Transforming financial auditing with data-analysis at a Big4 audit firm: all aboard

A descriptive case study of the change and stakeholders involved

SPM5910 SEPAM Master Thesis Project
Transforming financial auditing with data-analysis at a Big4 audit firm: all aboard

A descriptive case study of the change and stakeholders involved

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Preface

This thesis is the outcome of the research I have performed during a large part of 2014, while interning at a Big4 audit firm. The research forms the graduation project for the Master of Science degree in Systems Engineering, Policy Analysis & Management from the Delft University of Technology.

This research deepens the understanding of how data-analysis is changing the financial audit of financial institutions in practice from multiple perspectives. It can be used to manage this audit transformation more adequately at the reviewed Big4 audit firm and other audit firms as well. This is valuable because data-analysis has great potential for better auditing and therewith a better working financial world.

For being able to successfully perform this research, I would like to thank my supervisors from the Delft University of Technology, namely Marijn Janssen, Joris Hulstijn and Bram Klievink. Their guidance and comments aided me in reflecting on my research and herewith stimulated the quality of the research and my learning experience. Moreover, I also owe a big thank you to Tjeerd Nieuwenhuizen and Natascha Hasperhoven, who set me on the right track and were always available for help. I'm especially thankful for the opportunities given to me by the audit firm. Many doors opened up to me. Everybody at the firm was always helpful in showing me how data-analysis is transforming the audit in his/her perspective. Everybody was always happy to discuss the subject with me. And everybody was always cooperative in setting up and carrying out interviews.

Amsterdam, January 7th,

Florian de Vries
Executive Summary

Increasing demands from clients, increasing regulatory pressure, and increasing technological opportunities are forcing and enabling the, in this study concerned, Big4 audit firm to reconsider its way of approaching the financial audit. In particular data-analytics has a huge potential for improving the effectiveness and efficiency of the auditing process (Dowling & Leech, 2014; Moffit & Vasarhelyi, 2013; Munro & Stewart, 2011; Werner et al., 2012). Moreover, the competition, which is more present than ever due to mandatory auditor rotation, isn't sitting on their hands either. To remain a business leader, it is essential to transform the financial audit approach in a successful manner. The reviewed firm acknowledges this and has installed an ‘audit transformation team’ to stimulate and guide the change.

Yet, it is unknown how data-analytics will affect the financial audit in practice because of its novelty and because most literature is technology-driven (Jans et al., 2013; De Swart et al., 2013; Vasarhelyi & Romero, 2014; Vasarhelyi et al., 2014). Additionally, De Swart et al. (2013) and Vasarhelyi & Romero (2014) have already identified a lack of utilization of the full potential of data-analysis, while tools are already available. This indicates that support from auditors for the transformation might be lacking, while it is essential for successful change (Pendlebury et al., 1998). If financial auditors are supportive of more data-analysis in the audit is currently unknown as well. A lack of support can negatively influence the adoption of data-analysis techniques and therefore the audit transformation (Kim, 2002).

These uncertainties form complications that, if not addressed appropriately, can lead to a change failure, and consequently to missing market opportunities and reduced client satisfaction. Hence, better understanding the impact of data-analytics on the financial audit in practice and the attitudes of internal stakeholders (audit staff, management, partners and IT-auditors) is crucial for a successful audit transformation and the firm’s continuity.

The purpose of this study is therefore to provide understanding on these uncertainties and to offer much needed insights on the data-analysis induced audit transformation by answering the following two research questions:

1) ‘How is the use of data-analysis transforming the financial audit of financial institutions in practice with respect to the audit approach, data and tooling?’;
2) ‘Are the firm’s key stakeholders supportive of the data-analysis induced transformation?’

These questions are answered through five sub-questions that were separately formulated based on extensive literature review. The research method for answering these questions is a case study, where the concerned audit firm forms the subject. Within the firm, two engagements with intensified use of data-analysis, or ‘pilot cases’, were selected to examine the impact of data-analysis on the audit by means of interviews and document analysis. A stakeholder approach - consisting of a stakeholder analysis, additional literature reviewing and semi-structured interviews - is used to identify the key stakeholders and subsequently to assess their support. Given its purpose and research questions, the study is descriptive and mainly of a qualitative nature.

Several findings on how the use of data-analysis is transforming the financial audit are considered as main results. Firstly, data-analysis enables testing whole populations and leads to better understanding the business. Second, the use of data-analysis in the financial audit sets a cost of adoption, which is of more than only monetary nature. The ‘cost’ appeared to be at least two-sided: auditors need to familiarize themselves with the use of data-analysis, and the data-
analyses must be fitted to the auditee as well. More aspects to the cost of adoption were identified in the stakeholder approach. Third, the use of data-analysis leads to the identification of more outliers. To deal with this, auditors look for patterns to explain the outliers, instead of following them up separately. Fourth, data-analysis is currently not changing the audit approach as whole at the firm; only activities within steps change so far.

Further, one can conclude from the examined engagements that data-analysis is not being used to its full potential: in the engagements it was only used at seven audit steps collectively, while there are fourteen audit steps identified as possible locations for data-analysis. Hence, the use of data-analysis has not transformed the financial audit to its full potential yet. It can even be considered that there is still a long way to go in the audit transformation.

The main findings resulting from the stakeholder approach are threefold. First, the financial audit staff and management are the key stakeholders, and their full support is essential for a successful audit transformation, since their day-to-day business is at the core of the transformation. Second, the audit staff and management are generally considered to be supportive of the change when assessed on the relevant elements. However, they do believe that communication on the change can be improved. They are particularly unsure about how data-analysis is to be applied with added value. Third, there is more to the cost of adoption than the technical two aspects identified earlier: there are process-oriented aspects, or barriers, such as the lack of and need for effective communication and there are institutional barriers as well since the current institutional setting for instance does not incentivize auditors enough to use data-analysis.

The research shows that the cost of adoption can be regarded as a collection of barriers that is substantially obstructing the audit transformation and its management. The reason for this is that the cost is part of a larger trade-off that is at the core of the situation, namely the chargeability vs. innovation trade-off: the focus on chargeability impedes auditors becoming familiar with data-analysis and using it. One identified underlying cause of this trade-off is a misalignment of short-term goals (chargeability) and long-term goals (firm development).

The following recommendations are most important. First, the short and long-term goals should be better aligned to reduce the cost of adoption for staff and managers, by, for instance, creating short-term wins such as rewards for the auditors when they apply more data-analysis. Another way to reduce the cost of adoption is to start applying data-analysis immediately in the first year of new auditee clients and thus enabling the involved parties to benefit from the advantages of data-analysis straightaway in the time-limited auditor-auditee relation.

A second recommendation is to inform financial auditors about the transformation in a more proactive manner, especially in terms of the application of data-analysis and on the possible efficiency gains. A good means for this is the promulgation of one or more success stories that clarify the added value. These should then be communicated through regular team meetings, email updates, etcetera.

The audit partners at the firm and the audit transformation team should play their constructive part in accomplishing these recommendations. To become better acquainted with data-analysis, the staff should actively pursue more training, which should then also be provided and facilitated by the firm.

When interpreting the results, it is important to take into account that the study was limited by the fact that only two progressive engagements have been examined. Also, the recommendations should be further specified before they are acted upon.
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Part A

Introduction
1. Introduction
First an introductory overview is presented. Later sections will introduce the research with more detail.

1.1 Introduction Overview
Market circumstances, such as increasing technological opportunities and client demands, have inspired a Big4 audit firm to update their financial audit approach. Accordingly, the firm has installed an audit transformation team to guide the transformation towards a situation in which data-analysis is used more prominently in the financial audit process.

There are several complications in this transformation though. In particular, it is unsure how the use of data-analytics will transform the financial audit with respect to the audit approach and tooling. Also, support for the transformation is likely to be needed from the financial auditors and other employees since they will need to apply it, but this support is currently unsure in both components (type of support) and presence (is there support?). These complications can, if not addressed appropriately through change management, lead to a change failure, and consequently to missing market opportunities and reduced client satisfaction. Therefore, a better understanding of the complications is crucial for a successful audit transformation and for the firm’s continuity.

Hence, the goal of the research, which has a descriptive nature, is to deepen the understanding of the data-analysis induced transformation of financial auditing at a Big4 firm, including the aspect of internal stakeholders support of the transformation as well.

Two main research questions have been formulated to reach this goal:

MRQ1: How is data-analysis transforming the financial audit of financial institutions in practice with respect to the audit approach, data and tooling?

MRQ2: Are the firm’s key stakeholders supportive of the data-analysis induced transformation?

These questions will be answered through sub-questions (formulated in 1.3.1) for which the central research method will be a case study. Within the case study two progressive audit engagements have been selected to analyze in regard to the use of data-analysis. Methods used under the ‘case study umbrella’ are literature reviewing, document analysis, stakeholder analysis and semi-structured interviews.

This report will consequently describe how the audit approach is changing at a Big4 audit firm, illustrated by the results from the case study. Hereby a stakeholder approach is used as well to identify the difficulties faced in this transformation and to examine the attitudes of internal stakeholders towards the change.

1 with intensified use of data-analysis
In this introduction chapter a brief literature review is presented to position the research before presenting the problem statement, research objective and later on the research questions and methods. A more thorough literature analysis will follow in Chapter 2. The structure of the total report is given at the end of this chapter.

1.2 Research Problem
The research problem will be described by discussing the research motive and by presenting the current state of research on the subjects of auditing and employee support, a problem statement, the case, and the research objective and relevance.

1.2.1 Research Motive
Financial auditing is under pressure. One cause for this is increasing competition, which is inspired by the audit rotation regulations (Van der Heijden, 2014). Another cause for this is that the relevance of financial auditing is questioned: many frauds go unprevented (Driessen & Van der Heijden, 2004) and the value of an auditor’s opinion that is given only once a year is questionable in the current real-time economy (Lombardi et al., 2014).

Together with increasing technological opportunities and client demands, this has inspired audit firms to evolve. One part of this movement concerns transforming the audit by making further use of data-analytics. The use of data-analytics can tackle the increasing competition on two sides: financial audits can be performed more efficiently and audit quality can be increased because of richer insights (internal source). The use of data-analysis can also bring more assurance by testing whole populations instead of using samples. Adequate use of data-analysis use allows a higher detection rate of accounting errors and possible frauds (Coderre, 1999).

A Big4 audit firm has recognized this need for change and the accompanying change management and has installed an audit transformation team in its Amsterdam office. The task of this team is to guide the transformation towards a situation in which data analysis is used more prominently in the financial audit process. This team is focused on the financial sector and hence the auditing of banks, insurance companies etcetera. They emphasize that the market and regulators need a renewed focus on audit evidence quality. They also state that data-analysis is expected to improve the ability to deliver richer business insight and that analytics will lead to a better understanding of clients’ processes (internal source).

There are several complications in this transformation though. In particular, it is unsure how the use of data-analytics will transform the financial audit with respect to the audit approach and tooling. Also, support for the transition is likely to be needed from the financial auditors and other employees, since the financial auditors (staff especially) will be the end-users of data-analysis tools and the other employees will probably be affected as well, as the nature of the core activity of an audit firm - auditing - is about to change. Since the audit transformation is primarily technology-driven and the focus so far has been on

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2 ‘Internal source’ refers to non-public documents and other information sources that were consulted at the reviewed Big4 audit firm.
developing tools, the support of employees hasn't had much attention yet. This support is subsequently unsure both in components (type of support) and presence (is there support?).

These complications can, if not addressed appropriately through change management, lead to a change failure, and consequently to missing market opportunities and reduced client satisfaction. Hence, a better understanding of the impact of data-analytics on the financial audit in practice and of the attitudes of internal stakeholders (audit staff, management, partners and IT-auditors) is needed for successful change management, which is crucial for transforming the audit and for the firm's continuity.

1.2.2 Problem Division
In the previous paragraph it became clear that complications lie within two related areas, namely: the financial audit (“how data-analytics transforms the audit”) and the management of that change. Subsequently, the problem can be divided according these two aspects.

The first aspect is mainly technical and financial auditing stands central. It provides an understanding of the nature of the transformation, which is needed to grasp the second aspect. The second aspect addresses the involvement of the concerned internal stakeholders and their attitude towards the change. So a change management perspective on the transformation is provided as well.

The interconnectedness can be explained as follows: Understanding the impacts of data-analysis in the audit is needed to explore the stakeholder aspects of the audit transformation. And understanding the stakeholder’s perspectives on the audit transformation assists interpreting the impacts of data-analysis on the audit. Using the synergy, these two aspects give a good view of the audit transformation that is needed to answer the questions and to draw uniform conclusions that connect the two aspects.

1.2.3 Literature
The current state of research is presented per aspect.

Data-Analysis in the Financial Audit
External financial auditing is the process of verifying financial statements of a company or a subdivision thereof and to prepare and provide an opinion regarding the assurance they can give on its appropriateness (Johnson et al., 2002). And data-analysis is the process of reviewing, transforming and visualizing data for purposes of obtaining information, predicting, formulating conclusions or supporting decisions.

Moffitt & Vasarhelyi (2013) identify data-analytics as having huge potential for efficient auditing. De Swart et al. (2013) also recognize the potential, but a lack of utilization of data-analytics as well. It can also benefit effectiveness since more assurance can be given on financial statements and records if a whole population of for instance transactions is
tested instead of samples (internal source). Data-analytics enables this since it gives auditors a way of swiftly inspecting large masses of these transactions for instance.

The environment of auditing is changing and auditing itself should adapt and change along. Vasarhelyi & Romero (2014) observed that this is already happening with technology meant for data-analysis. They applied a case study approach at a large audit firm to examine the usage of technology. In their case study Vasarhelyi & Romero (2014) found that enough technological tools are available to facilitate auditors in updating their approach, but that the use of the tools is not optimal.

Lombardi et al. (2014) discuss the current state and future of auditing. They argue that the business environment has evolved more rapidly than the audit profession, since decisions in the market are being made on real-time information while the auditor’s opinion is given once a year historically.

Vasarhelyi et al. (2014) argue that exploiting the automation opportunities and shifting the tool set will lead to the audit program—a structured set of procedures and policies that an audit firm uses to dictate how the audit should be performed—becoming a combination of automated steps, manual linkages, and auditor judgment. Consequential result will then be a flexible, modular and adaptable approach that can be fitted to requirements of the environment. Main difference from the current approach seems that dependence on data is growing, while dependence on client data systems and data requests will belong to the past in their vision. This should be realized with a common data storage.

It appears that data-analytics technology is ahead of the practice in financial auditing. And so, because the literature is technology-driven, we can speak of a theory-practice gap. More literature is discussed in chapter 2, including paragraph 2.3 that contains the research model for the audit transformation.

**Employee Support in Change Management**

The goal of the audit transformation team is to change the audit approach. To make this change, which is an episodic change in work approach that involves technology through data-analytics and tools, successful, adequate change management is needed.

Change management can be simply defined as the task of managing change. A more elaborate definition is that of Nandeshwar & Jayasimha (2010; p4): „Change management is the process, tools and techniques to manage the people side of change process, to achieve the required outcomes, and to realize the change effectively within the individual change agent, the inner team, and the wider system which includes the organization”

This is complex though; there are various stakeholders (financial audit staff, management, partners, IT-auditors e.g.) to deal with for instance and their support is expected to be essential since they will need to apply and coordinate data-analysis. The support of these stakeholders has not been examined yet though in the case and in general.
The complex nature of change management is evident by the number of change and transition processes that fail, while a lot of time and other resources often have been invested in managing them (Kotter, 2007; Strebel, 1996). They simply don’t lead to the intended changes. Smith (2006) has identified some common reasons for this such as:

- Lack of change readiness
- Failures in the leadership and management of the change program
- Ineffective communication

Smith (2006) has also identified nine fundamental interrelated elements for a successful transition:

**List 1. Smith’s Nine Fundamental Interrelated Elements (2006)**

<table>
<thead>
<tr>
<th>Elements for Successful Transition and Achieved Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure readiness for change</td>
</tr>
<tr>
<td>Plan for change</td>
</tr>
<tr>
<td>Lead change</td>
</tr>
<tr>
<td>Manage change</td>
</tr>
<tr>
<td>Deal with resistance to change</td>
</tr>
</tbody>
</table>

While this collection is rather general and can be debated, it is clear that employees are key to a successful change in a firm, but at the same time people can also be the reason of failure. Hence, the research will use a stakeholder approach to change management to enhance the transition to next generation auditing within a Big4 firm. This approach consists of a stakeholder analysis that focuses on the firm’s employees and an evaluation of employee support for the transition at the firm.

One of the most important stakeholder aspects of change management (Pendlebury et al., 1998) is support of employees for the change. Support of employees is a somewhat vague term though and needs to be further defined according the characteristics of the concerned change.

Change support of employees for change is not only important for successful change, but also for employee performance, job satisfaction and job retention, since these will be negatively affected if employees have to go through a change that is not supported by them (Kim, 2002). And thus it is essential to take these aspects also into account in the case study of the audit transition at the Big4 firm. Especially since it is currently unclear how internal stakeholders at audit firms feel about changing their work approach. And often people don’t appreciate change by habit (Levin, 2012).
1.2.4 Gaps

It appears from all mentioned articles on auditing that data-analysis is inspiring a transformation. However, most of the literature is not derived from current general practices; the literature is technology-driven instead. This results in a theory-practice gap that shows a need for more practical oriented studies to add to the understanding of the evolution of audit approaches. It also becomes clear from the literature that interesting aspects of this transformation are the audit approach itself, the use of technology, the use and handling of data and data-analytics, and the difficulties in adopting new practices. It is interesting to see how the technology push from the literature connects to efforts in practice with respect to knowledge, experience and faced difficulties, and this study enables that.

In addition to this theory-practice gap, another issue has been identified: the perspectives and views of audit staff on new approaches have not been researched comprehensively. The study of Lombardi et al. (2014) for instance was focused purely on high level professionals such as partners and CEO’s. It would be interesting to study the perspectives of lower staff on a new approach, especially since they are the end users of the tools.

Also, employee support for change is much needed for the Big4 firm that is trying to change. There’s a need to know if the employees are supportive of the change and what underlies their support or lack of support. Two more research gaps have now surfaced: What factors determine employee support in a change like the audit transformation? And on a more practical note: who are the key internal stakeholders and are they supportive and why or why not?

By addressing these gaps in the research, it is expected that much can be added to the understanding of the evolvement of auditing.

1.2.5 Problem Statements

In an effort to synthesize what is mentioned before and make the problem more specific two problem statements have been formulated. Again, the problem has been divided in the transformation of the audit and the employee support. This has been done to clarify the problem statement since the research is also about complications in the two subjects. Both subjects are captured in one research project, since they cannot be seen apart from each other: the transformation can’t be successful without employee support and the employee support depends on a clear vision or objective of how auditing is transforming and its consequences for the employees.

1. It is uncertain how the use of data-analysis is transforming the financial audit of clients from the financial sector at a Big4 audit firm with respect to the audit approach and tooling.
II. Employee support for audit transformation is critical for successful change, but is unsure in both components as presence.

1.2.6 Case Study
The Dutch Big4 audit firm with their audit transformation team can be seen as the overall case in this case study. This team, focused on the audit for clients from the financial sector, concerns the EMEIA division of the firm and its core exists of four team members that are based in the firm’s Amsterdam office. Hence, the scope of this research aligns with their scope: financial audit for clients from the financial sector.

Within this overall case two sub cases have been selected. Their availability was of utmost importance for the research. These sub cases are pilot audit cases that were guided by the audit transformation team: a past engagement at an insurance company and an engagement at a commercial bank that has been followed as a live case. The cases were selected for their progressive use of data-analysis and because the insurance company and commercial bank fit the financial sector scope. Hence they are very interesting to examine with respect to the theory-practice gap. Moreover, they fit the research objective and are suited for performing the research.

By combining audits at different types of clients and with different focus areas of the data-analysis, these two cases give a complete view of the current impact of data-analysis in the financial audit of financial institutions as illustrated in the figure.

<table>
<thead>
<tr>
<th>Data-analysis deployment</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Insurance</td>
</tr>
<tr>
<td><strong>Focus</strong></td>
<td></td>
</tr>
<tr>
<td>Journal entries</td>
<td>Large Dutch insurance company engagement</td>
</tr>
<tr>
<td>Substantive procedures</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 1. Complete View with Subcases Matrix

1.2.7 Research Objective, Relevance and Scope
For the problem statements research objectives have been specified. They have been split for the same reasons as the problem statement. The research objectives are:

I. The objective is to deepen understanding of the data-analysis induced transformation in financial auditing at a Dutch Big4 audit firm.

II. The objective is to examine the transformation from a change management perspective by assessing internal stakeholders’ attitudes towards it.
Additionally, confined recommendations for the change management will be drawn from the conclusions, but this is not a main objective.

The expected relevance of the research is twofold. It has both a practical and a scientific aspect.

**Practical Relevance**
Firstly, the research is expected to have practical relevance because it enhances the understanding of the data-analysis induced change within the firm and it can enhance the change management within this firm. Knowing the elements that form support for change is valuable for management and understanding employee support can contribute to better management of the transition. The expected knowledge gains on their perspectives on change are thus relevant.

Secondly, by enhancing the change management within the firm it can stimulate progress in the auditing practice. This research might lead to a more adequate use of data-analysis in the audit, which can lead to higher detection rate of error and fraud as earlier explained. And this way auditing can gain more relevance and serve the society better by preventing and detecting frauds at companies, in which pension funds have invested for example. This 'societal' relevance is considered part of the practical relevance.

**Scientific Relevance**
This report describes how the audit approach is changing at a Big4 audit firm in The Netherlands by performing a case study and using a stakeholder approach to identify faced difficulties in this transformation and examine the attitude of internal stakeholders towards the change. This is scientifically relevant, because it contributes to the current state of literature about data analytics in auditing that is mainly technology-driven. This research enables the connecting of efforts in practice to the literature. Also, with a better understanding of the topic, both researchers and professionals can guide auditing to a higher level of efficiency and accuracy.

