solve the root causes of inefficient resource planning.

**5. *What recommendations could be considered to solve the root causes of inefficient resource planning at company X?***

In Appendix A, Table 18, an overview of the sub-questions can be found, together with the research type, data gathering method and data analysis method for each sub-question.

## **1.2. Research design**

For the problem-solving approach, a root cause analysis (RCA) will be used. The root cause analysis approach focuses extensively on understanding the problem in depth, before moving to the solutions. The approach consists of the following steps (Okes, 2019):

- “1. Define the problem
2. Understand the process
3. Identify possible causes
4. Collect the data
5. Analyse the data
6. Identify possible solutions
7. Select solution(s) to be implemented
8. Implement the solution(s)
9. Evaluate the effect(s)
10. Institutionalize the change”

The first five steps are part of the **diagnostic phase**, the next five steps are part of the **solution phase**. During this research the focus will be on the first seven steps of this research approach. In section 1.2.1. every phase of the RCA is described.

### **1.2.1. Problem-solving approach**

In Phase 1, the problem of company X must be identified. For the identification, a problem cluster is made, which can be seen in Figure 1. In the problem cluster, cause-and-effect relationships are visualized. From this, the action and core problem can be identified.

In Phase 2, understanding of the current process is necessary. This will be done by looking into the current way a planning is made at company X. Making a flowchart could be useful in this step because this gives a clear overview of the current process and the stakeholders involved. Another way to get a better insight into the current process of resource planning is by consulting experts involved in the planning process. This should provide more information about the planning process and which decisions are taken in the process.

In Phase 3, possible causes should be identified. This can be done best by talking to employees and ask where they experience problems. Moreover, it can be useful to look into the daily practices at company X.

In Phase 4, the data must be collected. The data used for this research will be provided by the planning department of company X. It is important to make sure the collected data is correct and complete, therefore we will conduct data cleansing.

In Phase 5, the data will be analysed. The analysis of the data will start off broad, and eventually will become more specific. To start, an analysis of the budgeted hours against the actual used hours will be made for each assignment. This gives an overview of how big the problem actual is. The next step is conduct a data analysis for each phase, month and function. For each phase, month and function a certain amount of hours is set at the beginning of the assignment. Comparing these budgeted hours with the actual hours that were necessary to complete the assignment could give specific information on where the discrepancies between actual and budgeted hours are located. We will also categorize the client assignments, based on actual hours needed to complete the assignment, into multiple groups ranging from 1-11. With this information we can check if there are certain groups with a higher deviation, and indicate where the problem is located.

In Phase 6, possible solutions should be identified. In order to come up with those solutions, a literature search is needed. In the literature, more information on root cause analysis methods can be found. This could give us more information on which root cause methods there exist, and which method is useful for this research. This method will be used to identify the root causes of inefficient resource planning. If the possible causes are identified, we can provide recommendations to company X.

In Phase 7, the possible solutions that were suggested in phase 6, will be investigated more. Eventually recommendations for company X will be given, in which different possible solutions are stated to solve the inefficient resource planning.

The Phases 8, 9 and 10 should be evaluated by audit company itself, because this research will not implement the solutions and therefore it is not possible to analyse effects of the recommendations offered.

### **1.3. Measurement norm and reality**

It is essential to first make a sketch of the current situation of resource planning for audit assignments at company X. This will be the starting point of this thesis. The reality will give an indication of the current situation at company X, the norm will outline the situation that is desired (Heerkens et al., 2017).

### **1.3.1. Reality – budgeted hours and actual hours do not align**

When accepting to audit a client, company X estimates how many hours it will approximately take to complete the assignment. This is important for company X to know, because an internal planning must be made. They must decide who is going to be part of the audit team and how many hours they will spend on this assignment. Moreover, it is also important for a client to know how many hours the completion of the audit process will take. This gives the client an indication of when the audit will be finished and how much the costs will be. However, during or at the end of the assignment it could appear that not enough or too many hours have been budgeted and therefore more/less hours are being needed to complete the assignment. This causes problems for company X in their internal planning, but also leads to client dissatisfaction. At this moment, company X does not have an idea where the problem is located within their resource planning.

### **1.3.2. Norm – budgeted hours and actual hours do align**

The desired situation for company X is that the budgeted hours are equal to the actual used hours. This can only be the case if the forecasting method for company X is more accurate. It may be impossible to ensure that the budgeted hours are equal to the hours spent, therefore the goal of this research is to identify where the discrepancies are located and provide possible recommendations to improve the forecasting. The goal is to increase the efficiency of resource planning, by making the gap between budgeted hours and actual hours as small as possible.

## **1.4. Deliverables**

- **Flow chart of the current planning process**

To facilitate improvements in the resource planning, it is crucial to gain a good understanding of the existing planning process. Making a flowchart of the current process is an useful way to accomplish this. The flowchart will show the involved stakeholders in the resource planning process, and shortly explain the tasks of these stakeholders.

- **Data analysis report**

This report will compare the budgeted hours with the actual hours for a variety of assignments. The data analysis report will include an overview of the total hours used for each assignment, along with a breakdown of hours used for each phase, month, group and function. The results will be presented with the use of graphs to visualise the data.

- **Root cause analysis**

The data from company X will be analysed to identify the underlying factors contributing to the discrepancies between budgeted and actual hours. This analysis will include a detailed report of the identified root causes. Furthermore, a literature search will be conducted, to investigate different root cause analysis methods. The aim is to identify the root causes behind the inefficient resource planning at company X, and give recommendations to the company on how they can possibly solve these root causes and therefore eventually increase the efficiency of the resource planning.

- **Recommendations**

Recommendations can be made once the root causes have been identified with the use of data analysis and the root cause analysis method. At this point, we have an indication on what the root causes are and therefore can provide recommendations to solve these causes.

## **1.5. Data gathering method**

To conduct this research, a combination of different data collection approaches will be used. Firstly, qualitative methods will be used to get a deeper understanding of the decision-making process and involved stakeholders related to resource planning at company X. Secondly, quantitative methods will be used to collect numerical data regarding the utilization of resources.

This helps us to conduct a statistical analysis to identify patterns, trends and discrepancies (Machado & Davim, 2020).

### 1.5.1. Qualitative data

- **Consulting experts**

In this research we will identify and reach out to key stakeholders who have experience in the planning field. The goal of consulting these stakeholders is to gain a deeper understanding of the current planning process, including its challenges and strengths. Moreover, we will consult experts to gain more knowledge about company X and their goals.

- **Observations**

Direct observations provide a valuable insight of how resource planning is carried out in practice. By directly witnessing the process, it is easier to gain a deeper understanding of the process. It helps to identify challenges and it validates findings obtained from experts and documents. To gather this information, an audit team and the planning department will be joined for some days, to see which challenges in the planning (process) they are both facing.

- **Literature study**

The literature study is a crucial fundament in understanding the resource planning process for audit assignments. The goal of the literature review is firstly to identify key concepts related to this research. Secondly, the goal is to understand which tasks are involved in the audit process. Thirdly, we will use a literature study to investigate which root cause analysis methods there exist, and with this information choose the most fitting method for this research.

### 1.5.2. Quantitative data

- **Forecasting documents**

The forecasting documents provide estimates of the number of hours required for each assignment. This estimation is based on different criteria, such as historical data and client expectations. By examining forecasting documents, valuable insights into the current resource planning process can be gained. The budgeted hours stated in these documents are used to investigate the discrepancies between forecasted and actual hours spent.

- **Time tracking records**

Time tracking records offer a view in the actual hours spent on a specific assignment. These records capture detailed information about the date and duration of a task within an assignment. By analysing time tracking records, budgeted hours can be compared to the actual hours spent.

## 1.6. Data analysis method

To answer the research question, we will have to analyse real-time data. The different sorts of data we will receive are mentioned in the previous section. Before we can draw any conclusions from this data, it has to be analysed. A mixed-method approach will be used for this, while it exceeds the information that could be obtained using only a quantitative or a qualitative method (Almeida, 2018).

The qualitative data (consulting experts, observations and literature study) are used to increase our knowledge about resource planning. The quantitative data (forecasting documents and time tracking records) are used to discover inconsistencies and patterns using numbers. The combination of both qualitative and quantitative research leads to a better understanding of the problem (Creswell & Garrett, 2008).

A mixed data analysis method will be used to detect the potential root causes and propose recommendations for the inefficient recourse planning at company X. The knowledge gained from the qualitative analysis and the patterns and findings from the quantitative analysis will be combined to come up with potential root causes and recommendations.

### **1.7. Limitations and assumptions**

Given that this research will take place in a time period of 10 weeks, some limitations and assumptions need to be put into place. This is to make sure the research will be completed and there is enough time to make recommendations.

#### **1. Dependence on self-reported data**

This research relies on self-reported data, as it uses time sheets filled in by company X's employees. This introduces the possibility that employees misreport the time spent on tasks. If this is the case, biased and incomplete data is analysed, which may lead to incorrect conclusions drawn from this research. Therefore, in this research it is assumed that filled-in hours accurately reflect the time spent on a task.

#### **2. Limited geographic scope**

This research will focus on the offices from company X in the Netherlands, mostly on the offices in North-East Netherlands (Groningen, Zwolle and Enschede). The recommendations resulting from this research may also be applicable for the international offices. However, there may be factors only relevant for Dutch offices. Consequently, the recommendations resulting from this research may not be useful to international offices.

#### **3. Lack of implementation phase**

The goal of this research is to identify where the discrepancies between budgeted and actual hours are and propose recommendations to address this problem. However, due to the time constraint of 10 weeks, there is not enough time to implement the recommendations coming from this research. Without implementation of the suggested recommendations, the effectiveness of the outcome is uncertain. Long-term research and adaptiveness is necessary to evaluate the actual impact of the recommendations.

#### **4. Data only based on 1 year**

The data we will use in the data analysis is ranging from May 2023 until April 2024. Using only the data from one year introduces the risk of abnormalities, not making the results reliable for long-term. Moreover, there is also a risk of missing relevant data or details when using data from one year only.

### **1.8. Validity and reliability**

Validity and reliability are crucial concepts in research methodology, as they ensure quality results. Validity ensures that the data collected actually contributes to the research goal. Meanwhile, reliability ensures that the results are consistent (Cohen et al., 2000).

There are two important types of validity for this research: construct validity and external validity. Construct validity checks whether the data measured contributes to answering the research question (Carmines & Zeller, 2012). We have to carefully evaluate which data we should research and if this aligns with the research goal. External validity evaluates whether this research can easily be conducted by external parties (Findley et al., 2021). Even though the data we use for this research is based on the resource planning from company X, the methods used this research should be easily implemented by other external audit companies.

To assure reliability in this research, the conclusions from the different data gathering methods should be in line (Quintão et al., 2020). Therefore, to ensure reliable data in this research, every finding should be checked using multiple (different) data sources.



## 2. Theoretical framework

A theoretical framework will be the foundation of this research, as it summarizes the existing theories for resource planning, specifically for audit assignments. The arguments found in this literature will be used in this research. To improve the resource planning, it is crucial to get a good understanding of what auditing is, and which tasks are involved in the audit process. In Section 2.1., the key concepts of this research are explained. In Section 2.2. the different phases of the audit process are mentioned including a description of the relevant tasks involved.

### 2.1. Key concepts

In this research, several key concepts are mentioned and these concepts will be defined in this paragraph.

#### **Audit**

The goal of this research is to increase the effectiveness of resource planning for audit assignments. In short, the definition of auditing is; the examination of a client's financial information (Hayes et al., 2005). Auditors have to ensure the financial statements of their clients are correct and do not mislead anybody. Internal and external audit are the two most common and important methodologies. Internal auditors focus on internal processes and risk management within an organization. They serve as proactive advisors to the management providing continuous improvements. External auditors conduct an independent examination of the financial statements and express an opinion based on fairness and reliability. They serve as safeguard for external stakeholders, who rely on the financial statements (Pramukti, 2024). This research will focus on external audit, performed by an external audit company.

#### **Audit engagement**

In audit terms, an engagement refers to the audit process of a client's financial statements. An engagement consists of multiple phases, all including different tasks. The five phases are: preliminary activities, planning and risk assessment, interim response, final response and completion. In this research we will mainly focus on the planning process for the three middle phases: planning and risk assessment, interim response, and final response. The reason that we only choose the middle phases for this research is because the first and the last phase differ per client, depending on specific requirements and starting position, and therefore no pattern can be found in this data.

#### **Resource planning**

External audit companies earn money by auditing other companies. To complete this audit, a resource planning has to be set up. This involves determining the start- and end date of the assignment, deciding which employees will be working on the assignment and which tasks should be included to fully examine the company.

#### **Budgeted hours**

Budgeted hours are based on the estimated amount of time required to complete an engagement. Accurate budgeting of hours is important to effectively allocate resources. For both the audit company as for the client, an expected time frame is desired. The budgeted hours for this research are equal to the hours stated in the forecasting documents.

#### **Actual hours**

The actual used hours spent is the real-time amount of time auditors spent on the audit assignment. This information can be found in the time tracking documents. These documents serve as a basis for the evaluation of the performance and productivity of employees. Moreover, these documents are used to improve the forecasting of budgeted hours in the future (Ettredge et al., 2003). For this research, the actual hours are the reported hours in the time sheet documents provided by company X.

## 2.2. Audit tasks

In this Chapter we will look into the core activities of an auditor, referred to as audit tasks. The audit tasks are important to understand in order to improve the resource planning of audit assignments. The audit process consists of five phases; preliminary activities, planning and risk assessment, interim response, final response and completion. They all include different tasks and activities. We will shortly explain every phase in this paragraph. The phases are described based on literature findings and knowledge gained from consulting experts at company X.

### 2.2.1. Preliminary activities

The preliminary activities are essential tasks to complete before the actual audit process begins. These tasks are important to perform, because it evaluates the acceptance of a client. The key tasks for preliminary activities, according to (Vinatoru & Calotă, 2015) are:

#### **Consider the acceptance and continuance of client relationships**

For new clients a deep investigation of the reputation, stability and guidelines is needed. Moreover, the competence and availability of an audit team is checked. Decisions regarding continuance of existing clients are based upon significant issues that arise during engagements and high-risk changes in the client's company. This potentially leads to withdrawing of the audit firm.

#### **Evaluate according to ethical standards, including independence of the team**

An Engagement Partner is responsible for ensuring that the ethical standards are followed throughout the engagement. This involves the following fundamental principles: integrity, professional competence and due care, professional behaviour, privacy and objectivity. It is necessary to check the independence of the audit team. If any ethical conflicts arise during the audit process, the partner takes action to resolve these conflicts.

#### **Clarity regarding terms of the engagement**

An examination of potential risks of a client should be performed before accepting the client. Therefore, several activities should be performed: establishing client relationships, communication with previous auditor (if applicable), developing an audit strategy, plan audit procedures for opening balances and assign employees with the necessary skills. With this information audit companies decide whether they want to audit a company. When accepting the client, an engagement letter will be sent to the client. In this letter the time frame, fee and responsibilities of the audit are stated.

### 2.2.2. Planning and risk assessment

The planning and risk assessment is significant, as it highlights the areas with the highest importance and sets the direction of the audit process. In this phase auditors gain an understanding of the organization's risk profile. The goal of the risk identification is to ensure that the resources of the audit company, which are limited, are addressed to the highest risk areas of the client. Several steps are undertaken in the planning and risk assessment phase, according to (Adjei-Kuffour, n.d.):

#### **Identify audit scope and events**

The scope of the audit is set by defining boundaries and determining which areas and activities are being examined. Also, the reporting standards applicable for this research should be determined. Specific processes that could impact the organization's objectives will be investigated, such as financial transactions, operational process or compliance activities.

