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OTTO-OSKARI LAMMINPÄÄ

DIGITALIZATION OF THE FINANCIAL FUNCTION IN FINNISH CORPORATIONS

Master of Science Thesis

Examiner: prof. Nina Helander
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ABSTRACT

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The financial function of corporations around the world is transforming. This is due to the accelerating clock speed of business, the increasing pressure to reduce costs and improve operational efficiency but also the growing expectations and demand for better services with more advanced deliverables. Large corporations view disruptive technologies as the most profitable solution to fulfill the demanding requirements. Without a digital transformation, they risk becoming an impediment, a bottleneck for the business. The paradigm shift is also visible in the transforming role of the chief financial officer (CFO). Often perceived as traditionalists and corporate auditors, CFOs are now assuming the roles of financial strategists, business partners and, increasingly, digital leaders. This changes the CFO function's modus operandi significantly, even more so in the future as the transformation accelerates. However, the status of digitalization in Finnish corporations is unclear with little research available.

The objective of this research is to provide insights to the current status of digitalization in the CFO functions of large Finnish corporations and how the transformations could be accelerated. To approach the problem holistically, it is divided into three parts: the CFO function's digital maturity, technology enablers in the CFO function and the effects of organizational and cultural factors. The research was conducted in two parts: a literature review and an empirical study. The literature review explored the theoretical framework with a goal to gain knowledge on the topics. In the empirical study, semi-structured interviews were used to validate the contents of the findings from the theory. Then, a questionnaire was used to survey the CFO functions of the largest Finnish corporations on the topics. The sample size of the survey was 42.

The results of this research indicate that the digital maturity of Finnish corporations is, on average, lower than their European competitors. The technological maturity is lower as well, as Finnish CFO functions are slightly slower to adopt disruptive technologies with less complex business applications. On the other hand, the adoption rate is accelerating rapidly. Furthermore, CFOs are especially focused in business process improvements and process automation as those are perceived to deliver the most tangible benefits. The most significant threats that digital transformations face are often organizational and cultural challenges, for example, poor vertical communication of digital strategy and poor organizational agility. The identified key success factors in digital transformations are change management and driving the transformations with digital leadership. The results provide novel information to the business and academic communities on the status of digitalization in the CFO function, on the effects of digitalization on the financial function and on the ways to support digital transformations.

TIIVISTELMÄ

OTTO-OSKARI LAMMINPÄÄ: Digitalisaatio suomalaisten yritysten taloustoiminnossa
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Avainsanat: taloustoiminto, talousjohtaja, digitaalinen transformaatio, digitaalinen maturiteetti

Yritysten taloustoiminnot ympäri maailmaa ovat murroksessa. Tämä johtuu muun muassa liiketoiminnan kiihtyvästä kellotaajuudesta, paineista kulujen vähentämiselle ja operatiiviselle tehostamiselle sekä kasvavista palveluvaatimuksista. Disruptiiviset teknologiat nähdään suurissa yrityksissä usein kannattavimpina ratkaisuina muuttuviin vaatimuksiin. Ilman kokonaisvaltaista ja johdettua digitaalista transformaatiota taloustoiminnosta saattaa kuitenkin muodostua pullonkaula liiketoiminnalle. Perinteikkäänä auditointitoimijana tunnetun talousjohtajan rooli muuttuukin enenevissä määrin kohta talousstrategia, liiketoiminnan kumppania ja digijohtajaa. Muutos vaikuttaa taloustoiminnon toimintatapoihin huomattavasti, mutta aiheen merkittävyydestä huolimatta siitä on tehty suhteellisen vähän tutkimusta, varsinkaan Suomessa.

Tämän tutkimuksen tarkoituksena on syventää ymmärrystä suurten suomalaisten yritysten taloustoimintojen digitalisaation nykytilasta sekä siitä, miten tilaa voidaan kehittää. Tutkimusongelma on jaettu kolmeen osaan: taloustoiminnon digitaalisen maturiteetin, taloustoiminnon teknologioiden sekä organisatoristen ja kulttuurillisten tekijöiden selvitykseen. Tutkimus suoritettiin kahdessa osassa: teoreettiseen viitekehykseen perustuvana kirjallisuuskatsauksena ja empiirisenä tutkimuksena. Empiirinen tutkimus koostui teorialöydöksiä validoivista puolistrukturoiduista haastatteluista sekä kyselytutkimuksesta, jolla kartoitettiin Suomen suurimpien yritysten talousfunktioiden digitalisaation tilaa. Otoksen laajuus tutkimuksessa oli 42.

Tutkimuksen tulokset osoittavat, että digitaalinen maturiteetti suomalaisissa taloustoiminnoissa on keskimääräisesti matalampi kuin muualla Euroopassa. Myös teknologinen maturiteetti on hieman matalampi ja teknologioiden sovelluskohteet ovat yksinkertaisempia. Toisaalta teknologioiden omaksumisnopeus kiihtyy vauhdilla. Taloustoiminnot ovat keskittyneet liiketoimintaprosessien parantamiseen ja prosessiautomaation kehittämiseen, sillä nämä tuottavat tulosten perusteella selkeimpiä hyötyjä. Merkittävimmät uhat digitaalisille transformaatioille ovat pääosin organisatorisia ja kultuurillisia; esimerkkeinä heikko digistrategian viestintä ja matala organisatorinen ketteryys. Menestyksen kannalta selkeimpinä tekijöinä esille nousevat muutosjohtaminen ja digijohtajuus. Tulokset tuottavat merkittävää uutuusarvoa niin liiketoiminta- kuin tiedeyhteisöllekin, erityisesti digitalisaation tilasta taloustoiminnossa, digitalisaation vaikutuksista taloustoimintoon sekä tavoista tukea digitaalisia transformaatioita.

PREFACE

Every grad student knows that the best pieces are written in a state of flow. That is when your scrap paper overflows with ideas, characters emerge on the paper as if by magic and the synthesis between theory and empiricism is flawless. The writing process of this thesis was quite the opposite. I wanted to take up a challenge and jump in at the deep end. Choosing to conduct a survey (an arduous strategy) on the CFO function's (something which I have no experience of) digitalization (the definition of a broad subject) did the trick for me. Taking that path, however, proved to be the right choice as the learning curve was steep throughout the process.

I would like to express my gratitude to my mentors and co-workers at the case company for lending me their collective brain power and assisting me in data collection from day one. I want to thank Professor Nina Helander for taking the time off her very busy schedule and for always providing me with insightful advice on conducting the best possible (not to mention reliable and valid) research. I also want to thank the interviewees and survey respondents who participated in gauging the status of digitalization of Finnish CFO functions. And then there is the community at Tampere University of Technology that will definitely stay near and dear to my heart even after graduation.

Finally, I want to thank my friends and family for motivating me with carrots and sticks and pushing me to the next level. You challenged me to write that one more paragraph at 1AM when it was most needed. And thank you Essi for giving me the love and unwavering support to finish what I started. I promise, I won't write another one of these any time soon.

Helsinki, 16.11.2018

Otto-Oskari Lamminpää

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LIST OF SYMBOLS AND ABBREVIATIONS

AA	abbr., advanced analytics
AI	abbr., artificial intelligence
ANN	abbr., artificial neural networks
BI	abbr., business intelligence
BPM	abbr., business process management
CFO	abbr., chief financial officer (may also refer to the CFO function)
DLT	abbr., distributed ledger technology, also known as blockchain
EFM	abbr., enterprise financial management
EPM	abbr., enterprise performance management
fintech	abbr., financial technology
GUI	abbr., graphical user interface
FTE	abbr., full time employee
IoT	abbr., internet of things
KPI	abbr., key performance indicator
KSF	abbr., key success factor
MDM	abbr., master data management
MECE	abbr., mutually exclusive, collectively exhaustive
ML	abbr., machine learning
OCR	abbr., optical character recognition
ROE	abbr., return on equity
ROI	abbr., return on investment
RPA	abbr., robotic process automation
SVM	abbr., support vector machine
TE500	abbr., a top 500 -listing of Finnish corporations by Talouselämä
TMT	abbr., top management team

1. INTRODUCTION

This introductory chapter presents the background and motives for the research supported with the objectives, research problem and questions. They present the justification and arguments for the research from both necessity, reliability and validity point of view. Thirdly, the limitations and scoping of the research are presented to introduce the important directional parameters and outlines for the outcomes. Finally, the structure of this research is presented.

1.1 Research background and motivation

The business environment of today is evolving quickly. Much of this is due to globalization, fiercer competition in more accessible markets and improvements in technology. However, all of these are greatly affected by digitalization which has become an essential part of every business' operating model during the last decade (Bouwman, Nikou, Molina-Castillo, & de Reuver, 2018; Praeg & Schmidt, 2015). More businesses place the foundation of their business model on digitalization than ever before, and for many, digitalization has become an instrument of survival rather than a tool to gain competitive edge (Ahlemann, 2016; Carr, 2003; Davenport & Harris, 2007). In addition to being essential to corporate sales and marketing operations, digitalization has also substantially affected their financial operations. The first wave of digitalization has changed many aspects of everyday life and existing business models have been challenged and partially replaced (Alt & Puschmann, 2016; Praeg & Schmidt, 2015) which is also valid for financial operations. Finance has traditionally been one of the functions that has been able to remain relatively unchanged for decades with many tasks from reporting to accounting still done with a pen and paper. While an effective financial function is a prerequisite for life for every corporation, only recently have these technological advancements started to appear on the chief financial officer's (CFO) agenda. And today, 70 percent of CEOs say technology will have the greatest effect on the future of the financial function (Treadway, 2017).

The constantly updating requirements of the business world obviously reflect on the need for research as well. Research on digitalization in finance is accumulating rapidly with ProQuest producing nearly 64 000 results on "digitalization" and more than 15 000 results on "digitalization AND finance" within 2010–2018. The complexity of the area is extremely high as both finance and digitalization are umbrella terminology for numerous sub-concepts. For example, Gartner defines digitalization as the use of digital technologies to change a business models and provide new revenue and value-producing opportunities (Gartner, 2018b) but also recognize that it can directly refer to technologies such as artificial intelligence (AI), analytics, IoT (Internet of Things) or robotic process

automation (RPA) (Tratz-Ryan & Duerst, 2018). For the purposes of this thesis, digitalization is defined as the process of technology-initiated change in businesses. Digital transformation, on the other hand, is the overarching effect of digitalization (Ahlemann, 2016; Nadeem, Abedin, Cerpa, & Chew, 2018). Not only does the complexity of terminology and concepts make research more challenging but it also significantly slows down the implementation of disruptive technologies in the business world. Corporations want to invest in technologies they benefit from but most importantly to those they understand (Kauffman, Liu, & Ma, 2015). In addition to the complexity of the subject matter, the approach to the substance varies. Many researchers have chosen to focus on technology but CFO functions, like any other functions, are undeniably affected by the cultural and organizational aspects of digitalization as well (Ransbotham, Kiron, & Prentice, 2016). Therefore, this aspect of the transformation must also be acknowledged.

CFO functions have conventionally been branded as slow to adapt and resistant to change with a questionable attitude toward investments in new and experimental technology. Additionally, the CFO function has previously existed as a siloed support function, separately from business and IT. Now this function is facing a revolution where they must transform into a digital trailblazer instead of continuing their existence as a technological hermit. The CFO's role is shifting from a cost authority to a business value architect. In practice, this means that the CFO function is absorbing capabilities from functions like IT while simultaneously assuming the role of a business partner. Both external and internal pressure to digitalize are clear. Internally, there is a critical need to reduce costs and workload but externally the growing expectations and requirements demand more and more advanced deliverables. It has also become increasingly challenging for the CFO function to understand the value creation processes in their complex technology landscapes (Baril, Nicholson, & Stephenson, 2018). This is made even more difficult by the gap of know-how and time between the present state and the potential realization of value for their investment (i.e. future state).