We also expect to make a small contribution to the change management field. This case gives us the possibility to study the attitude of financial auditors towards the technology-driven change. Despite it being a case study at a single firm, the results can be converged since Big4 audit firms have identical structures and are affected by the same market dynamics.

**Scope**
Several scope aspects have been mentioned before. Underneath an enumeration is presented to make clear where the research will focus on and what is left out of the scope.

- The first part will focus on the change of financial auditing (involving mainly financial auditors, but also IT-auditors) for clients drawn from the financial sector (banks, insurance companies e.g.), the consequences of the change to their work activities and difficulties being faced.
The second part will focus on employee support from a change management perspective, since employees are key for successful change.

The research will be done within a Big4 accounting firm in the Netherlands.

The research will focus on the change for the financial services department: we will examine cases that involve clients of the audit firm from the financial sector (e.g. banks and insurance companies).

1.3 Research Questions and Methods

1.3.1 Research Questions

Based on the research gaps two main research questions (MRQ) are formulated that are central in the research. These are subsequently divided in sub research questions (SRQ) through which they will be answered. Therefore, the sub-questions are formulated to cover the main question, but they are also adapted to what is known and unknown in academic literature. SRQ 1 and 2 are formulated to answer MRQ1, while SRQ 3-5 serve MRQ2.

Main Research Questions

**MRQ1:** How is data-analysis transforming the financial audit of financial institutions in practice with respect to the audit approach, data and tooling?

**MRQ2:** Are the firm’s key stakeholders supportive of the data-analysis induced transformation?

Sub Research Questions

**SRQ1:** How is data-analysis applied in progressive engagements, and what were the experiences?

**SRQ2:** What are the application’s consequences for auditors and their activities?

**SRQ3:** The support of which internal stakeholders is needed for a successful change in the financial auditing approach in a Big4 firm?

**SRQ4:** What elements, with respect to the case and alike situations, generally determine employee support of change?

**SRQ5:** Can the firm’s key stakeholders be considered supportive of the audit transformation?

1.3.2 Research Approach and Methods

The approach of the research can be summarized as a descriptive qualitative research approach based on the several methods: case study (observations), document analysis, literature review, semi-structured interview and a stakeholder analysis.

The case study serves as umbrella method. Central in the case study is the comparison of expectations (on the use of data-analysis in the financial audit) from the theory with experiences from practice. A case study is defined by Yin (2003) as an empirical enquiry to examine facts in its context. Yin also names the ability to deal with a variety of evidence
(documents, interviews and observations e.g.) as the great strength of a case study. This is very much in line with the stated research and fits the questions and their suited methods. Eisenhardt (1989) points out that the case study approach is wanted if empirical research on a topic is limited. A case study is thus suitable for the problem, since it was observed that the literature might be out of line with practice in the introduction. Consequently, because of the research context, a case study as overlapping method is an appropriate way to go about this research. Moreover, a case study at an audit Big4 firm, in combination with the two pilot cases, allows us to examine the use of data-analysis at the business front.

The other named methods - mainly data collection methods - are used under the case-study umbrella. These and their deliverables are briefly presented beneath per sub-question. The chapters that deal with the sub-questions contain more detailed method descriptions.

**SRQ1: How is data-analysis applied in progressive engagements, and what were the experiences?**

**Method:** Case study at the two mentioned engagements with a research model (see paragraph 2.3), including interviews with involved auditors and document analysis to gather data. Expectations from theory will be compared with experiences in practice.

**Result/Deliverable:** Description of appliance.

**SRQ2: What are the application’s consequences for auditors and their activities?**

**Method:** Case study at the two mentioned pilot cases, including interviews with involved auditors and document analysis to gather data.

**Result/Deliverable:** Description of consequences for auditors.

**SRQ3: The support of which internal stakeholders is needed for a successful change in the financial auditing approach in a Big4 firm?**

**Method:** Stakeholder analysis with methodology of Murray-Webster & Simon (2006) based on the firm structure and observations during the case study (for instance at internal presentations and through ‘off-the-record’ notes during interviews).

**Result/Deliverable:** Mapping of internal stakeholders based on their power, interest and attitude. Plus additional insights on key stakeholders.

**SRQ4: What elements, with respect to the case and alike situations, generally determine employee support of change?**

**Method:** Literature review.
Result/Deliverable: List of elements that determine employee support of a change. Example: ‘sense of urgency’.

SRQ5: Can the firm’s key stakeholders be considered supportive of the audit transformation?
Method: Semi-structured interview based on the result of SRQ4.
Result/Deliverable: Assessment of financial auditor’s support. Example: there is high sense of urgency; Underlying issue: awareness on competition.

Also, based on the results confined recommendations are drawn (refer to paragraph 8.2).

1.3.3 Data Collection
Most essential for the research was the availability of enough people in the relevant roles (financial audit staff; managers; partners; IT auditors) who were willing to be interviewed about the earlier mentioned progressive engagements and their perspective on the audit transformation, as well as primary data sources (audit methodology; audit plans; task descriptions; tooling documents)
Numerous people have been interviewed about the use of data-analysis in the financial audits in general and the two mentioned engagements in particular. Various documents, such as documents on data-analysis tools and the audit methodology, have been examined as well for the first main research question. An overview of these sources is presented in appendix 3.
For the interviews on employee support no less than eight respondents have been found willing. These eight have various client focuses within the financial sector and various levels of experience with data-analysis. And so, data was adequate for the research.

1.4 Report Structure
To bring order in the report the whole research is divided - according the research structure - into the following parts:
- Part A: Introduction
- Part B: Auditing
- Part C: Change Management
- Part D: Conclusion
- Part E: Appendices
- Part F: Scientific Article

Part A is this introduction. The reader should now have an understanding of the research environment, the problem situation / research opportunity, the objective of the research and the questions that will be answered.
The first of two parts of the research will be dealt with in Part B. Part B contains three chapters of which the first will provide more context on data-analysis and auditing. The following two chapters (3&4) correspond with the first two sub research questions: Chapter 3 will describe how data-analysis is applied in the progressive engagements; Chapter 4 will subsequently deal with the consequences for auditors.

Part C then handles the second part of the research, namely the change management part. It will start with a stakeholder introduction in chapter 5. In chapter 6 a review on literature on employee support in change will be presented. From this review several elements are derived that determine support. Through these elements the level of support will be assessed under the key stakeholders. This will happen through semi-structured interviews and is addressed in chapter 7.

Part D contains the conclusions, in which the research questions will be explicitly answered, recommendations and a reflection. Part E contains all the appendices, like the stakeholder analysis and interview guide for instance. Part F is the last part of this report and this is the scientific article that is written based on the research.
1.5 Research Framework

The research is summarized in the picture below that contains the research questions and steps in the middle, the environment (scope) on the left side and the methods on the right side.

Figure 2. Research Framework

Also, a research model has been designed that specifically addresses the theory-practice gap (in this figure located next to SRQ1). This model is presented and discussed in paragraph 2.3.
Part B

Auditing
2. Context of the Audit Transformation

This chapter gives an introduction to the audit domain and its context.

2.1 External Financial Audit Domain

External financial auditing is the process where financial auditors verify financial statements of a company or a subdivision thereof and prepare and provide an opinion regarding the assurance they can give on its appropriateness (Johnson et al., 2002). The audited entity is called the auditee. This verification process is needed since the financial statements, which are used for reporting to shareholders for instance, usually come from the internal organization and they could in principle be manipulated and so independent and objective verification is needed, to provide additional assurance to all stakeholders. This verification is done by the external auditor.

Subjects for verifying are:

- do the financial statements appropriately follow generally accepted accounting procedures or standards?
- do the financial statements truthfully reflect a company’s financial position and is all relevant information adequately disclosed?

This verification is done for a given period. Standard for this is the fiscal year. Interim statements as semi-annual and quarterly reports are also often subject to an external audit or a review. This chapter is focused on the end of year audit, but most is applicable to interim audits as well.

Generally accepted accounting standards are for example the International Financial Reporting Standards (IFRS), issued the International Accounting Standards Board (IASB). These IFRS are mandatory for every stock market listed company in the EU and other countries are moving to adaption as well (Chen, 2013; IFRS, 2013).

Generally, the result can be a clean (or so called unqualified) opinion, a qualified opinion, an adverse opinion or a disclaimer of opinion (PCAOB, 2014a; NBA, 2014). The latter three can also be collectively named as a modified audit opinion, which means that the financial auditor disagrees with the auditee on the financial statement and the financial statement needs to be modified before a clean opinion is given. The external auditor’s opinion is presented in the auditor’s report that generally is part of the annual report of the audited company.

The fact that this is done by an external and independent party should facilitate confidence in the company and its financial statements. Parties in the general public who are interested in the auditor’s opinion are stockholders, pension funds and the auditee’s clients for instance.
Core purpose of the external financial audit is verifying the financial statements. Assessing the risk of material misstatement (due to error or fraud) is key for this purpose, but the external financial auditor can also detect business performance trends. This adds value to the audit and can help the auditee in their business. A rigorous audit will likely lead to insights about areas that can be improved, like controls or processes (PWC, 2013). The auditor can communicate those to the auditee and in this way the audit has more quality than when only verifying the financial statements.

External financial audits are often obligatory for larger companies, like in most EU member states and for stock listed companies, but not always (Lennox & Pittman, 2011). However, many larger companies choose for an external audit, because it likely increases confidence in their financial communication and herewith eases their business (Cassel et al., 2013). High confidence in a company's financial position lowers the company's cost of attracting capital for instance.

Many companies, like those who are listed on the stock market in the United States, are also obliged under the Sarbanes-Oxley Act to give an 'in control' statement signed by the company's Chief Executive Officer and the Chief Financial Officer. This statement declares that internal risk management and control systems focused on the financial statements have been effective. This is often performed in combination with the financial audit, since key-control testing is part of the audit approach as will be explained in paragraph 2.4.

The Sarbanes-Oxley Act (SOX), which was established in 2002 due to failing internal and external controls at companies such as Enron, accordingly has an important section on these controls focusing on the financial statements, namely SOX 404. SOX 404 states that the annual report of a company should also contain an assessment on the adequacy of internal controls on the financial reporting by the external auditor (Soxlaw, 2014).

This act focuses on the US since the standards SOX sets are only mandatory for companies listed in the US. Many foreign companies however are also listed in the US and this makes the act also relevant on worldwide scale. Moreover, companies also choose to comply voluntarily because it increases confidence in them and lowers their cost of capital (Cassell et al., 2013).

SOX has been an important measure to establish additional assurance for the financial reporting of companies and affected therewith the work of external financial auditors. Big consequence for external financial auditors of SOX (and mainly SOX Section 404) is that there is more focus on controls testing in the audit approach.

2.2 Audit Environment: Under Pressure
The environment of external financial auditing is currently dynamic. Several drivers of the dynamicity can be identified in the literature: regulation and supervision, standardization, and IT & automation.
Regulation in external auditing is evolving and regulatory pressure is increasing (Dowling & Leech, 2014). This is leading to an increasing cost of compliance (Munro & Stewart, 2011). This also means additional work for auditors, which is good for them if they can translate it to more revenue. One way this evolution is directed is the frequency: it is expected by some that regulation authorities will increase the expected reporting frequency (Welters & De Kimpe, 2013). Another impelling regulation issue is the audit rotation, which is introduced in the EU to create more competition between audit firms and to increase quality of audits and therewith to increase the confidence in the financial system (European Commission, 2014; Van der Heijden, 2014). Banks and financial institutions are subject to this regulation.

More and more technical standardization, like the standardization of data formats, is being prescribed as well (Hoy & Foley, 2014; Messier et al., 2012). The American Accounting Association (Titera, 2013) is now also arguing for revision in audit standards (the Generally Accepted Audit Standards (GAAS) in particular) to enable more data analysis and to promote the use of technology in audit.

Moving to the topic of data-analysis: Automation (of business processes at the client), the third driver, also enables an emerging role of data analysis (Titera, 2013), because of the substantial use of IT and data generation. This data can be mined and used for data-analysis in auditing for instance (Werner et al., 2012).

Another important cause in this dynamic environment for the pressure on auditing is the increased competition that is supported by the audit rotation regulation: EY managing partner Marcel van Loo claims that audit fees have already decreased with 10 to 25% (Van der Heijden, 2014) due to the obligation of auditor’s rotation.

On top of the increasing competition auditing is also under pressure by questions raised on the relevance of the profession as a whole. The value of auditing can be unclear to people. First, this is because the auditor’s opinion is usually given only once a year, while the economy is real-time (Lombardi et al., 2014): stocks from audited companies are being traded continuously. Second, there have been several frauds and scandals that went undetected or unprevented by the responsible external financial auditors: Landis³ blamed EY for their bankruptcy and EY had to pay hefty in a settlement (Piersma, 2013); In another case, the liquidator found that PwC auditors uncritically approved annual reports of bankrupt Econcern⁴ (Driessen & Van der Heijden, 2014).

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³ A Dutch ICT company that went bankrupt, while financial statements were promising and verified by EY and 3000 people lost their jobs (“Landis ging Failliet door Misleiding”, 2007).
⁴ Econcern was an international holding company with 1400 employees that went bankrupt in 2009.
Moreover, in the event of Lehman Brothers\(^5\), the auditors from EY even assisted in bringing about the demise with their questionable actions with regard to the financial statements (Valukas, 2010). The other Big4 audit firms have had damage to their reputation as well; KPMG for instance created tax shelters to help clients evade billions of dollars in taxes 2005 and had 6 partners criminally indicted (Gerakos & Syverson, 2014).

These and more scandals have led people to question the quality and societal relevance of auditors, while it can also be argued that these scandals prove the societal relevance and need for quality and for independent auditing.

Enabled by technological innovations and increased standardization, we believe that data-analysis has the potential to become a decisive part of the audit. Using data-analysis in external financial auditing anticipates on the other environment aspects too as can be deducted from the above discussed literature:

- Data-analysis can enable a higher frequency in auditing since it can automate (parts) of the audit and hereby react more on real-time needs and on expected regulation on higher frequency in audits.
- Data-analysis can reduce audit costs by making audits more efficient and herewith counter the increasing cost of compliance.
- The cost reduction can also be decisive for an audit firm's continuity in an increasingly competitive environment.
- Data-analysis can increase the value of an audit by providing the auditor the ability to give the auditee more insight in their data and in their processes.
- This increased value can, together with more assurance (more quality) by testing whole populations instead of samples, increase faith in the audit profession and auditor's judgments.

Subsequently, four reasons or goals for the use of data-analysis in the audit can be deduced (Lombardi et al., 2014; Moffitt & Vasarhelyi, 2013; De Swart et al., 2013; PWC, 2013; internal sources):

**List 2. Possible Goals for Data-Analysis (DA) in the Financial Audit**

<table>
<thead>
<tr>
<th>Possible Goals for DA in the Financial Audit</th>
</tr>
</thead>
<tbody>
<tr>
<td>More efficiency</td>
</tr>
<tr>
<td>More quality</td>
</tr>
<tr>
<td>More value</td>
</tr>
<tr>
<td>Higher frequency</td>
</tr>
</tbody>
</table>

Of the above goals, quality is the most important one for the financial audit, because that is at the core of the financial audit (main goal: verifying the financial statements; refer to

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\(^5\) Lehman Brothers was a global financial services firm that went bankrupt in 2008 with a record $600 billion debt (Mamudi, 2008) and played a large role in the financial crisis.
paragraph 2.1). The other goals in list 2 are also very relevant for data-analysis in the financial audit according the academic literature and various other sources. These goals are also taken into account in the research through the research model that is presented in the next paragraph.

2.3 Audit Transformation Research Model

A research model (figure 3) has been constructed to guide the case study for part A. The position of this model in the whole research becomes clear in the research framework in figure 2. The model will guide the bridging of the theory-practice gap. This gap exists because, as earlier explained, the literature is mostly technology-driven and the practice is business-driven (time pressure, budget pressure e.g.).

Expectations from theory will be compared with experiences from practice (the two progressive engagements) to bridge the gap. Theory and practice come together in the application of data-analysis in the financial audit through the audit approach, audit steps, audit activities and audit tools (auditors and audit guides combine knowledge from the theory with knowledge from practice in the audit process). The application will be studied through the case and progressive audit engagements. Goals of the application of data-analysis in the financial audit, as identified in the literature (Lombardi et al., 2014; Moffitt & Vasarhelyi, 2013; De Swart et al., 2013; PWC, 2013) and internal sources, are more quality, more value, higher frequency, and more efficiency.

The expectations from the theory are divided in advantages of the use of data-analysis in the financial audit, the disadvantages of that use, and the impact of that use on audit prerequisites.

First advantage is named by Jans et al. (2013), namely that whole populations can be tested. This advantage leads to a higher detection rate of errors and frauds, which is also identified by Coderre (1999). Second advantage, which is discussed in the same article of Jans et al. (2013), is that the use of data-analysis enables the auditor to gain more understanding of business processes of the auditee.

There are two expected disadvantages of the use of data-analysis in the financial audit. Firstly, a cost of adoption –not only of monetary nature- needs to be incurred, since the auditors need time to familiarize themselves with data-analysis (Vasarhelyi & Romero, 2014). Second, Vasarhelyi & Romero also indicate that heavy involvement of the client in the data extraction phase is required and that it is a disadvantage.

From the literature three expectations about the impact of the use of data-analysis in audit prerequisites are deduced. Jans et al. (2013) expect a positive impact on ‘data independence’ (data independence refers to the correctness of data and that data are not manipulated). Vasarhelyi & Romero (2014) indicate that data access and data quality (independent data access is also the first step to data quality) are issues that are affected by the use of data-analysis in the financial audit, since these issues become more imperative with intensified use of more data.
The above translates to the following research model:

The Use of Data-Analysis in the Financial Audit

![Diagram of the research model]

The model shows how the impact of data-analysis on the financial audit will be researched. It will be used for Part B, and more particularly for SRQ1 and for bridging the theory-practice gap. This will thus be done by comparing the expectations (on advantages, on disadvantages and on audit prerequisites) from theory with the outcomes from practice through the application of data-analysis in the two progressive engagements. The practice is mainly productivity-driven because the audit firms aim to make a profit and expect auditors to make billable hours, while not overrunning budget and time-planning made for audit engagements.
Connection with Stakeholders and Change Management

A connection with the research model and the stakeholders and change management can also be made, due to the interconnectivity of the two parts of the research. In particular, it is unsure if the advantages outweigh the cost of adoption (disadvantage) for auditors. Besides, the time- and budget-pressure are expected to influence their perspectives.

Understanding the impacts of data-analysis in the audit is needed to explore the stakeholder aspects of the audit transformation. And understanding the stakeholder’s perspectives on the audit transformation assists interpreting the impacts of data-analysis on the audit. Using the synergy, these two aspects give a good view of the audit transformation that is needed to answer the questions and to draw uniform conclusions that connect the two aspects.

This stakeholder oriented approach to the problem and its change management is subject of Part C in this report.

2.4 Audit Approach

There are many guides and principles from auditing boards, from regulation authorities and other organizations that prescribe how to perform an audit⁶, and in particular on how to scope the audit, how to plan it, how to obtain evidence, how to conclude and how to report the audit findings and observations. The auditor is responsible for meeting the appropriate rules and standards. A big part of the quality of an audit is also determined by the auditor’s professional judgment, since every audit is unique and requires unique judgment where the rules and standards leave room (Gul et al., 2013; Satava et al., 2006).

Usually, the standards and rules have been integrated in a general audit approach. This audit approach is designed to adhere with the standards and rules, while on the other hand the easing and systematizing of the audit approach within the firm by assisting the auditors in their work. At the Big4 audit firm concerned in the case this approach is known as the Global Audit Methodology (GAM). This global framework to auditing is a means to an end and should not be used as just a set of rigid instructions.

The audit objective in that methodology is stated as follows:

- “To obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, thereby enabling us to express an opinion on whether the financial statements are prepared, in all material respects, in accordance with an applicable financial reporting framework”; and
- “To report on the financial statements and communicate in accordance with our findings”

⁶ Several examples: the AICPA guides by the American Institute of CPA’s (2014); the Fundamental Principles of Financial Auditing by the The International Organisation of Supreme Audit Institutions (INTOSAI, 2014); The International Financial Reporting Standards by the International Accounting Standards Board (IFRS, 2014); and the PCAOB created by the Sarbanes-Oxley Act (PCAOB, 2014b).
This objective is in line with the general objective of financial external auditing as mentioned before, but also gives an insight in the Big4 audit guide.

The auditors then realize their objective by:
- Complying with internal policies and procedures
- Obtaining sufficient appropriate audit evidence
- Exercising professional skepticism
- Applying professional judgment
- Applying a risk based methodology (this will be explained later)
- Preparing documentation

These actions are done in the several phases that the audit is divided in; an elaboration on this will follow later. Highly important in the process is the gathering and collecting of sufficient and appropriate audit evidence, since it forms the base for the audit opinion. Common sources for audit evidence are the auditee’s accounting records, documentation from previous audits, the auditee’s internal control environment, and industry data.

Important in audit evidence are sufficiency and appropriateness. Sufficiency of audit evidence relates to the quantity of the evidence and dependent on the auditor’s risk assessment and also the quality of evidence. Appropriateness of audit evidence relates to quality of the evidence. Quality of the evidence is determined by its relevance and reliability in providing backing for the auditor to give his or her opinion (International Federation of Accountants, 2009 (ISA 500)).