#### **Evaluate inherent risk**

Examination of the likelihood and potential impact of inaccurate information on the financial statement, due to an error, is crucial. The inherent risk assessment prioritizes areas that require a closer look in the audit process. The management team, business type and data processing are areas examined for inherent risk factors.

### **Evaluate residual risk**

The effectiveness of the existing control system is measured when evaluating residual risk. This helps the auditors to identify the areas in which the internal control is not functioning effectively, and therefore where risks are not optimally managed. By understanding the residual risks the auditors identify areas that require additional control.

### **Develop audit plan**

A detailed audit plan is made, based on the findings in the risk assessment. In the audit plan specific objectives, tasks and timelines are outlined, ensuring that the resources are allocated effectively. Risk factors and criteria are developed, to assign weight to a specific task.

## **2.2.3. Interim response**

The interim response of an audit is the critical period where essential assessments and procedures are carried out. In this phase data is gathered, internal controls are evaluated and potential business risks are identified. The main goal of the interim response is getting a good understanding of the business processes of the client. Completing this phase at an earlier stage makes the next, more complex stages, easier. The steps taken in the interim response, according to (Herrhammer, 1956), are the following:

### **Review accounting system and internal control**

The financial accounts and business operations are examined, up to a specific interim date. This date is typically two/three months before the end of the (financial) year. A closer look is taken into the accounting system, the internal controls, the board meeting minutes, the contracts and the tax issues. This information provides an overview of the company's financial position and performance.

### **Review internal financial reports**

To gain insight into the financial health of a company, internal financial reports are examined. This is done by reviewing financial reports, sales information, cost of sales and information about trends and any unusual fluctuations.

### **Review journal entries**

Journal entries and records of business transactions are carefully evaluated in the interim response. The purpose of this examination is to ensure that all transactions are accurately recorded, classified and authorized. Any unusual or suspicious entries are documented and may require further investigation. To verify the transactions, the invoices, the receipts and the payments, necessary authorizations are reviewed.

### **Examine details of assets and liabilities**

Details of the assets listed on the company's balance sheet are reviewed. This includes property, equipment, investments, receivables and other (in) tangible assets. The purpose of reviewing assets is to check whether they are properly accounted and classified. In addition to assets, details of the liability are also being reviewed. This includes accounts payable, accrued expenses, loans and obligations. For both assets and liabilities, the information is verified by using supportive documentation such as the invoices, the contracts or agreements.

## **2.2.4. Final response**

In the final response, we go into detail of the examination of the financial statement. The identified risks at the earlier stages of the audit process, will now be examined in more detail. This phase encompasses the following elements: reviewing the year-end adjustments, investigation into significant fluctuations in the balance sheets since the interim phase and the preparation of the year-end report. The final response represents the conclusion of the audit process and provides

stakeholder assurance regarding the financial information of the company. Several steps are undertaken in the final response, according to (Porter et al., 2014):

#### **Examination Year-End adjustments**

The most important part about the final response, is reviewing the year-end financial statements. The accuracy, completeness and compliance are checked, as well as a check to verify if the financial statements are in line with the relevant accounting standards and regulations.

#### **Investigate changes balance sheets**

In the interim response the balance sheet is already reviewed. This saves a lot of time in the final response. However, in the final response we still have to review significant changes in the balance-sheets since the interim examination. The cause of the significant changes should be analysed, as well as if they are reflected accurately in the financial statements.

#### **Review preliminary work**

The work already performed in the previous stages, does not have to be repeated. However, in most cases the suspicious entries found need some more investigation. This further investigation should be reviewed in the final response. Some examples of findings that need further investigation are (Petraşcu & Tieanu, 2014): unusual transactions, integrity of the management and insufficient audit proof.

#### **Preparation final audit report**

In the final audit report, a summary of the audit process is given, as well as the auditor's opinion on the financial statements. Before this report can be made, all information has to be combined. This involves all the necessary documents for the audit procedure (documentation findings, reflection year-end adjustments, evidential support) and all the significant findings from the process (issues, risk assessments, discussion summaries).

### **2.2.5. Completion**

The completion is the last phase of the audit process. In the completion all relevant audit findings are mentioned and the audit conclusion is given. The outcome of the completion will be presented to the stakeholders, which rely on the auditor's opinion. It is important that the auditor's opinion is strongly argued. There are several key activities in the completion phase, according to Mcgladrey and Porter (Mcgladrey, 1951; Porter et al., 2014):

#### **Final analytical procedures**

The final analytical procedures serve as final check to ensure that the financial statements are correct and make sense in the operational environment. It will provide a final reassurance of the accuracy and integrity of the financial reporting. All documentations are reviewed again to ensure it supports the audit findings and conclusions.

#### **Evaluation of misstatements**

All the identified misstatements during the audit process need to be mentioned in the final report. The impact of the misstatements is evaluated. Some misstatements were corrected by the management of the client, however misstatements with a large impact need to be mentioned in the final report.

#### **Representation letter**

A written representation from the audit team is needed on the day of the final report. In this letter the auditors confirm the statements made by the managers, include all relevant information and acknowledges the responsibilities of the audit process. Moreover, auditors have to mention the going on concern regarding the client's company. This expresses their opinion about the ability to continue the company for a period of time.

#### **Final audit report**

After finishing all the previous procedures, the final audit report can be developed. In the final report the opinion of the auditors is addressed, according to the relevant reporting standards. Also, the reason for this opinion is elaborated on. A description of the responsibilities for the

management should be described. This includes designing, implementing and maintaining internal control of the financial statements. Other relevant information should also be mentioned in the final report, such as significant issues, director's report of material inconsistencies. Lastly, the report must be signed, dated and must include an address.

**Evaluation with client**

As last step of the completion, an evaluation interview with the client will be held. In this evaluation both client and audit team can discuss the audit process. This evaluation is important for both parties, because next year the audit process will be executed all over again. Both parties can learn from this evaluation.

### 3. Current situation

In this Chapter, the sub-question: **What is the current situation at company X, regarding their resource planning?** will be answered. In this Chapter we will investigate the current resource planning process at company X. It is good to mention that the current planning process has two different approaches, based on the type of client. One approach is based on a continuous client, this means that company X also audited this client previous year(s). The other approach is based on a new client. In Section 3.1. the members of an audit team are explained. In Section 3.2. the involved stakeholders of the planning process are mentioned and their task in the planning process is described. In Section 3.3. a flowchart of the audit process is given. In Section 3.4. the Key Performance Indicators regarding the planning are mentioned and explained. The information in this Chapter is obtained by consulting experts from company X.

#### 3.1. Audit team

Before we go into detail about the resource planning process, we first need a good understanding of the different job functions in company X. When a starter begins to work at the company, they receive the function “trainee”. The employees with this function are starters and need more help with completing their tasks.

This help is given by a “senior”. This function, as well as the other functions, are not bounded by time constraints but by capabilities. As a senior you are more involved in the audit process and you help the trainee to complete their tasks. The function above seniors is “supervisor”. Supervisors have multiple clients and work on more complex tasks. Also, they help with the team planning and they guide the seniors.

Above supervisors we have three different types of managers: assistant managers, managers, and senior managers. The difference between these three functions are the experience and capabilities needed for the function. Assistant managers are partly responsible for the planning process and also for the completion of engagements. The main job of an assistant manager is to review the work of the supervisors, seniors and trainees.

The difference between manager and senior manager is only determined by the years of experience in the relevant client area. Senior managers have a lot of contact with the clients and therefore more experience is demanded. Managers are more involved in the planning of the audit team. The main tasks for a (senior) manager are keeping contact with the client, coordinating work within the team and make the planning. To conclude, we have the partner function. Partners have significant responsibilities and are responsible for the process of decision making. Partners are responsible for keeping good client relationships, which is also important when gathering new clients. A partner has the end responsibility over the work of the whole audit team. In Figure 2, the structure of an audit team at company X can be seen.



Figure 2, Structure audit team

### 3.2. Involved stakeholders planning

For this research it is relevant to know who is currently involved in the planning process and what their tasks within the planning process are. Between the planning process for a continuous client and the planning process for a new client there are some differences. In section 3.2.1 the involved stakeholders and their tasks within the planning process of a continuous client is given, in section 3.2.2. the involved stakeholders and their tasks within the planning process of a new client is given.

#### 3.2.1. Stakeholders continuous client

If an audit company reaccepts to audit a client, based on experiences from the previous year and/or new changes in the company, they start by making a planning for the engagement. For continuous clients, this planning is mainly driven by the experiences of the previous year(s). In Figure 3, the order of the stakeholders involved in the planning process of a continuous client is given. In Appendix B, an elaborate description of the involved stakeholders for continuous clients can be found.

The planning process at company X begins with the Engagement Manager (EM). The EM estimates the number of hours needed to complete the audit process, based on previous experience and changes in the company. The EM sets the budgeted hours, team preferences and the fee for the engagement. The planning of the EM should be in line with the Key Performance Indicator (KPI) targets. If a KPI target is not met, the EM must justify these deviations. Once completed, the planning is reviewed by the Engagement Partner (EP). The EP critically evaluates if the planning aligns with realistic expectations.

Subsequently, the planning is sent to the planning coordinator. The role of the planning coordinator is to verify the completeness of the planning, without evaluating the planning. The planning partner then reviews the planning, focusing on KPI compliance. The finance partner assesses the financial profitability of the engagement, based on the realisation rate. Finally, the planning department resolves scheduling conflicts and ensures that all functions within the audit team are appropriately assigned.

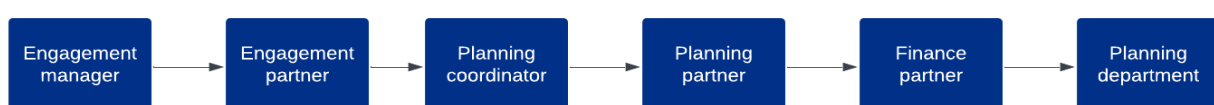


Figure 3, Involved stakeholders continuous client

### 3.2.2. Stakeholders new client

There are several ways new clients get in touch with company X. The first way is that company X approaches the potential client itself. Mostly, this is the case with large clients, already on the target list of the audit company. Companies have to switch from external auditor after a specific number of years (depending on what type of company the client owns), to assure independent and reliable audit reports. The audit companies already know when this switch takes place, therefore they approach the client on time and try to persuade them to choose their audit company as the next auditor. Another way is the client approaching the audit company. They talk to the auditors to see if there is a match and potentially a proposal can come out of this. In this section we will discuss the involved stakeholders for a new client. In Figure 4, the order of the involved stakeholders for a new client is visualized. In Appendix C, an elaborate description of the involved stakeholders for new clients can be found.

The process of a new client starts at the partner group. This group, consisting of partners with different focuses, evaluates potential clients on various aspects, such as client type, fee and required audit hours. The client is evaluated on different fronts, also including a risk evaluation. Once the partner group decides to proceed, they consult the planning coordinator, to ensure that there is enough capacity to assemble an appropriate audit team. The connection of the audit team with the client is crucial, as it can influence the client's choice during the proposal process.

Once the audit team is formed and the client is approved, the proposal process begins. The audit team is responsible for creating and presenting a proposal, detailing the fee and audit hours. These hours are based on the experiences from the previous auditor and on the client's specific needs. If the client selects the audit firm, the planning department takes over to finalize the scheduling of the audit hours. The discussed audit hours and fee are integrated into the planning, and potential conflicts regarding the planning are resolved.

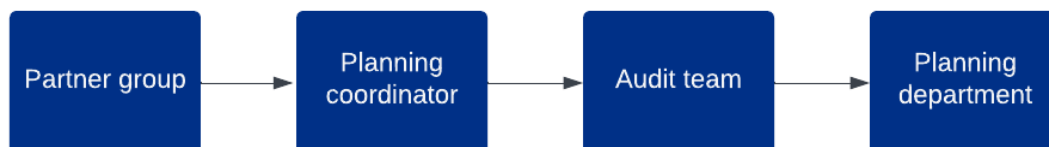


Figure 4, Involved stakeholders new client

### 3.3. Process / Flowchart

In Figure 5, a Business Process Modelling and Notation (BPMN) that represents the audit planning process is shown. In Appendix D, the definition of BPMN is described, including an explanation of the different elements in the BPMN model. The identified stakeholders and the decisions required for the audit planning process as discussed in section 3.2., are presented in the BPMN model.





### 3.4. Planning Key Performance Indicators

As mentioned in section 3.2., for the planning there are several Key Performance Indicators (KPI) targets the planning has to meet. It is important for this research to know what the different planning targets are and how they are calculated. When these targets are not met after the Engagement Manager has filled in the fee, budgeted hours and desired audit team, a so called “red flag” will appear. For each KPI target that is not met a red flag is shown. In this section we will shortly explain the different KPI’s and their targets.

#### 3.4.1. Audit hours

The KPI of audit hours looks at the minimum requirement of hours needed to complete an assignment, based on the level of risk the client. Before accepting the audit of a client, new or continuous, the risk assessment needs to be evaluated. Based on the outcome of this risk assessment, a certain risk emerges for a client. Sometimes this level of risk is too high, and the audit company decides to decline the client. When the audit company does decide to audit a client, they give the client a risk indicator; high, medium or low. Based on this risk indicator, a minimum number of hours is given to certain functions in the audit team. With a high-risk indicator,  $\geq 15\%$  has to be senior staff. Senior staff includes the functions manager, senior manager and partner. Furthermore  $\geq 23\%$  should be in charge, meaning the functions supervisor and assistant manager. For medium and low risk indicators these percentages are less,  $\geq 10\%$  has to be senior staff and  $\geq 19\%$  in charge. So, when a client has a higher risk, more senior and in charge functions have to supervise the audit process.

#### 3.4.2. Hours vs previous year

As discussed before in section 3.2., the planning is mostly based on the experience of previous year. This KPI focuses on the deviation of the actual hours used last year and the current hours budgeted for this year. Company X wants a deviation of less than 15% in these hours. If these hours deviate more, an elaborate explanation is needed about why the hours this year would differ that much from last year. This KPI will also not be included in this research, as we only analyse the data from one year.

#### 3.4.3. Realisation rate

The realisation rate is a rate based on the estimated hours needed for an engagement and the fee the audit company will receive for the engagement. Company X has set a realisation rate of 55%, this rate is determined by the Leadership Team Assurance. The calculation of the fee is as follows: (fee total assignment / planned costs (hours x hourly rate) – 10% for surcharge and expenses). The hourly rate is different for each function, and are based upon the selling hourly rates, not the actual hourly rate.

#### 3.4.4. Planning in phase

This research will focus on three phases: planning and risk assessment, interim response and final response. This KPI focuses on the distribution of the planned hours over those three periods. This KPI targets that in both the planning and risk assessment and the interim response at least 15% of the total budgeted hours should be included. If, for example, the total engagement takes 100 hours, at least 15 hours should be in planning and risk assessment, and at least 15 hours should be in the interim response. The KPI for this phase also includes an indicator that the total of the planning and risk assessment and interim response should be at least 35% of the total hours budgeted. In an assignment of 100 hours total, this would mean at least 35 hours have to be planned before the final phase starts. It is important to have a good spread of the hours, otherwise there too much workload during the final phase.