For the CFO, the most profitable avenue for development is challenging to recognize. For example, some are suggesting AI, blockchain and smart contracts as the main technological disruptors in the CFO function during the next years (Boots & Wilkins, 2018) but on the other hand some are highlighting financial analytics and master data management as the way to go (Mäder & Akiki, 2017). The long-time megatrend has also been to automation to allow for increases in accuracy and speed (Andal-Ancion, Cartwright, & Yip, 2003; Vanmali, 2017). On the contrary, some are suggesting that the true change is not necessarily related to technology but rather to the digital culture transformation in the organizations (Westerman, Calméjane, Ferraris, & McAfee, 2011). For example, only 2 out of 83 respondents in a recent study identify technology as their main challenge for success but 46 respondents think of culture and 13 respondents lack of vision as their main challenges (Lauslahti, 2018). The digital transformation in the CFO function is not only about the implementation of new technologies but also about redefining the approach to the financial function's core mission and value-added services.

This thesis is commissioned by a multinational management and technology consulting firm which also has operations in Finland. The firm will later be referred to as Firm X. Firm X operates in multiple industries in Finland with most of its clients being large Finnish privately owned and publicly traded corporations. Firm X is specialized in operations in the financial services sector but has also significant presence in public sector organizations, high-tech and manufacturing industries. This thesis provides insight to Firm X Enterprise Performance Management (EPM) unit's operations. Due to Firm X's presence in the Finnish FS-sector, its EPM unit is also especially interested in the current status of digitalization in the CFO functions of its Finnish clients. The improved understanding of the current status of digitalization enables the development of additional value generation channels in client projects and the identification of both pros and cons of its offerings in relevant industries. The general hypothesis is that there is a significant amount of potential in developing both core processes and value-added services in the financial function by changing ways of working and employing disruptive technologies. As Firm X is specialized in both management and technology consulting, it is especially interested in identifying how different technologies and organizational factors are related to the CFO function's digitalization journey.

Currently, the amount of academic research on the digitalization of the CFO is very limited in Northern Europe let alone Finland. Most research are conducted by local management consultancies with questionable if not biased agenda. Also, the conclusions are often contradictory depending on the approach of the author. Therefore, there is demand for some academic research in the previously mentioned region that pursues to remove speculation from the argumentation and provide updated insight on the current status. Not only is this important for Firm X's client operations, but also for the clients and CFOs in general as it provides insights on the competitiveness of Finnish corporations against their international contenders.

1.2 Research problem, research questions and objectives

The objective of this thesis is to research and provide insights to the current status of digitalization of large, Finnish corporations' CFO functions. This is achieved by identifying the functions' current status and benchmarking the best practices from other industries, functions and cases.

To solve this problem in a detailed and holistic way, the problem is subsequently divided to research questions. Research questions facilitate the introduction to the area of research. Firstly, we must understand what the current status of digitalization is in the CFO function and how it is related to financial function's core processes and value-added services. Then we must identify how technology, organizational and cultural factors can affect the digital transformation. The research questions can be developed based on these requirements.

The research questions of this thesis are:

- *What is the status of digitalization in the CFO functions of Finnish corporations?*
- *How can technological enablers improve the CFO function's performance?*
- *How can organizational and cultural factors enable digital transformation in the CFO function?*

The first research question is answered on some level in the literature review, but the fundamental understanding is validated with the survey. All other research questions are answered on some level in the literature review and validated by the results of the survey. Reaching the objective provides insights that are valuable to not only Firm X and its clients but also to other Finnish and Nordic corporations from a theoretical and a practically perspective.

1.3 Research limitations and scope

The scoping of this research is largely based on the needs of Firm X, but it is also affected by the thesis' academic requirements. From Firm X's perspective, there is a need for improved, updated and holistic understanding of CFO functions' digitalization. Much of Firm X's operations are directly related to the CFO function and its role in the corporate trinity of CFO, IT and business and therefore the need is to get improved insights to this relationship while maintaining the focus on the CFO function. The population of the survey is also limited to Finland. This decision is done to ensure that responses are benchmarkable with each other (to provide more insights on the Finnish market) but also to ensure that the population is not too large to analyze with the given time frame and theoretical framework.

From a practical perspective, including other Nordic corporations in the survey would be challenging due to lack of direct contacts and lack of time for coordination of a larger scale research. There aren't any specific corporations or industries within Finland that are out-scoped from this research, however, this thesis focuses on the current and prospective clients of Firm X which sets some limitations to the corporations from a revenue and size perspective. The scope of this thesis is limited to commercial corporations excluding non-profit organizations as well as public organizations. Also, due to the need to study the CFO function, the corporations in the scope must have one. This effectively excludes most smaller companies from the scope as they often don't have a CFO function. Therefore, not all results are directly generalizable to the Finnish market at large, however, they remain valid for most larger companies and organizations. Additionally, the research includes some focal areas of interest due to Firm X's existing offerings in both technology and organizational management.

There are also multiple limitations that the academic requirements pose. Firstly, this research has included limitations to its functional scope, subject matter scope and geographical scope to increase the validity and reliability of the results. Secondly, there is a

time limitation that poses challenges in terms of survey respondents' vacations, availability for validative interviews and length of time available for result analysis. Also, due to the high-level role of many respondents in their organizations, there is also a limited number of respondents available for both the survey and the validative interviews. From a behavioral point of view, it must be acknowledged that due to the rather business critical nature of the subject matter, the truthfulness in the respondents' answers can be affected by how damaging to their employer the respondents may perceive their answers to be. For example, if the answers risk portraying their employer in a negative light from a strategic, branding or competition perspective, the respondents may be inclined to answer differently. This is further analyzed in chapters 6 and 7.

1.4 Research structure

This thesis is a multi-method study that consists of a literature review, validative interviews and a survey. The theoretical framework is constructed from the literature review which is used to set certain directions for the contents of the research. They are used when designing the interviews which validate the relevant domains and contents of the research. The results of the interviews are then used in constructing the survey to ensure its validity and reliability. In conclusion, the results of the survey are analyzed and synthesized with regard to the theoretical framework. This thesis is structured as depicted in the following figure 1.

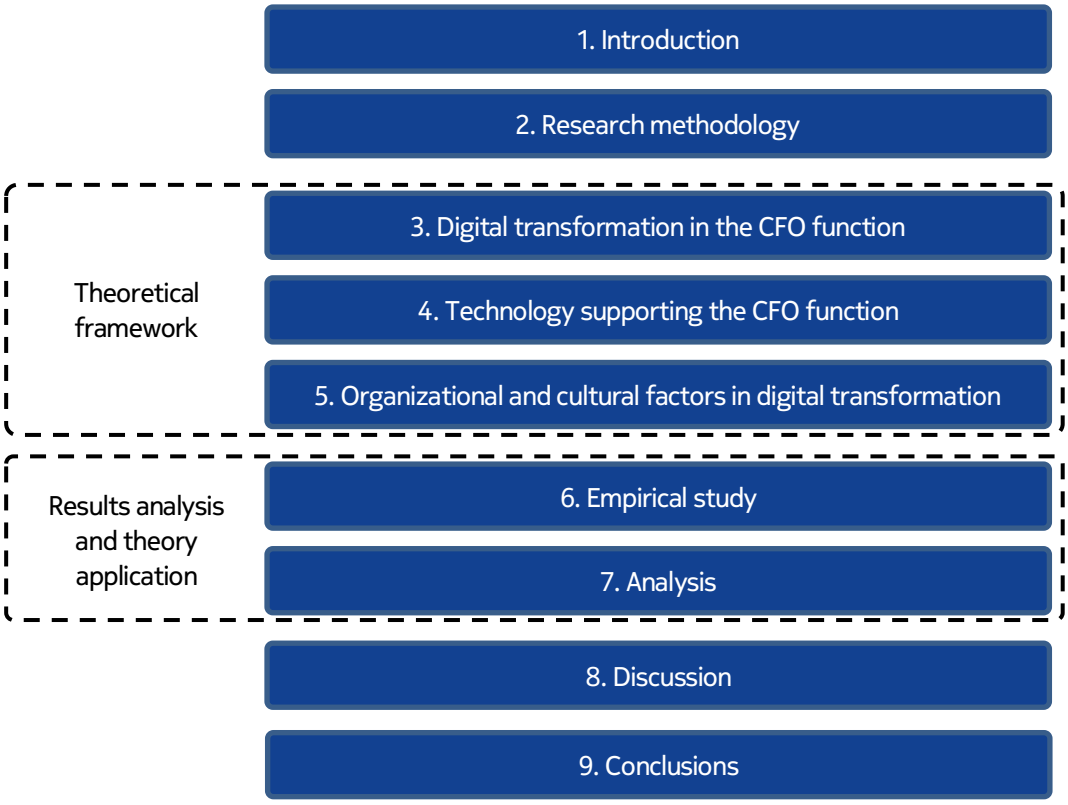

Figure 1. Research structure

The introductory chapter provides the outlines of this research in terms of objectives and motivations as well as a clearer definition to the research problem and research questions. The limitations and scope of the research are also elaborated in the first chapter. In continuation, the second chapter provides theoretical background for the methodologies used in this research. Different methodologies used in this research include a literature review, semi-structured interviews and a questionnaire-survey. Finally, this chapter elaborates on the analysis of the results and how they are reflected on the case of Firm X.

In the third, fourth and fifth chapters, the literature review is conducted. These chapters introduce the different theoretical frameworks that are used in this research while maintaining critical discussion between different sources. The third chapter is focused on the CFO function and its current status of digitalization. It focuses on the core processes as well as the value-added services that the financial function produces. The most important challenges to the success of digital transformations are also introduced in this chapter based on case examples discovered from the literature review. The approach of the financial function to digitalization is discussed first to allow for natural discussion of the theoretical framework later on. The fourth chapter focuses on different technologies that can be employed to support the financial function. This chapter also explores the future requirements and limitations of the prospective technologies and how they can be adapted to the requirements of the financial function. In the fifth chapter, the organizational and cultural factors are presented. This chapter focuses on their importance on the success of digital transformations and how organizational and cultural methodologies can be used when adopting new and disruptive technologies.

The sixth chapter presents how the interviews and survey were conducted and what the results were. The seventh chapter analyses the results and presents the findings. The eighth chapter consists of discussion between the results of the survey, the theoretical framework. The final chapter concludes the findings of this research and reflects on the requirements for future research.

2. RESEARCH METHODOLOGY

In this chapter, the research methodologies used in this thesis are introduced and elaborated on. We discuss the thesis subject and its relationship with the research philosophy and research approach used in this thesis. Specifically, we discuss the conduction of the literature review, the construction of the theoretical framework and their relationship with the empirical research. We also discuss interview and survey strategies as well as the methods of analysis and how the results of the thesis are delivered.

2.1 Methodology

The objective of this thesis is to clarify the current status of digitalization in Finnish CFO functions as we all as to discuss how it is supported with disruptive technologies and organizational and cultural factors. This chapter further explains why certain research decisions are made to support achieving the research objective.

Firstly, a researcher has to consider how to conduct their research. They must choose the tools and methodologies among others in a scientifically valid and reliable way. Saunders, Lewis & Thornhill (2009) present the research requirements in the form of layers, as in an onion. The outermost layer is research philosophy that most directs the way the research is conducted, and the innermost layer is the techniques and procedures to gather and analyze the data. Altogether, there are six layers: research philosophies, research approaches, research strategies, research choices, time horizons and finally the research techniques and procedures (Saunders et al., 2009). These six layers do not directly translate into six decisions, as a research may employ more than one method on each level. However, the research onion gives an outline to the decisions that must be made, also for this thesis. In figure 2, the research decisions for this thesis are presented.