The GAM can be considered to be a risk-based audit methodology. In practice this means that business risks in the auditee’s business process will be assessed and it will be evaluated to what extent those risks are considered to be covered by the auditee’s internal control environment. This then influences the design (extent, scope e.g.), and execution of substantive audit procedures. The risks follow from the processes that influence the financial statement. These processes can be prone to error or fraud: what could have gone wrong? Controls are in place to cover potential ‘wrongdoings’ and these controls are audited. The figure beneath shows the positions of the substantive audit and control audit.
Ultimately, for auditors, the most important risk is the risk of material misstatement, which is defined as the risk that the financial statements are materially misstated and that they don’t give a fair and true view.

Accordingly, the risk on material misstatement is assessed by using the audit risk model. This model, used worldwide to underpin the audits of financial statements, is codified in International Standard on Auditing (ISA) 400 (Blokdijk, 2004).

Inherent risk is the risk that an account balance, financial statement or transaction could be materially misstated due to error or fraud, before consideration of the internal controls. Control risk is the risk that such a statement, that could be materially misstated, is not prevented, or detected and amended by the auditee’s internal control environment in time. The inherent and control risk are ‘owned’ by the audited company and are independent from the external auditor’s actions, but they do influence them. The detection risk is where the external auditor comes into play. The detection risk is the risk that the procedures
performed by the auditor don't detect a misstatement that is or could lead to a material misstatement.

Altogether these risks are the basis of the audit risk; the audit risk is the product of inherent risk, control risk and detection risk. The audit risk is the risk that an audit opinion is given that does not provide a fair view of the financial statements. Example of this is a clean or unqualified audit opinion in the case of materially misstated financial statements (Pine, 2008).

The audit risk model can be interpreted as follows: Audit risk can be set (e.g. 5%) and if the combined risk of the auditee (inherent risk and control risk; refer to the matrix in appendix 1) is considered high, a low detection risk is needed. Usually a low detection risk is obtained by more substantive testing, where the size of the sample for a given materiality and given confidence level is given by a formula, or by a look-up table in the GAM. A quantitative example of this interpretation can be found in appendix 1.

To assess the risks that are owned by the auditee, risk assessment procedures are performed by the auditor. It is key to gain understanding of the company, its internal control settings and its environment such as the markets it operates in. Procedures could be interviews with management and personnel and walkthroughs through hiring procedures for instance. With a gained understanding of the business, suitable audit procedures in the next phases can be designed and executed.

The audit can be divided in several phases in which planning, risk assessment, audit strategy, execution and finalization are often central activities. The number of phases distinguished might vary per audit firm but generally will contain those activities. At the Big4 firm in this case the audit is divided in four phases:

- Planning and risk identification
- Strategy and risk assessment
- Execution
- Conclusion and reporting

These phases and the approach that the GAM sets out will be elaborated in the following sections.

2.5 Auditing in the Financial Sector

The research is done at the Financial Services Office of the Big4 audit firm, because of the chosen research scope. This means that clients of the department usually are financial institutions such as banks, insurance companies and pension funds. Performing an audit at a financial institution like this is different from an audit at a manufacturing company for instance.

The general ledger (GL) of a bank for instance is often set up in a more complicated way than the GL of non-financial companies. Elements of this are that there can be a large number of GL accounts, that GL data feeds are interfaces from back office systems to the
GL and that there is a multitude of back office systems (internal source, 2014). And often the system is developed uniquely.

Moreover, file sizes of financial data are often larger for companies in the financial industry, because of the larger number of GL accounts and higher complexity.

Consequence of this is that data-analysis applications for auditing in the financial industry are more challenging and standard applications may not be suitable. Examples of incurred difficulties are the increasing data processing and render times. On the other hand, this also means that there are more opportunities for data-analytics to provide added value, as the complexity of financial services makes manual checks almost impossible.

Another illustration of the differences for auditing in the financial industry is the type of substantive audit procedures. For a manufacturing company this can be the physical examination of an inventory to check if it matches with accounting records. For a mortgage bank, however, this could be the analysis of mortgage loans to support testing of controls and verify transactions.

Furthermore, Starreveld et al. (1977) made a widely used typology of organizations and, recognizing their uniqueness, reserved a specific type for financial institutions. Characterizing for these institutions is that they don’t have a real production cycle. Services are mostly virtual, so more data is secured in IT. As a consequence there are also more opportunities for data-analysis. The mortgages in the previous paragraph are good example of this.

### 2.6 Steps in Audit Approach

The precise content and sequence of the steps performed in the audit approach are arbitrary, depending on aspects such as the assessment of risks and the impact of professional judgment, but the steps can generally be assigned to the four previously mentioned phases: planning and risk identification, strategy and risk assessment, execution, and conclusion and reporting.

These four phases are illustrated in the next figure. Steps for every phase are listed by their objectives.
The first phase, planning and risk identification, is about scoping the audit and getting an understanding of the requirements and expectations first. A general understanding of the auditee and its environment (market characteristics etcetera) is necessary for the risk assessment and also obtained in this phase. For example: does the business handle many cash payments? Also established in this phase is the materiality of an error. Materiality is a concept of measure that relates to information (amount, transaction, account e.g.) being important or not with respect to the accuracy and completeness of financial statements. An error is considered material, when it affects the decision to issue a clean opinion, or not. The decision would have been otherwise if the error hadn't been there. Materiality is generally expressed as a percentage of an amount (of net income for instance). Professional judgment forms a big part of the process of establishing materiality. With this materiality in mind, risks can be identified and later on significant accounts and disclosures can be identified.

In phase two, strategy and risk assessment, the risk assessment is made based on the identified risk, the financial statement closing process (FSCP) and the IT general controls (ITGC). This risk assessment is then the basis for determining the nature, timing and extent of audit procedures. Examples of audit procedures are the test of controls (to check validity...
of internal controls), journal entry testing and other substantive procedures (refer to the Audit Risk Model of figure 4). For example: if the ITGC are operationally effective and the FCSP is solid, then the internal control risks can be minimal or low (depending on the nature of the business and its environment etcetera) and the extent of additional audit procedures for substantive testing can be relatively succinct.

The third phase, execution, is about performing the audit procedures designed and planned in the previous phase. The risk assessment done earlier will also be evaluated in this phase and if necessary audit procedures will be adjusted or added as response to the evaluation.

The last phase, conclusion and reporting, deals with finalizing the audit and communicating the findings. Based on the risk assessments and performed tests together with professional judgment the auditor will form his overall conclusion. The central question is generally: is there sufficient evidence to give a clean opinion? In other words there should be reasonable assurance that the financial statements are free from material misstatement and that they follow accounting procedure standards (according the GAM). Reasonable assurance is as much as the auditor can give; full certainty can never be obtained, as evidence is always based on activities of the party being audited.

Use of data-analysis has potential in several phases and steps in the audit. The next paragraph will address this potential and will give various examples as well.

### 2.7 Data-Analysis and the Big4 Firm

According to Chen et al. (2012) data-analysis applications, also called Business Intelligence and Analytics (BI&A)
8, can be divided in three levels:

<table>
<thead>
<tr>
<th>Level</th>
<th>Data Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI&amp;A 1.0</td>
<td>data mostly structured and collected by companies through legacy systems and often stored in relational database management systems</td>
</tr>
<tr>
<td>BI&amp;A 2.0</td>
<td>data mostly gathered from internet (web-based), often user-generated and can come from a multitude of sources, and are unstructured.</td>
</tr>
<tr>
<td>BI&amp;A 3.0</td>
<td>newly emerging BI&amp;A 3.0 builds on data from mobile (phone and tablets e.g.) and sensor based sources.</td>
</tr>
</tbody>
</table>

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8 Chen et al. (2012) state that BI&A is generally referred to as “the techniques, technologies, systems, practices, methodologies, and applications that analyze critical business data to help an enterprise better understand its business and market an make timely business decisions.”
Characteristics of the used data is provided in the table as well to give an idea what they are about. The data-analysis application opportunities in external financial auditing currently seem limited to BI&A 1.0, since the data used is generally structured and owned and generated by a company (the auditee). Relevance of next levels of BI&A for external financial auditing is questionable and also aren’t practiced at the Big4 audit firm in their audits.

This means that core capabilities for auditing currently are ad hoc queries, dashboards and predictive modeling amongst others. In the next table an overview of these capabilities is given.

Table 2. Core Capabilities BI&A 1.0 (adapted from Gartner, 2013)

<table>
<thead>
<tr>
<th>Core Capabilities</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ad hoc query</td>
<td>Users can ask their own questions with the data, without IT support</td>
</tr>
<tr>
<td>Reporting, dashboards &amp; scorecards</td>
<td>Formatted and interactive reports can be formatted with the data. Dashboards are intuitive, interactive displays that indicate the state of a performance metric compared with a goal</td>
</tr>
<tr>
<td>Online analytical processing (OLAP)</td>
<td>Enables users to analyze data by facilitating extraction and viewing of data from various point of views</td>
</tr>
<tr>
<td>Interactive visualization</td>
<td>Users have the ability to display data clearer and more efficient with interactive charts and pictures</td>
</tr>
<tr>
<td>Predictive modelling &amp; data mining</td>
<td>Enables organizations to classify categorical variables and to predict variables by algorithmically calculating estimations</td>
</tr>
</tbody>
</table>

There are several providers of software platforms for BI&A. Well known IT research and advisory firm Gartner has ordered and mapped them on base of completeness of their vision and their ability to execute it, with the following as result:
The audit firm in this case selected Tibco Software to make a customized version of their Spotfire product for the firm. Tibco Software is known for “their flexible, easy to use platform for user-driven information exploration and analysis” (Gartner, 2014a). This, together with its strength in visualization (charts, dashboards etcetera), was why Spotfire was selected⁹. According to Gartner’s quadrant, Tibco Software is a leader in the BI&A field and Tibco Software “executes well against their vision and is well positioned for tomorrow” (Gartner, 2014b).

The software for the firm is in the process of being delivered and deployed. Some analyses are at this time ready to be used. Other parts are still in development and being tested intern at the firm. The state of this will become clear in the next chapter.

Currently there is already a more basic interactive data-analysis tool up and running at the firm: EAGLe (Enhanced Analysis of the General Ledger). This tool is basically an Excel macro-enabled workbook and it uses the general ledger data to assist auditors in all phases of the audit and more specific in understanding the business, identifying and assessing the

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⁹ So became clear from observations of the use of Spotfire at the firm.
risk, and designing and executing substantive procedures. Then there also is Global Analytics (GA), of which EAGLe is an add-on.

A problem, which became clear in the case study, with this tool is that it is hardly used. In an interview with a Big 4 director\(^\text{10}\), who is in charge of financial audits for financial clients, two main causes were identified: the time pressure upon financial auditors; and start-up problems with data-preparing and mapping. These two aspects prevent that auditors can familiarize themselves with the tool and that the tool often gets neglected.

Data-analysis is generally applicable on journal entry testing and on substantive audit procedures, but is also relevant for the before mentioned understanding of the business, and identifying and assessing of risks.

Moreover, manual control testing could be eventually substituted to some extent if the other audit procedures can give assurance on their perceived effectiveness. This issue will be discussed later.

Several examples of data-analysis in the audit, which are taken from several internal firm documents, are given below:

- Data-analysis can be used to gain understanding in the auditee's business in the first phase of the audit by analyzing the income in regard to the nature of revenues, seasonality and trends of the business for instance.
- Significant accounts can be identified and/or validated with data-analysis by for instance the use of thresholds.
- Data-analysis can identify journal entries that are posted on unexpected dates and times, which helps assessing the risk of material misstatement due to fraud. And those entries can be selected for testing. Herewith the testing of journal entries can be more targeted and this reduces the detection risk and consequently the audit risk (refer to figure 5).
- Data-analysis can be used to examine the effect of identified deficiencies in IT general controls and/or other controls.
- As substantive audit procedure data-analysis can also enable the identification of matters that, even without being material, have been deemed important by the auditee because of for instance the auditee’s reputation that could be at stake if the matter went undetected. This could be for instance the issuing of products with an unfavorable public image like some endowment mortgage types.
- In Spotfire, analytics have been designed to deal with financial products like mortgages and insurances for instance. With data-analysis, mortgages can for instance be mapped on Loan-to-Value ratio and Loan-to-Income ratio. This mapping provides more insight in risks of mortgages for banks. This information can then support testing of the mortgage process and adequacy of loan loss provisions for

\(^{10}\) During the first subcase
instance. The gained understanding also enables the auditor to provide the auditee with more insight on his business.

The above can be performed with both Spotfire and GA/EAGLe, unless stated otherwise. Difference between their uses should be the as considered better handling by Spotfire of the increased complexity of financial institutions and Spotfire’s great visualization power.

Figure 5. shows how this reflects on the audit steps and update has been made and is presented in the next figure. The steps, where data-analysis is applicable in the audit are highlighted in yellow. This also adds to the overview of this paragraph.

Figure 8. Data-Analysis Application Possibilities in the Audit

The introduction, more specifically section 1.1.1, addressed research of Vasarhelyi & Romero (2014). In their case study, that focused on forensic and IT auditors, they found that technological tools are available for data-analysis in the audit. Its use, however, was not optimal. The same appears to be the case at the Big4 audit firm, judging on the limited use made of the tool according to an audit director and early observations.

All in all, data-analysis can be applied in various ways with various tools at various procedures in the financial audit. In the next chapters the use of data-analysis techniques at the Big4 audit firm will be further examined with the two mentioned cases.

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11 A list of this can be found in the appendix 2
3. Data-Analysis Use in Progressive Engagements

The use of data-analysis techniques in two progressive audit engagements, pilot cases if you like, is observed to assess the change in auditing. In this chapter the first sub-question will be answered:

1) How is data-analysis applied in progressive engagements, and what were the experiences?

3.1 Progressive Engagements

The two selected (pilot) cases for the research are a past engagement at an insurance company and an engagement at a commercial bank; the latter has been followed as a live case. These cases were selected for their progressive use of data-analysis and because they fit the scope of the research. More information about the cases can be found in the introduction chapter. The observations and results are presented in section 3.3 for the insurance company and in section 3.4 the commercial bank.

3.2 Research Model and Method

To answer the question in a systematic way a model is set up that will be used for both cases. The model presented in paragraph 2.3 is used for this purpose:
The Use of Data-Analysis in the Financial Audit

First, a description of how data-analysis was applied will be given. Subsequently, this will be linked and compared to the possible goals and applications (refer to list 3) of data-analysis in the financial audit with the help of a matrix.

Then it will be described what advantages the application of data-analysis had for the goals in mind. Lastly, other advantages and disadvantages of the use of data-analysis in practice are named. This is especially interesting, since most of the current literature is still technology-driven as is discussed earlier. At the end of this chapter the theory on advantages, disadvantages and prerequisites will be compared with the outcomes of the subcases.
Data was collected through interviews, observations and document analysis mainly. A detailed log on the data sources and collection per case can be found in appendix 3. Appendix 4 contains the case guide used for the interviews.

3.3 Insurance Company

First the engagement and the use of data-analysis in the audit engagement will be described. Subsequently, paragraph 3.3.3 contains a reflection upon that use.

3.3.1 Data-Analysis in the Engagement

The auditee in this case is a large Dutch insurance company. The audit firm has been responsible for the external audits for the most recent years and will also perform the audit over fiscal year 2014. Auditors involved have been interviewed and relevant audit documents have been consulted. Moreover, the author observed and participated to some extent in the data mapping for the following half-year review.

The progressive use of data-analysis that was present in the 2013 insurance company engagement was the more than average utilization of the EAGLe-tool (enhanced analysis of the general ledger). This means that data-analysis was mainly applied with the general ledger (GL). Although EAGLe already is available to use for all financial auditors at the firm, the actual use is still to be considered very low.

The audit team gathered the data from the auditee in the common manner: the auditee provided their GL data and with the use of queries these data were mapped to Global Analytics of which EAGLe is an add-on. Then, through EAGLe, data-analysis has been used to understand the types of journal entries that exist in the financial reporting process (routine transactions vs. non-recurring entries; system generated entries vs. manual entries e.g.). This helped to identify journal entries with higher risk or other unusual entries more accurately and to focus on selecting the unusual entries for testing, which is considered to be part of understanding the business as well.

While these entries are normally selected from a predetermined sample, they are now selected from the whole population. Such an approach gives a better view, since the selection can be based on risk factors and is not limited by an existing predetermination of the population of journal entries.

“Usually you look at processes and controls and take 25 transactions, while millions actually took place. That doesn’t give a very good feeling. Using data-analysis, instead of random selection, that can be turned around: Outliers can be identified by setting boundaries and they can be further examined. Basically, you go from top-down to bottom-up.”

-Audit Director in charge
Also, more outliers are found than with regular sampling. Consequences of the auditors observing more outliers resulting from this adjusted approach by making intensified use of data-analysis, for auditors, will be discussed in the next chapter.

Herewith the journal entry testing objective is realized with more focus and accuracy than before and by the additional focus and accuracy it will be achieved that the auditor’s detection risk will be reduced and if all tested entries are considered as confirmations of effectively operating controls this should lead to more assurance and hence more audit quality.

Recapping, the progressive use of data-analysis supported the following activities:

- Understanding types of journal entries and processes
- Identifying higher risk journal entries:
  - Management override
  - Entries made near end of reporting period
  - Post-closing adjusted entries
  - Entries outside normal course of business
- Analyzing and filtering the journal entries
- Selecting journal entries to test

Next to that, its use removed the need to the following activities within the journal entries testing steps (refer to figure 8):

- Determine whether to include additional journal entries throughout the period in the testing population
- Plan for data capture of the testing population
- Assess completeness of the testing population

Hence, the audit approach used was by and large still the same as the standard approach that the GAM puts forward with all the same steps (refer to figure 5). Despite the testing of whole populations the testing of controls still remained. It was indicated however that control testing might be focused less upon (and less work will be involved) in the future if more focus will be on the data-analysis. An example of how this might work was given during a case interview:

"With commission payable on insurance policies of, let’s say, 10%, you can test the concerned controls and look at samples, but you can also check the totals from the general ledger. This way you have convincing numerical evidence and testing of the relevant controls isn’t needed anymore [if the numbers match]. This is how data-analysis can make the audit more efficient”

Because the approach by and large was still the same as in figure 5, this format can also be used to show where data-analysis was used in the insurance company engagement:
The purpose of the financial audit was still the same as usual: verifying the company's financial statement. Stated reasons for the new approach were the ability to get more assurance and the ability to perform the audit more efficient. Table 3 illustrates shows where data-analysis was used and with which goal.

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12 GA data-analysis' refers to the previous generation tool and is not considered as intensified, or progressive, use of data-analysis.
Gains in efficiency in the audit were mainly established due to the fact that the 2012 engagement used EAGLe as well and the auditors were familiar with the use and data mapping was already figured out. The use of EAGLe and data-analytics was less smooth in 2012 however, but forced upon the audit staff by the director in charge to get the auditors more familiarized.

### 3.3.2 Experiences on Advantages, Disadvantages and Prerequisites

Advantage of the new approach was that more quality in the audit could be delivered, because journal entry testing was based on the whole population of journal entries of the period in scope. Advantages, unrelated to the goals, weren’t identified, except for the better understanding that auditors gained of the journal entries during the use of data-analysis. Mentioned experiences of disadvantages were the difficulties related to the consequences for auditors and these are the focus of the next sub-question, and thus discussed in the next chapter. It should be mentioned here though that the cost of adoption was an important one, but this ‘cost’ was partly taken earlier since auditors were already familiar with EAGLe this year.

The impact of the progressive use of data-analytics on audit prerequisites such as data quality and audit trail was for this specific engagement minimal. This is because the same data as normal was used and EAGLe is a fully developed tool.

### Data Mapping Half-Year Review (2014)

For the half-year review 2014 the data were mapped to be used in Spotfire under the observation and with participation from the author. For GA, and its add-on EAGLe, the data have to be mapped as well, but for this mapping queries are already in use. With these queries the data are transformed at a firm’s office in India.
The client data used in this engagement for GA were sufficient for the new Spotfire audit environment as well, so in the client data gathering nothing changed. During this process it became clear that the difficulties are in the start of the process. The data had to be mapped\textsuperscript{13} and new queries had to be designed to guide the data transition (from raw client data to usable data rendered in the data-analysis environment). It is expected though that these queries can be used for the next audits at the insurance company too, once these have been designed successfully.

\textbf{3.3.3 Reflection}

The purpose of the financial audit was still the same as usual. This is noteworthy to mention, because the purpose could have been broader because of the ability of data-analysis to give additional insights (De Swart et al., 2013 e.g.). This is an indication that its use isn't yet fully optimized.

The director in charge also stated himself that the use was admittedly very basic. This is also visualized earlier in figure 8: no intensified data-analysis was used in the substantive audit procedures, where maybe most gains can be realized.

Moreover, the basic use (remember, this was a progressive engagement) is confirmed by the lack of use of Spotfire. An involved auditor even called Spotfire still a very distant reality.

Faced difficulties with the new approach and tooling, like the data mapping, mainly relate to the auditors activities and thus will be discussed in the next chapter. It should be said here, however, that a common data repository as mentioned by Vasarhelyi et al. (2014) is not present or near present. The new approach of auditing is still of periodic nature and a common data repository is not necessary though.

\textbf{3.4 Commercial Bank}

First the engagement and the use of data-analysis will be described. Section 3.4.3 contains a reflection upon that use.

\textbf{3.4.1 Data-Analysis in the Engagement}

The auditee in this case is the commercial bank department of a large Dutch bank. The audit firm has been responsible for the external audits for over ten years, but mandatory audit rotation is due in two years. Just as the previous case, auditors involved have been interviewed and relevant audit documents have been consulted, but developers of the Spotfire data-analysis have been interviewed as well. This is especially relevant since the analyses in Spotfire, contrary to EAGLe, are still in development.