## 4. Data analysis

To identify where the problems are located, so where budgeted hours do not align with the actual used hours, a data analysis has to be performed. The data is provided by the planning department of company X, and additional information is provided by (assistant) managers. The budgeted hours presented in the data are the hours as registered in the forecasting documents. These forecasting documents are filled in by the planning department. The actual hours in the dataset represent the information on the time tracking records, filled in by the employees themselves. At the end of each day, employees fill in how many hours they have worked, and which tasks they have completed during these hours.

In this Chapter we will answer the sub-question: **Where are the discrepancies between budgeted and actual hours located within audit assignments?** In section 4.1. we will discuss the data cleansing method. In section 4.2. we will explain the grouping of the data based on actual hours and phases. In section 4.3. the dashboard that is made to analyse the data is shown, together with an explanation of the dashboard. In section 4.4. we will discuss the discrepancies identified on different scales. Lastly, in section 4.5. a cross-level analysis is performed and explained, to deepen the understanding of the identified discrepancies.

### 4.1. Data cleansing

Before diving into the data analysis, it is important to first perform a data cleansing. Data cleansing is important, because incorrect or inconsistent data can impact the results of the data analysis (Hellerstein, 2008). For our analysis we use a dataset provided by company X, including the forecasting documents and time tracking records from May 2023 until April 2024. This period aligns with the most common used audit process, capturing all the three important phases of the audit process. The dataset provided by company X consist of 214 different clients, including hours from previous year, clients that do not complete all the phases and extreme outliers.

#### 4.1.1. Deleting hours previous year

The dataset provided by company X also includes hours related to the audit cycle of 2022-2023. If an assignment has been delayed, this means that there will be hours needed in the current audit cycle necessary to complete the previous audit cycle. We do not want to include these hours in our data analysis, and therefore the data regarding 2022-2023 is excluded. This exclusion leaves us with 132 clients.

#### 4.1.2. Deleting phases with no hours

The data we analyse in this research ranges from May 2023 to April 2024. Depending on the size of the engagement, the audit process of each engagement may start later or end earlier. However, for a valid analysis, each phase must have more than 0 budgeted hours and more than 0 actual hours spent. The months assigned to each phase will be explained in section 4.2.2.. If either of those conditions have not been met, it indicates that the entire audit process, including all three phases, was not completed. We should exclude this data from our analysis, to ensure we analyse only the data regarding a complete audit process.

A reason for having 0 budgeted hours could be clients that follow different audit cycles, starting earlier or later than the norm. The dataset used includes the most common audit cycle from company X, ranging from May to April. However, some client deviate from this cycle and have different start dates. This can result in either the planning and risk assessment or the final response having 0 budgeted hours.

A possible reason for 0 actual hours in a phase, could be the audit firm withdrawing in/after the planning and risk assessment phase. In the first phase of the audit process, planning and risk assessment, the risk of a client is being evaluated. Before accepting the audit of a client, the risk of

a client is already evaluated. However, in the first phase, the audit company looks even more in detail to the risks involved. If in this phase it is discovered that the client's risk is too high, the audit company can still reject the client. The audit process may be discontinued, despite the initial scheduling of the interim response and the final response. The data for clients with 0 actual hours in one of the phases will therefore be excluded.

The removal of the clients with either 0 budgeted hours or 0 actual hours in any phase results in excluding 5 additional clients.

#### **4.1.3. Deleting extreme outliers**

The extreme outliers should also be deleted because this can result in unrepresentable results. To identify the extreme outliers, we used the 2SD method. This method should cut off outliers by creating an interval from (mean - 2 \* standard deviation) to (mean + 2 \* standard deviation). Values outside this range can be considered as diseased or non-normal (Sharma & Jain, 2013).

For the 127 clients that were left after excluding hours from previous year and the clients without hours in a phase, we calculated the deviation in percentage. From these deviations, we calculated the mean and standard deviation. Applying the 2SD method resulted in an interval ranging from -110,86% until 98,90%. Deviations outside this interval were discussed with company X, and considered as outliers, and excluded from this research. This method led to the exclusion of 6 additional clients.

#### **4.1.4. Outcome data cleansing**

After removing the data concerning phases with no hours and the extreme outliers, we have a dataset left including 121 clients from the North-East region of the Netherlands, from the period May 2023 to April 2024

### **4.2. Data grouping**

To ensure the anonymity in our data analysis, we assigned each client with a random letter from the alphabet. This will help us to protect the confidentiality of the client, while still providing company X with a tool to easily access previous year's data from different clients. Additionally, we have categorized the companies into 11 groups, based on the actual hours needed to complete the audit process. The hours are also categorised in the three different phases, as discussed in section 2.2..

#### **4.2.1. Categorization in groups**

We have divided the companies into 11 groups, based on the actual hours required for the audit process. The groups differ from requiring 100 hours to more than 2000 hours to complete the audit. In each group at least 10 clients should be included, to ensure representable outcomes. This division will help us to analyse the differences between budgeted and actual hours. In Table 2, an overview of the group numbers, the actual hours related to these group numbers and the number of clients in the corresponding group are presented.

Group number	Actual hours	Number of clients
1	>0 AND <=250	10
2	>250 AND <=300	10
3	>300 AND <=500	13
4	>500 AND <=700	10
5	>700 AND <=800	12
6	>800 AND <=1000	11
7	>1000 AND <=1100	10
8	>1100 AND <=1300	10
9	>1300 AND <=1600	11
10	>1600 AND <=2000	12
11	>2000	12

Table 2, Categorization in groups

#### 4.2.2. Categorization in phases

The dataset we will use includes the data from one whole audit process, ranging from May 2023 to April 2024. We first must organize all data per month, and then assign each month to a phase. The first phase, planning and risk assessment, starts at May 2023 and ends in August 2023. The second phase, interim response, starts at September 2023 and ends in December 2023. The last phase, final response, starts at January 2024 and ends in April 2024. In Figure 6, a visual representation is given of the phases and their related months.

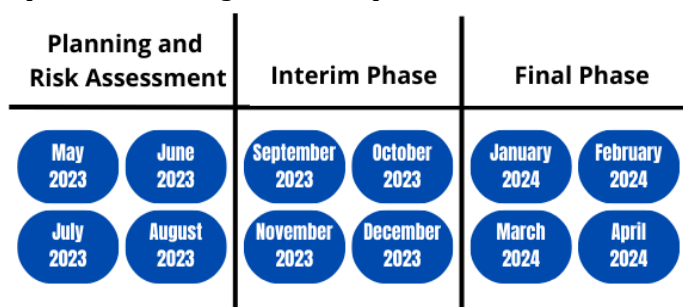


Figure 6, Categorization in phases

#### 4.3. Dashboard

With the data cleaned and organized, we can now start constructing a dashboard to conduct a data analysis. The dashboard will help us to easily understand complex and diverse data. There are several purposes of a dashboard. The first purpose is to make sure all the data is consistent in the measurement, also across different departments. Secondly, a dashboard can help to monitor the performance of the company. Thirdly, a dashboard can be used to plan goals and strategies for the future of a company. Lastly, the dashboard is an easy tool, used to communicate with stakeholders. A dashboard is an easy understandable instrument and makes it easier for stakeholders to review the performance of a company (Pauwels et al., 2009). Figure 7 shows a screenshot of the dashboard. The different elements and graphs are shortly explained in Appendix E.

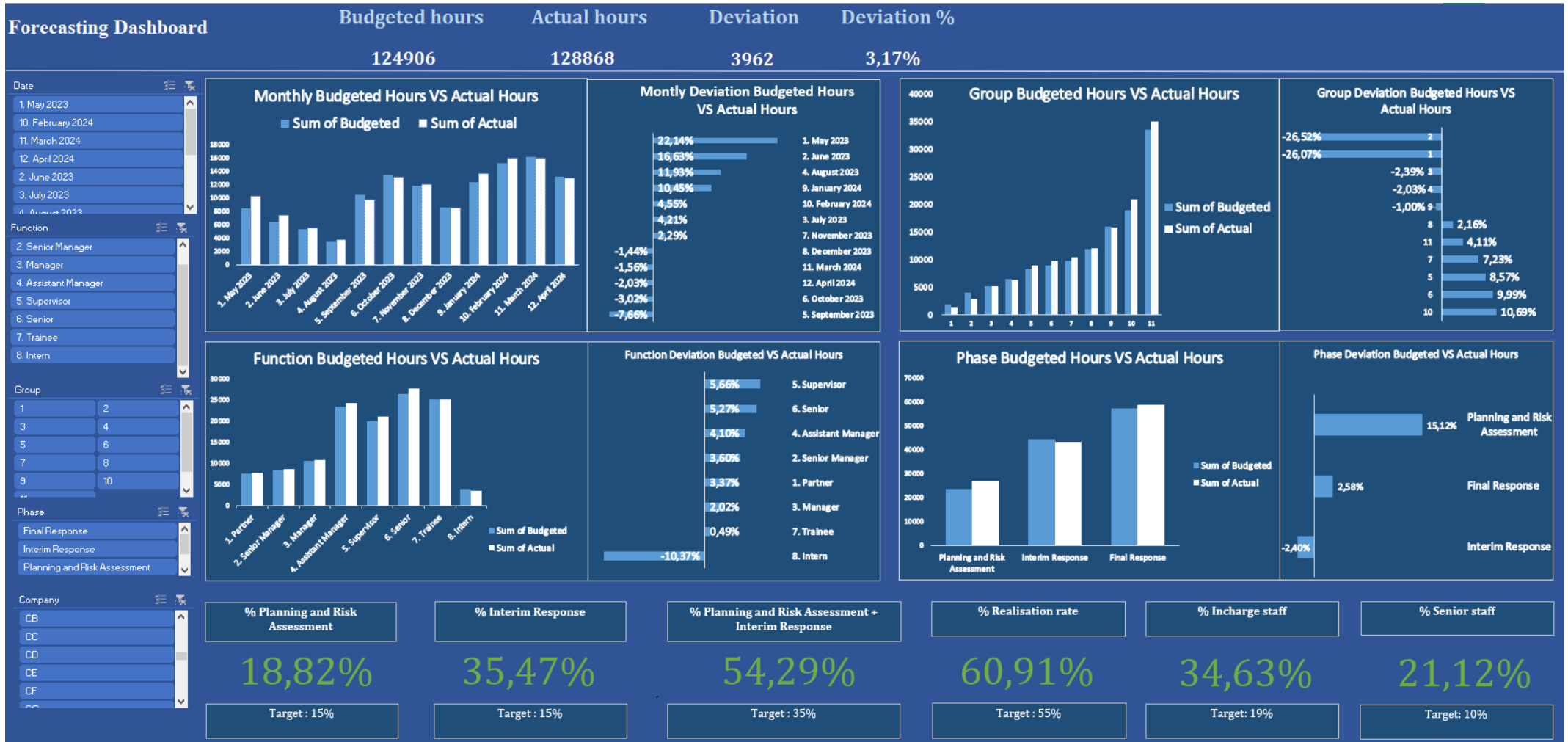


Figure 7, Screenshot dashboard

#### 4.4. Identify discrepancies

Using the dashboard, we can easily identify discrepancies between budgeted and actual hours. This will be performed on multiple scales: phase level, month level, group level and function level. In this section we dig into the details of the discrepancies and look for patterns.

##### 4.4.1. Phase level

In Appendix F, Figure 14, the comparison between budgeted hours and actual hours at phase level and the corresponding deviation can be found. As can be seen, the most significant differences are located in the planning and risk assessment phase. The interim response has slightly fewer actual hours than budgeted hours, while the final response has slightly more actual hours than budgeted hours. The detailed numbers corresponding to each phase can be seen in Table 3.

The budgeted hours correspond to the total budgeted hours, as shown in the forecasting records. The actual hours correspond to the total actual hours, as shown in the time tracking records. The deviation is calculated by (actual hours – budgeted hours). The deviation % is calculated by ((actual hours – budgeted hours) / budgeted hours).

	Planning and Risk Assessment	Interim Response	Final Response	Overall
<b>Budgeted Hours</b>	23.509	44.300	57.097	124.906
<b>Actual Hours</b>	27.064	43.236	58.568	128.868
<b>Deviation</b>	3.555	-1.064	1.471	3.962
<b>Deviation %</b>	15,12%	-2,4%	2,58%	3,17%

Table 3, Budgeted hours, actual hours, deviation and deviation % for the 3 phases and overall

##### 4.4.2. Month level

To map the outliers on monthly basis, we use the graphs showing budgeted hours versus actual hours and the deviation in percentage for each month. Both graphs can be seen in Appendix F, Figure 15. The most extreme outlier is in May 2023. Additional notable outliers are in June 2023, August 2023, September 2023 and January 2023. September 2023 is unique, as it shows that fewer hours have been used than budgeted, unlike the other months. Table 4 summarizes the outliers identified on month level.

	May 2023	June 2023	August 2023	September 2023	January 2024
<b>Budgeted Hours</b>	8.414	6.405	3.375	10.478	12.413
<b>Actual Hours</b>	10.277	7.470	3.777	9.675	13.710
<b>Deviation</b>	1.863	1.065	403	-803	1.297
<b>Deviation %</b>	22,14%	16,63%	11,93%	-7,66%	10,45%

Table 4, Budgeted hours, actual hours, deviation and deviation % for May 2023, June 2023, August 2023, September 2023 and January 2024

##### 4.4.3. Group level

Both the graphs showing budgeted hours versus actual hours and the deviation in percentage on group level can be seen in Appendix F, Figure 16. Extreme outliers are found in the groups 1,2 and 10. Remarkable is the negative deviation of groups 1 and 2, with more budgeted hours than actual hours. Group 10 has more actual hours than budgeted hours. Overall, the most groups show a positive deviation, indicating that actual hours exceed the budgeted hours. Table 5 shows the details of the groups 10, 2 and 1.



	10	2	1
<b>Budgeted Hours</b>	18.892	4.001	1.973,8
<b>Actual Hours</b>	20.913	2.940	1.459,25
<b>Deviation</b>	2.020	-1.061	-515
<b>Deviation %</b>	10,69%	-26,52%	-26,02%

Table 5, Budgeted hours, actual hours, deviation and deviation % for group 10, group 2 and group 1

#### 4.4.4. Function level

At function level, there are no significant outliers. Interns are excluded from this analysis, as they are not part of the audit team, as discussed in section 3.1.. The graph displaying the budgeted hours versus actual hours and the corresponding deviations on function level can be found in Appendix F, Figure 17. The functions with the highest deviation percentage are the assistant managers, supervisors and seniors. Table 6 provides an overview of these values.

	Assistant Manager	Supervisor	Senior
<b>Budgeted Hours</b>	23.342	19.916	26.360
<b>Actual Hours</b>	24.300	21.044	27.748
<b>Deviation</b>	958	1.128	1.388
<b>Deviation %</b>	4,10%	5,66%	5,27%

Table 6, Budgeted hours, actual hours, deviation and deviation % for assistant manager, supervisor and senior

#### 4.5. Cross-level Analysis

After examining discrepancies at different scales, we can now integrate these findings to get new insights and potentially discover patterns in the inconsistencies. From the analysis on phase level, the planning and risk assessment was the outlier, and therefore we will investigate further what the causes are of the high deviation in this phase.

On month level we identified that May 2023 has the largest deviation. Therefore, we will also perform a cross level analysis on this month.