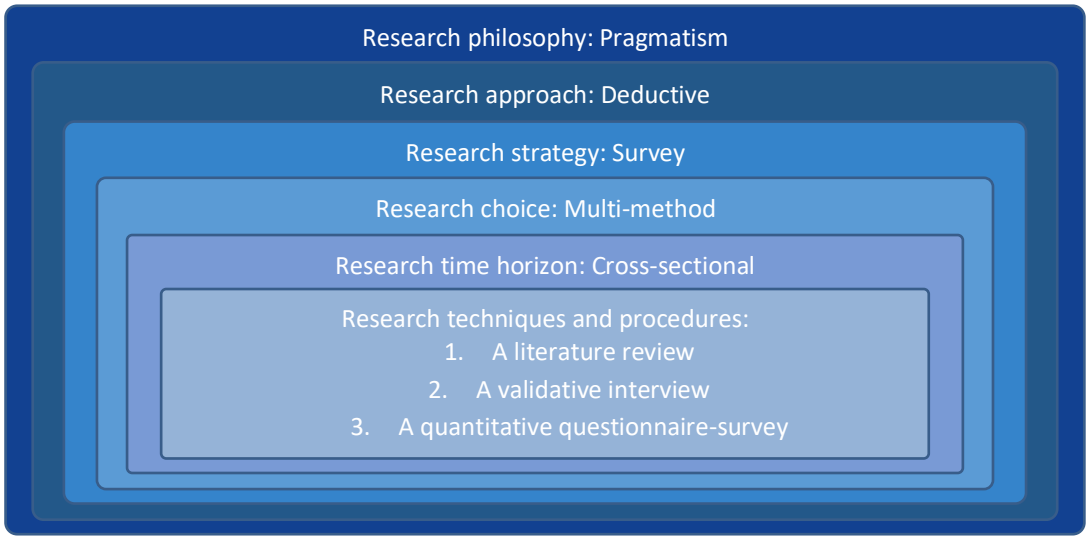

Figure 2. Construction of this thesis based on Saunders et al. (2009) model of layers of research

Research philosophies are effectively descriptions for creation and development of knowledge and are thus the first decision that a researcher must make. Starting from the outermost layer, Saunders et al. (2009) recognize four key research philosophies which are interpretivism, realism, positivism and pragmatism. The philosophies can be further dissected into ontological, epistemological and axiological decisions. Ontology describes the studies approach to the nature of reality, epistemology constitutes to the researcher's view on what knowledge is acceptable and axiology describes the researcher's view on what is the role of values in the research (Eriksson & Kovalainen, 2008; Saunders et al., 2009). However, a unique approach to all of these decisions is embedded in each of the four research philosophies which means that a chosen research philosophy also defines the ontology, epistemology and axiology of the research. The research philosophy used in this thesis is pragmatism. This is due to the multi-method research choice used in this thesis.

Pragmatism is chosen because some aspects of the research benefit from other research philosophies than others. The thesis is very closely related to organizational research, which always incorporates people. This is especially true for the interviews, which is why interpretivism must be used. However, when analyzing the results of the survey, critical realism must be used to interpret the current status of digitalization in the CFO functions from the survey responses. Interpretivism therefore translates to a subjective ontology while realism translates into an objective ontological decision. From an epistemological point of view, interpretivism means that input from, for example interviewees, must be analyzed based on the background and current situation of the interviewee rather than directly accepting it as a fact or truth. On the other hand, the survey data should be approached from a critical realism point of view. While the data should be considered as truthful as possible (which is why risk for misinterpretation is mitigated as well as possible with criteria explanations and such), survey results must be explained within a context. However, only with a realist approach to the data, can phenomena be explained. The same bipartition is not true for axiology. Where interpretivism is used, the research is considered subjective as the researcher cannot be separated from the context. The same goes for realism. The researcher is biased by their world views and individual experiences which will impact the research. Hence, the values of the researcher play a significant role in the research.

As for the research approaches, there are two different options: deductive and inductive approach (Saunders et al., 2009). A deductive approach is chosen if the study is based on a certain theory and that theory is then tested with a set of hypotheses, like in the case of a survey. An inductive approach, on the other hand, forms a theory based on observations, like interviews. (Eriksson & Kovalainen, 2008) This thesis uses the deductive approach. The literature review, where this thesis begins, forms the basis for the research with a set of theories. Also, the survey is based on a set of expectations or theories that are then tested. Although this thesis uses validative interviews as well, they are effectively just that: validative. The interviews introduce a set of theories that are then being tested in a live situation against the interviewees.

When the research philosophy and approach have been chosen, the next layer in Saunders et al. (2009) research onion is research strategy. This research decision describes what data is gathered and how the gathering is done. There are three elements on this layer: the purpose of the research, the form of the gathered data as well as the actual strategy. The research aim of this research is two-fold. It is both exploratory and descriptive. Exploratory researches pursue to gain a better understanding of the current situation and give more insight in to a specific subject (Robson, 2002). A literature research is an example of an exploratory study (Saunders et al., 2009). However, the survey is descriptive as it describes the current situation of digitalization. Descriptive researches require a clear picture of the phenomena being researched before the actual data collection can be implemented (Saunders et al., 2009), like the survey questions in this case.

All research strategies are created equal meaning that no strategy is inferior or superior to the other strategies. When selecting a strategy, however, the most important question the researcher must ask themselves is which strategy allows one to answer the research questions. (Saunders et al., 2009) To best answer the research questions of this thesis, a survey is chosen to be the primary research strategy. Surveys allow researchers to collect quantitative as well as descriptive data which is standardized allowing comparison both within the sample but also against other, previous researches. While there are certain complications to using survey, like doing the due diligence on sampling the population and framing the questions (Hewson, Yule, Laurent, & Vogel, 2003; Saunders et al., 2009), it allows the research to present quantitative and clear results fairly easily. A survey is also chosen in order to produce valuable information for the employer of this research and the Finnish market in general, but especially for the scientific community since an academic research of this kind has not been conducted in Finland or other Nordic countries in the past.

Finally, the researcher must select the data collection techniques and procedures. There are three used in this thesis: a literature review, an interview and a questionnaire-survey. By definition, this makes this thesis a multi-method research as multiple different data collection techniques are used (Saunders et al., 2009). While the literature review and interviews collect qualitative data (and therefore must be analyzed using qualitative methods), the survey results are quantitative and must be analyzed appropriately with quantitative methods. However, due to the small population and therefore a small sample size, the scientific validity and reliability allow for somewhat less strict quantitative requirements (Bourque & Clark, 1994). The use of specific techniques will be elaborated on later. This study also uses a cross-sectional time horizon, meaning that it investigates the current status as of right now and does not focus on long-term development (Saunders et al., 2009).

2.2 Literature review

Sharp, Peters & Howard (2002) identify two main reasons for using a literature review in research: firstly, to help the researcher generate better ideas and questions regarding

the topic, and secondly, to provide more detailed knowledge about the subject and the context. On the other hand, Gall, Gall & Borg (2006) say that additionally a literature research helps in identifying gaps and research possibilities in existing literature and to provide explicit recommendations for further reading. While the primary reason for including a literature review in this thesis was to provide more information on the CFO function and disruptive technologies in general, it was also used to validate the research questions and identify the gaps that current literature does not sufficiently cover.

The literature review in this thesis was conducted as per Saunders et al. (2009), Stewart & Kamins (1993) and Searcy & Mentzer (2003) instructions. After the research questions and objectives were drafted, the generation of the key words began. Those key words were used in searching several databases, journals and other sources to discover proper articles that matched the set parameters. Those articles were then evaluated, and the writing of the theoretical background began. Simultaneously, new versions of the key words were iterated, and new articles and material was searched. The material was compared against the set exclusion criteria to ensure validity and reliability of the thesis (Searcy & Mentzer, 2003). The scope of the research was also reviewed at regular intervals in order to maintain the focus set in the beginning.

As for the key words, there were two main topics that this thesis includes: the digitalization of the financial function and the implementation of new disruptive technologies. The literature review began with by searching existing research on the two main topics by using "CFO digitalization", "financial function digitalization" and different technologies like "robotic process automation" as key words. These were used to gain a better understanding of the amount of research covering these topics as well as to better understand the area of research. The material found the initial phase was then evaluated and better, more topical search words were generated. After this initial iteration, three major topics were recognized: 1) CFO digitalization and transformation 2) disruptive technologies (especially in CFO context) and 3) digitalization of organizations (especially in CFO context). Some examples of the search words used in the literature review are listed below:

- (digital AND transformation) AND challeng*
- digital* AND challeng* AND financ*
- digital* AND (change AND manag*)
- (AI or "artificial intellig*") AND (CFO OR "financial func*" OR financ*)
- fintech AND (CFO OR "financial func*" OR financ*)
- "optical character recognition" AND financ*
- (AI or "artificial intellig*") AND financ*
- "robo-advisor" OR "virtual assist*" AND (financ* OR accounti* OR CFO* OR control*)
- ("organizational factors" OR "organizational factors" or "cultural factors") AND (digital* AND transform*)
- "digital transformation" AND process*

Most of the material was discovered from conventional research databases like EBSCO-Host and ProQuest. However, to find the material, research services like Scopus, Google Scholar and TUT's Andor were used. These search engines search multiple databases simultaneously and thus provide a more exhaustive search results of articles and documents.

All search results were also filtered based on the exclusion criteria and some parameters were weighed over others. For example, a recent year of publishing was emphasized since most valid research of the topics is from the last four years. This was done due to two reasons: firstly, there isn't much research available from before 2010-2012, and secondly, most of the research is obsolete since there have been so many significant developments in all areas related to the topics during the last decade. Another criterion that was used is that the full text of the publication is available. Therefore, all research is based on the full documents, not just abstracts or titles. The references are mostly in English, but if other languages were used, the reference needed to be a major publication and even then, they were mostly used as a secondary reference. To ensure the scientific quality, reliability and validity of the research, high-quality publication forums were also emphasized (Mingers, 2000; Stewart & Kamins, 1993). This means that peer-reviewed journals, articles and conference papers were used as the main sources to make sure that the content is relevant and that the choices made in this research are valid. Using high-quality sources also means that views expressed in this thesis can be argued via widely-recognized publications. Articles that were selected to be used in this thesis passed the set exclusion criteria.

The novelty of the topics of this researched meant that there was little academic research available. Therefore, some commercial research was also included in this thesis. In this context, corporate white papers and research by management consultancies or research corporations is considered commercial research. This research is often more up-to-date on business needs and commercial actors tend to react to market demand quicker than academic actors. This is the primary reason why some commercial research was used. However, commercial research needs to be taken as what it is (Stewart & Kamins, 1993). In this thesis, commercial research is being treated accordingly so that possible biases, agendas or lack of scientific proof or descriptions of research methodologies is noted and not being considered as reliable as academic research. These sources were used after heavy consideration. While the reliability may not be as high as in academic research, commercial research often includes more relevant case studies and practical use cases directly from corporations. In this thesis, commercial research was often used to support academic and theoretical arguments with real-life examples.

2.3 Empirical research

The research methods used in this thesis are chosen to achieve the research objectives and to support the scientific requirements. In addition to the literature review, there were two other research methods used: a survey as the primary method of data collection and an interview as the secondary method of data collection to support the validity

of the survey. First, the validative interviewing was conducted to validate the contents of the survey with relevant members of the survey population. After the contents were validated, the survey was conducted to a sample of the population. This chapter discusses both methods in more detail.

2.3.1 Validative interviews

The validative interviews were conducted using a semi-structure interview format. Semi-structured interviews employ an interview template (a pre-defined interview structure) but allow breakouts from the structure in the interest of discovering interesting discussion topics (adapted from King, 2004; Zikmund, Babin, Carr, & Griffin, 2013). Semi-structured interviews allow researchers to gain a better understanding of the topic, and in this case explore enhancement possibilities that are not included in the pre-defined interview structure (Cassell & Symon, 2004). Saunders et al. (2009) also say that semi-structured interviews are suitable for non-formal interviews, which the validative interviews are. In the appendix A, the interview template is presented with all the questions. As per King's (2004) instructions, the template was not strictly followed to allow discovering interesting improvement suggestions.