\textsuperscript{13} Data mapping is the process by which different data models (in this case the client’s data model and the model used for the data-analysis environment) are linked to each other using a defined set of methods to characterize the data in a specific definition (Janssen, 2014). Basically the data has to be synchronized with the data input model of Spotfire.
Since the analysis was still in development and there were data-issues with the client, as will be discussed later, the engagement and the use of data-analysis were delayed. And so the observations about this case are also based on expectations of the involved audit manager about the Spotfire data-analysis. Since the audit manager was closely involved in and has had much exposure to the set-up and design of the analysis as well as to the interpretation of the observations, the results are still expected to be valid.

The progressive use of data-analysis in this case involves the use of Spotfire. More specifically, a ‘yield\textsuperscript{14} analysis’ is developed in Spotfire for this specific client. It is planned to make analysis compatible for other clients later. Hence, it is safe to say this was a progressive engagement.

This yield analysis enables the financial auditor to gain more insight in the (daily) profit and loss (P\&L) developments relevant for the Income Statement: on interest revenues, interest costs, or on operational costs (profit and loss) and balances of positions in both assets as in liabilities such as in loans and receivables, financial assets and liabilities and deposits, for instance. This can be done on various levels: yield per product, yield per currency, and yield per profit center etcetera.

With automated visualizations (line graphs, pie charts e.g.) it swiftly becomes clear where materiality lies and deviations requiring clarifications appear to be. Positive factor of the in-depth analysis and Spotfire-tool is that it allows the financial auditor to drill down on product types and / or deviations. For instance, if the auditor observes a sudden (relatively) large movement on P\&L for interest costs on one day in a graph he can zoom in on that day, consider the in- and outflow of client’s deposits and might even see the specific transactions that caused such a movement. Other significant movements, for example relating to liquidity positions might relate to dividend-, salary- or tax-payments or to receipts related to expired loans.

This yield analysis will be used when the client transaction data and general ledger is available. The auditor plans to use data-analysis initially to gain a better understanding of the business and subsequently also to identify significant accounts and to identify and understand significant classes of transactions. A simple example of how this works is that an automated pie chart with P\&L-balances per account straightforwardly makes clear which revenues and costs are material and significant.

With this understanding, the substantive procedures can be better directed by focusing on more material and more ‘suspicious\textsuperscript{15}’ - with odd trends compared with related accounts or previous months - accounts and underlying transactions. For example interest revenues in

\textsuperscript{14} Yields are the monetary returns to owners of securities such as loans and deposits. E.g. interest is a form of yield. Position and their yields can be seen as the core business of a (commercial) bank.

\textsuperscript{15} According the auditor’s professional judgment e.g.
relation to loans and receivables; interest costs versus deposits; sudden raise in salaries; sudden downfall in operating costs.

Also substantive procedures are planned to be supported with the tool. Expectations – average interest rate in September is between x and y percent every day e.g. - can be built in in the analysis and can be tested and outliers can be identified. Expected is that the substantive procedures with this application of data-analysis can be more efficient than before by supporting financial auditors in focusing and also offer more assurance. In case of absence of any outliers very efficiently the adequacy of the by the auditee reported total interest revenues (for loans and receivables) or of the reported total interest costs (for deposits) will be determined.

The overall audit approach (phases and steps in general) that will be used will remain by and large the same as the standard approach that the GAM puts forward (refer to figure 5). Just as in the previous case control testing remains. It was indicated though that understanding the business better through data-analysis can lead to a more select testing of controls.

Because the approach by and large was still the same as in figure 5, this format can also be used to show in which steps data-analysis will be used in the commercial bank engagement.
The purpose of the financial audit was still the same as usual: verifying the company’s financial statement, but the financial audit manager also explicitly named the extra service from the audit firm to the auditee, by giving the client more insight in his processes as motivation. And so, in the case study next to more quality and efficiency in the financial audit process, more added value from the auditor towards the auditee was also one of the reasons for the intensified use of data-analytics in the financial audit process.
The table above shows where data-analysis is to be used and how that matches with the goals.

3.4.2 Experiences on Advantages, Disadvantages and Prerequisites
Advantages were that entire populations of yield positions can be analyzed which leads to a higher detection rate. Also the audit manager involved was already certain, due to his exposure to the tool and development of the yield analysis, that his understanding of the business would be enhanced through the use of the yield analysis.

However three disadvantages have already been experienced in the audit engagement of the Commercial Bank during this years' audit, which also explain the delay.

First, the client had to be thoroughly convinced of the added value of the data-analysis before they made their data available for the financial auditor. This was needed, since more transaction-data and data on balances than previously required, had to be delivered enabling the planned analysis in Spotfire, contrary to EAGLe. Hence disadvantage is that the client must be willing and capable to give more of his data. It was indicated that it could sometimes also be an issue that data may not leave the client’s location, and so the auditors have to perform their analyses at the client. This was not seen as a significant disadvantage though by the audit manager.

Second disadvantage is that the commercial bank will have to rotate from auditor firm within two years, since the recently by law set maximum term of an audit-engagement will then expire. This means that the available budget is less than earlier years and that there's not much profit to gain since there are only two years left. The cost of adoption is thus also a client-specific issue and not only about auditors needing time and budget to get familiar with the tools. Client-specific cost of adoption can be relatively minimized by applying data-analysis right away with new clients.
The third disadvantage is about the prerequisite of data quality. There was more trouble than expected with mapping the client's data into the Spotfire environment. There were a lot of peculiarities in the data that had to be dealt with by IT-auditors at the audit firm in order to keep the data accurate and sufficient (data quality).

Impact on other prerequisites is experienced as non-conflicting: the used data comes directly from the auditee's systems and is considered independent and Spotfire allows for an audit trail since transactions can be drilled down to and the auditor's work flow can be presented step by step.

3.4.3 Reflection
First of all it should be noted that the data-analysis in the engagement wasn't performed yet. Nevertheless, the case was still useful to answer the question since the audit manager has enough knowledge about and exposure to auditing the client and using yield analysis in Spotfire. Moreover, this case was maybe even more useful since it invited to go more in depth on the by the audit team experienced obstacles.

This engagement uses data-analysis more progressively than the previous, since substantive procedures is at the core of it. At financial institutions more gain can be held from here than journal entries with data-analytics arguably.

3.5 Practice vs. Theory
Table 5 is used to present the differences between expectations derived from the literature and outcomes from the cases
It is clear now that expectations from theory greatly match outcomes in practice. There are three differences though that are worth mentioning. First, heavy client involvement in practice meant that the client had to be convinced of providing his data. Second, cost of adoption is not only incurred by auditors to get familiar with data-analysis, but is also client-specific in the sense that their data needs to be linked to developed analyses individually. Therefore and because of mandatory rotation, cost of adoption can be minimized by immediately applying data-analysis with new clients. Third difference is that data independence wasn’t considered an issue with the application of more data-analysis.

### 3.6 Conclusion

The raised question can now be answered:

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16 NB. Ultimately the insurance company case is considered ‘moderately progressive’ with respect to the intensity of the involved use of data-analysis since the use was only intensified at three of the possible fourteen audit steps (refer to figure 8 and table 3). The commercial bank is considered more ‘progressive’, since the use of data-analysis was intensified at six of the audit steps (refer to table 4).
How is data-analysis applied in in progressive engagements, and what were the experiences?

At the insurance company data-analysis was applied in a basic way, especially in reference with the list of examples in paragraph 2.7. The whole population of journal entries was taken into account and tested by using an already available tool. The form of data-analysis can be described as an ‘upgraded form of excel’. This was done for reasons of more assurance and more efficiency. The audit approach in general remained the same.

The data-analysis that will be applied at the commercial bank is of more progressive nature. Most of the added value is gained at the step of understanding the business and the substantive procedures. In Spotfire a specific analysis is developed for this purpose, namely the ‘yield analysis’. Main visualization types are line graphs and pie charts. Classes of transactions and types of positions can be drilled down to identify outliers and their origins. Data analysis will be applied for reasons of more assurance, more efficiency and more value. The audit approach, however, still will be by and large the same in the current future.

Expectations from the academic literature on advantages, disadvantages and prerequisites have been challenged with outcomes in practice in the last table (table 5). Mostly they match. Two aspects are most worthy to mention here:

- The cost of adoption is also client specific. Because of this cost and the time limit on the auditor-auditee relation, it is not most beneficial to start applying data-analysis at the end of this period in an engagement.
- Vasarhelyi & Romero named heavy involvement of the client in the data-extraction phase as disadvantage of data-analysis in the financial audit. In the case the disadvantage was more that the client needed to be convinced thoroughly to provide all his data, since the client is not eager to do so because of confidentiality issues most likely.

### 3.7 Reflection

The subcases have already been reflected individually. When reflecting on the method and research model for this sub-question, it should be said that the model, like models in general, is not perfect. Choices had to be made about what to include and what not. And so, for a future research on this topic, it might be wise to evaluate it.
4. Consequences for Auditors

This section will focus on the activities, tasks and used tools of the auditors. Furthermore their faced difficulties and responses are subject. The following question will be answered in this chapter:

What are the consequences of the application of data-analysis in financial auditing for auditors and their activities?

4.1 Pilot Cases and Research Methods

The used pilot cases, sources and guide for this question and chapter are the same as for the previous question and described in paragraph 3.1 and 3.2, and appendix 3 and 4.

The question is answered in three steps. First, the steps for which activities for auditors change are repeated. Then, the activities that change are described. Third, experienced or potential difficulties, as identified in the engagements, are given. The first two steps are interesting since it gives insight in the change from an audit staff and manager perspective, which is not only an earlier defined gap in literature, but is also interesting for the change management aspect of the transition. The third step is interesting, since it is practice-driven, while most literature currently is technology-driven as earlier discussed.

4.2 Insurance Company

Consequences of the progressive approach and tooling for the tasks of the auditors are not much, since intensified use data-analysis was limited (refer to 3.3.1). On top of this, the data was already mapped to use the GA/EAGLe tool, since GA is more standardly used for audit engagements.

For the half-year review, the data was also being mapped for the new tool Spotfire. This data-mapping was a task for the audit firm’s IT-audit department, which has assisting the financial audits as one of its main responsibilities. In this case, also nothing will change in this respect for the financial auditor.

The financial auditors basically performed the same tasks as figure 5 (audit phases and steps) presents. Only the activities performed within these tasks differ, because of the new use of the tooling.

Consequence for the activities of auditors lay within two of the steps, or tasks, mapped in figure 5:

- Design Test of Journal Entries and Other Mandatory Fraud Procedures
- Execute Tests of Journal Entries and Other Mandatory Fraud Procedures

And within these tasks it’s the activities of audit staff that are different than standard and not the audit managers or director. This is because managers only guide and review these tasks, while the audit staff was performing the activities.

Within these tasks the following activities weren’t needed anymore:
Determine whether to include additional journal entries throughout the period in the testing population
Plan for data capture of the testing population
Assess completeness of the testing population

The following activities changed, because of the new approach:
  - Understanding types of journal entries and process
  - Identifying higher risk journal entries:
    - Management override
    - Entries made near end of reporting period
    - Post-closing adjusted entries
    - Entries outside normal course of business
  - Analyzing and filtering the journal entries
  - Selecting journal entries to test

In summary, what changed for auditors is the move from sampling journal entries to test them through boundaries. EAGLe was used to ‘design test of journal entries’ by helping understand the GL and journal entries and based on this understanding together with the risk understanding boundaries were set in EAGLe (like transaction amount and period) and outliers were identified (EAGLe enables the auditor to run analyses almost instantly instead of building constrained limited analyses in Excel). With this manner more outliers were found than standard sampling. Now, because of that, it was key that trends were discovered in these outliers instead of following them up individually.

Difficulties were experienced in the new approach. For 2012, when EAGLe was first used in an engagement by the auditors. Auditors needed time to get familiar with EAGLe and this resulted in time pressure. Normally, indicated by the audit director in charge, this would lead to the auditor returning back to old ways, but this was prevented by his imposing of EAGLe. So getting the audit staff to work along was also a difficulty for the audit director\(^\text{17}\). In 2013 this wasn’t a problem anymore, since auditors were more familiar with EAGLe and more efficient as well.

Other identified pitfall for audit staff is that there are possibilities to go very far in the administration of the auditee and the auditor can lose the goal of verifying the financial statement out of sight.

Reflecting on the interviews, an important issue can be noted here, also in advance of the stakeholder introduction in chapter 5. It namely became clear that staff receives training in the use of EAGLe, but they are seldom stimulated by managers to use it. In the contrary,

\(^{17}\text{NB. This illustrates the relevance of the change management part of this research.}\)
getting comfortable with EAGLe takes time in the beginning and so it is not stimulated to use, since the auditors are mostly on a tight time schedule.

It can thus be said that managers are slowing down the progression of data-analysis in auditing, while they should actually stimulate it.

The audit director and staff in the case indicated that generally people, as opposed to them, aren’t open for innovation in their work and that there seems to be no sense of urgency at the auditors nor do they see added-value in a new approach. More about this and other stakeholder issues are handled in Part C of this report.

### 4.3 Commercial Bank

Consequences of the progressive and approach and tooling for the tasks of auditors are still not certain, since the engagement wasn’t completed during the research due to delays.

For IT-auditors there already were consequences. The audit transformation team ‘chartered’ an IT-auditor to map the data to the new environment and take care of data-quality issues. This is expected to be needed for every new client.

The financial auditors will still perform the same tasks as in figure 6, since the audit approach in general did not change. The activities in these steps will change though, because of the new tool and better insights that are derived from the data through the tool.

Consequences for the activities of auditors will lay within the following steps in the audit:

- Understand the business
- Identify significant accounts and disclosures and relevant assertions
- Identify SCOTs, significant disclosure processes and related IT applications
- Understand SCOTs and significant disclosure processes
- Design substantive procedures
- Perform substantive procedures

Within these steps it will mostly be activities of audit staff that will change and not those of audit management or higher since managers mostly guide and review these tasks, while the audit staff are performing the activities.

Since the audit has not been performed and there is a lack on internal documentation on how to work with the brand new developed analysis it cannot be determined yet which activities have changed and/or will change. It is already clear though that the new analytics most heavily change ‘understanding the business’ and the substantive procedures. Example of an activity that will change is the setting of expectations in the substantive procedures, since the tool and analysis will enable that.

Basically what will change is that auditors will use the analysis to gain a better understanding of the business and have better insight in oddities in the P&L and transactions. This can then be used to better focus substantive procedures and control testing.
It's not too early to name some experienced difficulties with the new method. Although two earlier (previous chapter) named disadvantages, are difficulties for auditors in their actions as well. First the financial auditors need to convince the client to make more of his data available. Second, peculiarities in the data need to be handled by the IT-auditor at the audit firm in charge of the mapping. These peculiarities were experienced in this case and this is not so strange since an analysis of data for one month already contained 10.000.000+ records. These volumes are representative for the financial sector and so peculiarities are expected at other clients in that sector as well.

Other already experienced consequences of the use of data-analysis in the financial audit are that the audit manager had more to offer to the client. And also, as mentioned before, the audit manager indicated that the data-access for auditor might be location restricted because of their data security policies.

### 4.4 Experienced Consequences of the Application of Data-Analysis

In the next table, table 6, the experiences on the consequences of the intensified use of data-analysis for auditors are presented per case as addition to the previous table.
It is clear now that there are both beneficial and non-beneficial consequences for auditors. It should also be noted that this list is not complete since only a select number of people have been consulted during the case, while many people were involved. The ambiguity of consequences makes it hard to say if auditors in general will support the transition to a financial audit with more data-analysis.

<table>
<thead>
<tr>
<th>Table 6. Consequences for Auditors: Addition to Practice Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data-Analysis Application</strong></td>
</tr>
<tr>
<td><strong>Main Scope</strong></td>
</tr>
<tr>
<td>N/A</td>
</tr>
<tr>
<td>N/A</td>
</tr>
<tr>
<td><strong>Expectations - Outcomes</strong></td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
</tr>
<tr>
<td><strong>Prerequisite issues</strong></td>
</tr>
<tr>
<td><strong>Consequences for Auditor</strong></td>
</tr>
<tr>
<td><strong>Beneficial</strong></td>
</tr>
<tr>
<td><strong>Non-Beneficial</strong></td>
</tr>
<tr>
<td><strong>Neutral</strong></td>
</tr>
</tbody>
</table>
4.5 Conclusion

The earlier raised question can now be answered:

What are the consequences of the application of data-analysis in financial auditing for auditors and their activities?

Actually, not a whole lot changed since the approach is generally the same and all steps remain. What changed is how the steps are performed and this does have consequences for the auditors. These are shown in the previous table in paragraph 4.4. The most important consequences are: that auditors can work more efficiently after getting familiarized (e.g. they can run analyses instantly instead of building constrained limited analyses in Excel); that patterns should be found to deal with outliers, which are detected in higher volume with data-analysis; and that there is more work to do for the IT-auditor when adopting the techniques and tools.

Also worth to mention is that there are positive and negative consequences for tasks of auditors and other involved stakeholders. This deserves more research and part C will address this.

4.6 Reflection

Again, it should be said that the commercial bank case wasn’t fully performed yet and so experiences on consequences are limited. Also, it should be reminded that two engagements have been followed and that the list of consequences likely isn’t complete. Moreover, only a small part of all auditors involved have been interviewed and so experiences on consequences might have been missed in the research. Interviewing more auditors or following the cases more intensively wasn’t allowed for by the time scope of the research though.
Change management can be simply defined as the task of managing change. A more elaborate definition is that of Nandeshwar & Jayasimha (2010; p4): “Change management is the process, tools and techniques to manage the people side of change process, to achieve the required outcomes, and to realize the change effectively within the individual change agent, the inner team, and the wider system which includes the organization”
5. Introducing the Internal Stakeholders: Which Are Critical?

In the introduction it became clear that employee support is essential for a successful change in a company (Smith, 2006; Pendlebury et al., 1998). Therefore, the focus in this chapter is on internal stakeholders. It too became clear in the interviews during the case study that several levels of employees within an audit firm can be distinguished and they have different perspectives on a change in auditing. It is much needed to create an understanding of the variety of internal stakeholders before progressing with the change management aspect in this research and this understanding is also expected to add to the insight on the audit transformation itself. Hence the following question is relevant and it will be answered in this chapter.

*The support of which internal stakeholders is needed for a successful change in the financial auditing approach in a Big4 firm?*

### 5.1 Research Method

To answer the question a stakeholder analysis is performed. This stakeholder analysis has been executed according to the methodology of Murray-Webster & Simon (2006). They have developed a method that enables categorizing stakeholders based on their power, their interest and their attitude. Knowing to which of the identified categories (saboteur, sleeping giant e.g.) a stakeholder belongs gives valuable insight in the stakeholder complexity and helps understanding it. Therefore, in combination with earlier experiences this methodology is chosen. Oversimplification might be considered a hitch of the method, but as the method gives a good indication of stakeholder type, it's a very suitable method for answering the aforementioned research question.

The analysis is performed on basis of the firm structure and observations during the case study such as internal presentations and informal conversations before and after interviews. Along such ways useful input for the stakeholder analysis arised.

The stakeholder analysis is not done from a single stakeholder perspective, but rather from an independent perspective. For the approach of the analysis this means that the stakeholders are categorized regarding their stance towards the general goal of a successful transition and not to a certain stakeholder and his/her personal interests.

The question is approached from the case (specific change, specific firm, specific location), but the answer is valid for related changes at audit firms worldwide, since they have equal structures and alike market circumstances. Hence, answering this question is expected to add not only to the firm's knowledge, but also to the scientific relevance of the research.

### 5.2 Essential Internal Stakeholders

There are both external and internal stakeholders. Relevant external stakeholders are the client, who needs to provide the data and needs to agree on using data-analytics, the
various software providers, who have to adapt their products to the needs of auditors in a specific domain, and the regulators who need to approve use of data-analytics as part of the financial audit. Here there are two regulators: NBA, the Netherlands Association of Chartered Accountants, which is responsible for audit guidelines in the Netherlands, and AFM, the Authority Financial Markets, who legally supervises the quality of the audit, in order to protect customers of audit firms.

The relevant internal stakeholders have been analyzed in more detail, namely: the audit staff, the audit managers, the audit partners, the audit transformation team, and the IT-auditors. Their relevance became clear during the case study. Descriptions of the stakeholders and the full stakeholder analysis can be found in appendix 5. A mapping of the internal stakeholders is presented in the next figure.

![Internal Stakeholders Financial Audit Structure](image)

Underneath the stakeholders and the results of the analysis are presented.

### 5.2.1 Audit Staff

The audit staff, both junior auditors and senior auditors, are considered as *saviour*\(^\text{18}\) or *saboteur*, because they have significant influence and interest in the transformation. Their attitude toward the change is however unclear, hence the ambiguity in their role. It is still unsure how they stand towards more data-analysis in the audit approach. If they expect to be restricted by the new approach, they could oppose it (Dowling & Leech, 2014). On the

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\(^{18}\) A complete list of stakeholder types and descriptions can be found in the appendix 5.
other hand, they can also consider the use of data-analysis useful and a valuable experience. Whatever their attitude might be, they are very important stakeholders because of their large influence and interest.

The roles of the audit staff mean that they are influential, active and backers or blockers, for saviour and saboteur respectively, of the transition (Hillson & Simon, 2012). Consequence of this is that they need to be paid attention to. However, because of the ambiguity it's unsure how to handle them in order to make a successful change. And so more research is needed on the perspective of the audit staff, especially since they can heavily influence the transition. Important question is: will they be supportive or not?

5.2.2 Audit Managers
The audit managers, managers and senior managers are also considered as either potential saviour or saboteur. Just like the audit staff their attitude is unclear and interest is high. Where the audit staff has ability to influence the transition, the audit managers have real power since they guide the staff. Also, they can determine and control the budget for an engagement. Especially this makes them very important stakeholders, since the initial use of data-analysis asks for time and budget so auditors can get familiar with the use without time-pressure.