Lastly, on group level we had three significant outliers, group 1, group 2 and group 10. Because group 1 and 2 do not differentiate a lot in actual hours and both have a negative deviation, we only perform a cross-level analysis on the largest negative outlier, group 2. We also want to analyse the group with the highest positive outlier, group 10. Given that there are no significant outliers at the function level, we will not perform a cross level analysis on function level.

##### 4.5.1. Planning and risk assessment

###### Month level

The months included in the planning and risk assessment are the months May 2023, June 2023, July 2023 and August 2023. Table 7 summarizes the deviation in percentage for each month.

	May 2023	June 2023	July 2023	August 2023
<b>Deviation %</b>	22,14%	16,63%	4,21%	11,93%

Table 7, Deviation % for May 2023, June 2023, July 2023 and August 2023

From this table we can quickly identify that in the months May 2023 and June 2023 way more hours have been used than were budgeted, with the highest deviation in May 2023 of 22,14%. In July 2023 and August 2023 also more hours were used than budgeted.



### Group level

Deviation percentages of various groups in the planning and risk assessment phase are displayed in Table 8. Group 2 and 10 are a significant outliers, with a group 2 having a negative deviation and group 10 a positive deviation. The deviation of group 2 is -40,77%, the deviation of group 10 is 40,06%

	1	2	3	4	5	6
<b>Deviation %</b>	1,76%	-40,77%	31,23%	12,82%	25,90%	13,67%
	7	8	9	10	11	
<b>Deviation %</b>	18,88%	7,65%	0,25%	40,06%	16,4%	

Table 8, Deviation % for all groups, ranging from 1-11, in the planning and risk assessment phase

### Function level

Each function's deviation in the planning and risk assessment phase is detailed in Table 9. All functions contain a positive deviation, meaning that for each function more hours were needed than budgeted. The highest deviation is 41,48%, belonging to the manager function. The deviation from the partner function is also quite high, with a deviation of 24,76%.

	Partner	Senior Manager	Manager	Assistant manager	Supervisor	Senior	Trainee
<b>Deviation %</b>	24,76%	13,76%	41,48%	20,88%	13,80%	12,39%	0,59%

Table 9, Deviation % for all the different functions within an audit team, in the planning and risk assessment phase

### Conclusions Planning and Risk Assessment

The overall deviation of the planning and risk assessment phase is 15,12%. To look into the causes of this high positive deviation, we performed a cross-level analysis on month, group and function level. The outcomes were the following:

The months May 2023 and June 2023 show the highest deviation, 22,14% and 16,63% respectively. The group 2 and 10 are the outliers in this phase, with group 2 having a negative deviation of -40,77% and group 10 having a positive deviation of 40,06%. The manager and partner have the highest deviation on function level with 41,48% and 24,76%.

#### 4.5.2. May 2023

##### Phase level

The month May is part of the planning and risk assessment phase.

##### Group level

The group deviations for May 2023 vary significantly, with group 10 having a very high positive deviation of 65,85% and group 1 having a large negative deviation of -51,80%. Table 10 provides the deviations for each group in May 2023. Overall, there are quite some groups with a high positive deviation in May 2023.

	1	2	3	4	5	6
<b>Deviation %</b>	-51,80%	-27,28%	0,19%	47,52%	6,86%	-0,2%
	7	8	9	10	11	
<b>Deviation %</b>	-3,81%	19,35%	23,76%	65,85%	55,09%	

Table 10, Deviation % for all groups, ranging from 1-11, in May 2023

### Function level

All the functions have a positive deviation, with the deviation of the manager being the highest with 71,01%. The middle functions, senior, supervisor and assistant manager also have a high deviation in the month May. In Table 11 the deviation of each function in May 2023 can be found.

	Partner	Senior Manager	Manager	Assistant manager	Supervisor	Senior	Trainee
<b>Deviation %</b>	18,32%	7,02%	71,01%	23,81%	33,40%	27,30%	2,61%

Table 11, Deviation % for all the different functions within an audit team, in May 2023

### Conclusions May 2023

The overall deviation of May 2023 is 22,14%. To look into the causes of this high positive deviation, we performed a cross-level analysis on phase, group and function level. The outcomes were the following:

The month May is part of the Planning and Risk Assessment phase. May 2023 shows significant discrepancies on group level, with group 10 having the largest positive deviation of 65,85%. The manager function stands out in May 2023, with a deviation of 71,01%.

#### 4.5.3. Group 10

##### Phase level

Group 10 has a positive deviation across all three phases, with the highest deviation in the planning and risk assessment phase. The deviation of group 10 in the planning and risk assessment phase is significantly higher than in the other phases, with a deviation of 40,06%. The deviations of group 10 in the three phases can be found in Table 12.

	Planning and risk assessment	Interim response	Final response
<b>Deviation %</b>	40,06%	3,59%	7,91%

Table 12, Deviation % for the 3 phases, from group 10

##### Month level

The analysis on month level of group 10 confirms the high deviation of the planning and risk assessment phase. With May 2023 having the highest deviation of 22,14%. The deviation of group 10 for all months can be found in Table 13.

	May 2023	June 2023	July 2023	August 2023	September 2023	October 2023
<b>Deviation %</b>	22,14%	16,63%	4,21%	11,93%	-7,66%	-3,02%
	November 2023	December 2023	January 2024	February 2024	March 2024	April 2024
<b>Deviation %</b>	2,29%	-1,44%	10,45%	4,55%	-1,56%	-2,03%

Table 13, Deviation % for all months, from group 10

### Function level

For group 10, the partner has the largest positive deviation of 22,06%. Except for the manager function, the deviations are all positive. The deviation of each function in group 10 can be found in Table 14.

	Partner	Senior Manager	Manager	Assistant manager	Supervisor	Senior	Trainee
<b>Deviation %</b>	22,06%	6,34%	-3,43%	6,01%	16,34%	8,26%	18,42%

Table 14, Deviation % for all the different functions within an audit team, from group 10

### Conclusions group 10

The overall deviation of group 10 is 10,69%. To investigate the causes of this positive deviation, we performed a cross-level analysis on phase, month and function level. The outcomes were the following:

The planning and risk assessment is with a deviation of 40,26% the phase with the highest deviation. The analysis on month level confirms this, with a high deviation in the months May 2023 and June 2023. May 2023 has the highest deviation with 23,45%. The partner has the highest deviation of 22,06%.

#### 4.5.4. Group 2

##### Phase level

There is large negative deviation in each of the three phases for group 2, meaning that in all three phases more hours are budgeted than actual spent. The largest deviation is in the planning and risk assessment phase, with a deviation of -40,77%. The deviation of the three phases for group 2 can be found in Table 15.

	Planning and risk assessment	Interim response	Final response
<b>Deviation %</b>	-40,77%	-29,30%	-21,57%

Table 15, Deviation % for the 3 phases, from group 2

##### Month level

For group 2, the deviations on month level are mostly positive. The largest positive deviation is in May 2023, with 22,14%. The largest negative deviation is in September 2023, with -7,66%. The deviation for each month for group 2 can be found in Table 16.

	May 2023	June 2023	July 2023	August 2023	September 2023	October 2023
<b>Deviation %</b>	22,14%	16,63%	4,21%	11,93%	-7,66%	-3,02%
	November 2023	December 2023	January 2024	February 2024	March 2024	April 2024
<b>Deviation %</b>	4,21%	2,29%	10,45%	4,55%	-1,56%	-2,03%

Table 16, Deviation % for all months, from group 2

### Function level

For almost each function, the deviation is negative, except for the senior and senior manager function. The function with the largest negative deviation is the partner, with a deviation of -37,25%. The deviation from each function from group 2, can be found in Table 17.

	Partner	Senior Manager	Manager	Assistant manager	Supervisor	Senior	Trainee
<b>Deviation %</b>	-37,25%	4,17%	-28,36%	-20,62%	-34,99%	3,05%	-11,06%

Table 17, Deviation % for all the different functions within an audit team, from group 2

### Conclusions group 2

The overall deviation of group 2 is -26,52%. To look into the causes of this high negative deviation, we performed a cross-level analysis on phase, month and function level. The outcomes were the following:

The deviation of group 2 is negative in the three phases researched. The deviation is the largest in the planning and risk assessment phase with a deviation of -40,77 %. On month level, the largest deviation is in May 2023, with a deviation of 22,14%. The deviation for almost each function is negative. The partners have the highest negative deviation with -37,25%

## 5. Root Cause Analysis methods

A root cause analysis can be used to explore possible root causes contributing to inefficient resource planning at audit companies. There exist multiple root cause analysis methods in literature, and the goal of this Chapter is to find the most fitting one for this research. We will find an answer to the following sub-question in this Chapter: **What root cause analysis methods are described in literature, and which is the most fitting for this research?**

Finding an answer to this question could help us with our research, when identifying the root causes of inefficient resource planning.

### 5.1. Fishbone diagram

The Ishikawa diagram, better known as fishbone diagram or cause-and-effect diagram, is a tool used to break down a process and illustrate correlations between events (Wieczerniak et al., 2017). It was originally developed as a quality tool, to identify potential causes that affect the quality. Fishbone diagrams are a commonly known method for root cause analysis. The head of the fishbone, represented in Figure 8 as “effect”, represents the problem or effect researched. The spine, the horizontal straight line that leads to the head, connects all the potential causes relating to the problem/effect. The main bones, represented in Figure 8, as “cause A”, “cause B” etc., are the overarching categories of the potential causes (Holifahtus Sakdiyah et al., 2022).

According to (Minto, 1996), it is important that the different identified causes are mutually exclusive and collectively exhaustive (MECE). With mutually exclusive is meant that the different causes should be clearly separated with no repetition. Collectively exhaustive refers to every aspect should be considered, in a way that all important factors are included (Li & Lee, 2011).

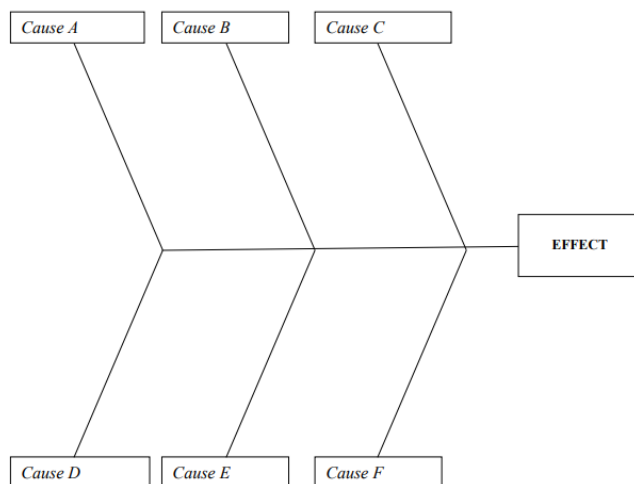


Figure 8, Fishbone diagram (Coccia, 2018)

### 5.2. 5 why's technique

The 5 why's technique is a commonly used technique for discovering potential root causes. The technique is originally developed by the founder of Toyota industries and was an important method for the production system of Toyota. Asking 5 times why, should bring up the root cause(s) of a problem. Each why is asked to the previous answer, to dig deeper into the cause-and-effect chain (Gangidi, 2019).

The first step of the 5 why's technique is to clearly write down the problem statement. The next step is to ask yourself, why this problem occurs. Answer this question, and then ask yourself, why? Repeat this step until it becomes difficult to answer the question. If this is the case, you probably identified the root cause of the problem. The reason you have to ask yourself 5 times 'why?', is because after two or three times "why?" you only identified the symptoms of the problem, not the cause. The fourth and fifth whys are necessary to identify the cause of the problem (Pojasek, 2000). In Figure 9, an example of the 5 why's technique can be found, with as problem statement "I am being turned down for risk capital".

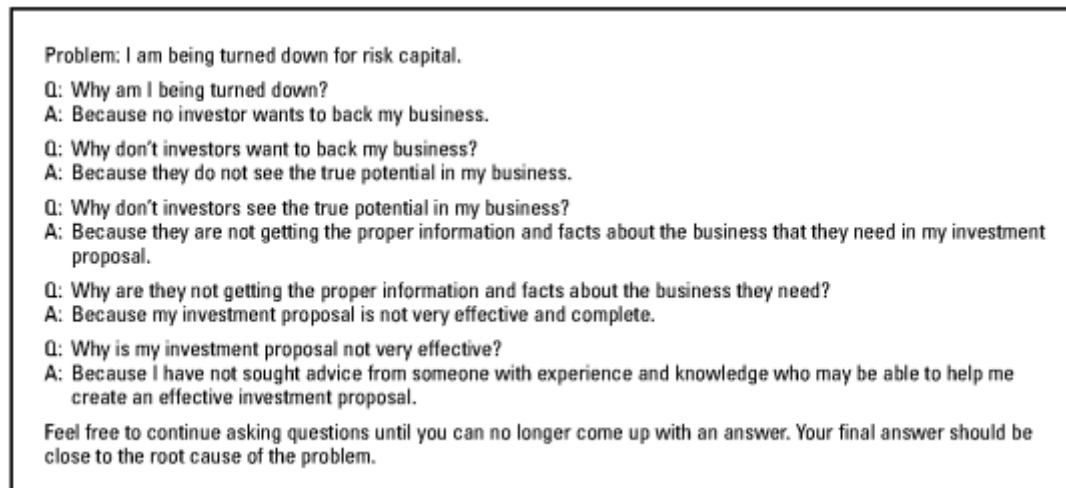


Figure 9, 5 why's technique (Pojasek, 2000)

### 5.3. Pareto analysis

The Pareto analysis is named after Vilfredo Pareto, an Italian economist. He is well known for his 80/20 rule. He observed that 80% of Italy's land was owned by 20% of the population. This inspired him for the 80/20 rule, which states that 80% of the problems are due to 20% of the causes. According to him it is important to understand that when trying to improve a process, the focus should be on a few sources which are causing most of the problems (Pyzdek, 2021).

The first step of the Pareto analysis is dividing the data into categories. The second step is to select a time interval for the data used in the analysis. The data should not be too old, because this information may be irrelevant now. The third step is to sum up the data for each category and find all totals. Fourth step is to compute the percentage each category has on the total. Fifth step is to rank these percentage, from largest to smallest. Finally, the last step is to compute the cumulative percentage, including each category (Pyzdek, 2021).

With these causes and their effects, we can create a Pareto chart. In one graph we include both a bar chart and a line chart. The bar chart shows the percentage of the individual categories, the line chart shows the cumulative total, including each category. The bottom axis shows the different causes, ranking from largest to smallest percentage. When choosing the causes that are responsible for the most problems, we should include the causes until the cumulative total is added up to 80%. In Figure 10, a Pareto chart is shown.

The rule of thumb of the Pareto analysis is that 20% of the causes account for 80% of the total problem. In real life, those percentages may differ. However, if there are no dominant categories, it may be useful to think about other ways to categorize the data.