The objective of the interviews is to validate the contents of the survey. The interview was also used to gain more insight of the population, which is somewhat different from conventional populations. This is due to the quite small size of the population. Also, most respondents are top-level executives in large, publicly traded firms which means that they are very busy, and it is challenging to get them to spend time answering the survey. This must be considered when interviewing high-status interviewees (Cassell & Symon, 2004). This part of the interview covered the presentation of the questions so that they are understood correctly (and therefore ensure the validity of the data), the engagement of the sample and finally the presentation of the incentives so that the answer rate is maximized. The incentives used for this survey were a personalized report which allows respondents to benchmark the answers from their company against those of the general population of the survey as well as a white paper by Firm X on the topic of digital CFO.

Since this was a secondary research method, the scientific requirements were somewhat less strict than if it had been the primary method of data collection. While the interviews were recorded to allow summarization later, they were not transcribed word for word. After the summarization, the correction suggestions were implemented in the survey and approved by Firm X.

2.3.2 Survey

As the primary method of empirical research, this thesis employed a questionnaire, which is a sub-category of a survey. A questionnaire is a general term that includes all techniques of data collection in which each person (respondent) is asked to respond to

the same set of questions in a predetermined order (deVaus, 2002). In this case, the specific survey used was a self-administered, internet-mediated questionnaire. Surveys are great tools to collect data in an economical way from large populations and when respondents are not easily otherwise reachable. They are often quantitative, like in this case, and therefore measured and analyzed using descriptive and inferential statistics. Questionnaires also enable the researcher to suggest relationships between variables. (Saunders et al., 2009) For example, in this case, survey responses can be compared against the size of the respondents' companies. In this thesis, the analysis of the data collection methods was done in the beginning and a questionnaire was clearly the most feasible option which is why it was selected.

According to Saunders et al. (2009), the most significant drawback of a survey is the large number of ways it can be done incorrectly. Therefore, paying attention into conducting the survey in a scientifically valid and reliable way is paramount. Saunders et al. (2009) present a checklist for conducting a survey. Firstly, the sample needs to representative of the population. This means that the sample size that is administered the survey would as closely as possible resemble the potential answer of the entire population (Hewson et al., 2003). Since it would be tremendously impractical to survey entire population (especially for a time-constraint perspective) (deVaus, 2002), the sampling in this thesis is done using a non-probability based convenience-method. In practice, this means selecting as many potential respondent candidates that fit the criteria as possible. Considering the size of the population, the minimum sample size was defined as 300 for this thesis. This is further elaborated on in chapter 6. Then the data collection must be designed. Essentially this means designing the survey structure including all questions and options (Corbetta, 2003). However, designing the survey requires careful literature review so that all angles of the research area are covered sufficiently and in a balanced way. According to deVaus (2002), the subject and topics benefit from brainstorming with other people, which was also done with Firm X's subject-matter experts. This ensures that all and only essential data is collected. Only then can the designing of the questions, question formats and options begin. This phase also includes an analysis of what information must be delivered to the respondents so that a) they are equipped to provide a valid answer and b) without biasing their answers with too much instructions (Bourque & Clark, 1994; Corbetta, 2003). This was also done accordingly and is explained in detail in chapter 6.

After the data collection has been configured, the questionnaire needs to be configured in the data collection instrument (Hewson et al., 2003). In the case of this thesis, the instrument was SurveyMonkey, a cloud-based survey tool. Selecting the instrument required analysis of the different features on, for example, question formatting, survey workflow and post-survey analysis. After the data collection instrument is configured, the survey must be piloted before actually administering it to the sample (Corbetta, 2003). In this case, the tool was first piloted internally within Firm X with people knowledgeable of the subject, and then during validative interviewing. Corrections to the survey were made and the final version of the survey is presented in appendix B.

Before the survey can finally be administered, some preparations regarding the accompanying materials must be made. Dillman (2007) says that including an informative and engaging cover letter greatly affects the open rate of the survey. Similarly, the introductory text at the beginning of the survey is equally important. Therefore, both the cover letter and the introductory text were given the appropriate attention. Only after these preparations are made can the survey be administered to the population. Often times, the respondents may have to be followed-up to answer to the survey, via the same channel or different channels (Hewson et al., 2003; Saunders et al., 2009). For example, in this survey most respondents were followed-up using email while some were called if it was deemed suitable. After achieving an appropriate number of responses, the survey can be analyzed using a statistical analysis tool. Considering the population of the target group and minimum sample size of this thesis, the threshold number was defined as 30.

As the questionnaire was the primary method of data collection in this survey, it is very important that all scientific requirements and best practices are followed accordingly to ensure the validity and reliability of the results and the following analysis. A more in-depth description of the empirical research is presented in chapter 6.

2.4 Analysis

To interpret the results of the survey in validly, a structured scientific analysis is required to be conducted. The analysis includes the processing of the results to an interpretable form from the raw data, presenting and analyzing the data and finally drawing conclusions from the presented data (Bourque & Clark, 1994; Cooper & Schindler, 1998). Data analysis can be performed in several ways, many of which are valid and produce reliable results. However, neglecting this phase of the research may also produce untrustworthy results, hence, the analysis must be performed carefully (Tashakkori & Teddlie, 1998). The survey results of this thesis include both quantitative and qualitative data, which means adapting the data analysis methods when necessary.

According to Saunders et al. (2009), there are four primary steps into the analysis of quantitative data. Firstly, the data must be prepared, checked and processes into a suitable format. This step includes formatting the data so that it is unified, values can be compared against each other and from a statistical point of view it is analyzable. This step also includes coding the data in specific ways (like using binary if the software so requires), weighing cases and checking the data for errors (Anderson, Sweeney, & Williams, 1999). Secondly, the data must receive a first round of analysis (referred to as exploration) and then presented. For this thesis, there are some requirements that must be addressed. For example, the data must be anonymized so that no individual responses can be identified, the data must be visualized as summarized data so that proportions and general trends are identifiable easily, the raw data must be presented in anonymized format and some statistics must be presented.

The third step of Saunders et al. (2009) is describing the data using statistics. Whereas quantitative researches often have quite strict requirements due to the quantitative format of the data, this data in this thesis does not require such strict analysis because of the relatively low *n* from a statistical point of view (Anderson et al., 1999; Curwin & Slater, 2007). For example, statistical analysis of the reliability of the results is not required, nor the p-value as there are no predefined statistical hypotheses against which tests are made. However, where applicable, data about the mode, median and average should be presented. The mode of a data set is the value that occurs most frequently, median is the middle value of the data set and average is the sum of all results divided by number of observations (Saunders et al., 2009). As the fourth step, an analysis includes examining relationships, differences and trends using statistics. As for this thesis, addressing these with statistics is not required as the number of observations is very low and therefore the reliability of the statistical analysis is low. However, examining the relationships, differences and trends will be done qualitatively. A more in-depth analysis of the data analysis is done in chapters 6 and 7.

3. DIGITAL TRANSFORMATION IN THE CFO FUNCTION

In this chapter, the core concepts and terminology of the CFO function are presented. At first, we discuss the core processes and value-added services of the financial function followed with an introduction to the organization and characteristics of the corporate CFO. We then explore the transformation challenges that CFO's business environment sets for digital transformation, specifically management, technological, organizational and cultural challenges.

3.1 Core processes and value-added services of corporate CFO

The chief financial officer (CFO) and the financial function – often also referred to as CFO – serve a fiduciary duty as the decision-making element responsible for the financial management of a corporation. There are a number of duties that CFO is responsible for, ranging from financial activities such as accounting, compliance, management and control, strategy and risk, funding to organizational activities (Smith & Payne, 2011). In literature, many different frameworks for classifying and grouping these activities have been introduced and there aren't any specific widely accepted definitions. There are also varying terminology and definitions for different functions. For example, the International Federation of Accountants refers to a generic corporate financial function as Enterprise Financial Management and subsequently divides it to three broad areas: tax accounting, financial accounting and managerial accounting (Phillips, Libby, & Libby, 2011). The framework is presented in figure 3.

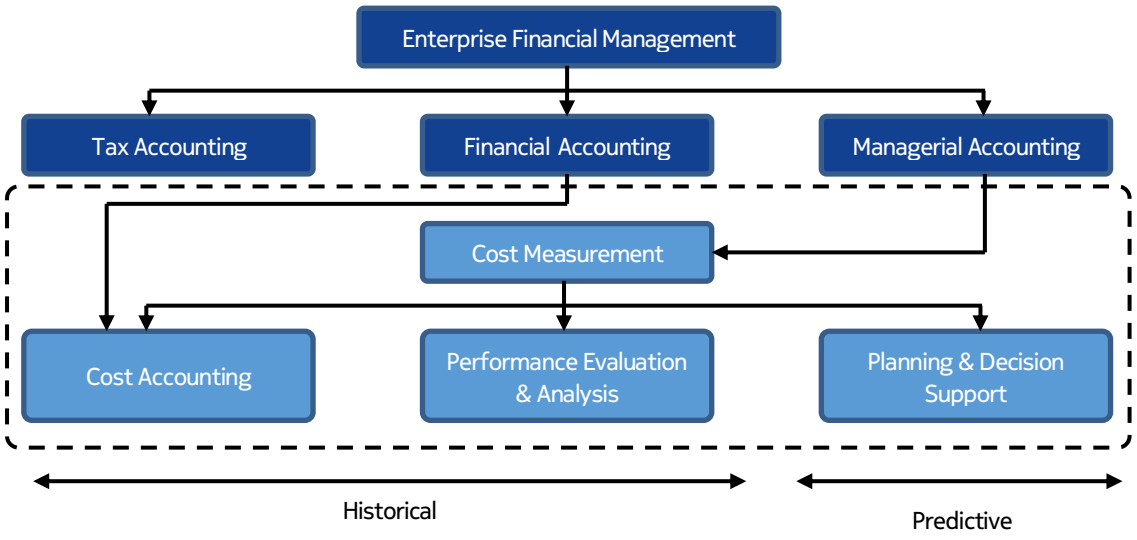

Figure 3. IFAC definition of Enterprise Financial Management (Phillips, Libby, & Libby, 2011)

This division looks at CFO operations from a purely financial accounting (reporting to external stakeholders) and managerial accounting (reporting to internal stakeholders) point of view. IFAC's definition also highlights the difference in nature for both managerial and financial accounting. Whereas financial accounting tends to be regulatory and external reporting – therefore based on historical data – managerial accounting often also includes a predictive element. However, according to Smith & Payne (2011), CFO is also responsible for multiple other activities such as strategy, compliance and even some organizational activities. This framework supports a similar postulation that CFO's tasks can be divided into two categories. In this thesis, we refer to the external deliverables as the core processes and to the internal deliverables as the value-added services. This division is represented in figure 4.

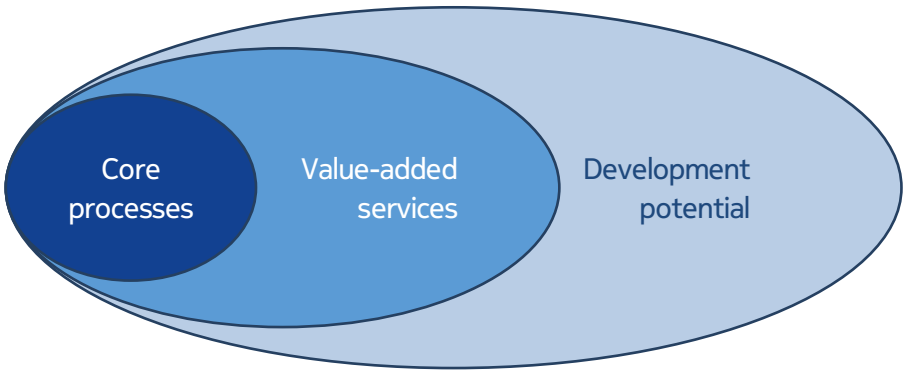

Figure 4. Functionalities and responsibilities of the CFO function

The core processes of the financial function are often referred to as financial accounting. Financial accounting refers to the preparation of financial statements for public consumption. They are controlled by external requirements which essentially outline the reporting needs for corporations' financial reporting to their external shareholders such as stockholders, suppliers, banks, employees, government agencies, business owners and other stakeholders for decision making purposes. These requirements are governed by both local and international accounting standards and the CFO is the corporation's fiduciary in complying with them. (Phillips et al., 2011)

There are three primary deliverables for the core processes: 1) statement of cash flows, 2) statement of profit and loss (often also referred to as income statement) and 3) statement of financial position (often also referred to as balance sheet). Additionally to the three above, corporations may be required to produce a statement of retained earnings or changes in equity. (Phillips et al., 2011) The core processes are the minimum requirement for any corporations' financial function. On the operative level, the accounting function is responsible for delivering them, but the CFO is responsible for oversight. Notably, the effort of delivering on the core processes rarely fluctuates; it doesn't diminish, nor does it grow outside of seasonal change. Financial accounting's main objective is to regulatory information to users for rational decision-making.