Consequence of their role is that they deserve attention. They should be catered to their needs if they are saviours and they should be engaged in order to disengage in case they are saboteurs (Hillson & Simon, 2012). Considering the big difference between saviour and saboteur, also more research is needed on the attitude of audit managers.

5.2.3 Audit Partners
The audit partners, including audit directors, are powerful since they coordinate the audit managers and they are also capable of freeing up time and budget for auditors to familiarize themselves with a new approach. While it is their responsibility to develop their departments and firm, they aren't as interested in the transition as the staff and managers since data-analysis in the financial audit will not be their day-to-day business. The attitude of partners towards the transition is unsure. They might oppose to it, because it will cost time and budget. They might favor it, because it's an opportunity to develop their department. Subsequently, resulting stakeholder type for partners is sleeping giant or time bomb.

Consequence of the role of the audit partners is that they need to be kept in the loop, since they are critical because of their (access to) resources. They are however deemed less important stakeholders than staff and management considering the scope and will play a less central role the coming chapters.

5.2.4 Audit Transformation Team
The audit transformation team of the firm is categorized as friend, since they have a positive attitude towards and are highly interested in the transition. It's where the team is
for. Their power is limited though, since they need audit staff and management to work along. No ambiguity is present about the team’s type.

Being categorized as a friend means that the audit transformation team could be a good confidant or sounding board in the transition. This is relevant for when audit staff and managers support and actions are required in the transformation process.

5.2.5 IT-auditors

IT-auditors, mainly junior and senior IT-auditors, also play a role in the transition, since they are involved at the data extracting and the data-mapping which is needed for the subsequent data-analysis activities. This is however a small part of their overall work activities and this is performed in a facilitating manner (also refer to figure 12). Hence the IT-auditors are regarded as having low power and low interest. Their attitude towards the transition is considered positive, since their work is likely to become more interesting. All in all the IT-auditors are categorized as acquaintance. Consequently, IT-auditors aren’t expected to play a large role in the transition, but keeping them informed, acquainted, doesn’t hurt.

5.2.6 Summarization Internal Stakeholders

The results of the stakeholder analysis are summarized in the following table:

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Area of Interest</th>
<th>Attitude (+/-)</th>
<th>Power (+/-)</th>
<th>Interest (+/-)</th>
<th>Stakeholder Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audit staff</td>
<td>To perform their audit activities to their capabilities within their assigned time, while conforming to their coordination.</td>
<td>+/-</td>
<td>+</td>
<td>+</td>
<td>Saviour / Saboteur</td>
</tr>
<tr>
<td>Audit managers</td>
<td>To guide and coordinate the audit, so their budget and time planning aren’t exceeded.</td>
<td>-/+</td>
<td>+</td>
<td>+</td>
<td>Saviour / Saboteur</td>
</tr>
<tr>
<td>Audit partners</td>
<td>To coordinate the audit management to make sure that set financial targets will be met and audits are decently performed, since they are ultimately responsible. Furthermore, data-analytics in audit is a strategic chance to develop their department and firm.</td>
<td>-/+</td>
<td>+</td>
<td>-</td>
<td>Sleeping Giant / Time Bomb</td>
</tr>
</tbody>
</table>

19 More information on how the stakeholders were categorized can be found in appendix 5.
### 5.3 Reflection

First of all, the client should not be forgotten as it is a highly important stakeholder in the (transition to the) new audit approach. After all, it is the client who should make his raw data available\(^\text{20}\). This can be both a technical and a social difficulty that deserves more research to be understood, but this is not the scope of this research. The decision not to include the client in the stakeholder analysis is supported by findings in Part B of the research that indicated that clients may be hesitant in providing more data, but that in the audit approach the client data is central and not the client self. Potential issues with client data are then addressed by audit firm internal stakeholders, such as the audit firm’s IT-auditors that transition data and such as the audit firm’s auditors that may perform the analyses at the client’s location in case client data must remain at the client’s office.

Second, observations in the case study at the insurance company hint that often the audit managers seem to be an obstructing layer in the transition. The managers should stimulate the staff, who often already have received relevant training (for instance with EAGLe), to use more data-analysis. Instead of stimulating, they hold the audit staff back since they are afraid that the new approach would take additional time. And time is scarce, since the audit, and the managers, are often under time-pressure. This might be a hard-to-break cycle, because new auditors consequently only get experienced with the old approach and are less incentivized to innovate and eventually become managers themselves.

The above can be considered as an institutional barrier that is part of the cost of adoption. In other words, resources are needed to change the institutional set-up that obstructs successful adoption of data-analysis in the financial audit.

Third, the fact that partners have not made the use of more data-analysis in the audit a high priority, likely indicates a lack of sense of urgency for them.

Fourth, there can be heterogeneity in stakeholder type within the stakeholder groups: One senior auditor can be a *saviour*, while the other can be a *saboteur*. This issue is partly addressed by the assigned ambiguity in stakeholder types, but more about this heterogeneity will become clear in chapter 7.

Last, as earlier mentioned the methodology has its limitations but is suitable considering the question handled in this chapter.

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\(^{20}\) The data mapping is subsequently done by the audit firm, usually by IT-auditors.
5.4 Conclusion

The conclusion forms the answer on this formulated sub-question:

The support of which internal stakeholders is needed for a successful change in the financial auditing approach in an audit Big4 firm?

Audit staff and audit managers are the most important stakeholders, because of their influence, their power and their interest. Hence, their support is most needed for a successful change and they are the key stakeholders in the transformation. In the stakeholder analysis it too became clear that their attitude is unsure; positive or negative? It's important to know this to handle them well in order to make the transition a success. Consequently more research is needed on this and the next chapter will provide for this.

The support of audit partners also can be a big help, but is less critical since they aren't as interested in the transition as staff and managers. IT-auditors play a marginal role in the transition and their support is not critical. Support of the audit transformation team is needed, since they facilitate the transition. It is however less relevant, since their support is very certain.

The support of audit staff and audit managers is unsure, but truly needed and will therefore be a main subject in the further chapters.

Another important finding is the tension between audit staff and audit managers that can be considered as a negative cycle. The audit managers have no incentives to invest time and budget on the short term for more data-analysis and audit staff subsequently won't get familiarized with it. Audit staff will become audit managers later on and the situation repeats itself. Hence it can be considered that institutional barriers are also part of the cost of adoption.

The above also indicates the existence of a very important trade-off within an audit firm: chargeability versus innovation. Chargeability relates to the pressure on auditors to make billable hours, which undermines the time needed to develop their practice and skills. Another way to view this trade-off is as a conflict between a short term perspective (goal: make billable hours) and a longer term perspective (goal: develop audit practice). This conclusion is very important, since it hits the core of the transformation.

Important note is that heterogeneity within stakeholder groups went largely unaddressed. This subject will be handled in chapter 7.
6. Employee Support and How it can be Determined

It can be deduced from the stakeholder analysis that the support of the financial audit staff and financial audit managers, while unsure, is needed for a successful change in the financial auditing approach at a Big 4 audit firm. The need for such support in general also became clear in the literature review. Support is also important for job satisfaction, performance and employee health through commitment (Meyer et al., 2002).

Employee support of change is, for this research, defined as the extent to which employees are receptive and committed to change. It’s now interesting to further examine by which elements employee support of change is determined. For example, it is expected that having a sense of urgency for a change stimulates the level of support one has for that change. And thus the following sub-question is formulated.

*What elements, with respect to the case and alike situations, generally determine employee support of change?*

With more understanding of these elements, the actual presence of support of the staff and managers can be examined, which can guide and stimulate the management of the audit transformation.

6.1 Research Method

Support of individual employees, while being one of the most important aspects of change management (Pendlebury et al., 1998) can be a somewhat vague term. It needs more content to it. To find relevant elements that determine employee support, a literature review has been performed in the context of this thesis. This is a suitable method, because literature from various sources can be combined in order to gain more understanding of employee support.

Academic databases and search engines - namely Scopus and Google Scholar - have been accessed. The use of these made sure the focus was on peer reviewed articles in archived journals. These are meaningful indicators of academic quality. Subsequently keywords such as ‘employee support’, ‘change management’, ‘technology acceptance’, ‘support of change’, ‘employee commitment’, ‘employee engagement’, ‘employee adaptation’, ‘employee participation’ and ‘organizational change’ have been used, also in combination, to search for relevant articles. Many papers showed up in the queries and were subsequently scanned on their relevance to the situation based of their title and abstract. Articles about specific changes in firms are for instance more relevant than articles on cultural change. Other relevance indicators were terms such as ‘support framework’, ‘construct’, ‘[support] factors’. Around twenty articles were then selected and browsed to find appropriate elements determining employee support of change. Technology related elements are for instance also considered appropriate, since there is a significant role of technology in the transformation.
6.2 Results

The review made clear that determining elements can be of several types. In fact, coarsely three types of elements can be distinguished: demographic factors (age, education e.g.); episodic factors (sense of urgency for a specific change e.g.); and continuous factors (job satisfaction, job motivation e.g.).

Demographic factors aren't included in the scope, since these cannot be managed, except when they are used as criteria for personnel selection (Wanous et al., 2000). Continuous factors aren't included as well, since the research is about one specific transition. Hence the episodic factors are focused upon in answering the research sub-question. The identified elements are presented underneath with a description.

Also, it has to be noted that the question was focused on individuals because of scope and logistic reasons, while the transformation also is a group process.

**Sense of urgency for change**

Sense of urgency - do the employees feel the change is needed? - for the transition is taken into account, because all change should start with a sense of urgency (Kotter, 2008). Kotter argues that close to 50% of companies that fail in change, do so because not enough sense of urgency was present. This element is essentially a prerequisite for successful change: „When the urgency rate is not pumped up enough, the transformation process cannot succeed, and the long-term future of the organization is put in jeopardy“ (Kotter, 2007).

Philips (1983) also identifies that creating a sense of urgency is the first part of managing change. Important aspect of this is that the people involved recognize that industry dynamics offer problems or opportunities (as is, or should be, the case at the audit firm).

**Perception on the firm’s readiness for change**

This element is about the employees’ perception on the readiness of the firm to change. This readiness is important, since support for change cannot be expected from employees if they don’t believe the firm is ready to change. Smith (2006) also identified ensuring readiness for change as fundamental element for change success (refer to list 1). Perception on the firm’s readiness for change is defined by Weiner (2009) as the shared psychological state in which organizational members feel committed to implementing an organizational change and confident in their collective abilities to do so.

Holt et al. (2007) developed a framework to gauge this readiness. Their result is that readiness for change is a multidimensional construct that is determined by beliefs among employees (a) that they are capable of realizing the change, (b) that the change is appropriate for the firm, (c) that the leaders are committed to the change, (d) that the change is beneficial for the firm’s members. This last aspect is considered so important for employees that it is considered as a determining element on its own as well and thus will be discussed later.
Effective communication

Effective communication is a significant element, since it is considered as fundamental element of success (refer to list 1) and ineffective or inadequate communication is often the reason of failure in change processes (Smith, 2006; Seijts & O’Farrel, 2003).

Part of effective communication is the recognizability of a clear vision on the change. And a clear vision is identified as a driver of the employee support (Strebel, 1996). This vision shouldn't be too complicated or vague to be communicated in five minutes or less (Kotter, 1996).

Anticipated benefits (non-technological)

It should not be forgotten to include the benefits employees anticipate regarding the change, since this is expected to heavily involve employee support as well. The change's potential consequences for the employees, or gains and losses, form anticipated benefit. And they are an essential part of the employee perspective and heavily influence employee intentions to actively participate in, or support, the transition (Bartunek et al., 2006; Rousseau, 1995).

This view is reinforced by Hornung and Rousseau (2007), who have conducted a study that confirmed their hypothesis that anticipated benefits influences change commitment of employees and through that way support of change.

Direct gains or losses from the technology (a data-analysis application e.g.) are separated from anticipated benefits to stress the importance of technology in the transition and create a more clarifying list of elements. A non-technological benefit might be that auditors have more valuable work experience, while a technological benefit might be that auditors will spend less time on executing a test of journal entries. The two technology-involved elements are discussed later.

Resistance to change

Resistance to change is a key element as well, since it can be a large obstacle to a successful transition. It is a common reaction (Caldwell et al., 2004), and dealing with it is essential (Smith, 2006; refer to list 1).

Resistance to change can come from different sources such as the lack of above named elements. For example, a lack of communication leads to unawareness and that leads to resistance (Negovan et al., 2011). These reasons for resistance are measured and taken into account through the other elements. This element aims specifically on reasons like fear of failure, disruption of routine, loss of control etcetera, which are known to create resistance (Trader-Leigh, 2002; Shang & Su, 2004).

Since the intensified use of data-analysis in the financial audits involves the use of new technologies (in our case for example through the use of Spotfire software) the attitude towards using that technology is considered significant for the support of the transition as well. Davis (1989) has developed a widely used model for technology acceptance: the
Technology Acceptance Model (TAM). This model has been widely discussed as well. Chuttur (2009), for instance, indicates that its explanatory and predictive power is criticized, and this has to be considered when interpreting the results.

As can be seen, perceived usefulness and perceived ease-of-use determine the attitude towards the technology. Since technology is a big part of the transition it is assumed that these two elements also determine the employee support for change.

**Perceived usefulness of new technology**

Employees tend to use or not use an application or tool to the extent they think it will help them perform their job better (Davis, 1989). This is referred to as perceived usefulness of new technology\(^{21}\).

In his study, Davis developed a validated six-item-scale to measure perceived usefulness, containing: [technology is] *useful in job*, [technology] *makes job easier*, [technology enhances] *effectiveness*, [technology] *increase productivity*, [technology improves] *job performance*, and [technology enables to do] *work more quickly*.

**Perceived ease-of-use of new technology**

Even if prospective users believe that a particular application or tool is useful, they can also think that it is too hard to use and that the efforts of using the application outweigh the benefits (Davis, 1989). This is referred to as perceived ease-of-use of new technology\(^{22}\).

Davis also developed and validated a six-item-scale for this element, including: [technology is] *easy to learn*, *controllable*, *clear & understandable*, *flexible*, *easy to become skillful in*, and *easy to use*.

\(^{21}\) Davis (1989) also defines it „the degree to which a person believes that using a particular system would enhance his or her job performance”.

\(^{22}\) „The degree to which a person believes that using a particular system would be free of effort” (Davis, 1989).
All together, these elements (summarized with references in appendix 6) are considered to give a good view on how change support can be determined in a case such as the audit firm (episodic, new technology involved). These elements and how they influence change support through change receptiveness and change commitment are visualized below.

![Diagram showing elements of change support](image)

**Figure 14. Determining Individual Employee Support in Change**

### 6.3 Reflection

The above identified elements combine change management models and frameworks, statistical factor research and the Technology Acceptance Model and the resulting collection of elements is expected to give a fair qualitative view of employee support in a transition.

Some overlap might be present, but that is hard to avoid since the elements are of qualitative nature. Also, existing frameworks or constructs could have been used directly, but none seemed to have a suitable fit. This specific collection is expected to be of more value, since it is suited to the specific characteristics of the change. This view was supported when the construct was presented to and discussed with an auditor involved in the transformation. And so it can be said, also in line with the earlier footnote, that the construct is validated from the field of practice.

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23 NB. ‘Change Support’ in this figure deals with individual episodic changes where technology is involved.

24 The collection of elements is supported and validated by the fact that all the elements were generally considered important by the interviewees and none had elements to add.
6.4 Conclusion

The conclusion forms the answer on the earlier formulated question:

*What elements, with respect to the case and alike situations, generally determine employee support of change?*

Based, on the literature the following elements generally will determine the individual, episodic employee support of change:

- Sense of urgency for change
- Perception on the firm's readiness for change
- Effective communication
- Anticipated benefits (non-technological)
- Resistance to change

On top of these elements two additional elements have been identified that are relevant to determine employee support of change, when the change involves the use of new technology as is the case at the audit firm:

- Perceived usefulness of new technology
- Perceived ease-of-use of new technology

All these elements will be used in semi-structured interviews, in the next question and chapter, to determine if support for the transition is present at the audit staff and audit management of the audit firm.
7. Firm's employees; Are Audit Staff and Management Supportive of the Transition?

In the fifth chapter it is established that financial audit staff and financial audit management are the most critical stakeholders for a successful transformation, but also that their attitudes and support toward the transformation are unsure. In the previous chapter several elements are identified that together form employee support for an audit transformation like change. Now we want to and are able to examine if the financial auditors, at the firm, are supportive of the change. Hence, the question dealt with in this chapter is:

*Can the firm’s key stakeholders (financial auditors) be considered supportive of the audit transformation?*

With more insight on the auditor’s perspectives, the transformation can be managed better and is more likely to be successful.

7.1 Research Method

The support is evaluated during semi-structured interviews. During a semi-structured interview the interviewer and interviewees engage in a formal interview, for which an interview guide is developed with a list of topics that should be covered (Cohen & Crabtree, 2006). A semi-structured interview allows for the interview to go “off course”, while all topics can still be addressed. Another good reason to use this method is its ability to provide reliable and comparable data (Laforest, 2009). Laforest (2009) also identifies ‘time-consuming’, for the interviewee and even more for the interviewer, as a disadvantage it has.

Nevertheless, eight financial auditors have been found willing to respond. They are all active in the financial sector, which is in line with the scope of the research. Furthermore, they are expected to be a representative sample of the total population, since: (1) both auditors active in banking and insurance were included, which are the two dominant client focuses in the financial sector; (2) auditors with experience in data-analysis and auditors without were included; (3) both audit staff and audit managers have been interviewed; and (4) the response rate indicates that there is no significant bias present due to response willingness.

The list of elements that were identified as determining employee support in the previous chapter is the basis of the interview guide that is designed and used to assess the auditor’s supportiveness. This interview guide is presented in appendix 7. It shows that a closed question is included as well, together with a final question in which the auditors were asked to rank the elements on importance. Results of this are included below.

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25 Response rate was 89%
7.2 Supportiveness of firm’s employees

The results can be summarized in two tables. The first, considerably the more important one, shows if the elements that were determined in the previous chapter are present/fulfilled for the interviewed financial auditors (e.g. Do you feel urgency for the change? ‘yes’, ‘no’ or ‘unsure’). The second table of this paragraph shows how important the elements are considered to be by the financial auditors.

Table 8. Financial Auditor’s Support: Present/Fulfilled Support Elements for Auditors

<table>
<thead>
<tr>
<th>Elements</th>
<th>Present / Fulfilled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Sense of urgency for change</td>
<td>7</td>
</tr>
<tr>
<td>[Perception on] Firm’s readiness for change</td>
<td>5</td>
</tr>
<tr>
<td>Effective communication</td>
<td>2</td>
</tr>
<tr>
<td>Anticipated benefits</td>
<td>4</td>
</tr>
<tr>
<td>[NO] Resistance to change</td>
<td>8</td>
</tr>
<tr>
<td>[Perceived] Usefulness of new technology</td>
<td>6</td>
</tr>
<tr>
<td>[Perceived] Ease-of-use of new technology</td>
<td>4</td>
</tr>
</tbody>
</table>

The financial auditors are generally positive on the various elements as table 8 shows and this also became clear from the open questions. Except for one element though, namely ‘effective communication’:
Figure 16. Bar Chart on Effective Communication According to Financial Auditors

Only two of the interviewed auditors feel that communication about the more intense use of data-analysis in the financial audit and the vision around it is effective. The underlying issues of this and more that surfaced in the interviews are addressed in paragraph 7.4.

Figure 15 shows that auditors feel that every element is important for their support of the change. A ‘sense of urgency’ and ‘anticipated benefits’ are considered most important. For a successful change it is good to see 7 of the auditors also really feel the sense of urgency. Half of the auditors are convinced that the change will have (personal) benefits, while the other half is not sure or neutral. Identified benefits are ‘having more to offer to the client’ and ‘gaining valuable work experience’ for example.

All in all, the financial auditors can definitively be considered supportive of the concerned transformation. Communication can be done more effectively though.

These were the results in summary. Paragraph 7.3 presents other relevant findings and paragraph 7.4 will discuss the results on a more detailed level. Appendix 8 contains pie charts on individual elements to enhance a quick understanding.

7.3 Other Findings

Strebel (1996) identifies a gap between how (senior) managers see change and how staff sees it. He argues that managers often think of change as an opportunity, while staff thinks of it as balance disrupting. Hence it’s important to distinguish these two groups of internal stakeholders. And the support can consequently be examined from both perspectives. This has been done at this case as well. However, no striking differences were found between the level of support of staff and management as table 16 in appendix 8 shows.

Furthermore, the interviewed auditors were also categorized regarding their client focus - banking or insurance - and experience with data-analysis in the financial audit. However, no relations between their focus or experience with support can be deduced from the results. If more insight is wanted on these correlations, the author suggests to design and execute a large-scale survey, since semi-structured interviews are not optimal to examine these relations.

7.4 Underlying Issues of their Support and Resistance

Almost everyone had a sense of urgency for the change. Most indicated reasons for this were that it is a hot topic at (potential) clients and that it is urgent from a competition perspective as well.

The majority of the financial auditors had a positive perception on the firm’s readiness for change. Indicated reasons for this are a firm belief in the expertise of the internal
developers of the analyses and the firm's adequate organization. A quarter of the interviewees had a negative perception though, mainly because of a lack of experience with the new tools. Need for more training on this topic was often indicated.

Only a quarter of the interviewees were positive about the communication and its effectiveness. Despite the vision concerning the transformation being clear, it was widely experienced that the application of data-analysis was still unclear. Or as one interviewee put it: “(data-analysis in the financial audit) raises more questions than answers”.

Consensus was that not enough attention has been paid to the transformation in regular team meetings, learning sessions, email updates etcetera. The apparently currently ineffective communication can be considered as a process-oriented barrier for successful adoption. And since this needs to be overcome it can also be considered as part of the cost of adoption.