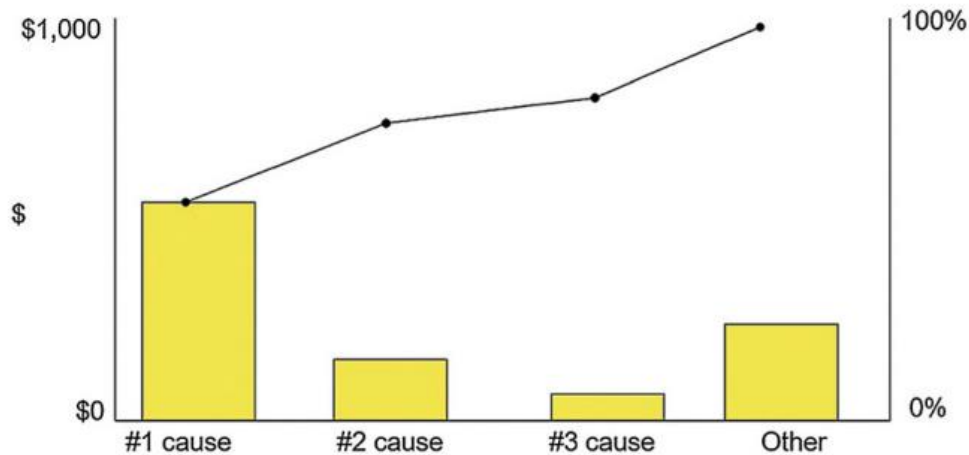


Figure 10, Pareto analysis (Pyzdek, 2021)

#### 5.4. Fault tree analysis

The fault tree model is an analytical technique, used to identify which faults contribute to a certain (undesired) event. A fault tree consists of two types of nodes: events and gates. An event represents any failures that contributes to the top event. A gate is used to indicate an AND or OR input. The AND gates are represented with a dot in the middle, the OR gates with and X in the middle (Roberts & Haasl, 1981).

As shown in Figure 11, at the top of the fault tree the top event is displayed, this is the (undesired) event is investigated in this analysis. The second row shows the causes of this event, displayed in different categories. In the third row, possible reasons for the second row are shown. When all the factors influencing the top event are identified, the causes can be quantified and ranked. When solving the highest ranked causes, this would have the most impact on solving the top event (Mahmood et al., 2013).

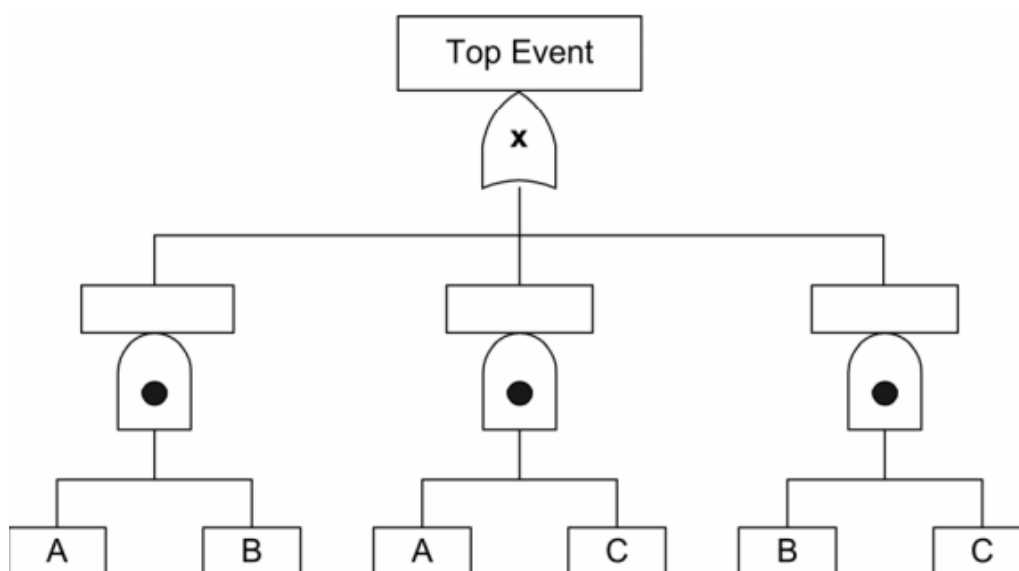


Figure 11, Fault tree analysis (Roberts & Haasl, 1981)

## 5.5. Choosing best fitting method

Now that we discussed multiple methods appropriate for a root cause analysis, we now must choose the most fitting method for this research. The goal of this research is to identify the root causes of inefficient resource planning at audit companies.

### **Fishbone diagram**

This is a systematic approach, categorizing different factors into broad categories. Since we do not yet have any specific ideas about the root causes, the fishbone diagram can be useful. The visual representation makes it easy for all stakeholders to understand the root causes. By visually mapping out the causes, areas that are not immediately obvious can be highlighted.

### **5 why's technique**

The 5 why's technique focuses on a deep understanding of immediate causes, rather than exploring broader factors. Assuming that there may be multiple factors involved in inefficient resource planning, the 5 Why's technique may not be suitable for this research. This method is more effective in situations where there is only one single root cause.

### **Pareto analysis**

The Pareto method is useful for prioritizing significant causes of inefficient resource planning. However, it is only effective when a few causes are responsible for the majority of the issues. In the case of audit companies, the different causes of inefficient resource planning are more likely to be evenly distributed.

### **Fault tree analysis**

The fault tree analysis is used primarily in engineering and technical fields. The method is less suitable for addressing organizations or human issues, due to its focus on logical relationships. The issues of resource planning in audit firms are influenced by numerous factors, which cannot be easily implemented in this model.

### **Conclusion**

In conclusion, the most fitting method for this research is the fishbone diagram. This method provides a systematic approach to identifying root causes. The visualization of the causes in the fishbone diagram will help ensure that all potential factors are considered and understood by all stakeholders.



## 6. Identifying root causes

Now that we have investigated the inconsistencies in the data and identified the most fitting root cause analysis method for our research, we can combine these elements. To solve the research question and provide recommendations to audit companies about how to align budgeted and actual hours, we first have to identify the root causes of the problem. If we know the root causes, we can provide recommendations on how to solve these root causes. In this Chapter we will use the results of the data analysis from Chapter 4, and answer the following sub-question: **What are possible root causes of inefficient resource planning at company X?**

In Section 6.1. the fishbone diagram of the data results regarding inefficient resource planning at audit companies is presented. In Section 6.2. the theoretical root causes are discussed, based on the data findings. In Section 6.3. a fishbone diagram including the theoretical root causes of inefficient resource planning is presented.

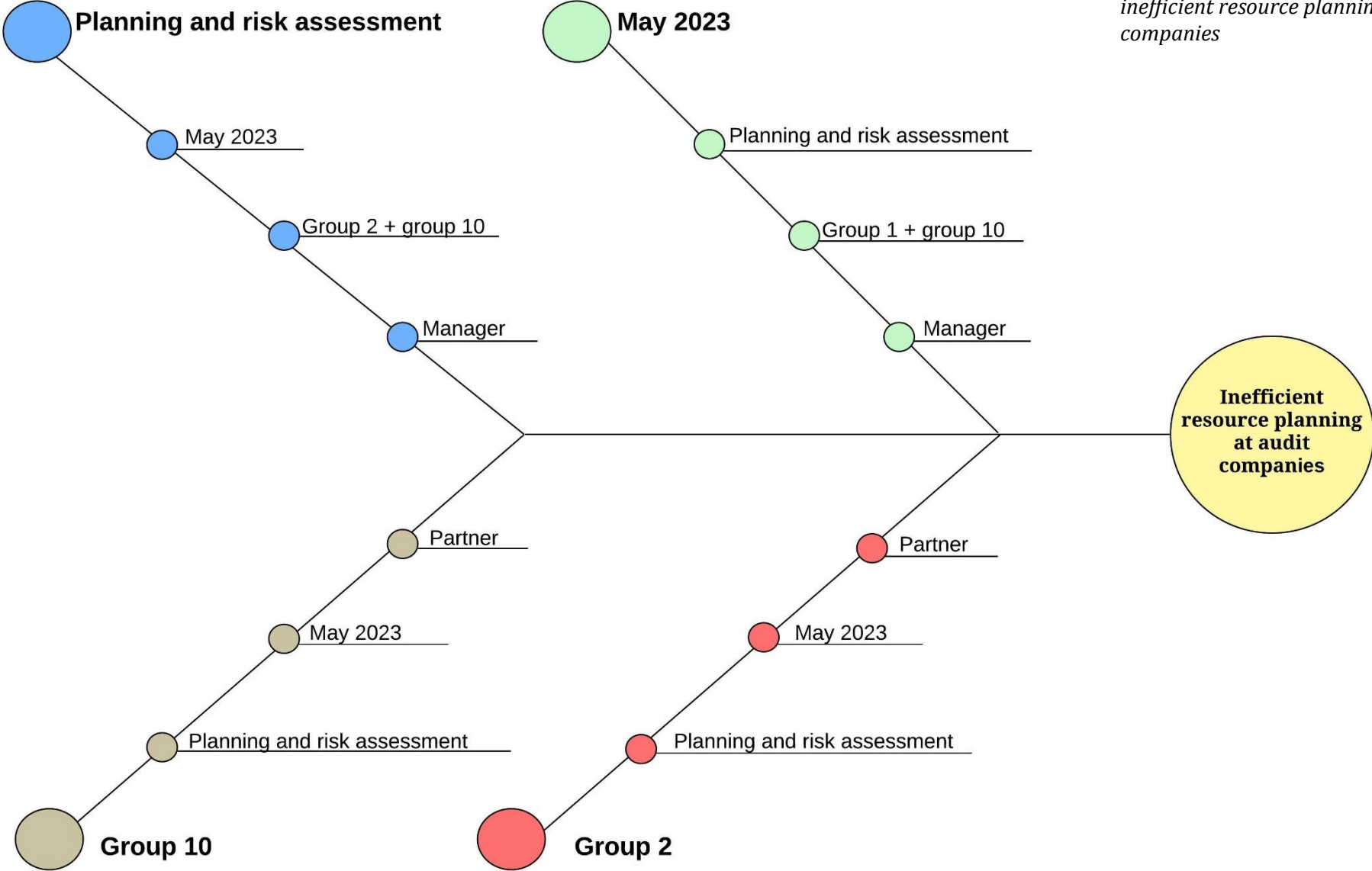
### 6.1. Fishbone diagram data; inefficient resource planning at audit companies

In Chapter 4 we executed a data analysis, to find patterns in the discrepancies between budgeted and actual hours used for audit assignments. This analysis was performed on phase, month, group and function level.

The phase with the highest deviation is the planning and risk assessment phase. The month with the highest deviation is May 2023. The groups with the highest deviation are group 1, group 2 and group 10. On function level there were no extreme outliers. This information was used to perform a cross-level analysis. Group 1 was not included in the cross-level analysis, because of the small difference in actual hours between group 1 and group 2. The goal of the cross-level analysis was to combine different findings to identify if there are any consistencies in the deviation of hours.

In Chapter 5 we have discussed several methods that can be used for root cause analysis. The most fitting method for this research is the fishbone diagram based on its systematic approach. The fishbone diagram can easily visualize different root causes for an effect/situation. For this research it is used to identify the root causes of “inefficient resource planning at audit companies”. In Figure 12, a fishbone diagram of the data results is made, including four different root causes with each three different sub causes of inefficient resource planning at audit companies.

Figure 12, Fishbone diagram data; inefficient resource planning at audit companies



## 6.2. Theoretical root causes

In the previous section, we identified different root causes and their sub-causes based on the data analysis. In this section, we delve into the theoretical root causes to explain inefficient resource planning. These theoretical root causes are based on the results of the data analysis and consulting experts of company X.

### 6.2.1. Lack of understanding client's risks

When giving a possible explanation of the causes, we must look back at the theoretical framework in Chapter 2. In the theoretical framework the different phases from an audit process are described, together with the tasks involved in each phase. In the planning and risk assessment the goal is to set the direction of the audit process. The most important areas should be identified and based on the risk level the audit plan is developed.

The planning and risk assessment phase can be perceived as complex. All the different risks should be identified, as well as their potential impact. The planning of the planning and risk assessment must be made before the start of the audit process. The initial risk assessment, as can be seen in section 3.3., is filled in before the planning process starts. This risk assessment determines if company X should audit the client, based on the risks of a client's company. This risk assessment has a small part in the planning process, but it already gives an indication of how many risks are connected to a client.

In the planning and risk assessment phase, the audit team gets in close contact with the client. A lot of conversations and studying are needed to map all the possible risks of the client. It is important that all the risks are identified in this phase, as it is used to allocate the resources for the audit process. This can take a lot of time, especially for large clients. When the number of hours are assigned for the planning and risk assessment phase, there is not a lot of insight into the amount of risks a client has, and therefore how long the planning and risk assessment will take.

The three senior functions (partner, senior manager and manager) have the biggest tasks in the planning and risk assessment phase. They are closely involved in identifying risks and talking to the client. In the interim response and final response, their role is mainly supervising other functions and communicating with the client. In the planning and risk assessment phase, they are also involved in identifying a definite number of risks. The planning and risk assessment phase can take more time than expected, due to the lack of insight into the risks in the planning process. This is also visible in the fishbone diagram in Figure 12, where the senior functions have the largest deviation. The partner and manager functions keep showing up as highest outlier, even when looking from different scales.

As mentioned earlier, it is particularly challenging for the large assignments to map all the risks in advance. There are many processes that can be overlooked, and it is not possible to fully understand the company in such a short risk assessment. Group 10, with actual hours between 1600 and 2000, is the group with nearly the highest actual hours. Group 10 also shows up in our fishbone diagram as the group with the highest deviation, across multiple scales. This can be substantiated to the difficulty of estimating the risks for large clients in advance. The assignments with less actual hours, group 1 and 2, have a large negative deviation, meaning that the budgeted hours are more than the actual hours. This could indicate that for smaller assignments, the number of risks involved are most likely overestimated.

### 6.2.2. Challenging realisation rate

As explained in section 3.4., realisation rate is one of the key performance indicators (KPI) of company X. They set the target for the realisation rate at 55%, to balance sales and costs efficiently. The formula of the realisation rate is:  $(\text{fee total assignment} / (\text{budgeted hours} * \text{hourly rate}) - 10\% \text{ for surcharge and expenses})$ . When the planned costs increase, assuming the hourly rate remains constant, more hours have been planned. If the fee for the total engagement remains unchanged, but the planned costs rise, the realisation rate will decrease. This is not desired, as the realisation has as target 55% or higher.

After the Engagement Manager fills in the fee, budgeted hours and audit team preference, several red flags may appear. One such red flag can appear for a realisation rate lower than 55%. The red flag functions as a warning sign to reconsider the planning. If the Engagement Manager is of the opinion that the planning cannot be changed, they must provide an explanation of why the target is not achieved. The Engagement Partner, planning partner and finance partner will also review this planning and explanation. If they agree with the planning and a rate below 55%, the planning stands. However, if any stakeholder disagrees, two solutions are possible, either change the fee or change the planning. Changing the fee of an assignment can be difficult, since it is usually fixed, making adjusting the planning the most feasible option.

The quickest way to increase the realisation rate without significantly reducing the budgeted hours, is to cut hours from the most expensive functions. The partner, senior manager and manager are the highest functions and have the highest hourly rate. Removing hours from the senior functions will therefore rapidly increase the realisation rate. While this approach solves the issue of a low realisation rate, it also removes hours necessary to complete specific tasks assigned to senior functions, which cannot be performed by other functions. Consequently, the hours are still needed and implemented, leading to discrepancies between budgeted hours and actual hours.

Removing the hours from the senior functions to lower the realisation rate, will primarily affect the senior function's hours. The fishbone diagram of Figure 12 supports this theory, showing the highest deviations in the senior functions, across different scales.