On the other hand, the value-added services that the financial function provides are purely for internal decision-making purposes. A simple definition for managerial account is the provision of financial and non-financial decision-making information to managers (Quinn, Oliveira, Burns, & Warren, 2013). In other words, CFO provided value-added services are the tools used in steering the corporation to the desired direction. Where core processes are operated by accountants, value-added services are operated by business controllers. Internal reporting contains e.g. performance evaluation and analysis tasks such as assessment of current strategy and plans, profitability reporting and process analysis. These elements are based on historical data. Internal reporting also includes planning and decision supporting activities such as forecasting, budgeting, cost-based planning and incremental costing. (Phillips et al., 2011) These are some of the predictive elements as per figure 3.

As opposed to the financial function's core processes, the growth and further development of value-added services is not similarly limited. The more insightful and valuable services the CFO function can provide, the better for the business. Value-added services are also where a substantial amount of development potential is currently lying (Chandra, Plaschke, & Seth, 2018). For example, accountants can't directly improve the checks and balances since it's regulatory data that is reported by operations whereas business controllers can continuously improve their insight to the underlying root-causes for management's decision-making purposes.

Nevertheless, for the CFO function to reach is full potential, both core processes and value-added services need improvement. The potential represents the kind of core processes and value-added services the financial function could provide if the existing and future obstacles are overcome. This also includes the development of technological tools, management support, capabilities etc. that a corporation possesses. Although value-added services are often more easily improvable, there is untapped potential in core processes as well. One of the key benefits is streamlining accounting and compliance functions (Tucker, Foldesy, Roos, & Rodt, 2017). Make no mistake: accounting is a massive operation for the financial function to run. It is costly and time-consuming. Reducing the amount of human errors, increasing transparency and enhancing control and efficiency would significantly reduce the costs and resources required to run it. (Tucker et al., 2017) Not only would this reduce costs to the CFO function itself but also indirect costs to IT and other corporate functions. For the value-added services, there is vast amount of development potential. Corporate CFO functions often pursue development of more high value business advice, better planning and forecasting and data for enhanced decision-making. (Tucker et al., 2017) Combined, digitizing financial operations decreases risk and yields higher returns (Bhimani & Willcocks, 2014; Chandra et al., 2018; Tucker et al., 2017).

3.2 Organization and characteristics of corporate CFO

To begin, it is acknowledged that there isn't just one CFO role for all corporations and organizations. In many cases, however, the financial function is organized according to

a common trend of which different varieties exist and, in this thesis, we refer to the generic organization structure of the financial function. In fact, the generic CFO function has developed into its current form over a period of more than 50 years. The Chief Financial Officer came to prominence in the 1960s as it grew out of the corporate treasurer. The primary objective of this new C-level executive position was to focus on tax reporting, financial statement preparation and budget creation. (Denford & Schobel, 2012) Although the financial function had existed even before, it was not directed with the type of focus that a CFO could render. The senior financial executive's narrow and sole focus was on accounting and controlling (Howell, 2006). The financial function lacked the agility and ability to integrate and analyze the data, the growth potential is limited by legacy systems and digital workforce capabilities only went so far (Chandra et al., 2018; Hiebl, Gärtner, & Duller, 2017; Tucker et al., 2017). Traditionally, CFO had not been perceived as the forward-looking function when it comes to digitalization.

However, the CFO role has expanded to one of a financial strategist and business advisor. Today's CFOs are expected to be extraordinarily broad-gauged, ranging from technical experts to strategic activists, acting in close alignment with their CEOs and boards of directors to satisfy their external stakeholders demands. (Howell, 2006; Vanmali, 2017) The world changes rapidly and the business environment is highly competitive which requires the financial function to provide timely information and insight with pare resources (Fabich, Firnkorn, Hommel, & Schellenberg, 2011; Tucker et al., 2017). Forced to do more with less, CFOs must balance performance, efficiency, and risk – but that requires digital tools as well as the agility to manage volatility and drive enhanced decision making at reduced cost. Few CFOs have these capabilities. (Tucker et al., 2017)

The financial function's responsibilities, and subsequently its characteristics, have changed and continue to transform dramatically. According to McKinsey & Company's 2016 study of 545 senior financial executives, many functions other than finance now report to the CFO: risk management, IT, corporate strategy, investor relations, cybersecurity and digital to mention a few (Agrawal, Dinneen, & Seth, 2016). The CFO is transforming into a business partner and strategic decision maker and is involved in driving digitalization efforts and strategic decisions. Haislip et al. (2017) note that CFOs have become more tech savvy and many now serve a major IT governance oversight role with the firm, sometimes to the extent of being a liaison between IT and the board (Haislip, Lim, & Pinsker, 2017). CFOs without the ability to deliver on the updated business requirements pose a risk to the success of the financial function, the board and to the corporation at large.

The financial function is increasingly involved in all areas of company management including strategy selection and operation (Bhimani & Willcocks, 2014; Fabich et al., 2011). Tucker et al. (2017) note that digitalization is a significant part of this change. They have identified numerous finance topics that are currently undergoing a critical period. For example, CFOs are shifting from being the finance performance manager to

the de facto chief of digital and data officer unit and from historical paradigm of controllers and accountants to provider of advanced analytics services in the digital paradigm. Other relevant trends are the automation of transactional activities, increasing proactivity and decreasing reactivity as well as the overall digitization of corporate financial services. (Tucker et al., 2017) In the historical paradigm many of these topics were the responsibility of the respective units such as IT and operations but the ever-deeper integration with the financial function requires the CFO's involvement. The paradigm shift is an all-encompassing rebirth of the CFO and it doesn't just apply to the technology layer but also to processes, organization, culture, management and the company's workforce (Bhimani & Willcocks, 2014).

In fact, the paradigm shift that the CFO function is experiencing is not unequivocal. Fabich et al. (2011) are referring to it as the strategic CFO which links financial policies to strategy, and operations – in the context of managing the company's risk position – assumes a central role in the task portfolio. The interpretation of Fabich et al. emphasizes the strategic position of the financial function in directing the operations, but it does somewhat downplay the CFO's significance on the operational level for example regarding digitalization. Tucker et al. (2017) and Schwieters et al. (2015) on the other hand highlight the digitalization element of the paradigm shift by calling it the digital CFO. While acknowledging that many finance organizations still lack the digital basics, they recognize that in order to reach the full potential of core processes and value-added services, they must transform the financial function by employing digital technologies. (Schwieters, van Hoof, & Etheridge, 2015; Tucker et al., 2017) A combination of the two perspectives is Srikant Sastry's hybrid CFO. Sastry argues (2018) that future CFOs will need to understand both regulatory and financial complexities, as well as technology, including cloud-enabled ERP and data analytics to ensure success. The three most important skills are a combination of the two functional areas: data analytics, technology management and risk and compliance management (Sastry, 2018). While CFOs still own finance, they also have major influence over many IT decisions (Haislip et al., 2017) and therefore the hybrid CFO -thinking seems valid. Haffke et al. (2016) concept of CFO being the firm's CDO of internal digitalization supports this thinking. In this thesis, however, the focus is more on digitalization as opposed to the traditional finances which is why digital CFO is the preferred conceptual context.

According to Baril et al. (2018), 21 percent of CFOs currently own digital transformation initiatives in their organizations (Baril et al., 2018) and the percentage is expected grow rapidly during the next years. But why is digitalization often assigned as the responsibility of the financial function? It is still somewhat unclear whether this organizational setup is optimal. After all, finance and IT are two quite different functions. IT is a substantial operation for a corporation to run so it would justifiable for a CIO or CDO to earn the seat in the top management team (Wailgum, 2010). Conversely, many argue that the significant IT spend and its close relationship with ROI create such a significant connection with finance that it is the only valid organizational structure. While the common answer to the question at hand is that it has always been that way, there is

still some valid reasoning behind the setup. IT was forged in finance departments to help with the digitization of accounting functions in the early days when the majority of IT spend was on financial computing initiatives (Wailgum, 2010). Even today, IT remains one of the largest capital outlays in a firm and one of the greatest contributors to strategic advantage (Denford & Schobel, 2012). The dyadic relationship between a firm's CIO and CFO is critical in exploiting the resources in support of the strategic goals. As the financial function is still one of the most important users of IT services, it makes sense for CFO to have the visibility and the oversight (Haislip et al., 2017) that it requires. Now if not before, IT provides the strategic tools for the strategic decision maker (Fabich et al., 2011; Masli, Richardson, Weidenmier Watson, & Zmud, 2016). This setup also increases the mutual trust within the top management team (Masli et al., 2016).

With the CFO leading the edge on digital transformation, the financial function is enabled to drive decision making on e.g. project prioritization, capital allocation and KPI setting (Tucker et al., 2017). This is critical to ensure the continuous and effective development of the core processes and value-added services. CFOs have a clear opportunity and mandate to shape the evolution of their companies but the benefits will not come at all if CFOs don't take the first steps (Chandra et al., 2018).

3.3 Digital transformation challenges

In order for the financial function to reach the potential in their core processes and value-added services, they must overcome obstacles, many of which are common to digital transformations. This is also the prerequisite for building a firm digital foundation for the future of a corporation (Sastry, 2018; Tucker et al., 2017). Identifying and breaking down the challenges is necessary if they are to be addressed comprehensively. For the purpose of this thesis, identifying the challenges is important not only to develop and justify the background for the survey in order to fulfill its objective but also to create a better and holistic understanding of the CFO function's roadmap for the next years.'

In this chapter, we elaborate on further on the challenges that digital transformation introduces to the financial function's management, technological landscape and organization and culture. To cover the most relevant challenges, it is crucial to categorize the challenges as accurately as possible. This demands for a MECE-categorization (mutually exclusive and collectively exhaustive) which in practice translates to separating the items to subset categories so that all relevant areas will be covered with each challenge belonging to one category only. Developing the categories began with Sauer et al. (1997) wider view which considers alignments among strategy, structure, management and people to contribute to the organizational effectiveness (Sauer, Yetton, & Associates, 1997). The similar logic is also applicable for the effectiveness of digital transformations. This was amended by Bhimani & Willcocks (2014), who divide factors affecting organizational effectiveness into five categories: technology, management, culture,

governance and people. Similar thinking is supported by Lauslahti (2018), who similarly identifies five categories vision (management), culture, skills (people), processes and technology. For the purposes of this thesis, these categories are binned into 1) management and leadership challenges, 2) technology and process challenges and 3) organizational and cultural challenges.

One of the key challenges that CFOs face in digitizing their financial function is identifying the most important processes (Chandra et al., 2018). The objective in the following chapter is to identify some of the most important challenges. Although prioritization of the challenges is likewise important, that conclusion will be based on the assessment of the survey results later in analysis of the empirical results. While it is acknowledged that the most fruitful development areas for the financial function are in value-added services (Chandra et al., 2018), the core processes are also a substantial operation to run and they will be considered with equal importance.