Anticipated benefits were regarded as the most important element for the support of financial auditors. Half of the interviewees anticipated benefits for themselves due to the transformation such as ‘having more to offer to the client’ and ‘gaining valuable work experience’. Other half was neutral or unsure, mostly due to lack of knowledge and experience on application. No one anticipated negative net benefits.

None of the interviewees felt resistance towards change itself. Hence it can be argued that the audit firm has employees that rather favor change and innovation than that it makes them uncomfortable.

Most interviewees were convinced of the usefulness of the new technology. General expectation was that it will enable them to work more efficient.

All interviewees had a positive or neutral perception on the ease-of-use of the new technology. It became clear in the interviews that the interviewees had faith in the developers of the tools and analyses and in their own skills.

In paragraph 4.2 it was argued that managers seem to be hesitant to stimulate the transformation. During the interviews an explanation for this came to surface: Managers are not sure how data-analysis can and will be applied and hence they see only additional work in the short term and no efficiency gains. And they are not eager to allot additional work for which they don’t have much time and budget.

### 7.5 Reflection

While the interviewees have various functions, various client focuses and various levels of experience, they might not be totally representative. This is because the interviewees were approached through other contacts (e.g. on behave of a partner) to ensure a high response rate. These were (indirect) contacts from the author at the audit firm. These might be

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26 It has now become clear that the cost of adoption can be considered as a collection of technical barriers (e.g. client data has to be transitioned by the audit firm before being usable in the analysis; chapter 3), institutional barriers (e.g. auditors need to be evaluated less on chargeability to be more incentivized to data-analysis; chapter 5) and process barriers (effective communication is needed; chapter 7).
biased since the author was mainly in contact with directors and partners that have an affinity with data-analysis.

Indications have been given on the existence of correlations between auditor characteristics and support, while semi-structured interviewed aren't particularly suited for this. If more insight is wanted on these relations a larger scale survey should be held.

For the goal of this chapter and sub-question the method proved very adequate. Much more insight is now known about auditors and their perspectives on the change.

7.6 Conclusion

The earlier formulated question can and will now be answered.

*Can the firm's key stakeholders (financial auditors) be considered supportive of the transition in the audit approach?*

The firm's financial auditors can be considered supportive of the transformation, since they generally have a sense of urgency for the change, a positive perception on the firm's readiness for change, anticipate benefits from the change, have positive perceptions on the technology and feel no resistance on change (refer to table 8).

There is one shortcoming though, namely effective communication. While that is an important element (refer to figure 15) for auditors and their support, the communication isn't perceived well. Related identified underlying issue is that auditors are unsure how data-analysis will be applied and in lieu of what it will be applied. One auditor even stated 

''[data-analysis in the financial audit] raises more questions than answers’’. This indicates another content of the cost of adoption.

In addition, there was no striking difference found between the level of support of financial audit staff and financial audit management. Relations between support and client focus or experience with data-analysis could also not be identified.

These were the most important results. Now it seems that a pioneer role isn't appealing because of the cost of adoption. This issue can be countered by providing more training and actively formulating success stories. More on this and the recommendations will be handled in the next chapter.
Part D

Conclusion
8. Conclusions & Recommendations

This last chapter contains the conclusions and recommendations. These will subsequently be discussed. After this the chapter will end with a discussion on the limitations of the research.

8.1 Conclusion

This section will firstly summarize the conclusions per sub-question, since these are presented earlier and in more detail at the individual chapters. Combining these, several more conclusions will be drawn in paragraph 8.1.2. Lastly, the main research questions will be answered. Focus lies on the latter conclusions, since these are new.

8.1.1 Answering the Sub-questions

The first question aimed to assess the use of data-analysis in progressive engagements at the audit firm and to compare them with expectations from the literature.

At the insurance company engagement data-analysis was used in a basic way through analyzing the whole population of journal entries with a specific tool instead of taking a sample first. At the other case, the commercial bank engagement, the use of data-analysis was more progressive. It focused on substantive procedures by means of a ‘yield analysis’ specifically designed in Spotfire. Also, a lot of added value was gained in understanding the business. For both cases, data-analysis was used for more assurance, for more efficiency and in the case of the commercial bank also for more value in the auditor-auditee relationship. Nevertheless, the audit approach in both cases remained the same on the whole (meaning that the same phases and steps were gone through).

Expectations from the academic literature on advantages, disadvantages and prerequisites concerning the use of data-analysis in the financial audit greatly matched with the outcomes in practice. For instance, testing whole populations and gaining more understanding of the business - identified by Jans et al. (2013) as reasons for the use - were in practice recognized as the greatest advantages. For more, refer to table 5. Moreover, cost of adoption - identified by Vasarhelyi & Romero (2014) as disadvantage of the use - is recognized as well and appeared to be two-sided: auditors need to get familiar with the use; and the data-analysis has to be suited to the client as well.

For the second question, which focused on the consequences of the use of data-analysis in the financial audit for auditors, it can be concluded that not a whole lot changed, since the approach remained the same on the whole. What did change is how the steps - mainly regarding understanding the business, substantive procedures and journal entry testing, are performed. This has positive and negative consequences. For instance: positive consequence is that auditors can work more efficiently; negative consequence is that first additional work of them is needed to adopt the tools (refer to the earlier mentioned two-sided cost of adoption). Also, to deal with outliers that are found with data-analysis,
patterns should be discovered, since outliers are detected in higher volume with data-analysis;

The third question aimed to identify which internal stakeholders' support is needed for a successful change. Through a stakeholder analysis it became clear the support of all stakeholders (financial audit staff, management, partners; IT-auditors; AT team) is needed. However, support of financial audit staff and management is most critical, since mainly their day-to-day activities are involved in the audit transformation.

Other important finding was the presence of a tension, or negative cycle, between managers and staff: Managers don't have enough incentives to invest time and budget for additional data-analysis work and staff subsequently won't get familiarized with it. Later on, audit staff will become managers and the situation can repeat itself.

Meanwhile, the analysis did not clarify the attitude - are they supportive? - of staff and management. This is important to know when managing the change though. The next two questions addressed this issue.

The fourth question focused on identifying what elements determine employee support in a case such as this. Transforming the financial audit with data-analysis at a Big4 audit firm is an episodic change that involves technology. On an individual level the following elements are found - during a literature review - to determine employee support: 'sense of urgency for change', 'perception on the firm's readiness for change', 'effective communication', 'anticipated benefits', 'resistance to change', 'perceived usefulness of new technology', and 'perceived ease-of-use of new technology'.

The fifth question was directed at assessing if the firm's key stakeholders are supportive of the audit transformation. The earlier stakeholder analysis pointed out that financial audit staff and management are the key stakeholders. They can be generally be considered supportive, since the elements identified in sub-question 4 are all generally regarded positively present except for one. The auditors don't think that the communication around the transformation is very sound. They are particularly unsure about how data-analysis is to be applied with added value. To create more support, this should be communicated more effectively.

8.1.2 Synthesizing the Sub-conclusions

During the research several issues were found through synthesizing conclusions from sub-questions and also issues that don't fit a particular question. These findings are presented here.

First, throughout the research the presence of a trade-off that is at the core of the situation became clear: chargeability versus innovation. Financial auditors and managers are pushed to have a high level of billable hours and are also evaluated on this.
Consequently they aren't incentivized to innovate their work by adopting new tools or new ways of working. This trade-off results from a misalignment between short term goals (chargeability) and long term goals (innovation / development).

Second, although clients were mainly left out of scope, it did became clear there's a tension present there during the commercial bank engagement and the employee support interviews: The client often does want more data-analysis in its audit and get more valuable insights back from the auditor, but at the same time also isn’t eager to provide its data because of confidentiality and compliance issues likely.

Furthermore, a note can be made to come back on the introduction; more specifically section 1.2.3 that addressed research of Vasarhelyi & Romero (2014). In their case study, which focused on forensic and IT auditors, they found that technological tools are available for data-analysis in the audit. The use of these available tools, however, was not optimal. The same is the case at the audit firm in question, based on the overall limited use made of the tools firm wide and the cases.

Lastly, it’s still unclear how data-analysis should eventually be applied and what other activities can then be withdrawn. This statement is based on both the support interviews and the cases. In the interviews this was consequently linked to ineffective communication. Moreover, the lack of a well communicated success story was indicated too.

8.1.3 Answering the Main Research Questions

The two main research questions of this thesis are:

**MRQ1**: How is data-analysis transforming the financial audit of financial institutions in practice with respect to the audit approach, data and tooling?

**MRQ2**: Are the firm's key stakeholders supportive of the data-analysis induced transformation?

With respect to the first question, thus for the cases, it can be concluded that:

- The financial audit has not changed greatly yet, since the approach on whole is still the same and the two available complementing tools weren’t used together in one engagement. It are only the activities in the audit steps that change, not the audit steps, phases or approach itself.
- Two recent tools are designed to enable the data-analysis to support mainly understanding the business, substantive procedures and journal entry testing. The overarching audit tool hasn't changed in years.
- From the 14 steps in the audit identified as possible locations for data-analysis only 7 were utilized in total, and at the most progressive engagement only 5 were utilized.
- Experiences in practice on the use of data-analysis greatly match the expectations from the literature:
Whole populations are tested now, resulting in more assurance.
More understanding of the business is created, enabling a better scope of the audit.
There is a substantial cost of adoption to incur first before data-analysis can efficiently be used. There is also more to the cost of adoption than Vasarhelyi & Romero (2014) describe.
More data is needed for the analyses in the Spotfire tool. Clients aren’t eager to provide these.

- With testing whole populations, more outliers are expected to be identified. To deal with this, auditors have to find patterns in the them since too much outliers are expected to follow them up individually. This is a main consequence of the application of data-analysis for financial auditors.
- Analyses in Spotfire are still in development; just as new overarching audit tool. There is still a long way to go in the audit transformation.
- The cost of adoption, that needs to be incurred at the firm to apply more data-analysis in the financial audit, proves to be a large bottleneck.

With respect to the second question, it can be concluded that:

- All the involved internal stakeholders’ support is needed for a successful transaction, but audit staff and audit managers are the ones who will guide and perform data-analysis in the financial audit and so they are the key stakeholders
- Support for the episodic change consists of the following elements: ‘sense of urgency for change’, ‘perception on the firm’s readiness for change’, ‘effective communication’, ‘anticipated benefits’, ‘resistance to change’, ‘perceived usefulness of new technology’, and ‘perceived ease-of-use of new technology’.
- The audit staff and managers can generally be considered supportive of the transformation, but do experience a lack of effective communication.

**Cost of Adoption: connection the two research parts**
The cost of adoption is regarded as main finding of the research in which the two MRQ and research parts are also integrated. The cost of adoption is regarded as a collection of barriers that is needed to overcome in order to make the audit transformation successful. This cost of adoption is more than just a monetary cost. In chapter 3 it became clear that there are technical barriers to the cost of adoption such as the need to develop the data analyses and the need to transition client data to a serviceable format. In chapter 5 it became clear that there are institutional barriers as well. For instance, auditors are currently evaluated on high chargeability goals which obstructs them getting much needed familiarization with data-analysis. In chapter 6 and chapter 7 it became clear that there are process barriers as well that are considered part of the cost of adoption as well. Example here is the need for effective communication.
This cost of adoption can be considered an impact of data-analysis on the financial audit, since the use of data-analysis sets that substantial cost of adoption.

Concerning Practical Relevance
Regarding the practical relevance of the results it’s important to know for the stakeholders at the audit firm that the cost of adoption, in combination with the chargeability vs. innovation trade-off, prevents a smooth transformation and should be overcome. Also, they should be aware that there is much room left for optimization concerning the use of data-analysis in the financial audit. And, while the financial auditors are generally supportive, the communication concerning the transformation could be done better to increase support, especially since they are the key stakeholders.

Concerning Scientific Relevance
Scientifically relevant results relate to theory-practice gap that was identified in the introduction. Hence, expectations from the academic literature on advantages, disadvantages and prerequisites concerning the use of data-analysis in the financial audit were compared with the outcomes in practice. The expectations and experienced outcomes greatly matched. For instance, testing whole populations and gaining more understanding of the business - identified by Jans et al. (2013) as reasons for the use - were in practice recognized as the greatest advantages. For more, refer to table 5. Besides, cost of adoption - identified by Vasarhelyi & Romero (2014) as disadvantage of the use - is recognized as well and appeared to be two-sided: auditors need to get familiar with the use; and the data-analysis has to be suited to the client as well.

Moreover, the use of data-analysis tools at big4 audit firm, even in progressive engagements, is still suboptimal. This is equal to what Vasarhelyi & Romero (2014) found in their case study.

Also, there was a large hindrance for a smooth transition observed, namely the chargeability-innovation trade-off. This observation gives insight in audit approach transformation situations at big4 audit firms.

Furthermore, the conclusions from subquestions 3 and 4 can be diverged to big4 audit firms in general, since they are all intensifying the use of data-analysis and have identical firm structures.

These results and their scientific relevance are also presented in further detail in a scientific paper, which is included at the end of this report in part F.

8.2 Recommendations
Confined recommendations and discussion are done concerning the practical results and future research separately.
8.2.1 Concerning Practical Results

Three of the main results are adequate points of departure for recommendations, namely the ineffective communication, the cost of adoption, and the chargeability vs. innovation trade-off.

Regarding the ineffective communication, where it particularly became clear that the financial auditors are unsure how to apply data-analysis and with what efficiency gains, the following is recommended: The audit transformation team can formulate one or more success stories with the input of financial auditors and communicate them with all of the financial auditors at the firm; Managers and partners can address the topic more in regular team meetings, email updates etcetera; The audit staff can actively pursue more internal training, which then also should be provided\(^{27}\), in the use of data-analysis and/or select further professional education that includes this topic\(^{28}\).

Regarding the cost of adoption it is recommended to reduce that cost. A good way to do this is to start utilizing the available tools right away with new clients, as became clear in the research and especially the commercial bank case. Training and better suited professional education programs will also help to reduce the cost.

The trade-off can be mitigated by reducing the cost of adoption but still remains. To prevent the trade-off from hindering a successful transition, several actions can be undertaken. The most effective action, though, will probably need reduced chargeability focus and goals by partners. Doing so will also align the partners' short term goals (revenue) and long term goals (development) better. Moreover, rewards can be formulated for auditors that are active in adopting data-analysis in the financial audit. Rewards are also a good way of winning support for change (Lawler & Worley, 2006). Rewards can also form the short term wins that are often needed to overcome the short term goals vs. long term goals gap (De Bruijn & Ten Heuvelhof, 2008).

Anyhow, since the adoption barriers are of different natures it is crucial that technical, institutional and process barriers will be addressed, when taking actions to reduce the cost of adoption and stimulating the audit transformation.

8.2.2 Concerning Future Research

Five recommendations are done for future research. First, identified area of interest for future research is the further identification of what barriers of adoption, in a technical-institutional-process framework, form the cost of adoption. Subsequently principles of design in this framework can be formulated to overcome these barriers and make audit transformation(s) more successful.

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\(^{27}\) The firm actually recently started with a 'data-analysis traineeship' for auditors.

\(^{28}\) If not available, educational institutions that provide professional education (for becoming a RA or CFA e.g.) should be stimulated to include this in their programs.
Second, the research model used in part B, namely figure 3, was constructed by the author who was restricted by the scope. Hence, the research model needs evaluation if it will be used again.

Third, since the thesis only describes the current use of data-analysis and the practice is dynamic, just as the technology that drives the literature, research of the same nature can be performed in reasonably short term to provide a more up-to-date picture.

If more (quantitative) insight is wanted into which factors determine support of financial auditors for data-analysis in the financial the author suggest to design and conduct a large scale survey.

The last recommendation for future research concerns the practical recommendations done in the previous section. It has to be reminded those are confined recommendations. If a concerned stakeholder decides to follow up on one, more research is needed on its suitability and the nuts and bolts.

### 8.3 Limitations

There are certain limitations to the research that is presented in this report and its findings. First of all, with respect to the first MRQ, only two progressive engagements within one Big4 audit firm have been examined. Although they are expected to be representative, it still needs to be considered that this might not be fully the case and this should subsequently be reminded when interpreting the results.

Second, the audit client – or auditee – has been left out of the scope of the research, while they also are considered an essential stakeholder to successfully make intense use of data-analysis during the financial audit. This should not be forgotten.

Also, a methodological limitation is present. The semi-structured interviews failed to identify correlations between auditor characteristics and support; simply because interviews can’t be held on a large enough scale. While the identification of these results were not part of the research objective, results could have been interesting.

Furthermore, at the beginning of the research the author was still new to external financial auditing and arguably still is due to the complexity of the process. Hence, the descriptions of the use of data-analysis in the audit don’t go in-depth in all places.
9. Reflection on the Research

In this chapter I will provide a personal reflection on the research scope, the research methods, the research model and the research process.

The time planning, as part of the research scope, was more extensive than prescribed with master theses at the SEPA M program, because of the topic's novelty for me. Despite this and much invested time, the research still overran the planning due to data dependence, broad scope and extensive reporting and finalizing of the research. In hindsight I still believe the scope of the research was fit to the research problem and its broadness was needed to answer the pressing questions.

Also in hindsight, the research could have benefited greatly with more work on the research design. Research questions could then have been formulated more sharply, methods could then have been more precise and conclusions and recommendations could have been more uniform then. However, this is in hindsight. The time scope of the process and research project did not have enough room for that, especially since the research subjects and main method were fairly new to me.

It proved to be hard to integrate the two research parts with a theoretical motivation. I believe the integration becomes most apparent in the barriers of adoption, also framed as cost of adoption, in a technical-process-institutional framework. Part B (first part of the research) explored mostly technical issues in the audit transformation and Part C (second part of the research; stakeholder approach) explored institutional and process related issues of the transformation. Together the two aspect fully cover the multifaceted audit transformation.

The used research methods proved suitable to answer the questions. Hence I am content with them. Furthermore, the stakeholder approach chosen gave various valuable insights about the multidisciplinary of the cost of adoption, about the use of data-analysis in the financial audit and about the support of auditors for that use (e.g. the chargeability vs. innovation trade-off) on top of answering the questions. The research model used for part B was a work in progress. It came into being on an iterative manner. It could have been more specified or more connected with part C, but it will continually be disputable like most models and decisions had to be made. For reflections on separate methods and results I refer to the reflection paragraphs per chapter.

The research process on the whole was satisfying in the end. It especially became clear how much internal support (from the audit firm) and willingness to participate stimulates the research and adds value to it. Moreover, I believe the study gives solid answers to the rightly raised questions and other valuable insights and as such provides a useful understanding of the data-analysis induced audit transformation. It’s now up to the involved stakeholders to take action based on the recommendations drawn from the results.

Lastly, one more question that rose during the research was to what extent the audit transformation actually is a transformation. It can certainly be argued that until now the
audit transformation at the concerned firm is better described as an audit transition, since the audit roadmap (such as the approach in figure 6) has not changed shape. However, I do consider that this roadmap will change on short term, depending on how the cost of adoption is managed, and that the audit transformation definitively is a transformation and that the same will happen at other firms because of the shared market dynamics.
References


Bastingdienst. (2014). *Controleaanpak Belastingdienst*.


Part E

Appendices
List of Abbreviations

AT: Audit Transformation
BI&A: Business Intelligence & Analytics
CEO: Chief Executive Officer
CPA: Certified Public Accountant
DA: Data-Analysis
EAGLe: Enhanced Analysis of the General Ledger (tool)
EU: European Union
EY: former Ernst & Young (one of the Big4 audit firms)
FSCP: Financial Statement Closing Process
GA: Global Analytics
GAAS: Generally Accepted Audit Standards
GAM: Global Audit Methodology
GL: General Ledger
IASB: International Accounting Standards Board
IFRS: International Financial Reporting Standards
ISA: International Standards on Auditing
IT: Information Technology
ITGC: IT General Control
KPMG: one of the Big4 audit firms
MRQ: Main Research Question
NBA: Nederlandse Beroepsorganisatie van Accountants
OLAP: Online analytical processing
P&L: Profit and Loss (Statement)
PCAOB: Public Company Accounting Oversight Board
PIE: Post Interim Event
PM: Planning Materiality
PWC: PriceWaterhouseCoopers (one of the Big4 audit firms)
RA: Registeraccountant (official Dutch financial auditor title; comparable with CPA)
SAD: Summary of Audit Differences
SCOT: Significant Classes Of Transactions
SOX: Sarbanes-Oxley Act
SRQ: Sub-research-question
TAM: Technology Acceptance Model
TE: Tolerable Error
TPE: Team Planning Event
US(A): United States (of America)
Appendix 1: Audit Risk Model

Table 9. Audit Risk Model Matrix

<table>
<thead>
<tr>
<th>Inherent Risk</th>
<th>Control Risk</th>
<th>Combined Risk of Auditee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Rely on controls</td>
<td>Minimal risk</td>
</tr>
<tr>
<td>High</td>
<td>Not rely on controls</td>
<td>Moderate risk</td>
</tr>
</tbody>
</table>

Example of Quantitative Interpretation

Control risk: not rely on controls (high) → 1
Inherent risk: high → 0.5
Audit risk is set at 0.1

Audit risk = inherent risk * control risk * detection risk
0.1 = 1 * 0.5 * detection risk
→ Detection risk = 0.1 / (1*0.5) = 0.2

A detection risk of 0.2 can be considered low and so, to reach this, extensive auditing (e.g. more substantive testing) is needed to keep the audit risk acceptable (0.1).