We discussed in section 6.2.1. the involvement of the partner and managers in the planning and risk assessment phase. Because the hours from these functions are the first hours removed to lower the realisation rate, the planning and risk assessment phase shows significant discrepancies between budgeted hours and actual hours. The initial months of the planning and risk assessment, where the involvement of the partner and manager is the largest, would logically have the highest deviations. The high deviations in May 2023 reflect this.

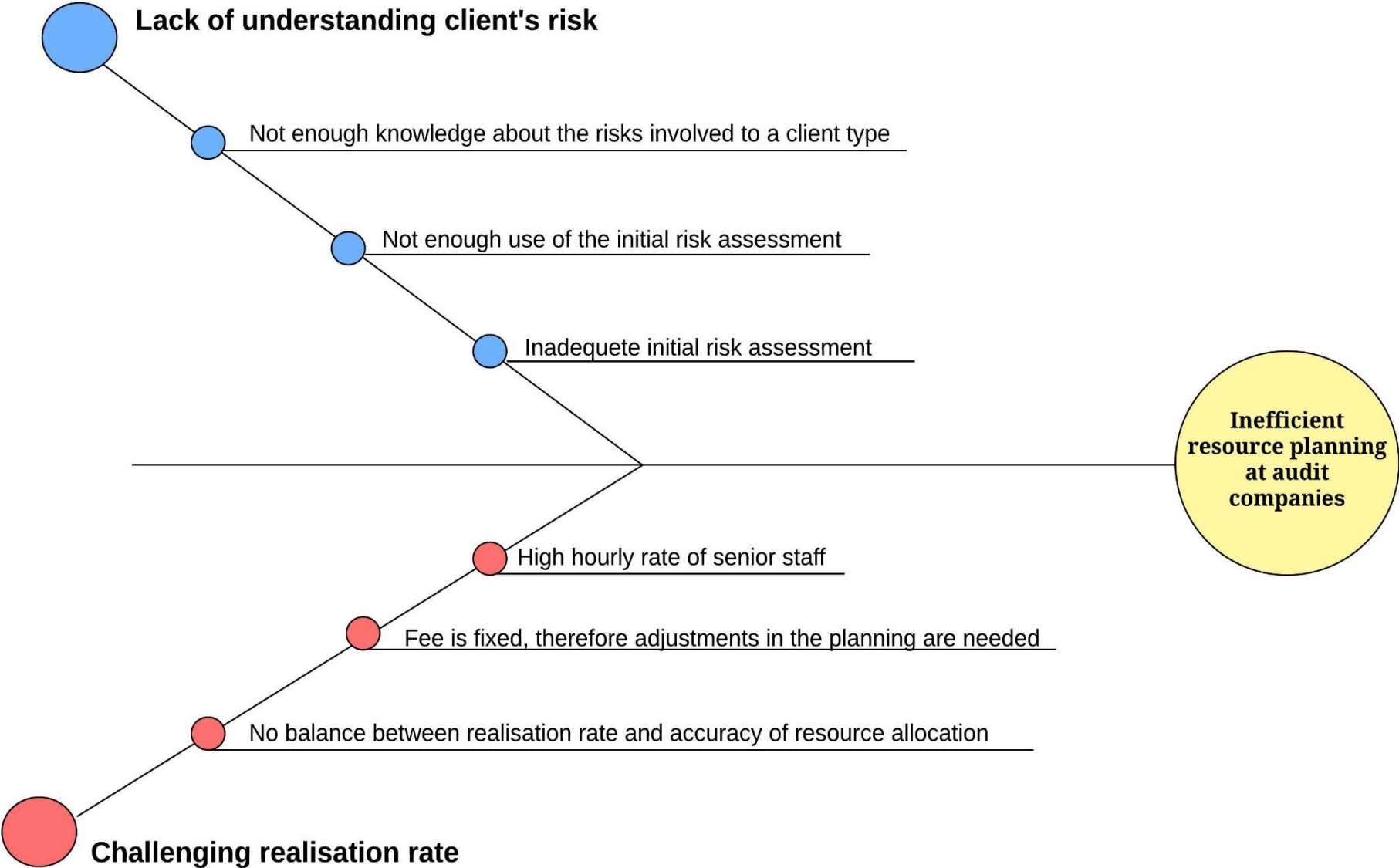
When looking at the realisation rate from the lowest groups, group 1,2 and 3, the realisation rate is very high, up to 300%. When looking at the largest groups, group 9,10 and 11, the realisation rate is lower, beneath the 55% target. This can be explained by the fact that company X prefers auditing large assignments, as this brings status to the audit company. Therefore, they will accept a lower fee for large assignments, as they want to win the proposal procedure from their competitors. For the large assignments it can be challenging to win the client and get a positive realisation rate.

Another reason for the low realisation rate for larger engagements is because the planning and risk assessment is more extended, requiring more hours from the senior functions. The low budgeted hours for senior functions in the planning and risk assessment have a larger impact on large assignments, because this phase takes longer for large clients. Group 10, with overall the highest deviation, confirms this.

### **6.3. Fishbone diagram theoretical; inefficient resource planning at audit companies**

The theoretical root causes as mentioned in section 6.2. have been visualised in a fishbone diagram, which can be seen in Figure 13. The use of a fishbone diagram makes it easy to understand the sub-causes related to the root causes of the effect researched, which serve as foundation of the recommendations provided to company X. The recommendations can be found in the next Chapter.

Figure 13, Fishbone diagram theoretical; inefficient resource planning at audit companies



## 7. Recommendations

In section 6.2. we identified the theoretical root causes of the inefficient resource planning at company X. To improve the resource planning, we should provide the company with recommendations. These recommendations are based upon the theoretical root causes identified. The two root causes, as shown in Figure 13 are:

1. Lack of understanding client's risks
2. Challenging realisation rate

Based on the two identified root causes and their sub-causes, we will answer the following sub-question in this Chapter: **What recommendations could be considered to solve the root causes of inefficient resource planning at company X?**

### 7.1. Investigation client's risks before the planning process

A possible solution to the problem "lack of understanding of client's risk", is to gain more knowledge on the client's risks before the audit process starts. This could be done in several ways.

The first way is to make more use of the initial risk assessment. The risk assessment must be filled in before the planning is made. The goal of the risk assessment is mainly evaluating if the audit company should want to audit this client, based on the level of risk of a client's company. Audit companies prefer clients with low risks, due to the quality assurance of the audit and fear of losing their reputation. The risk assessment is hardly used for the planning of the audit process. The risk assessment could give more insight into which risk a client has, and where these risks are located. This could be used to better forecast how many hours will be spent in the planning and risk assessment, because in this phase the risks are deeper investigated. The current initial risk assessment could also be adjust/extended with more questions to better understand the client, and therefore gain more insight before the audit process starts.

Another option is to use benchmarking for identifying possible risks belonging to a client type. External benchmarking is using information from competitors to improve a company its own performance (Stapenhurst, 2009). Internal benchmarking is comparing processes within the same organisation, rather than with external companies (Southard & Parente, 2007). To get more insight on the risks of a client, without thoroughly investigating the client, benchmarking could be used to get an idea of how many risks a client has, and the impact of these risks.

The use of external benchmarking provides a broader perspective including more data. With the data from competitors, possible risks that have been overlooked internally can be identified. To make use of external benchmarking, company X would have to find competitors willingly to share their data confirming resource planning. Internal benchmarking does not require data from external competitors. Different assignments within the organisation can be compared and used to discover risks attached to a client type. For both external and internal benchmarking it can be useful to gather information about various client types. This includes factors such as client size, the industry, the complexity of the operations and the regulations for the client. By doing so, company X can better identify and manage risks associated with different client types.

### 7.2. Balancing realisation rate and accuracy of budgeted hours

To solve the problem "challenging realisation rate", company X could consider making a better balance between the realisation rate and the accuracy of the budgeted hours desired. The realisation rate is currently set at a target of 55%. If the rate is 55% there is, according to the Leadership Team Assurance of company X, a good balance between sales and costs.

The realisation rate is important for the involved stakeholders of the planning process, as it gives a fast indication of the financial effectiveness of the planning. When this rate is not high enough, so when the costs are too high in comparison to return, it should be considered to change the planning. As explained in section 6.2.2., the easiest way to increase this rate is by removing budgeted hours from the senior functions. However, the tasks performed by these higher functions still need to be fulfilled. The budgeted hours are adjusted to upper the realisation rate, however this will result in a high deviation between budgeted hours and actual hours.

To decrease the differences between budgeted hours and actual hours, the budgeted hours should be better forecasted. As we saw in the data analysis, the senior functions have the highest deviation, and therefore more hours should be budgeted for these functions. However, budgeting more hours for the senior functions, would rapidly decrease the realisation rate, because the costs will rise.

A recommendation would be to adjust the desired realisation rate target including the costs of more hours used than budgeted. Lowering the realisation rate would in theory mean that the audit company gets less return from an assignment and this is not preferred by a company. However, the consequence of a discrepancies between budgeted hours and actual hours also results in profit loss, as we saw in the problem cluster in section 1.1.. The audit company should calculate a realistic realisation rate, also keeping in mind the costs of more hours needed than budgeted to complete the audit process. This would give a good indication of the financial profitability of the engagement, make the realisation rate target achievable and bridge the gap between budgeted and actual hours.

Company X could also consider a realisation rate depending on the size of the audit engagement. Audit companies prefer large engagements, because this brings status to the audit company, and they are willingly to lower the fee for large clients. Without a change of the costs, a lower fee would result in a lower realisation rate. It could therefore be considered to lower the target of the realisation rate for large engagements, so the target is still achievable and in line with the strategy of company X.

On long term, another possible solution to higher the realisation rate could be to higher the fee. The fee for a client is mostly fixed for a certain amount of years, so on short term this solution would not work. Moreover, if the fee of company X is way higher than its competitors, without offering anything special, this could lead to clients not choosing company X as their auditor. So, when choosing to higher the fee, this should be well considered.



## 8. Concluding points

This Chapter concludes the key points of this research. We first draw conclusions, in section 8.1. and in section 8.2. some topics for further research are discussed. The conclusion of this thesis will give an answer to the research question: **How can company X improve their resource planning for audit assignments, to align budgeted hours with actual spent hours?**

### 8.1. Conclusion

At the start of this research, the current state of the resource planning at company X is analysed. With the use of Business Process Modelling and Notation the planning process and the involved stakeholders are visualised. We also gathered a good understanding of the Key Performance Indicators of the planning. The KPI's "audit hours", "realisation rate" and "planning in phase" are adopted in our dashboard.

To analyse the dataset provided by company X, a dashboard was made. In this dashboard the most important features are budgeted hours, actual hours, deviation and deviation in percentage. The current resource planning delivers a positive deviation of 3,17%. This means that more actual hours are used than originally budgeted. When looking closer into the data, on phase level, month level, group level and function level, we identified differences in the deviations. The cross-level analysis identified patterns in the following part: planning and risk assessment, May 2023, group 1,2 and 10 and the senior functions.

To identify the root causes of these identified discrepancies, several root cause analysis methods were reviewed and concluded that the fishbone diagram is the most appropriate method for this research. We identified two theoretical root causes:

- 1 Lack of understanding client's risks
- 2 Challenging realisation rate

Based on the findings in the data analysis and the identified theoretical root causes, the following recommendations are given to company X, to solve the theoretical root causes:

#### 1. Investigation client's risks before the planning process

Better understanding of the client's risks in the planning process could help better estimate the hours needed for the audit process, especially the hours needed for the planning and risk assessment. This understanding could be improved by enhancing the risk assessment that is performed before the planning process starts. Another way is the use of benchmarking, to gain knowledge of risk associated with different client types.

#### 2. Balancing realization rate and accuracy of budgeted hours

Adjusting the target of the realisation rate to strike a better balance between profitability and the accuracy of the budgeted hours. This involves setting a realistic realisation rate target that involves costs of more hours used than budgeted.

Implementing these recommendations could lead to more accurate planning, reduce discrepancies, and enhance the overall efficiency of the planning at company X. The findings and recommendations of this research serve as a foundation for improving the audit resource planning process, with as goal of better alignment of the budgeted and actual hours, ultimately contributing to the company's efficiency and profitability.

## 8.2. Further research

While this study already provided some insight into the current resource planning at company X and identified areas for improvement, there remain areas for further research that could enhance the efficiency of audit firms.

In the first place, it could be interesting to involve client-specific variables in the data analysis. Examples of client-specific variables could be sector, size, complexity and location. Understanding these factors in greater detail could lead to more specific information on where the discrepancies are located.

In the second place, analyzing the forecasting documents and time tracking records from multiple years could be useful to also include the external factors on the accuracy of the planning. As mentioned in the limitations in section 1.7., in this research we only used the data from May 2023 to April 2024. In long-term it could be useful to also conduct a data analysis including the records from multiple year, because external factors can also impact the accuracy of the planning. Moreover, the use of multiple years could increase the representability of the results.

In the third place, this study could be further researched using another group division for the data analysis. By applying the Pareto principle, as discussed in Chapter 5, groups could be divided based on deviation. This leads to a more equally spread division. When investigating more clients, the Pareto approach could be applied to make the groups representable and reliable.

## Literature list

- Adjei-Kuffour, A. (n.d.). Audit planning and risk assessment. In *Ideal Journal of Economics and Management Sciences* (Vol. 2, Issue 6). <http://ijems.truescholar.org>
- Almeida, F. (2018). *European Journal of Education Studies STRATEGIES TO PERFORM A MIXED METHODS STUDY*. <https://doi.org/10.5281/zenodo.1406214>
- Chinosi, M., & Trombetta, A. (2012). BPMN: An introduction to the standard. *Computer Standards and Interfaces*, 34(1), 124–134. <https://doi.org/10.1016/j.csi.2011.06.002>
- Christ, M. Y. (1993). Evidence on the Nature of Audit Planning Problem Representations: An Examination of Auditor Free Recalls. In *Source: The Accounting Review* (Vol. 68, Issue 2).
- Coccia, M. (2018). *the Fishbone diagram to identify, systematize and analyze the sources of general purpose technologies*. <https://ssrn.com/abstract=3100011> Electronic copy available at: <https://ssrn.com/abstract=3100011>
- Cohen, L., Manion, L., & Morrison, K. (2000). *Research Methods in Education*.
- Creswell, J. W., & Garrett, A. L. (2008). The “movement” of mixed methods research and the role of educators. In *South African Journal of Education*.
- Ettredge, M. L., Bedard, J. C., & Johnstone, K. M. (2003). *An Empirical Study of Audit Effort Budgeting Dynamics*.
- Findley, M. G., Kikuta, K., & Denly, M. (2021). *Annual Review of Political Science External Validity*. <https://doi.org/10.1146/annurev-polisci-041719>
- Gangidi, P. (2019). A systematic approach to root cause analysis using 3 × 5 why’s technique. *International Journal of Lean Six Sigma*, 10(1), 295–310. <https://doi.org/10.1108/IJLSS-10-2017-0114>
- Hayes, R., Dassen, R., Schilder, A., & Wallage, P. (2005). *PRINCIPLES OF AUDITING An Introduction to International Standards on Auditing*. [www.booksites.net/hayes](http://www.booksites.net/hayes)
- Heerkens, H., Winden, A. van, & Tjooitink, J.-W. (2017). *Solving Managerial Problems Systematically* (First edition). Noordhoff Uitgevers B.V. .
- Hellerstein, J. M. (2008). *Quantitative Data Cleaning for Large Databases*. <http://db.cs.berkeley.edu/jmh>
- Herrhammer, K. A. (1956). *Interim work and client cooperation contribute to early completion of the audit*. [https://egrove.olemiss.edu/dl\\_hs](https://egrove.olemiss.edu/dl_hs)
- Holifahtus Sakdiyah, S., Eltivia, N., & Afandi, A. (2022). Root Cause Analysis Using Fishbone Diagram: Company Management Decision Making. *Journal of Applied Business, Taxation and Economics Research*, 1(6), 566–576. <https://doi.org/10.54408/jabter.v1i6.103>
- Kueppers, R. J., & Sullivan, K. B. (2010). How and why an independent audit matters. *International Journal of Disclosure and Governance*, 7(4), 286–293. <https://doi.org/10.1057/jdg.2010.22>
- Li, S. S., & Lee, L. C. (2011). Using fishbone analysis to improve the quality of proposals for science and technology programs. *Research Evaluation*, 20(4), 275–282. <https://doi.org/10.3152/095820211X13176484436050>