3.3.1 Management and leadership challenges

Contrary to the common belief, it is strategy that drives digital transformation instead of technology (Kane, Palmer, Phillips, Kiron, & Buckley, 2015) Instead, ability to carry out the transformation and to provide the organization with a vision is much more important to the success than any technology solution. However, one of the key challenges that Chandra et al. (2018) recognize is in fact the CFO's and the financial function management's inability to clearly define the digital vision and to share that vision across the organization to support a joint approach. To emphasize the joint approach, developing a common digital vision requires involvement from not only the management of the financial function but also from business units, IT and the TMT.

Chandra et al. (2018) also note that often digital transformation initiatives are not linked to the overarching business strategy which leaves the initiatives to without built-in organizational support and corporate incentivization which too often hinders or completely blocks the initiatives. When initiatives are not linked to strategy, they are rarely resourced or supported efficiently and outcome monitoring is minimal or non-existent. Finally, Chandra et al. (2018) identify the lack of clear, strong mandate to digitize financial processes across the organization as a key barrier to digital transformation success in the financial function. For many functional positions, as we later note, corporate digital transformation produces a significant workload and without a clear advocation from top management that work rarely receives the attention it requires. In many corporations, this is still a typical barrier which continues to dilute otherwise successful transformations into failed initiatives. Chandra et al. (2018) also note that management commitment greatly affects the success of digital transformations, especially if there is lack of commitment. Deductively, this also means that transformations initiatives and projects must be owned by someone from the management to ensure commitment.

Conclusions by Chandra et al. are supported by another survey conducted by an American research organization to 156 respondents. When asked to describe the key barriers

or impediments to fulfilling their digitalization strategies, respondents primarily focused on their cost and other difficulties related to determining the return on these investments (Owens, 2016). More than 40 percent of respondents say that competing priorities in terms of resources and budgetary allocation are hindering the development of the transformation. Additionally, CFOs perceive assessing the business value of the investments as challenging. The link between lack of digital vision and linking to business strategy is not difficult to form. This vicious circle is furthermore strengthened by CFOs' lack of familiarity with digitalization as Owens (2016) points out. When management lacks the skills and even the terminology to drive the transformation, it rarely comes out successful at the other end. In a 2017 study, just 6 percent of the surveyed CFOs of American corporations said they are aware of the technologies that were available for them (Simon & Fabian, 2017). For many organizations' financial functions, the maturity of their digital transformation is still at its infancy.

3.3.2 Technology and process challenges

A fundamental part of digitalization are the technology solutions that are implemented to support the business transformation. Although Kane et al. (2015) argue that technology is too often seen as a key barrier to transformational success, it's role as an essential contributor should not be disregarded. Most of the technological challenges that CFO functions face are not related to the capabilities of the specific solutions but to the overall business-IT landscape of the company. Most challenges are somewhat intangible almost to the extent being organizational rather than technological challenges.

Earlier in chapter 3.2, we noted that the growing amount of functions reporting to the CFO is complicating the financial function's operating environment. The lack of a sufficiently advanced operating model to support the complex business landscape is at the root of many financial functions' inability to run a standardized, effective and efficient finance organization. Additionally, growth through acquisitions and mergers is furthermore complicating the process-, control- and systems landscape in corporations. (Owens, 2016) Therefore, one of the key technological challenges for CFOs is the growing system complexity. For example, 42 percent of a 2018 study by Baril et al. identify it as the primary challenge for the digital transformation of the financial function. Contributing factors for system complexity are the growing number of legal entities and reporting systems (Simon & Fabian, 2017) in corporations. Also, the increasing need to better integrate business units with the financial function and to maintain the existing legacy system landscape add further complexity (Baril et al., 2018). Additionally to the crucial nature of the financial function (and the businesses dependency on its performance), security and business continuity is one a key concerns for decision makers in the financial function, especially from a system vulnerability point of view (Ahlemann, 2016).

A subsequent technological challenges is the continuing decentralization of technology solutions which deriveable from the aforementioned system complexity (Owens, 2016). A contributing factor is the background of the solution implementations: many are pro-

cured by business units or functions other than IT often resulting in weakly integrateable set of solutions. Considering this in the already complex IT landscape creates substantial challenges to for the IT function (Baril et al., 2018). IT-siloing is in direct contradiction with the financial functions' objective – which is applicable on corporate level as well – to standardize activities and platforms. Although this has been recognized as a valid challenge, many finance organizations are currently investing in building a common platform to run financial operations on, which supports sustainable development of the digital foundation.

Mäder & Akiki (2017) note that the recent development in the area of big data has expectedly increased the amount of data flows. Somewhat surprisingly, this has become a challenge for some as relevant data is now scattered across the organization and in some cases the financial function doesn't even have visibility to what data is available (Mäder & Akiki, 2017; Simon & Fabian, 2017). Big data management is not exactly the CFO function's area of expertise. In fact, Lauslahti (2018) and Chandra et al. (2018) argue that the lack of skills with technology and IT development has become a barrier for some CFOs in driving the digital transformation in their financial functions but for example Haislip et al. (2017) and Bhimani & Willcocks (2014) say that the paradigm shift and the birth of the digital CFO has recently significantly increased the technological knowhow in the financial function. To conclude, it seems that for some, lack of skills continues to be a relevant challenge although on average proficiency has increased.

3.3.3 Organizational and cultural challenges

Corporate culture and organization are by far the most impactful factors in digital transformations (Kane, Palmer, Phillips, Kiron, et al., 2015; Lauslahti, 2018; Nadeem et al., 2018). Both cultural and organizational factors are major areas of research but due to the purposes of this thesis they are addressed together. A traditional system implementation issue and also one of the most typical obstacles CFOs face in digital transformations is backlash within the function over changes resulting from the initiative (Chandra et al., 2018). Change resistance, as an inherently cultural phenomenon is surely expected in almost any project, but especially in transformational projects within functions that rarely are confronted with such substantial changes. The CFO function's expertise in managing such organizational change runs out quite quickly and in wider scope the initial challenge is complicated by the lack of organizational change management capabilities within the financial function (Owens, 2016). Timely and effective change management with pre-defined processes is essential for the success of any transformational projects (Fonseca & Domingues, 2017) but especially in digital transformation which dramatically change the way of working. Change resistance is often fueled by both technological or management challenges, such as lack of clear and strong mandate to implement the change (Chandra et al., 2018), as mentioned earlier.

Chandra et al. (2018) also find that the lack of understanding between development teams and their financial function customers may introduce difficulties. In practice this

means that IT department's experts are not experts in managerial nor financial accounting and business controllers do not have IT project management skills. This may result in challenges in specifying requirements, development and further support of the system architecture. Ahlemann's (2016) and Owens' (2016) conclusion is that the lack of understanding is due to the quite siloed organizational structure. Often, this translates to an obsolete organizational structure and operational models but also roles and positions that need to be updated. In the future, it is expected that IT departments begin dissolving slowly and their resources are gradually incorporated into the business functions themselves. Close collaboration allows for development of IT experts with specialized knowledge on certain business functions. (Ahlemann, 2016) Simultaneously, this requires functions such as CFO to develop their technical knowledge significantly.

The skills gap in the financial function remains a widely recognized organizational challenge (Bhimani & Willcocks, 2014; Chandra et al., 2018; Haislip et al., 2017; Lauslahti, 2018). Skilled human resources are a key success factor for digital initiatives today. However, digital transformations require specific qualifications and skills that are currently fairly rare. Even with many universities with new programs such as data science the required know-how is expected to scarce for the foreseeable future. (Ahlemann, 2016) For the skills gap to be addresses, CFOs need to first successfully identify the issue and then develop an innovative human resource management plan to secure the required resources. Mäder & Akiki (2017) propose that some gaps may be possible to – at least temporarily – filled with the correct sourcing plan, however, this is quite case sensitive.

Another organizational issue seems to be the lack of clarity in digital transformation ownership. Some corporations have handed the responsibility to the CFO (Baril et al., 2018), in others it is with CIO or IT director and some have introduced a completely new executive position to manage digital transformations: the chief digital officer (Haffke et al., 2016; Horlacher & Hess, 2016; Singh & Hess, 2017). The demarcation between IT and business functions is growing more ambiguous with the expected future merge of IT-capabilities into business functions. At some point, this will challenge the paradigm of functional separation and while the possible integrated approach will certainly yield positive results, it will also introduce challenges – at least during the transitioning period.

3.4 Summary

On a high level, the CFO function's activities can be divided into two categories: core processes and value-added services. Core processes include all financial accounting activities such as reporting to external stakeholders like shareholders and government agencies. While a financial function's core processes require substantial resources to run, they rarely change or develop due to regulatory stability. Value-added services, on the other hand, include all other reporting activities like performance and profitability analysis; in other words, any financial reporting that is required to run a corporation. (Phillips et al., 2011) Traditionally, core processes are run by accounting operations and

value-added services by business controllers. From a digitalization point of view, value-added services are generally considered more probable to digitize first as they provide the most potential for development (Chandra et al., 2018). However, while digitalization can support value-added services to reach better and more accurate estimations, it can also substantially reduce the amount of resources spent on running core processes. Therefore, both are equally interesting candidates for digitalization from the corporation's point of view.

CFO as a function has been historically perceived as a traditionalist which rather than driving innovation and change has resisted it due to its uncertainty among other reasons. Whereas the CFO used to spend most of its time strictly on enterprise financial management, the role has begun to shift towards a financial strategist and business advisor (Howell, 2006). The paradigm shift is due to corporations' growing need to increase competitiveness, reduce costs and subsequently the financial functions' requirement to provide corporate leadership with more timely and accurate information (Fabich et al., 2011; Tucker et al., 2017). The CFO function is also increasingly taking part in corporate digitalization efforts. It is also more involved in IT management as IT is one of the greatest capital outlays (Denford & Schobel, 2012) and business enablers in corporations today. It is clear, that the CFO is required to take much more responsibility outside of its traditional core processes and value-added services, especially in finance digitization. Where CDOs fill the business role that addresses the outbound-facing employment of digital technologies that typically involves customers and partners, CFOs are increasingly responsible for internal digitalization development (Haffke et al., 2016), although primarily in the financial function. Digital transformation in the financial function has several unique characteristics to it. In this thesis, the challenges of digital transformation in the CFO function have been divided into three categories: management and leadership challenges, technology and process challenges and organizational and cultural challenges. The division is presented in figure 5.