Also, interesting document in this context is the ‘Controleaanpak Belastingdienst’ (Belastingdienst, 2014).
Appendix 2. Data-Analysis in Steps in Audit Approach

List 3. Possible Steps in the Audit Approach for Data-Analysis Application

<table>
<thead>
<tr>
<th>Possible Steps in the Audit Approach for Data-Analysis Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the Business</td>
</tr>
<tr>
<td>Understand Entity-Level Controls</td>
</tr>
<tr>
<td>Identify Risk of Material Misstatement due to Fraud and Determine Responses</td>
</tr>
<tr>
<td>Identify Significant Accounts and Disclosures and Relevant Assertions</td>
</tr>
<tr>
<td>Identify SCOTs, Significant Disclosure Processes and Related IT Applications</td>
</tr>
<tr>
<td>Understand SCOTs and Sig Disclosure Processes</td>
</tr>
<tr>
<td>Evaluate and Understand the FSCP</td>
</tr>
<tr>
<td>Design Test of Journal Entries and Other Mandatory Fraud Procedures</td>
</tr>
<tr>
<td>Design Substantive Procedures</td>
</tr>
<tr>
<td>Plan General Audit Procedures</td>
</tr>
<tr>
<td>Execute Tests of Journal Entries and Other Mandatory Fraud Procedures</td>
</tr>
<tr>
<td>Perform Substantive Procedures</td>
</tr>
<tr>
<td>Perform General Audit Procedures</td>
</tr>
<tr>
<td>Perform Financial Statement Procedures</td>
</tr>
</tbody>
</table>
Appendix 3. Data Collection at the Subcases

Table 10. Data Sources Audit Transformation and Subcases

<table>
<thead>
<tr>
<th>Data sources</th>
<th>Interviewees</th>
<th>Number of interviews / participation moments / talks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audit transformation team</td>
<td>Partners/executive directors</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Managers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>staff</td>
<td></td>
</tr>
<tr>
<td></td>
<td>various&lt;sup&gt;30&lt;/sup&gt;</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>16</strong></td>
</tr>
<tr>
<td></td>
<td><strong>(Internal) Documentation reviewed</strong></td>
<td></td>
</tr>
<tr>
<td>Insurance company engagement</td>
<td>Partners/executive directors</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Managers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Staff</td>
<td></td>
</tr>
<tr>
<td></td>
<td>various</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
</tr>
<tr>
<td>Commercial bank engagement</td>
<td>Partners/executive directors</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Managers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>staff</td>
<td></td>
</tr>
<tr>
<td></td>
<td>various</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

<sup>29</sup> Information was not only gathered during formal interviews, but also during informal moments like discussions about data gathering delays during lunch.

<sup>30</sup> Example of a various meeting is a call about Spotfire and the story of the audit with the audit transformation team and an internal develop at an office abroad.
Appendix 4. Subcases guides

Subcases Guide

- What is audit quality to you?

SRQ 1: How is data-analysis applied in progressive engagements, and what difference does that make to the audit approach and tooling?

- How is data-analysis applied?
  - Which tools? Spotfire
  - Which steps?
  - Which activities?

  (Walkthrough / screenshots available?)

- What is new? ; What is different from before?

- Why is it applied? E.g. more efficiency, assurance, value, frequency?

- Which advantages were experienced in the process (concerning the data-analysis use)? And were they expected or not?

- Which disadvantages were experienced in the process (concerning the data-analysis use)? And were they expected or not?

- What about prerequisites?
  - Data-quality / independent data access e.g.
  - Audit trail e.g.

- What are the expectations for the future on the above topics?
  - Where will/can DA be applied and with which goal?
  - How will that (further) change the audit approach in general?

SRQ2: What are the consequences of DA application in the audit for auditors and their activities?
- Has audit approach in general changed?

- Which steps have changed for audit staff and audit managers?

- Which activities in those steps are concerned?
  - e.g. How is dealt with the increase in outliers found?

- Which advantages, regarding the auditor’s activities, were experienced and which potential advantages were identified?

- Which disadvantages and difficulties, regarding the auditor’s activities, were experienced and which potential ones were identified?

<table>
<thead>
<tr>
<th>Possible Steps in the Audit Approach for Data-Analysis Application</th>
<th>Goals of DA for the Financial Audit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the Business</td>
<td>More Efficiency</td>
</tr>
<tr>
<td>Understand Entity-Level Controls</td>
<td></td>
</tr>
<tr>
<td>Identify Risk of Material Misstatement due to Fraud and Determine Responses</td>
<td></td>
</tr>
<tr>
<td>Identify Significant Accounts and Disclosures and Relevant Assertions</td>
<td></td>
</tr>
<tr>
<td>Identify SCOTs, Significant Disclosure Processes and Related IT Applications</td>
<td></td>
</tr>
<tr>
<td>Understand SCOTs and Sig Disclosure Processes</td>
<td></td>
</tr>
<tr>
<td>Evaluate and Understand the FSCP</td>
<td></td>
</tr>
<tr>
<td>Design Test of Journal Entries and Other Mandatory Fraud Procedures</td>
<td></td>
</tr>
<tr>
<td>Design Substantive Procedures</td>
<td></td>
</tr>
<tr>
<td>Plan General Audit Procedures</td>
<td></td>
</tr>
<tr>
<td>Execute Tests of Journal Entries and Other Mandatory Fraud Procedures</td>
<td></td>
</tr>
<tr>
<td>Perform Substantive Procedures</td>
<td></td>
</tr>
<tr>
<td>Perform General Audit Procedures</td>
<td></td>
</tr>
<tr>
<td>Perform Financial Statement Procedures</td>
<td></td>
</tr>
</tbody>
</table>

**Figure: steps and goals for DA in the financial audit**

NB. Between the first and second subcase this guide was adjusted; Above is the final guide. The first case was approached with a broader scope, but would have had the same results if the final guide was used.
Appendix 5: Stakeholder Analysis

The used method for the stakeholder analysis is based on Stakeholder Mapping Cube, that was introduced in 2005 by Murray-Webster and Simon. This method is developed to enable the categorizing of concerned stakeholders based on their power, interest and attitude. Knowing to what category a stakeholder belongs gives valuable insight in them and the total stakeholder complexity. These are insights about the expected perspectives of stakeholders on the issue (data-analysis induced transition of auditing). It is also often used as guide to managing stakeholders.

Sources for the analysis are observations during the case study's interview and participation. Also, firm employees are consulted in informal manner to substantiate the analysis by validating the firm structure in figure 17 for example.

The Relevant Stakeholders

During the first case at the firm, it became clear from interviews and observations that internally there are five important distinguishable stakeholders: audit staff, audit managers, audit partners, IT-auditors, and the Audit Transformation team. These are considered most important because of the scope and their involvement in the audit transition. They are presented and described in the next table.
<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Description - Involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audit staff</td>
<td>These are the auditors that execute most steps of the audit and perform the detail work. They can be divided into junior and senior auditors; at the firm 'junior auditor' and 'auditor' are interchangeable terms. They are, or should be, the end users of data-analysis tooling.</td>
</tr>
<tr>
<td>Audit management</td>
<td>The audit managers and senior managers that guide and coordinate the audit staff in their work and their responsibilities include planning the audit, planning the audit resources, scheduling the staff, reviewing the staff's work, and evaluating the staff.</td>
</tr>
<tr>
<td>Audit partners</td>
<td>Only a small number of people are partner at the audit firm. They develop and manage client relationships. Other main responsibilities are identifying opportunities for the firm and developing their department and firm. Also they set and track financial targets and, taking this into account, they guide and coordinate the audit management. Overall they are responsible for the audit engagement and the auditor's opinion. The position of Director within the firm is in practice comparable with Partner.</td>
</tr>
<tr>
<td>Audit transformation team</td>
<td>The audit transformation team is installed in the firm to guide the transition towards a situation in which data-analysis is used more prominently in the financial audit process. Consequently, their goal is to change the audit approach. This team, focused on the audit for clients from the financial sector, concerns the EMEIA division of the firm and its core exists of four team members that are based in Amsterdam.</td>
</tr>
<tr>
<td>IT auditors</td>
<td>The IT-auditors can also be divided in the partner, management and staff structure, but since financial audits are central in the scope they are distinguished as one. IT-auditors can also be active in information security or data management, but are considered on their work for the financial audit in this stakeholder analysis. Their main responsibilities in this field are the IT controls and handling data for the financial auditors (guiding data-extraction at client to the financial audit environment).</td>
</tr>
</tbody>
</table>

The relations between these internal stakeholders are positioned and presented in the next figure.
As the description in the previous table showed, it is the partner who coordinates the audit management and, on their turn, they guide and coordinate the audit staff in their work. It is also the financial audit partner that directs the IT-auditors. They are responsible for IT general controls and application controls, and handling data. Within the IT-auditors it is also the managers that coordinate the audit staff. It is for example a senior IT-auditor who transitioned the client data of the insurance company to the GA/EAGLe environment. In their work they often interact with the financial audit management and staff.

**Mapping the Stakeholders**

The stakeholders will be mapped into categories by using three dimensions. These three dimensions - power, interest and attitude - are described by Murray-Webster and Simon (2006) as follows:

- **Attitude:** attitude to the project or program (audit transition). This is a measure of the extent to which the stakeholder is expected to support or resist the transition.
- **Power:** power or ability to influence in the organization. This power or influence can be derived from the stakeholders position, resources or credibility.
- **Interest:** interest in the project or program (audit transition). This is a measure of the extent to which the stakeholder is expected to be active or passive.
Example category is for instance ‘Time Bomb’, which is characterized by: “powerful, low interest, negative attitude, passive, blocker. They need to be understood so they can be ‘defused before the bomb goes off’ ” (Murray-Webster & Simon, 2006).

Figure 18. The Stakeholder Mapping Cube (source: Murray-Webster & Simon, 2006)

Now each stakeholder is categorized with clarifications where needed. The categorization, which is based on observations during the case and assumptions grounded on job contents, is done by assigning a plus or minus on the dimension in regard to transition. Also, a plus and minus can be assigned together when ambiguity is present at the attitude, power or interest. Consequently, there will also be ambiguity present at the stakeholder type that the stakeholder is categorized in.

The stakeholder types are described by Murray-Webster & Simon (2006) as follows:
- **Saviour** - powerful, high interest, positive attitude or alternatively influential, active, backer. They need to be paid attention to; you should do whatever necessary to keep them on your side - pander to their needs.
- **Friend** - low power, high interest, positive attitude or alternatively insignificant, active, backer. They should be used as a confidant or sounding board.
- **Saboteur** - powerful, high interest, negative attitude or alternatively influential, active, blocker. They need to be engaged in order to disengage. You should be prepared to 'clean-up after them'.
- **Irritant** - low power, high interest, negative attitude or alternatively insignificant, active, blocker. They need to be engaged so that they stop 'eating away' and then be 'put back in their box'.
- **Sleeping Giant** - powerful, low interest, positive attitude or alternatively influential, passive, backer. They need to be engaged in order to awaken them.
- **Acquaintance** - low power, low interest, positive attitude or alternatively insignificant, passive, backer. They need to be kept informed and communicated with on a 'transmit only' basis.
- **Time Bomb** - powerful, low interest, negative attitude or alternatively influential, passive, blocker. They need to be understood so they can be 'defused before the bomb goes off'.
- **Trip Wire** - low power, low interest, negative attitude or alternatively insignificant, passive, blocker. They need to be understood so you can 'watch your step' and avoid 'tripping up'.

**The Internal Stakeholders**

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Area of Interest</th>
<th>Attitude (+/-)</th>
<th>Power (+/-)</th>
<th>Interest (+/-)</th>
<th>Stakeholder Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audit staff</td>
<td>To perform their audit activities to their capabilities within their assigned time, while conforming to their coordination.</td>
<td>+/-</td>
<td>+</td>
<td>+</td>
<td>Saviour / Saboteur</td>
</tr>
</tbody>
</table>

Audit staff are interested in the subject since it concerns many of their activities and day-to-day work. While they don't have much power since they have audit managers and partners above them in the corporate structure, they are regarded as powerful\(^{31}\) because they have considerable influence in the transition as they are the end users of data-analytics. Their attitude is ambiguous as it is still unsure how they feel about more data-analysis in the audit approach. Consequently there is ambiguity in their stakeholder type; they can be considered both *Saviour* as *Saboteur*.

\(^{31}\) Refer to the power dimension description: “power or ability to influence in the organization. This power or influence can be derived from the stakeholders position, resources or credibility”.
Audit managers are also considered ambiguous in their attitude for the same reasons as the audit staff. They have the power though to use more data-analysis in the audit approach since they steer the audit staff. Their resulting stakeholder types are Saviour or Saboteur, depending on their positive or negative attitude respectively.

Auditors have a high interest in the transition, because it's in their day-to-day business. This doesn't mean they have no interest at all. On the contrary, they or should be interested in an audit approach with more data-analytics, since they should develop their department and firm from the top level. It is the audit transformation team though that is put in charge of developing the new approach by the partners. The partners do have power in the process though, since they are capable of freeing up time and budget for auditors to get more familiar with data-analysis and the use of it.

The audit transformation team that is heavily involved at the transition by for instance guiding pilot engagements has undoubtedly a positive attitude to the transition. In addition, the team and its members are unquestionably very interested as well. Their power, however, is limited. They need the audit staff and management to work along to make the transition come into place. Because of this dependence and the positive attitude and interest they are categorized as Friend.
The IT auditor is only involved on the sideline, but still taken into the analysis because of the scope. Since their marginal involvement they are considered as having low power and interest. Their attitude is expected to be positive, since their work is likely to become more interesting. Resulting stakeholder type is *Acquaintance*.

Further overall conclusions and results and consequences of these for the research are presented in the main text (chapter 5).

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Area of Interest</th>
<th>Attitude (+/-)</th>
<th>Power (+/-)</th>
<th>Interest (+/-)</th>
<th>Stakeholder Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT auditors</td>
<td>While they are involved, their work does not change much. Their work might become more interesting.</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>Acquaintance</td>
</tr>
</tbody>
</table>
Appendix 6: Employee Support Elements and References

Table 13. Employee Support Elements, Origins and References

<table>
<thead>
<tr>
<th>Elements</th>
<th>Origin</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense of urgency for change</td>
<td>statements</td>
<td>Kotter, 2008; Kotter, 2007; Philips, 1983</td>
</tr>
<tr>
<td>Firm's readiness for change</td>
<td>Framework Holt; List Smith</td>
<td>Smith, 2006; Weiner, 2005; Holt et al., 2007</td>
</tr>
<tr>
<td>Effective communication</td>
<td>statements; List Smith</td>
<td>Seijts &amp; O'Farrel, 2003; Smith, 2006; Strebel, 1996; Kotter, 2007</td>
</tr>
<tr>
<td>Anticipated benefits</td>
<td>statements</td>
<td>Bartunek et al., 2006; Rousseau, 1995; Hornung &amp; Rousseau, 2007</td>
</tr>
<tr>
<td>[NO] Resistance to change</td>
<td>statements; List Smith</td>
<td>Caldwell et al., 2004; Smith, 2006</td>
</tr>
<tr>
<td>Usefulness of new technology</td>
<td>TAM</td>
<td>Davis, 1989</td>
</tr>
<tr>
<td>Ease-of-use of new technology</td>
<td>TAM</td>
<td>Davis, 1989</td>
</tr>
</tbody>
</table>
Appendix 7: Employee Support Interview Guide

NB. Due to the semi-structured nature of the interview, the questions listed per topic were not each gone through, but used to direct the interview where needed.

Date:
Name:
Location:

Interview Guide Support Audit Staff and Management

Introduction:
- Introduction of myself
- Explanation Thesis
- Explanation Transition
  - Focus on data-analysis pillar and tools
- Explanation goal interview
- Recording permission

About interviewee:
- Function?
- Banking / Insurance focus?
- Experienced with DA (EAGLe/Spotfire)?

Explanation Construct:
### Closing Question

<table>
<thead>
<tr>
<th>Elements</th>
<th>Importance weight</th>
<th>Fulfilled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense of urgency for change</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Firm’s readiness for change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anticipated benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[NO] Resistance to change</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usefulness of new technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease-of-use of new technology</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Importance: [not important] 1 - 5 [highly important]
Fulfilled: Yes - Neutral/Unsure - No
Sense of urgency for change

- Do you feel a change is needed? Why?
- Do you recognize problems or opportunities from the industry dynamics that make a change urgent?
  - Competition is active with DA for example?
  - Business model relevant?
- Do you recognize a sense of urgency with people around you?

Firm’s readiness for change

- Do you think the firm is ready for the transition?
- It is capable to do so?
- Is the transition appropriate for the firm?
- Are the leaders committed to that change? Do you recognize a sense of urgency with people around you?
- Are the skills needed present at the audit staff?
  - Has there been (enough) training?

Effective communication

- What do you think about the communication on the transition?
- Do you think there is a clear vision on the transition?
- Are you aware of that vision?
- Do you know who to contact for questions (‘aanspreekpunten’)?

Anticipated benefits

- Do you think the change will be good for you?
- What potential consequences, gains/losses, do you recognize?

Resistance to change

- Do you feel resistance towards the change?
- Why? Any bottlenecks expected?

Usefulness of new technology

- Do you think the new technology (DA through Spotfire and EAGLe) is useful?

Ease-of-use of new technology

- Do you think the new technology (DA through Spotfire and EAGLe) will be easy to use?
• Easy to learn? Controllable, clear & understandable? Flexible? Easy to become skilful in? easy to use?

**Miscellaneous**

• What do you think you need for a successful transition?
• What do you think is needed in general?
• Is there anything more you want to add?
Appendix 8: Employee Support Interviews Results

Table 14. Financial Auditor's Support: Present/Fulfilled Support Elements for Auditors

<table>
<thead>
<tr>
<th>Elements</th>
<th>Present / Fulfilled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Sense of urgency for change</td>
<td>7</td>
</tr>
<tr>
<td>[Perception on] Firm's readiness for change</td>
<td>5</td>
</tr>
<tr>
<td>Effective communication</td>
<td>2</td>
</tr>
<tr>
<td>Anticipated benefits</td>
<td>4</td>
</tr>
<tr>
<td>[NO] Resistance to change</td>
<td>8</td>
</tr>
<tr>
<td>[Perceived] Usefulness of new technology</td>
<td>6</td>
</tr>
<tr>
<td>[Perceived] Ease-of-use of new technology</td>
<td>4</td>
</tr>
</tbody>
</table>

Figure 19. Average Importance of Support Elements for Financial Auditor

n=8

Average Importance

(range: 1-5)
Table 15. Average Importance of Support Elements for Financial Auditor

<table>
<thead>
<tr>
<th>Elements</th>
<th>Average Importance (range: 1-5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense of urgency for change</td>
<td>4,13</td>
</tr>
<tr>
<td>Firm’s readiness for change</td>
<td>3,50</td>
</tr>
<tr>
<td>Effective communication</td>
<td>3,38</td>
</tr>
<tr>
<td>Anticipated benefits</td>
<td>4,50</td>
</tr>
<tr>
<td>[NO] Resistance to change</td>
<td>3,25</td>
</tr>
<tr>
<td>Usefulness of new technology</td>
<td>3,38</td>
</tr>
<tr>
<td>Ease-of-use of new technology</td>
<td>3,63</td>
</tr>
</tbody>
</table>

Table 16. Financial Auditor’s Support: Staff vs. Managers

<table>
<thead>
<tr>
<th>Elements</th>
<th>Staff</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fulfilled</td>
<td>Yes</td>
<td>Neutral/Unsure</td>
<td>No</td>
<td>Fulfilled</td>
<td>Yes</td>
<td>Neutral/Unsure</td>
<td>No</td>
</tr>
<tr>
<td>Sense of urgency for change</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Perception on] Firm’s readiness for change</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective communication</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anticipated benefits</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[NO] Resistance to change</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Perceived] Usefulness of new technology</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Perceived] Ease-of-use of new technology</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Part F

*Scientific Article*
Transforming financial auditing with data-analysis at a Big4 audit firm: A substantial cost of adoption

Florian de Vries
Faculty of Technology, Policy and Management; Delft University of Technology; The Netherlands

December 2014

Abstract
Data-analysis is a hot topic within the external financial audit practice and is considered to have huge potential for auditing: a data-analysis induced audit transformation is happening. It is yet unknown though what the impact is on the financial audit and if auditors are supportive. More insight is much needed on these topics to adequately manage this transformation and to add to the academic understanding. The approach of the research was a case study to firstly analyze the impact of data-analysis on the financial audit and to subsequently examine the stakeholders’ perspectives. Main finding is that the cost of adoption is a large barrier – or collection of barriers– of financial and non-financial nature, due to which the audit has not been heavily affected yet. In order to progress the audit transformation, the cost of adoption needs to be reduced. Both practitioners and academics have a role to play in this process.

Keywords: Audit; Financial audit; External Audit; Data-analysis; Data-analytics; Change management; Case study; Big4 audit firm; Cost of adoption

1. Introduction
Increasing demands from clients, increasing regulatory pressure and increasing technological opportunities are forcing and enabling audit firms to reconsider their way of approaching the financial audit. In particular data-analytics has huge potential for improving the effectiveness and efficiency of the auditing process (Dowling & Leech, 2014; Moffit & Vasarhelyi, 2013; Munro & Stewart, 2011; Werner et al., 2012). Yet, it is unknown how data-analytics is impacting the external financial audit in practice because of its novelty and because most literature is theory-driven (Jans et al., 2013; De Swart et al., 2013; Vasarhelyi & Romero, 2014; Vasarhelyi et al., 2014). Additionally, De Swart et al. (2013) and Vasarhelyi & Romero (2014) have already identified a lack of utilization of the full potential of data-analysis, while tools are already available. This indicates that support from auditors for the transformation might be lacking, while it is essential for successful change (Pendlebury et al., 1998). If financial auditors are supportive of more data-analysis in the audit is currently unknown as well. A lack of support can negatively influence the adoption of data-analysis techniques and therefore the audit transformation (Kim, 2002). Hence the support is important to examine. The aforementioned uncertainties form complications for audit firms that, if not addressed appropriately, can lead to a change failure, and consequently to missing market opportunities and reduced client satisfaction. Hence, better understanding the impact of data-analytics on the financial audit in practice and better understanding the attitudes of the internal stakeholders (financial audit staff, management, partners and IT-auditors) is very much wanted and these are topics where academics can help practitioners.