- Machado, C., & Davim, J. P. (2020). *Management and Industrial Engineering Research Methodology in Management and Industrial Engineering*. <http://www.springer.com/series/11690>
- Mahmood, Y. A., Ahmadi, A., Verma, A. K., Srividya, A., & Kumar, U. (2013). Fuzzy fault tree analysis: A review of concept and application. In *International Journal of System Assurance Engineering and Management* (Vol. 4, Issue 1, pp. 19–32). Springer. <https://doi.org/10.1007/s13198-013-0145-x>
- Mcgladrey, I. B. (1951). The Audit Report. In *Source: The Accounting Review* (Vol. 26, Issue 2).
- Minto, B. (1996). *The Minto Pyramid Principle*.
- Okes, D. (2019). *Root Cause Analysis - The Core of Problem Solving and Corrective Action (2nd Edition)*. American Society for Quality (ASQ). <https://app.knovel.com/hotlink/toc/id:kpRCATCP02/root-cause-analysis-core/root-cause-analysis-core>
- Pauwels, K., Ambler, T., Clark, B. H., LaPointe, P., Reibstein, D., Skiera, B., Wierenga, B., & Wiesel, T. (2009). Dashboards as a service: Why, what, how, and what research is needed? *Journal of Service Research*, 12(2), 175–189. <https://doi.org/10.1177/1094670509344213>
- Petraşcu, D., & Tieanu, A. (2014). The Role of Internal Audit in Fraud Prevention and Detection. *Procedia Economics and Finance*, 16, 489–497. [https://doi.org/10.1016/s2212-5671\(14\)00829-6](https://doi.org/10.1016/s2212-5671(14)00829-6)
- Pojasek, R. B. (2000). Asking “Why?” five times. In *Environmental Quality Management; Autumn* (Vol. 10).
- Porter, B., Simon, J., & Hatherly, D. (2014). *Principles of External Auditing*.
- Pramukti, A. (2024). Internal Audit versus External Audit: A Qualitative Perspective. *Golden Ratio of Auditing Research*, 4(2). <https://doi.org/10.52970/grar.v4i2.372>
- Pyzdek, T. (2021). *The Lean Healthcare Handbook A Complete Guide to Creating Healthcare Workplaces Second Edition Management for Professionals*. <http://www.springer.com/series/10101>
- Quintão, C., Andrade, P., & Almeida, F. (2020). How to Improve the Validity and Reliability of a Case Study Approach. *Journal of Interdisciplinary Studies in Education*, 9(2), 264–275.
- Roberts, N. H., & Haasl, D. F. (1981). *Fault Tree Handbook*.
- Sharma, B., & Jain, R. (2013). Right choice of a method for determination of cut-off values: A statistical tool for a diagnostic test. In *Asian Journal of Medical Sciences: Vol. 1*. <http://nepjol.info/index.php/AJMS>
- Southard, P. B., & Parente, D. H. (2007). A model for internal benchmarking: When and how? *Benchmarking: An International Journal*, 14(2), 161–171. <https://doi.org/10.1108/14635770710740369>
- Stapenhurst, T. (2009). *The Benchmarking Book: A How-to-Guide to Best Practice for Managers and Practitioners*.
- Vîntorur, S. S., & Calotă, G. (2015). PRELIMINARY ACCEPTANCE OF THE ENGAGEMENT ACTIVITIES. In *Internal Auditing & Risk Management* \_\_\_\_\_ *Anul X, Nr* (Vol. 2, Issue 38).
- Von Rosing, M., White, S. A., Cummins, F., & De Man, H. (2014). Business process model and notation-BPMN. In *The Complete Business Process Handbook: Body of Knowledge from Process Modeling to BPM* (Vol. 1, pp. 429–453). Elsevier Inc. <https://doi.org/10.1016/B978-0-12-799959-3.00021-5>

Weske, M. (2012). Business process management: Concepts, languages, architectures, second edition. In *Business Process Management: Concepts, Languages, Architectures, Second Edition*. Springer Berlin Heidelberg. <https://doi.org/10.1007/978-3-642-28616-2>

Wieczerniak, S., Cyplic, P., & Milczarek, J. (2017). *ROOT CAUSE ANALYSIS METHODS AS A TOOL OF EFFECTIVE CHANGE*.

## Appendix A ; Overview research questions

<i>Research question</i>	<i>Research type</i>	<i>Data gathering method</i>	<i>Data analysis</i>
<i>What is the current situation at company X, regarding their resource planning?</i>	<i>Descriptive</i>	<i>Consulting experts, observations</i>	<i>Qualitative</i>
<i>Where are the discrepancies between budgeted and actual hours located within audit assignments?</i>	<i>Exploratory</i>	<i>Forecasting documents and time tracking records</i>	<i>Quantitative</i>
<i>What root cause analysis methods are described in literature, and which is the most fitting for this research?</i>	<i>Applied</i>	<i>Literature study</i>	<i>Qualitative</i>
<i>What are possible root causes of inefficient resource planning at company X?</i>	<i>Correlational</i>	<i>N/A</i>	<i>Mixed</i>
<i>What recommendations could be considered to solve the root causes of inefficient resource planning at company X</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>

Table 18, Overview research questions

## Appendix B ; Stakeholders continuous client

### Engagement manager

An Engagement Manager (EM) starts the planning process. This is in most cases the same Engagement Manager as previous year(s), and therefore has experience with this client and with the planning process of this client. The EM looks at the planning from previous year(s) and knows if enough/too many/too few hours were budgeted last year. With this information, the EM estimates how many hours will be needed to complete the engagement this year and decides how many hours from each function is needed. The EM can also fill in his/her preference for an audit team. This preference is in most cases the same audit team as last year, because they already have experience with the client. It is possible that more/less employees need to be on the team than last year. The EM also fills in the fee for the engagement, in most cases this fee is already discussed with the client.

After the EM has filled in the estimated hours, team preference and fee, the last step of the EM has to be completed. Company X has certain Key Performance Indicator targets they want the planning to achieve, these KPI's and their targets will be explained in section 3.4.. If the planning filled in by the EM does not meet these KPI targets, a red flag will appear. The EM now has to elaborate if or why it is justified to ignore the red flag, i.e., why his planning does not have to meet the KPI target(s).

### Engagement partner

After the Engagement Manager has filled in all the information, the planning goes to the Engagement Partner (EP). This is also, in most cases, the same Engagement Partner as last year. The EP gives a critical look at the planning provided by the EM. If, according to the EP, certain areas of concerns are identified, such as misalignment of planned hours versus realistic planned hours to complete the assignment, the submission is sent back to the EM.

### Planning coordinator

When both Engagement Manager and Engagement Partner are satisfied with the planning, the planning will be directed to the planning coordinator. The planning coordinator does not take a look at if the hours estimated are realistic. The task of the planning coordinator is only to check if everything is filled in and if applicable red flags are substantiated. The planning coordinator does not have any experience with the audit process itself, and therefore will not express his or her opinion. The role of a planning coordinator is therefore only checking if all the information needed is provided. If this is not the case, the planning coordinator will contact the Engagement Partner.

### Planning partner

If the planning is approved by the planning coordinator, the planning partner will take a look at the planning. One specific partner is assigned as planning partner for all assignments in the Netherlands, and therefore can take an independent look at each planning. The planning partner will focus on checking if there are any KPI targets that have not been met. However, unlike the planning coordinator, the planning partner does have a lot of experience with the audit process. The planning partner can judge if the given reasons for not meeting KPI targets are appropriate and well enough substantiated. If not, the planning partner can decide to send the planning back to the Engagement Partner, with the request to change either the planning or the given explanation.

**Finance partner**

Whereas the planning partner takes a look at the hours, the finance partner takes a look at the realisation rate of the engagement. The realisation rate gives an indication of the financial efficiency and profitability of the engagement. More explanation of the realisation rate will be given in section 3.4.3.. If the realisation rate is insufficient, the finance partner will contact the Engagement Partner to discuss the client. It will be discussed if the fee of the client has to be adapted, and in some cases, it may even be necessary to decline the request for an audit of the client for that year.

**Planning department**

When the planning has been checked and approved by all previous mentioned stakeholders, the planning will be sent to the planning department. The planning department will receive the planning of all the different clients, including their preference for a certain audit team. It may be possible that an employee is scheduled on multiple assignments in the same period. The planning department will now have to resolve these issues and discuss the issues with the EM and EP. The planning department is also responsible to make sure all the functions within an engagement are being assigned to the right person.



## **Appendix C ; Stakeholders new client**

### **Partner group**

The partner group is closely involved in the process of accepting a new client. The partner group consists of different partners, with each a different focus. Combining all the different focuses is important when considering a new client. The client should be evaluated on many aspects, and therefore all the partners are needed. The partner group typically looks at the client type, the fee and the audit hours needed. The partner group is also responsible for evaluating the risk assessment.

### **Planning coordinator**

When the partner group wants to proceed the proposal procedure of the potential client, it is important to check first with the planning coordinator if there is enough capacity to put together an audit team for this potential client. The audit team will not only have to audit the client for the next year, but is also really important in the proposal procedure. All the audit companies that want to audit the client, are participating in the proposal procedure. The client will mainly choose an audit company based on the connection with the audit team. The audit team will write and present the proposal. The planning coordinator discusses with the partner group the potential employees suitable for this potential client. The planning coordinator will mainly focus on who is available, the partner group mainly focuses on the best suitable employees for the potential client.

### **Audit team**

When the client is accepted by the partner group and together with the planning coordinator an audit team is set up, the actual proposal procedure starts. As mentioned before, there are multiple audit companies that compose a proposal. Therefore, it is important to make the proposal unique. The audit team is responsible for writing, shaping and presenting the proposal. In the proposal procedure, the fee and the number of hours needed to complete the audit process are being discussed with the client. The fee and audit hours needed are based upon the experience of the previous auditor of the potential client and the needs and/or demands of the client.

### **Planning department**

When the client chooses company X as their auditor after the proposal procedure, the planning department now has to schedule hours for the audit process itself. In the proposal procedure the number of hours, the fee and the audit team are already determined and discussed with the client, so we do not have to repeat this process. The task for the planning department is to fill in the hours in the planning, check if any conflicts arise and if applicable, solve these conflicts.

## Appendix D ; Business Process Modelling and Notation

The Business Process Modelling and Notation, referred to as BPMN, is a standardized method that helps companies to document, design and analyse their business processes. A BPMN model helps to get a clear and detailed visualization of the business processes. This visualization is not only useful for the company itself, but also for the involved stakeholders in order to get a better understanding of the processes (Chinosi & Trombetta, 2012).

According to Chinosi & Trombetta, the following graphical elements can be used to help creators to make a clear overview of different business processes:

### Flow objects

- Events
- Gateways
- Activities

### Connecting objects

- Sequence flow
- Message flow

### Swim lanes

- Pools
- Lanes

### Artifacts

- Data object
- Group
- Annotation

Flow objects represent the actions occurring in the business process. These actions are connected using connecting objects, to create a clear process flow and clarify the interactions between the different actions. External factors may also be relevant for the business process, so this is where swim lanes are introduced. Swim lanes are used to make a clear grouping of different elements, so it is easier for the viewers of the BPMN to understand any distinctions within the process. If there are additional actions left which do not directly impact the main business flow, artifacts are used to describe these activities. The most common elements of BPMN will be discussed below, based on Weske (Weske, 2012).

### Events

Events are used to initiate, to alter or to conclude the business flow, represented by a circle icon. The most common events are start event, intermediate event, and end event. A start event is used to initiate a process. The process is triggered by a specific situation or input. The intermediate event is used to indicate a change of the flow and is being used between the start event and end event. An end event is used to indicate the completion of the current path, and therefore the completion of a process. It is possible that multiple start events, intermediate events and end events occur in a more complex business process.

**Activities**

Activities can be recognized in the flowchart as rectangles with rounded edges. These rectangles represent tasks that must be achieved by persons or systems within the business process. Each activity typically has one incoming and one outgoing arrow, which implies that each task can occur only once within the process. Activities are crucial, as they provide a detailed and clear visualization of which actions take place in the business process.

**Gateways**

Gateways are visualized using diamond shapes. They play an essential role in BPMN, ensuring processes can adapt varying conditions. The most common used gateways the parallel gateway and exclusive gateway. The parallel gateways split the process in multiple paths, that can be executed simultaneously. The different paths finally converge into one single path, which can only proceed if all the different parallel paths are completed. The exclusive gateway splits the process in multiple paths, and certain conditions determine which path must be taken.

**Sequence flows**

Sequence flows are represented as arrows in the BPMN. They show how objects and actions are linked with each other and in what order (sequence) the actions and objects are in. They provide an overview of different connections and determine in which order the activities are occurring.

**Message flows**

Message flows are represented as arrows with a dashed line in the BPMN. They show how information and messages are being exchanged within the process. These often includes the information flow between different stakeholders.

**Pools**

Pools show the different participants in the process, which is typically regarding an entire organization or department within the organization. It is used to separate the different participants within the diagram.

**Lanes**

A lane is one part of the pool and represents a specific participant in the process. Lanes help to organize the process and to categorize tasks and activities. There is often an exchange of information between different lanes.

**Data objects**

Data objects are generally not found within the process of BPMN, they only exist to show what data is being used for the process. They are classified with the name of the data objects. Types of data used can be hard copy documents, physical artifacts or artifacts which can be found online.




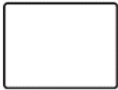





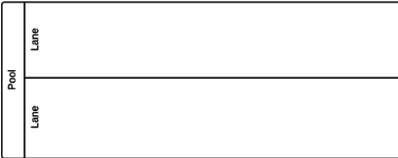


**Groups**


Groups are used to combine different activities of the business process. Unlike pools and lanes, which organize departments of the process, groups are used to categorize a collection of activities. Grouping helps to order the process; however it does not affect the flow of the process. The only purpose of grouping is for documentation and analysis.

**Annotations**

Annotations are textual or graphical elements that can be added to a process in order to provide additional information or necessary explanation regarding a specific part of the process. The goal of an annotation is to clarify the meaning and purpose of certain elements.

In the table below, Table 19, the name of these symbols and an explanation of symbols (Von Rosing et al., 2014).