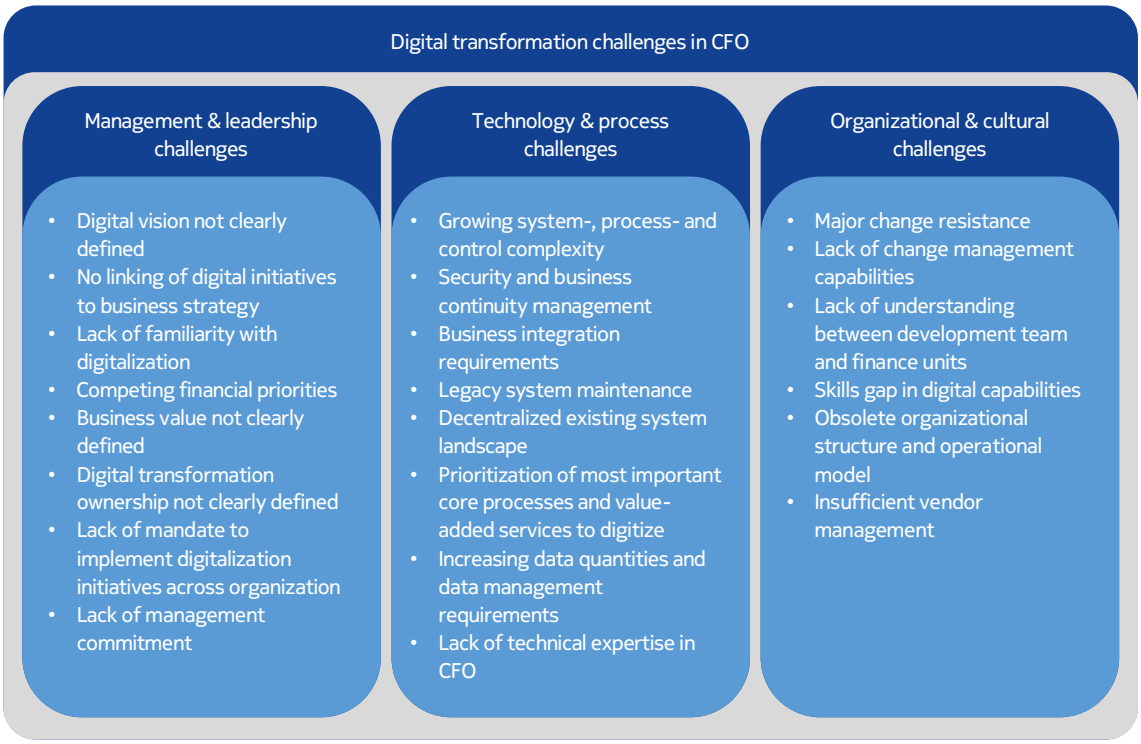

Figure 5. Most important digital transformation challenges in the financial function by category based on the literature review

Based on the literature review, we have identified several unique challenges to the CFO function in each of the categories. In management and leadership, we identify that the greatest challenges are in defining and linking the digital vision into the overarching business strategy, defining ownership of the digital initiatives and acquiring a mandate and commitment from corporate leadership to carry out the transformation. In technology and processes, we identify that growing system complexity, security and decentralization are the key barriers for sustainable digitization. From organizational and cultural point of view, we identify change resistance, a significant skills gap in both technology and change management and the complex and obsolete operational model as the most critical challenges.

4. TECHNOLOGY SUPPORTING THE CFO FUNCTION

In this chapter, we explore different technologies that can support the financial function in its digital transformation. In the previous chapter we identified a need for certain technologies and this chapter further elaborates on the future requirements for technologies supporting financial operations. We discuss the technologies' relationship with each other and with both core processes and value-added services of the financial function as well as some of the best practices for their implementation. Furthermore, we drill down to each technology and discuss their advantages and disadvantages as potential value creators for the CFO function.

4.1 Future requirements for technology and digital CFOs

In a Duke University quarterly survey conducted to American CFOs, 5 of the top 10 concerns were in some way related to technology or technology investments in March 2018 (Graham, 2018). It's clear that the financial function is under significant pressure to reduce costs while improving their services. However, much of this can be accomplished with the right recipe of technology. For example, many financial accounting tasks and processes are at least somewhat automatable, finds Chandra et al. (2018). In fact, nearly third of the potential in core processes and value-added services can be captured using basic task-automation such as RPA while the rest requires more advanced cognitive automation technologies (Plaschke, Seth, & Whiteman, 2018). As a rule of thumb, the more transactional the process is, the more easily automatable it is. On the other hand, the more strategic the activity, the more challenging its automation. However, we cannot directly deduce that more strategic activities could not be significantly aided or improved with digitalization. The financial function's value-added services tend to fall on the more strategic side of activities, but several technologies offer sophisticated capabilities to support managerial decision-making, even to the extent of offering prescriptive business advice.

The more pressing question, however, is how technologies could be employed to solve the high-level problematics that today's CFOs are facing. This requires an improved understanding of the challenges and future requirements for technology, specifically, for how the challenges are constructed. Firstly, CFOs need to be able to provide improved services to other corporate functions and themselves. This means enhanced information delivery: more information in quantity, more up-to-date information and more accurate information (Fabich et al., 2011; Tucker et al., 2017). CFOs need to be able to handle vast amount of data that their various systems produce and find finer grains of useful insight from the growing sea of noise. While for many corporations this is an expected consequence of the emergence of big data, it still has proven to be a huge barrier to overcome. As for the timely information, most corporations are still not able to provide

any real-time reporting. Corporations are fixed to periodic reporting requirements, be it monthly for internal reporting or quarterly for external reporting. CFOs, however, are under significant pressure to transition to a real-time, around-the-clock -type of approach. The growing data inflow and higher standards for success also introduce another challenge related to reporting accuracy. In many organizations, much of the reporting work is done manually but a strong trend indicates for the removal of human interference from the equation resulting in improved accuracy with less errors. Finally, regulatory requirements, which are also one of CFOs top concerns (Graham, 2018), require much more external reporting with an elevated level of accuracy from the financial function in both European and American corporations.

As for the decreasing costs, CFOs are inclined to reduce FTEs, especially in financial functions that could be automated (Plaschke et al., 2018). Often, these employees are blue collar financial function employees focused on less advanced, transactional tasks. There are multiple, valid reasons to the reduction of employees: firstly, the wages and salaries have been on the rise since the financial crisis in 2008 and secondly, employee productivity has been decreasing due to the increasing complexity in the working environment (Graham, 2018). In fact, according to a 2018 study, 17 percent of European CFOs have already reduced the financial function employment as a direct consequence of fintech and 18 percent expect to reduce within the next five years (Koedjik, Staupe, & Slikker, 2018). While employment accounts for much of the cost reductions, optimization and streamlining of, for example, business processes, organizational structures and roles are on the table as well. As part of a corporation's digitalization efforts, the aforementioned are critical to be reviewed. A brand-new skyscraper cannot be fit on the foundation of townhouse.

The challenges stem from business' requirements for the CFO to increase competitiveness by both lowering spent resources and improving the service level. In the past, offshoring, outsourcing and centralization have been the bread and butter of improving the financial function's productivity (Plaschke et al., 2018) but now CFOs are facing a novel and paradoxical issue of improving performance while reducing spending. Not surprisingly many CFOs are looking at technology as an option to respond to the pressure of streamlining the corporate cost structure. In fact, Koedjik et al. (2018) find 8 out of 10 European CFOs are prepared to increase technology spending during 2018. Other needs of the 21st century corporation include the high security level requirement that the technology will have to pass (Ahlemann, 2016). In the Duke University 2018 survey, data security was one of the top 10 concerns for CFOs (Graham, 2018). Also, the ease of use of the digital tools is key. After all, we have previously identified the trend of the gradual dissolving the IT function and the improving level of technical expertise in the financial function. Today, IT may still be configuring bots for the financial function's use, but in the future a finance specialist should be able to configure a robotics workflow without a need for an IT expert (Plaschke et al., 2018). While IT knowhow development looks promising, it still needs to develop significantly which is why the primary concern for US CFOs is the attraction and retainment of qualified employees (Graham,

2018). Without a doubt, technical skills play a major role in the definition for "qualified".

Finally, to unlock the full potential, CFOs understanding of technological opportunities must increase if they are to succeed in the digital paradigm. They must understand what can be automated and what cannot: for example, revenue management and general accounting operations are significantly more automatable than auditing and treasury tasks (Plaschke et al., 2018). The understanding must grow in digitalizing workflows, reducing manual reconciliations and automating matching and in introducing pattern recognition and prediction to substitute or support experience-based analysis (Tucker et al., 2017).

4.2 Disruptive technologies for the financial function

There are several technologies available which have received considerable attention from the CFOs across all industries in the past couple of years. Most of the research regarding the specific technologies from the financial function's point of view – and outside of financial services (i.e. banking industry) – is commercial or has a commercial component rather than being purely academic. This aspect of the research must be considered when reviewing the wide variety of sources. However, this is mostly due to the very fast development of the fintech industry and the technologies' application in the financial function in the past few years. Peer-reviewed academic research just hasn't had time to catch up with the business environment. Like ten years ago no one would have expected to see Teslas on the road, no CFO was expecting to reduce their workforce due to the introduction of robotics with this timeframe. Similarly, most of the technologies didn't match with the industry requirements ten years ago: for example, most platforms and providers were start-ups and struggled to survive the scrutiny of IT security reviews (Plaschke et al., 2018).

In the literature review, we find that multiple sources identify several technologies as relevant for the financial function's future. The listings are often different subsets of all the technologies, and depending on the source, they are defined differently. In the following subchapters, all relevant technologies are defined in a way we find relevant for this thesis. Additionally, the technologies may be grouped or binned with each other: some relate AI and RPA closely with each other, others relate AI with ML and some identify all technologies as individual entities. For the purposes of this thesis, we address the technologies as individual entities, although offering perspectives to their synergies. Finally, the sources use various orders of importance to prioritize the technologies, based on their complexity and topicality. In the following table 1, all relevant technologies discovered in the literature review are presented in alphabetical order with the respective supporting research.

Table 1. Disruptive technologies for the financial function in alphabetical order with supporting research

Technologies	Supporting research
advanced analytics (AA)	Baril et al. (2018), Bhimani & Willcocks (2014), Chandra et al. (2018), Koedjik et al. (2018), Mäder & Akiki (2018), Sher et al. (2018), Simon & Fabian (2017), Treadway (2017), Tucker et al. 2017
artificial intelligence (AI)	Baril et al. (2018), Beiranvand et al. (2012), Boots & Wilkins (2018), Dhar & Stein (2017), Fukuda (2016), Koedjik et al. (2018), Li & Wang (2017), Plaschke et al. (2018), Sher et al. (2018), Simon & Fabian (2017), Tucker et al. 2017, Ye (2017)
big data	Bhimani & Willcocks (2014), Koedjik et al. (2018), LaValle et al. (2011), Mäder & Akiki (2018), Sledgianowski et al. (2017), Treadway (2017), Tucker et al. 2017, Vasarhelyi et al. (2015), Zhang et al. (2015)
cloud computing	Jarvis (2015), Simon & Fabian (2017), Treadway (2017)
cryptocurrencies	Coyne & McMickle (2017), Koedjik et al. (2018)
distributed ledger technology (DLT)	Baril et al. (2018), Boots & Wilkins (2018), Gatteschi et al. (2018), Hossain (2018), Koedjik et al. (2018), Nicoletti et al. (2018), Richins et al. (2017), Simon & Fabian (2017), Valtanen et al. (2018)
machine learning (ML)	Baril et al. (2018), Koedjik et al. (2018), Kotsiantis et al. (2006), Krollner et al. (2010), Lin et al. (2012), Simon & Fabian (2017), Tucker et al. 2017
optical character recognition (OCR)	Arica & Yarman-Vural (2002), Baril et al. (2018), Koedjik et al. (2018)
robo-advisors	Jung et al. (2018), Koedjik et al. (2018)
robotic process automation (RPA)	Baril et al. (2018), Chandra et al. (2018), Jarvis (2015), Koedjik et al. (2018), Mäder & Akiki (2018), McCann (2018a), McCann (2018b), Plaschke et al. (2018), Sher et al. (2018), Simon & Fabian (2017), Tucker et al. 2017, Vanmali (2017)
smart contracts	Boots & Wilkins (2018), Coyne & McMickle (2017), Koedjik et al. (2018), Morrison (2016)
master data management (MDM)	Tucker et al. 2017

First, there are more than a dozen different technologies identified by different research and articles as relevant for the financial function. As said, there are also several prioritizations for technologies. For example, Baril et al. (2018) say that while the financial function sees optical character recognition (OCR) being developed right now, within two years they proceed to distributed ledger technology (DLT), or blockchain, and advanced analytics (AA). Within a five-year timeframe, they will proceed to AI, ML and RPA. Other are much more optimistic about the timeframe. For example, RPA is widely recognized as one of the trending technologies in 2018 with multiple corporate financial functions already employing the technology (Boots & Wilkins, 2018; Jarvis, 2015; Koedjik et al., 2018; McCann, 2018a, 2018b; Vanmali, 2017). Others prioritize AI (Dhar & Stein, 2017; Koedjik et al., 2018; Plaschke et al., 2018; Tucker et al., 2017; Ye, 2017) and some highlight advanced analytics and visualization engines (Chandra et al., 2018; Koedjik et al., 2018; Treadway, 2017; Tucker et al., 2017).