A Dutch Big4 firm acknowledges the potential of data-analytics too and an ‘audit transformation team’ has been installed to stimulate and guide the change. This firm has been subject of the study, for which this paper presents the results. This paper provides the understanding on the earlier named unknowns and offers additional valuable insights on the data-analysis induced audit transformation by answering the following research questions: ‘What is the impact of the use of data-analysis for the financial audit of financial institutions in practice?’ and ‘Are the firm’s key stakeholders supportive of the data-analysis induced transformation?’.

These two questions correspond with the two uncertainties that are both relevant for the audit transformation. The interrelatedness of these two aspects will become particularly evident in the conclusion.

The results of the study are not only expected to enhance the understanding and change at the concerned firm, but
also to enhance the understanding of the data-analysis induced audit transformation of academics by providing a practice perspective.

1.1 Theory

External financial auditing is the process of verifying financial statements of a company or a subdivision thereof and to prepare and provide an opinion regarding the assurance they can give on its appropriateness (Johnson et al., 2002). And data-analysis is the process of reviewing, transforming and visualizing data for purposes of obtaining information, predicting, formulating conclusions or supporting decisions. Furthermore, ‘Data-analytics’ refers to the methodology and techniques, while ‘data-analysis’ more often refers to an individual analysis.

Moffitt & Vasarhelyi (2013) identify data-analytics as having huge potential for efficient auditing. De Swart et al. (2013) also recognize the potential, but a lack of utilization of data-analytics as well. It can also benefit effectiveness since more assurance can be given on financial statements and records if a whole population of for instance transactions is tested instead of only samples. Data-analysis enables this since it gives auditors a way of swiftly inspecting large masses of these transactions for instance.

The environment of auditing is changing and auditing itself should adapt and change along. Vasarhelyi & Romero (2014) observed that this is already happening with technology meant for data-analysis. They applied a case study approach at a large audit firm to examine the usage of technology. In their case study Vasarhelyi & Romero (2014) found that enough technological tools are available to facilitate auditors in updating their approach, but that nonetheless the use of the tools is not optimal.

Lombardi et al. (2014) discuss the current state and future of auditing. They argue that the business environment has evolved more rapidly than the audit profession, since decisions in the market are being made on real-time information while the auditor’s opinion is given once a year historically.

Vasarhelyi et al. (2014) argue that exploiting the automation opportunities and shifting the tool set will lead to the audit program – a structured set of procedures and policies that an audit firm uses to dictate how the audit should be performed – becoming a mix of automated steps, manual linkages, and auditor judgment. Consequential result will then be a flexible, modular and adaptable approach that can be fitted to requirements of the environment. Main difference from the current approach seems that dependence on data is growing, while dependence on client data systems and data requests will belong to the past in their vision. This should be realized with a common data storage.

In the literature it appears that data-analytics technology is ahead of the practice in financial auditing. And so, because the literature is theory-driven, we can speak of a theory-practice gap.

2. Methodology

A case study has the perfect characteristics to provide understanding on the audit transformation and to offer valuable insights from practice. Hence, a case study is very suited for the research; especially since empirical knowledge on the topic is limited (Eisenhardt, 1989). The Big4 audit firm that installed the audit transformation team is subject of the case study. It proved to be a very interesting case since they are decidedly active in the process of utilizing more data-analysis in the financial audit and launched several pilot cases.

Two of these pilot cases, in which data-analysis was used in an intensified manner, were selected to examine the impact of the use of data-analysis. The first of these subcases concerns an audit engagement at a large Dutch insurance company, where data-analysis was applied with a focus on journal entry testing. The second subcase concerns an audit engagement at the commercial bank department of a large Dutch bank, where data-analysis is1 applied with a focus on substantive testing. By combining audits at different types of clients and with different focus areas of the data-analysis, these two cases give a complete view of the current impact of data-analysis in the financial audit of financial institutions as illustrated in the figure.

<table>
<thead>
<tr>
<th>Data-analysis deployment</th>
<th>Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Journal entries</td>
<td>Ins.</td>
</tr>
<tr>
<td></td>
<td>Banking</td>
</tr>
<tr>
<td>Substantive procedures</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Complete View with Subcases Matrix

Most searched for in these engagements were the impacts of data-analysis on the financial audit. These impacts are divided into advantages, disadvantages and impact on audit prerequisite issues. Firstly, impacts identified from theory were examined to assist identifying the impacts in

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1 The commercial bank case was studied as ‘live case’ and was not yet completed during the research. Despite this, the case was still useful in all respects, since the engagement was already up and running and the involved audit manager had enough exposure to the development of the data-analysis and the used tool to recognize further impacts.
practice. Herewith the earlier named theory-practice gap will be bridged too.

Furthermore, the stakeholder aspects are also important to consider when studying the audit transformation as became apparent in the introduction. Hence, a stakeholder approach — consisting of a stakeholder analysis, additional literature reviewing and semi-structured interviews — is used to examine the perspectives on the audit transformation of internal stakeholders, to identify the key internal stakeholders and subsequently to assess their support for the transformation.

Understanding the impacts of data-analysis in the audit is needed to explore the stakeholder aspects of the audit transformation. And understanding the stakeholder’s perspectives on the audit transformation assists interpreting the impacts of data-analysis on the audit. Using the synergy, these two aspects give a good view of the audit transformation that is needed to answer the questions and to draw uniform conclusions that connect the two aspects.

Given its purpose and research questions, the study is descriptive and mainly of a qualitative nature.

Additionally, several other methods were used for data collection in the case study, namely document analysis and (semi-structured) interviews.

3. Data-analysis in financial auditing

In order to answer the first research question, this part bridges the earlier identified theory-practice gap. For this purpose, expectations from theory were derived from the theory-driven literature firstly. Besides, the firm’s audit steps where data-analysis can be used were identified based on internal documents.

These expectations and audit steps, or locations, were subsequently compared with locations of data-analysis use in practice and with the impact of that use in order to bridge the gap. The two pilot cases were basis for this.

3.1 Theory

In theory, data-analysis can be used in fourteen steps of the audit that the audit firm prescribes in their globally used audit methodology. This methodology distinguishes four phases of the audit in which the steps are divided. These phases and the fourteen steps, which are identified as beneficial locations for intensified use of data-analysis, are displayed in figure 2.

The expectations from the theory are divided in the advantages of the use of data-analysis in the financial audit, the disadvantages of that use, and the impact of that use on audit prerequisites.

First advantage is named by Jans et al. (2013), namely that whole populations can be tested. This advantage leads to a higher detection rate of errors and frauds, which is also identified by Coderre (1999). Second advantage, which is discussed in the same article of Jans et al. (2013), is that the use of data-analysis enables the auditor to gain more understanding of business processes of the auditee.

There are two expected disadvantages of the use of data-analysis in the financial audit. Firstly, a cost of adoption needs to be incurred, since the auditors need time to familiarize themselves with data-analysis (Vasarhelyi & Romero, 2014). Second, Vasarhelyi & Romero also indicate that heavy involvement of the client in the data extraction phase is required and that it is a disadvantage.

From the literature three expectations about the impact of the use of data-analysis in audit prerequisites are deduced. Jans et al. (2013) expect a positive impact on ‘data independence’ (data independence refers to the correctness of data and that data are not manipulated). Vasarhelyi & Romero (2014) indicate that data access and data quality (independent data access is also the first step to data quality) are issues that are affected by the use of data-analysis in the financial audit, since these issues become more imperative with intensified use of more data.

These expected advantages and disadvantages of the use

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2 The 'cost of adoption' refers to non-monetary costs as well.
of data-analysis in the financial audit are also listed in the
theory column in table 1, together with the expected
impacts of the use on audit prerequisites.

3.2 Practice
In the insurance company case data-analysis was only
intensively used at three audit steps and this use focused
on the testing of journal entries. At the commercial bank
data-analysis is used intensively at six audit steps with a
focus on substantive testing. Collectively, only seven of
fourteen locations were utilized and hence the use of data-
analysis is still considered suboptimal.
Various impacts of the use of data-analysis are
identified. Most significant is the cost of adoption.

3.3 Comparing expectations with outcomes

Table 1. Theory Expectations vs. Outcomes in Practice

<table>
<thead>
<tr>
<th></th>
<th>Theory</th>
<th>Insurance Company Case</th>
<th>Commercial Bank Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data-Analysis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main Scope</td>
<td>N/A</td>
<td>Journal entries</td>
<td>Substantive procedures</td>
</tr>
<tr>
<td>Extent</td>
<td>N/A</td>
<td>3/14 audit steps</td>
<td>6/14 audit steps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advantages</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
|                     | -Testing whole populations (Jans et al. 2012) - higher detection rate
                     |        | errors/frauds (Coderre, 1999)
                     |        | -More understanding
                     |        | business processes
                     |        | (Jans et al. 2012)      |
|                     | -Testing all journal entries
                     |        | -More understanding
                     |        | General Ledger          |
|                     | -Whole populations involved in testing
                     |        | -More understanding
                     |        | and insight in business
                     |        | -Significantly better
                     |        | scope of audit due to
                     |        | increased insight       |
| Disadvantages        |        |                        |                      |
|                     | -Cost of Adoption (Vasarhelyi & Romero, 2014)
                     |        | -Heavy involvement
                     |        | client in data
                     |        | extraction phase
                     |        | (Vasarhelyi & Romero, 2014)
|                     | -Cost of adoption was already incurred in previous
                     |        | engagements            |
|                     | -Client had to be convinced to provide
                     |        | more data than usual
|                     | -Cost of adoption is also client-specific
                     |        | in this case             |
|                     | -Cost of adoption is also client-specific
                     |        | in this case             |
|                     | -Data independence (Jans et al., 2012)
|                     |        | -Data quality
|                     |        | (Vasarhelyi & Romero, 2014)
|                     |        | -Data access
|                     |        | (Vasarhelyi & Romero, 2014)
|                     | -No impact since the same data was used as
                     |        | normal                   |
|                      |        | -Data straight from the
                     |        | auditee's systems
|                      |        | -Data quality under
                     |        | pressure since many
|                      |        | peculiarities had to be
|                      |        | dealt with               |
|                      |        | (- It could have been the
                     |        | case that data access
|                      |        | was only allowed at
                     |        | the auditee's location)  |

In the table above the expectations from the technology-
driven literature are compared with the outcomes in
practice of data-analysis in the financial audit. These
expectations on advantages, disadvantages and
prerequisites prominently matched with the outcomes in
practice. For instance, testing whole populations and
gaining more understanding of the business – identified
by Jans et al. (2013) as reasons for the use – were in
practice recognized as the greatest advantages. Moreover,
cost of adoption – identified by Vasarhelyi & Romero
(2014) as disadvantage of the use – is recognized as well
and appeared to be at least two-sided: auditors need to get
familiar with the use; and the data-analysis has to be
suited to the client as well.

3.4 Cost of adoption
Concluding on this part, it should be noted that a
significant cost of adoption was not only recognized in
both theory and practice as disadvantage in the audit
transformation, but also as heavily effecting the audit
transformation: it is a barrier – or collection of barriers –
for a successful transformation.
Firstly, it takes time for auditors to get familiar with the
use of data-analysis and so efficiency gains with data-
analysis can’t be made on short-term (1 year). This is
inconvenient for auditors since they work with a tight
planning and on tight budgets. This is the case for both
audit staff that should perform the data-analysis and audit
management that should coordinate and review the data-
analysis.
Secondly, it takes time and effort to suit the data-
analysis to the auditee. While the data-analysis is already
developed in principal, the data of the client need to be
mapped and fitted to that analysis. Since clients have
rather different data structures and characteristics, this
can be a demanding task. Especially, since financial
institutions are often prolific and complex in their data
generation. However, once done, suited queries to
transition the data are known and can largely be used the
next years for audit engagements as well. In particular,
this issue surfaced at the commercial bank case, where
the audit suffered serious setbacks due to many
peculiarities in the client’s data.3

4. Stakeholder approach
Within the firm the internal stakeholders and their support
is examined as part of the case study. Results of this,
however, can be diversified, since most audit firms are
updating their audit methodology with data-analysis as
well and have identical structures (audit partners > audit
managers > audit staff) as the reviewed firm.

4.1 Key stakeholders
Through a stakeholder analysis4 it became clear that the
support of all stakeholders (financial audit staff, management, partners; IT-auditors; AT team) is needed.
However, support of financial audit staff and

3 These two aspects can be perceived as technical barriers that
are part of the cost of adoption.
4 The method of Murray-Webster & Simon (2006) was used for
this stakeholder analysis.
management is most critical, since mainly their day-to-day activities are involved in the audit transformation.

Other important finding was the presence of a tension, or negative cycle, between managers and staff: Managers don’t have enough incentives to invest time and budget for additional data-analysis work and staff, since they are predominantly judged on short-term goals such as chargeability and productivity and not on long-term goals such as development and innovation (e.g. intensifying the use of data-analysis). Subsequently, audit staff won’t get familiarized with the use of data-analysis. Later on, audit staff will become managers and the situation repeats itself.

Meanwhile, the analysis did not clarify the attitude – are they supportive? – of staff and management. This is important to know when managing the change though.

4.2 Change support

To assess the support of audit staff and management for the change, it’s needed to establish first what change support is. Firstly, to do so, the change is characterized: transforming the financial audit with data-analysis at a Big4 audit firm is an episodic change that involves technology. Secondly, a literature review in academic databases, aimed at change management articles, is performed to identify the elements that together form support for the aforementioned type of change.

On an individual level the following elements are found that determine employee support of change: ‘sense of urgency for change’, ‘perception on the firm’s readiness for change’, ‘effective communication’, ‘anticipated benefits’, ‘resistance to change’, ‘perceived usefulness of new technology’, and ‘perceived ease-of-use of new technology’. The sources and origin of these elements are presented in table 2 (refer to appendix). The construct that is now established is visualized in figure 3.

The change support of audit staff and audit management can now be assessed with these elements to gain a comprehensive understanding.

4.3 Support in the case

With the list of elements of 4.2 the support of auditors for the audit transformation at the reviewed firm is assessed through semi-structured interviews. A representative group of eight auditors were interviewed. Main results are summarized in the following figure:

The firm’s financial auditors can be considered supportive of the transformation, since they generally have a sense of urgency for the change, a positive perception on the firm’s readiness for change, anticipate benefits from the change, have positive perceptions on the technology and feel no resistance on change.

There is one shortcoming though, namely effective communication. While it is an important element (figure 5; appendix) for auditors and their support, the communication isn’t perceived well. Related identified underlying issue is that auditors are unsure how data-analysis will be applied and in lieu of what it will be

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5 Chargeability refers to the number of hours work that can be billed to the client as percentage of total hours worked.
6 The above shows that the cost of adoption is not only monetary. The situation also indicates that there also institutional barriers that are part of the cost of adoption.
7 The audit transformation.
8 Auditors of the reviewed firm were also asked to rate the importance of these elements for them during the interviews. All elements were considered important (refer to figure 5 in the appendix and so the construct can be considered as practice validated.
9 Including both auditors with client focuses on banks and insurance companies (the two largest client groups in the financial sector; including both audit staff and audit managers; and including both auditors with experience in intensified data-analysis and without experience.
applied. One auditor even stated ‘'[data-analysis in the financial audit] raises more questions than answers’'.

In addition, there was no striking difference found between the level of support of financial audit staff and financial audit management. Relations between support and client focus or experience with data-analysis could also not be identified.

4.4 Cost of adoption

Again, when approaching the audit transformation from a stakeholder perspective, the cost of adoption was identified by the author and auditors as large barrier in the transformation process. It became clear that there is more to the cost of adoption than learning and technical solutions. Suitable staff evaluation institutions and effective communication can be considered part of it as well.

Now it seems that a pioneer role isn’t appealing because of the cost of adoption. The cost can be put in perspective with a trade-off, namely chargeability vs. innovation. Chargeability relates to the pressure on auditors to make billable hours, which undermines the time needed to develop their practice and skills. Another way to view this trade-off is as a conflict between a short term perspective (goal: make billable hours) and a longer term perspective (goal: develop audit practice). This finding is very important, since it’s at the core of the transformation.

5. Conclusions

Main impact of the use of data-analysis in the financial audit of financial institutions is that it sets a substantial cost of adoption, or a collection of barriers, that needs to be overcome for the transformation to be successful.

This cost of adoption consists of technical barriers such as the transitioning of data. The stakeholder approach however indicated that other types of barriers also are part of the cost of adoption. Current institutions don’t incentivize the auditors enough to use data-analysis in the audit. Process-oriented barriers are present as well, as is indicated by the lack of and need for effective communication.

Other impacts show that data-analysis has great potential (table 1) for data-analysis in the audit. The audit staff and management, key stakeholders, are generally supportive of the transformation because of that potential.

However, they do believe that communication on the change can be improved. They are particularly unsure about how data-analysis is to be applied with added value.

Most significant finding, combining the two research questions and research parts, is the hefty cost of adoption of different natures. This cost is holding back the audit transformation, while data-analytics are also widely recognized in practice as having huge potential for more effective and efficient auditing and therefore supported by key stakeholders.

5.1 Discussion

In the introduction the potential of data-analytics for auditing is discussed. While this potential is also recognized in practice, the research shows that the cost of adoption is a large barrier that creates delay in the transformation. This delay becomes evident in the mismatch between potential locations for data-analysis in the audit (figure 2) and used locations in the engagements (table 1). Arguably, the reason for this is that the cost is part of a larger trade-off that is at the core of the situation, namely the chargeability vs. innovation trade-off: the focus on chargeability impedes auditors becoming familiar with data-analysis. One dominant underlying cause is considered of this trade-off, namely a misalignment of short-term goals (chargeability) and long-term goals (firm development). This issue should be addressed at the reviewed firm, but likely at other firms as well, in order to successfully transform the audit and to utilize the potential of data-analytics for the financial audit.

All in all, the current state of data-analysis in the financial audit can at this time be summarized with the aforementioned statement that an interviewed auditor made: ‘'[data-analysis in the financial audit] raises more questions than answers’’.

One more question that rose during the research was to what extent the audit transformation actually is a transformation. It can certainly be argued that until now the audit transformation at the concerned firm is better described as an audit transition, since the audit roadmap (such as the approach in figure 2) has not changed shape. However, I do consider that this roadmap will change on short term, depending on how the cost of adoption is managed, and that the audit transformation definitively is a transformation and that the same will happen at other firms because of the shared market dynamics.

5.2 Recommendations

Several points of departure for practical recommendations to smoothen the audit transformation are indicated.

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10 This shows that process barriers are also part of the cost of adoption.

11 The cost of adoption can also be considered as a collection of adoption barriers from technical, institutional and process nature. This perspective could be a suitable subject for future research.
First, the short and long-term goals should be better aligned to reduce the cost of adoption for staff and managers, by, for instance, creating short-term wins such as rewards for the auditors when they apply more data-analysis. Another way to reduce the cost of adoption is to start applying data-analysis immediately in the first year of new auditee clients and thus enabling the involved parties to benefit from the advantages of data-analysis straightaway in the time-limited auditor-auditee relation.

A second recommendation is to inform financial auditors about the transformation in a more proactive manner, especially in terms of the application of data-analysis and on the possible efficiency gains. A good means for this is the promulgation of one or more success stories that clarify the added value. These should then be communicated through regular team meetings, email updates, etcetera.

Anyhow, since the adoption barriers are of different natures it is crucial that technical, institutional and process barriers will be addressed, when taking actions to reduce the cost of adoption and stimulating the audit transformation.

6. Limitations and future research
When interpreting the results, it is important to take into account that the study was limited by the fact that only two progressive engagements have been examined within one firm. Also, the recommendations should be further specified before they are acted upon.

Identified area of interest for future research on this topic is the further identification of what barriers of adoption, in a technical-institutional-process framework, form the cost of adoption. Future research could also be carried out to decide how representative this case study is for the audit sector or to monitor the progress of the audit transformation.

References
F.A.K.S. de Vries  – Transforming financial auditing with data-analysis at a Big4 audit firm: A substantial cost of adoption


**SUPPORTING INFORMATION**

Additional supporting information can be found in the master thesis report, where this article is based on.
APPENDIX

Table 2. Employee Support Elements, Origins and References

<table>
<thead>
<tr>
<th>Elements</th>
<th>Origin</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sense of urgency for change</td>
<td>statements</td>
<td>Kotter, 2008; Kotter, 2007; Philips, 1983</td>
</tr>
<tr>
<td>Firm’s readiness for change</td>
<td>Framework Holt; List Smith</td>
<td>Smith, 2006; Weiner, 2009; Holt et al., 2007</td>
</tr>
<tr>
<td>Effective communication</td>
<td>statements; List Smith</td>
<td>Seijts &amp; O’Farrel, 2003; Smith, 2006; Strebel, 1996; Kotter, 2007</td>
</tr>
<tr>
<td>Anticipated benefits</td>
<td>statements</td>
<td>Bartunek et al., 2006; Rousseau, 1995; Hornung &amp; Rousseau, 2007</td>
</tr>
<tr>
<td>[NO] Resistance to change</td>
<td>statements; List Smith</td>
<td>Caldwell et al., 2004; Smith, 2006</td>
</tr>
<tr>
<td>Usefulness of new technology</td>
<td>TAM</td>
<td>Davis, 1989</td>
</tr>
<tr>
<td>Ease-of-use of new technology</td>
<td>TAM</td>
<td>Davis, 1989</td>
</tr>
</tbody>
</table>

Figure 5. Average Importance of Support Elements for Financial Auditor

n=8