Symbols	Name of symbol	Explanation of symbol
	<b>Start event</b>	Indicates the start of a process
	<b>Intermediate event</b>	Stands for any change of the flow that happens between the start of the process and the end
	<b>End event</b>	Alerts the end of a process
	<b>Activity</b>	Refers to an action that takes place in the process
	<b>Parallel gateway</b>	Represents multiple tasks happening side by side, the next activity can only start if all parallel activities are completed
	<b>Exclusive gateway</b>	Breaks the process in multiple paths, conditions determine which path will be taken
	<b>Sequence flow</b>	Connects objects with each other excluding messages
	<b>Message flow</b>	Shows the flow of a message, from one person to the other
	<b>Message</b>	Shows what message or information gets received in the process
	<b>Pool / lane</b>	The pool is used to show the different participants in the process. A lane is used to represent the activities of one specific participant
	<b>Data object</b>	Used to show which data is used in the business process
	<b>Group</b>	The use of a group can be helpful to categorize a collection of activities. It does not change the process, but only helps to make it clearer

	<b>Annotation</b>	Textual or physical elements added to provide additional information of specific parts of the process
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*Table 19, BPMN symbols*

## Appendix E ; Explanation dashboard

### Top dashboard

At the top of the dashboard four different features can be found. The first element is the budgeted hours, in this feature the sum of all the budgeted hours is calculated. The next feature is actual hours, where the sum of the actual hours is calculated. The next feature is the deviation. To calculate the deviation, we implemented a formula. This formula is as follows: actual hours – budgeted hours. If deviation is  $>0$ , this means that the actual hours are more than the budgeted hours, if the deviation is  $<0$  it means that the budgeted hours are more than the actual hours. The closer the deviation is to 0, the better the budgeted hours align with the actual hours. The last feature is the deviation in percentage. Percentages are used because they are easy understandable, and they are comparable. The slicers determine which data is summed up, depending on what is selected in the slicers.

### Slicers

On the left side of the dashboard, five different slicers have been implemented. The slicers can be used to filter the data, based on specific criteria. The features, graphs and KPI's are linked to the slicers, and will automatically change when a specific criterion is being selected. The month slicer can be used to only show data from a specific month(s). With the function slicer we can select a specific function. The graphs and elements will only show information related to this function. The group slicer can be used to select a group. As mentioned in section 4.2.1, the clients are divided in 11 different groups, based on the actual hours necessary to complete the assignment. The phase slicer can be used to select the data of only a specific phase, these phases are discussed in section 4.2.2.. The last slicer in this dashboard, the company slicer, can be used to select the data from a specific company. For this research, it is not relevant to only select one client, because we cannot identify any patterns with only this information. However, this slicer was implemented to make it possible for company X to only select one client. For this research, all the client names were left out due to privacy regulations and replaced by random letters in the alphabet. The selection of only one client could help in the planning process at company X, because they can easily get an overview of the variation of the hours from last year.

### Graphs

For each level of analysis – phase, month, group and function – we have included two different types of graphs. One graph displays the budgeted hours versus the actual hours, and therefore shows the absolute values of the hours. The other graph shows the deviation of the hours in percentage, to facilitate easy comparison between different assignments.

### KPI's

At the bottom of the dashboard, underneath the graphs, different Key Performance Indicators, as discussed in section 3.4., and their values are shown. These indicators show whether targets have been met or not. With the use of the slicers, we can easily identify which targets have been met and which targets need some more attention.

The first KPI implemented in the dashboard is planning in phase. This KPI consists of three different elements. The first element is % planning and risk assessment, calculated by: (number of hours in planning and risk assessment / total hours engagement). The target for % planning and risk assessment is set at 15%. For the % interim response the target was also set at 15%. This KPI is calculated by: (number of hours in interim response / total hours engagement). The %

planning and risk assessment + % interim response is calculated by:  $((\text{number of hours in planning and risk assessment} + \text{number of hours in interim response}) / \text{total hours engagement})$ . The target for % planning and risk assessment + % interim response is set at 35%

The next KPI implemented is the realisation rate. The target for the realisation rate is 55%. To calculate the realisation rate, we first calculated the costs for each engagement. We can calculate the costs by multiplying the budgeted hours for a function by its hourly rate. When we sum up all the costs from each function, we get the total costs of an engagement. Also, we evaluated the fee received for each engagement. The realisation rate was then calculated by:  $(\text{fee total engagement} / \text{total costs engagement} - 10\%)$

The last KPI implemented in our research is audit hours. This KPI consists of two different elements, % in charge staff and % senior staff. The risk level of all clients in this research were low or medium, and therefore the target for % in charge staff is set at 19%. The % in charge staff is calculated by:  $((\text{budgeted hours supervisor} + \text{budgeted hours assistant manager}) / \text{total hours engagement})$ . The target for % senior staff is set at 10%. This KPI is calculated by:  $((\text{budgeted hours manager} + \text{budgeted hours senior manager} + \text{budgeted hours partner}) / \text{total hours engagement})$ .

### Appendix F ; Screenshots dashboard

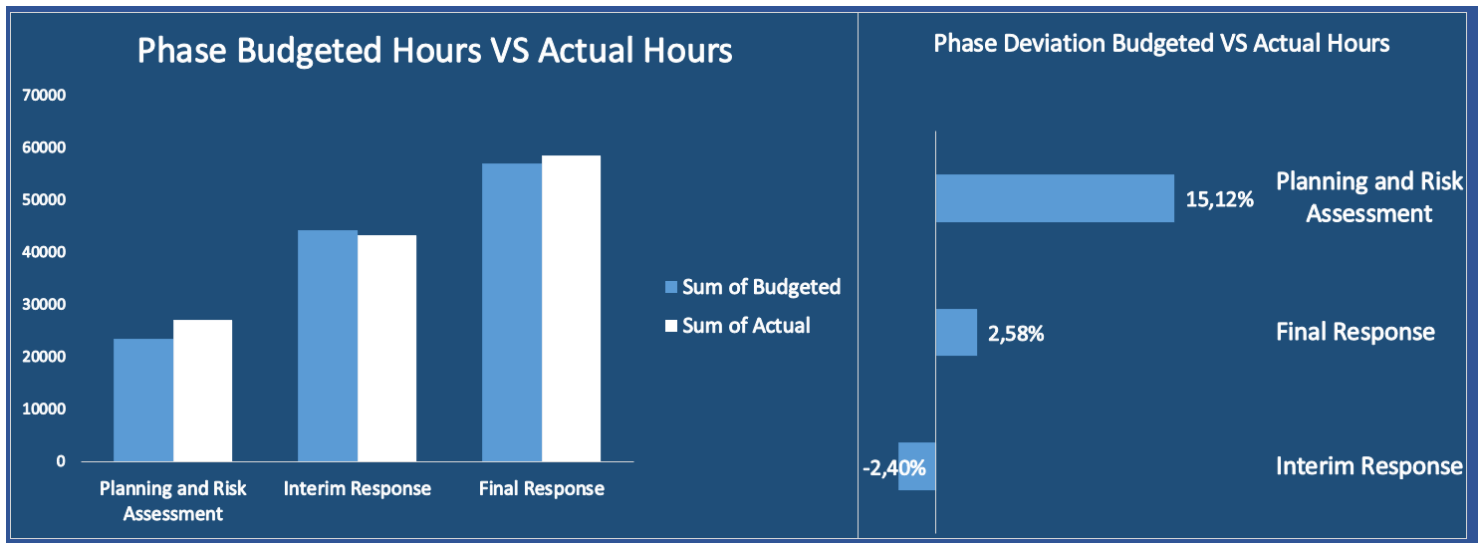


Figure 14, Graphs phase budgeted hours VS actual hours

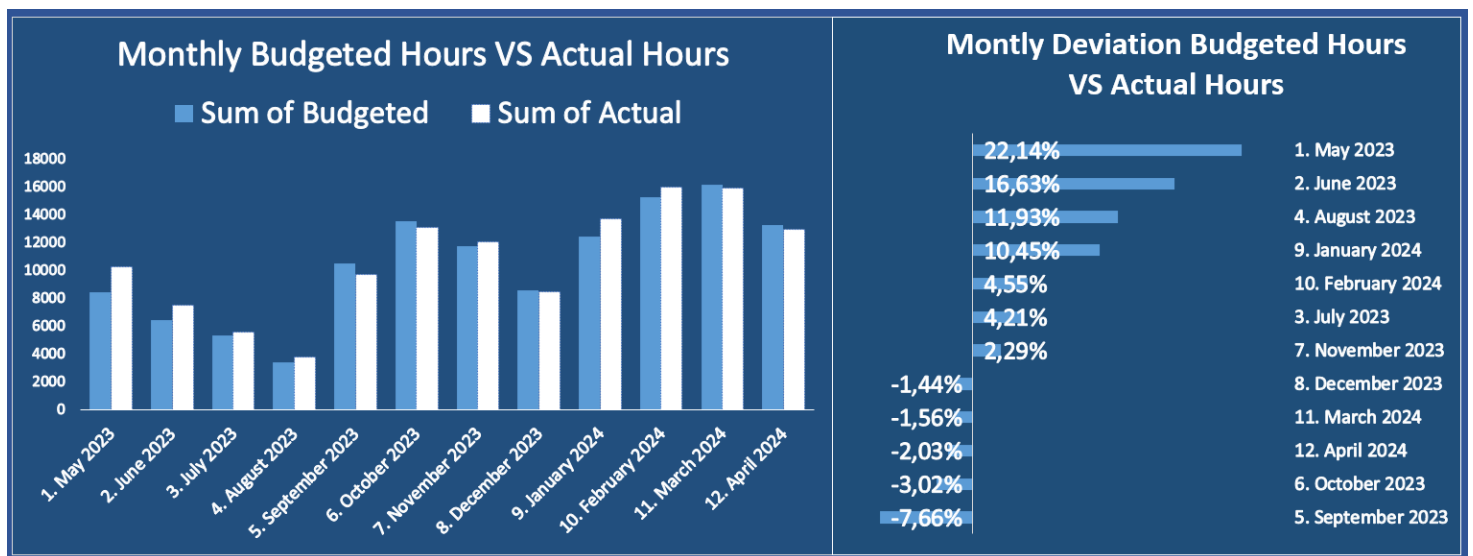


Figure 15, Graphs monthly budgeted hours VS actual hours



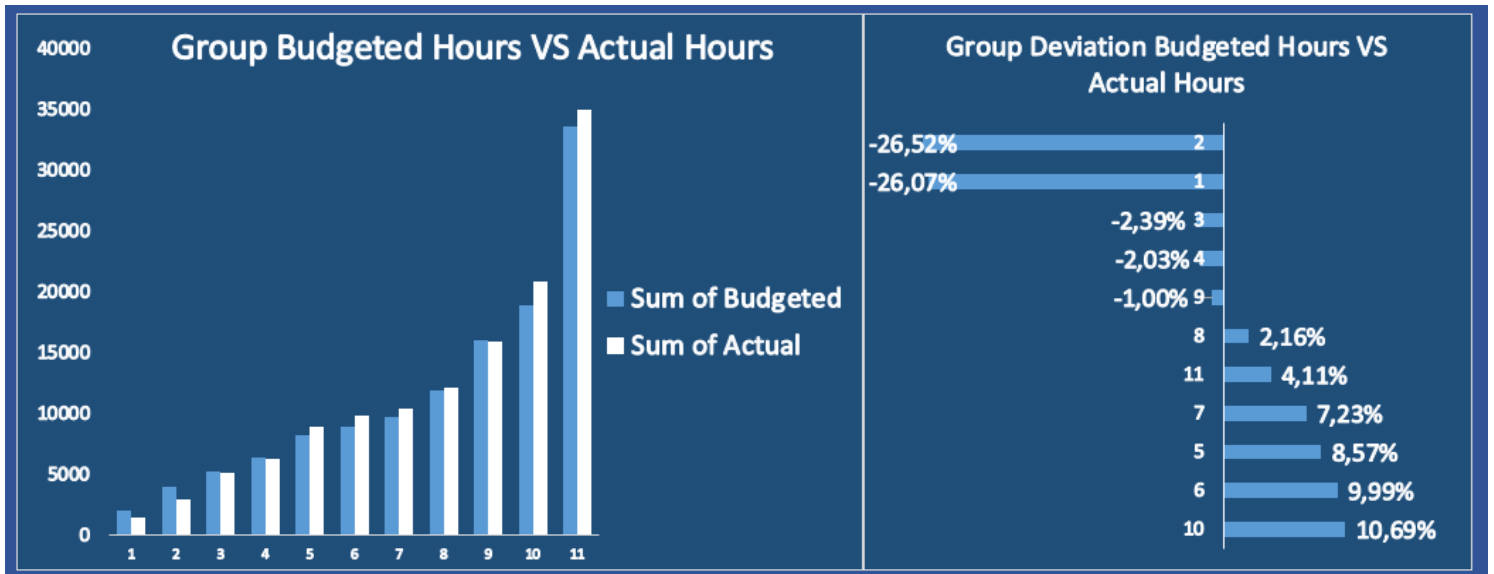


Figure 16, Graphs group budgeted VS actual hours

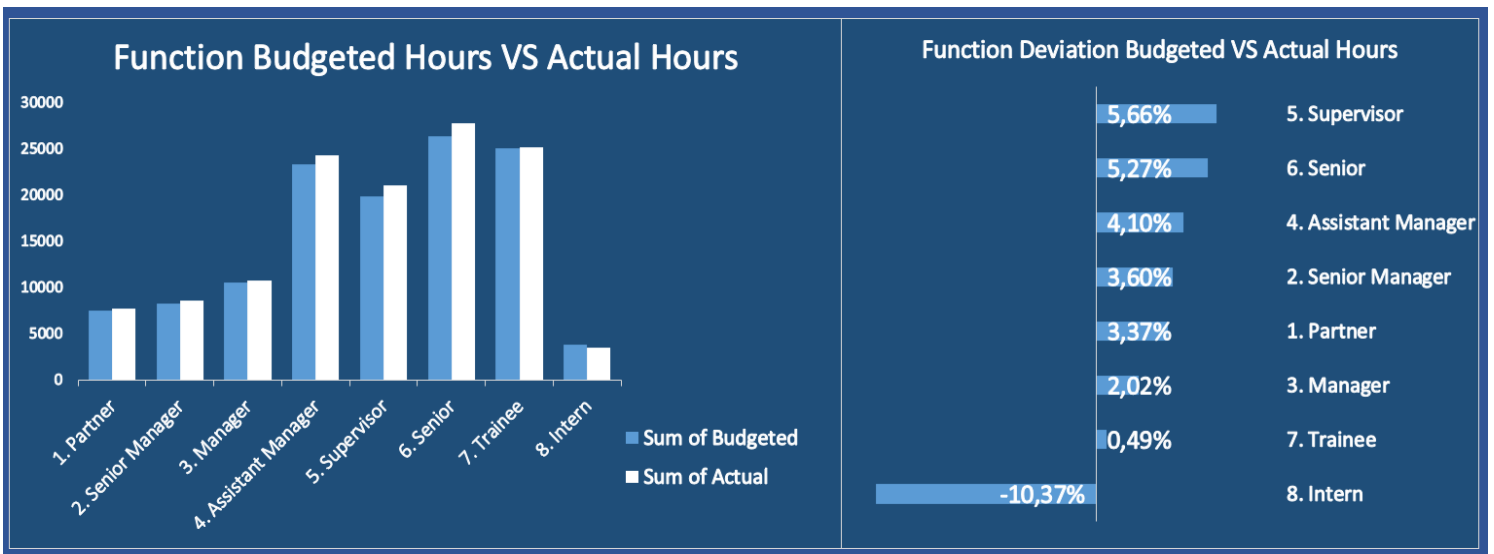


Figure 17, Graphs function budgeted hours VS actual hours