Due to the scope restrictions of this thesis, it is not possible to thoroughly review each of the technologies which is why some must be prioritized although all will be touched on some level. Based on the number of supporting research and the aforementioned prioritizations, we have selected to dive deeper into RPA, AI and AA. Each of these technologies will be reviewed in the following subchapters. The rest: big data, cryptocurrencies, distributed ledger technologies, machine learning, optical character recognition, robo-advisors and smart contracts will be reviewed in chapter 4.2.4. Cloud computing and master data management are covered within big data. Of the technologies, RPA is recognized by far as the most interesting new disruptor in the financial function. According to McCann (2018a), 40 percent of all process automation robots are currently equipped for the purposes of the financial function versus all other corporate functions. Therefore, RPA will be reviewed as the first technology.

4.2.1 Robotic process automation in the financial function

Robotic process automation, or RPA for short, is the technological imitation of a human worker, the goal of which is to tackle structured tasks in a fast and cost-efficient manner (Fersht & Slaby, 2012; Fung, 2014). RPA is implemented through a software robot, which mimics a human worker using software such as ERP systems or productivity tools (Asatiani & Penttinen, 2016). In the context of business process automation, robots are not referring to physical robots but software licenses that operate like human workers. The term RPA most commonly refers to configuring the software to do the previously done by people and is ideally suited to replace humans who perform “swivel chair” -processes. (Lacity & Willcocks, 2016) These are often rules-based and monotonous tasks that involve using multiple software and record types and processing them in multiple management information systems, similarly as a clerk would input information to an ERP system from spreadsheets and emails. In the context of business processes, RPA-tools can be divided into three generic categories depending on the tool’s complexity: desktop RPA, enterprise RPA and professional IT software development tools (Willcocks, Lacity, & Craig, 2017), the latest one of which most often is applicable for automatization of complex finance processes.

The benefits of RPA are clear: it is rather inexpensive, easy to experiment with which makes it optimal for corporate functions to build MVPs and prototypes before expanding to fully functional tools (McCann, 2018b). The primary reason for corporations’ interest in RPA are its cost-saving abilities but it can also help in scaling up functions strategically and offer previously untapped value to both corporations and their customers (Vanmali, 2017). The principal downsides of RPA are its limited ability to handle exceptions, lack of cognitive automation (for example NLP and reasoning) and limit autonomy (Fung, 2014; Vanmali, 2017). However, it can still offer dramatic improvements in productivity and performance in activities with lots of transactional tasks, such as those in the financial function.

According to McCann (2018b), more than 40 percent of American corporations have an enterprise-wide automation strategy in place, although in many corporations its implementation is still in its early stages (McCann, 2018a). The remark is supported by Koedjik et al. (2018) in a 2018 study, where more than 60 percent of European CFOs say they have a basic or professional understanding of RPA and its capabilities but only 18 percent are actively looking into its implementation. Rather counterintuitively, however, it seems that finance is leading the way in RPA, even though back office functions aren't generally the first beneficiaries of technology investments. Currently, the main focus with RPA are the low-hanging fruits and the improvements in the bottom line. (McCann, 2018b; Vanmali, 2017) Many are focusing on the basics: accounts payable, order-to-cash and record-to-report. These activities are the some of the more transactional tasks that are often still done completely manually (Chandra et al., 2018). There is still huge potential for further development in RPA and finance executives recognize effective robotic automation as an avenue to finish the transformation of the CFO function from scorekeeper to strategic business partner (McCann, 2018b).

Nonetheless, there are still major challenge in the financial function that RPA must overcome to reach its potential. Most importantly, the skills gap in robotics is still very wide with most financial function employees having no specialization in any technology. Additionally, the cost-benefit analysis is still on-going and it seems RPA value proposition may not be clear for all. (Jarvis, 2015) Maybe this is because CFOs don't see RPA as a priority for like other, more traditional IT system implementations or because they are focusing the efforts on core finance activities. Either way, RPA still has a lot to prove to reach acceptance across functions and industries.

If we know what kind of tasks RPA can solve in general, we should logically also be able to match those capabilities into the requirements of the financial function. Corporations often initially implement RPA for high-volume, low-value tasks to free up their employees (the expensive intellectual capital) to focus on more complex and challenging tasks. In addition to freeing up workforce, RPA can also process the tasks quicker and with less error which results in decreased risk level and more processed documents, which subsequently can enable a better detection of, say, illegal activity or sales opportunities (Jarvis, 2015; Vanmali, 2017). Many of the financial function's core processes can be automated. RPA can significantly speed up processing time for tasks such as payroll, travel and expense processing, vendor invoicing and payment generation, credit control, fixed assets and general ledger (Vanmali, 2017). Let's take payroll for example. In a large corporation, payroll operations are a substantial activity and while everything cannot be automated, many sub-processes can. Plaschke et al. (2018) gives flagging time-sheet errors and omissions, auditing reported hours against schedules, calculating deductions and harmonizing data across multiple timekeeping systems as examples. While these are individual processes, automating them can arguably reduce the need for FTEs which allow for cost reductions or repositionings to tasks with more complexity. Another example from Plascke et al. (2018) is accounts payable: RPA can automate entering of nonelectronic-data-interchange invoices (often couple with OCR), performing

2- or 3-way invoice matching or completing audits, for example screening for duplicate supplier payments. Automation of such transactional tasks can beef up internal audit capacity and allow for much quicker processing of the core deliverables like income statement and balance sheet. In a wider scope, RPA can actually accelerate the financial function's transition from automating the financial closing -practice to removal of the periodic closing -paradigm altogether. Vanmali (2017) argues that length of month-end transactions could be reduced from 4 days to substantially less, possibly even hours. Often the periodic closing process ties resources for multiple days on similar, monotonous tasks so releasing these resources to contribute on more critical tasks and provide value input on business decisions is key for CFOs.

Although RPA is often regarded as a tool to automate the core financial processes, it has also lots to offer for the financial function's value-added services. RPA's ability to complete highly data intensive tasks quicker and with reduced error rates – or nearly eliminate them – combined with robots ability to perform on that level 24/7 is crucial in value-added services (Jarvis, 2015; Vanmali, 2017). Although we have concluded that RPA does not include cognitive automation, it can in fact conduct also more sophisticated tasks such as classification for example. This, however, requires more high-end RPA software and cannot be completed with desktop RPA without the complementation of some AI (McCann, 2018a). Controllers can also benefit from robots when searching for data. Data can be located in only one of dozens of reporting systems, it can be available internally or in public databases or it can be located on a website somewhere. Data scraping is fairly simple from a technical point of view but can offer massive time-savings when implemented effectively. Similarly, reporting is a time-consuming activity that could be accelerated by employing RPA. Often management reporting requires business controllers to perform exactly the type of "swivel chair" -tasks that Lacity & Willcocks (2016) describe. The required data is located in multiple systems and just finding and gathering it may take hours or days. As a final example, robots can generate analyses, e.g. keep track of capital expenditure and new infrastructure investments and map this data from various sources on a graph. (Jarvis, 2015) Removing the lag from reporting can directly enable decision making as soon as opportunities or issues are found. However, although robots are increasingly able to provide analyses, RPAs lack of cognitive automation rarely provides any additional insight or business advice to the problematics. This still requires human involvement.

As rules-based routine roles get automated, shared services organization will be able to offer additional value-added services to business when employees can focus on more challenging and value-producing tasks. This also means that we can expect core processes to get automated first since they are – on average – significantly more transactional and rules-based as opposed to value-added services. (Jarvis, 2015; Plaschke et al., 2018) Even in value-added services automation can enable reduction of FTEs but it can also mean fewer customer penalties, better on-time delivery rate and therefore improved customer satisfaction (McCann, 2018a). Cost reduction for onshore operations can range from around 30 percent to nearly 65 percent according to Vanmali (2017). Jarvis

(2015) argues that robots can cost just 10 percent of onshore FTEs in the long run, which make automation an intriguing option for finance-oriented CFOs. In fact, robots are so cheap that many organizations have explored automating functions that have previously been outsourced, even as far as automating complete business processes (Plaschke et al., 2018). Even after implementation costs, robots can refund themselves rapidly.

4.2.2 Artificial intelligence in the financial function

In short, artificial intelligence (AI) is intelligence displayed by computers opposed to the natural intelligence of humans. A major part of AI's differentiation from other technologies is its cognitive functions that humans often associate with other human minds, such as learning and problem solving. (Russell & Norvig, 2009) Alternatively, Gartner's (2018) definition for AI incorporates the technology's ability to emulate human performance by coming to its own conclusions, appearing to understand complex content and engaging in dialogue even to the extent of replacing people on execution of nonroutine tasks (Gartner, 2018b). There are multiple competing definitions for artificial intelligence, but in the context of this thesis we have settled on the previous. AI can be both programmatic and cognitive: programmatic similarly to RPA where AI can help in delivering automatable tasks at a reduced cost and cognitive by introducing reasoning and judgement to the process (Boots & Wilkins, 2018).

The digitalization of financial transactions has led to the steady accumulation of massive amounts of both financial and personal data. Additionally, the growing size of enterprises, business and accounting operations are producing even more information. In many cases, the commercial value of this data has not been fully utilized. (Fukuda, 2016; Li & Wang, 2017; Ye, 2017). Like discussed before, the financial function has a need to reduce the workload in enterprise financial management, reduce costs and increase accuracy. As the data processing speed requirements continue growing, AI will become an indispensable asset to the CFO function (Li & Wang, 2017). Dhar & Stein (2017) say that the increasing volumes of unstructured data combined with AI's advancing functionalities for interpreting and acting on the data automatically will likely replace a growing number of human-intensive processes. Moreover, increasing complexity in the financial function and decreasing cost of computational power are making AI even more appealing to the CFOs.

In fact, we are already seeing dominant AI platforms beginning to emerge and becoming critical components of complete technology platforms in the future. Even though AI's percentage of production use is still very limited, many companies are investing on experimentation with the technology. In Duke University's 2018 study, a massive 90 percent of European CFOs say they have a basic or professional understanding of AI. Additionally, more than 21 percent are either actively adopting AI or have already adopted it in the financial function. (Koedjik et al., 2018) This is a significant as both are substantially higher than for example RPA (understanding 60 percent, adoption 18 percent), especially considering that RPA is a simpler technology and can deliver

quicker results in the short run for the financial function. In fact, the results are so high that their reliability is almost questionable as substantial amount of research from both academic and commercial sector completely oppose the findings and highlight the lack of understanding of AI technologies and the still ambiguous value proposition of the technology.

The future of AI in enterprise finance management is bright. As future investments in finance automation will focus on better strategy, analytics and prediction capabilities to enable growth, AI will likely see significantly more investments in the next five years (Baril et al., 2018). Its potential is outstanding and ranges from applications to operational efficiency to improving customer experience and even enabling completely new business models (Tucker et al., 2017). McCann (2018a) even suggests that AI might swamp RPA out of existence with products that incorporate both AI and RPA. Although this is not reality yet, the application of both technologies in practical tasks may make the demarcation between the individual technologies more ambiguous in which case it will be more about the evolving definition of the two.

For now, the most exciting development opportunities with artificial intelligence lie in the value-added services but there are a few significant application opportunities in core processes as well. The overwhelming majority of finance automation research suggests that the biggest trend in the future will be the partial or complete automation of the financial closing process. According to Sher et al. (2018), periodic reporting will no longer drive operations. When both actuals and forecasts can be produced on demand, traditional cycles become less relevant, for both internal and external stakeholders (Sher, Ehrenhalt, & Englert, 2018). Most of the financial close process activities are manual consolidation and reconciliations and although some of the tasks are highly complex, they remain rules-based. This is where RPA's capabilities end but where AI can excel. Other opportunities for AI's application are fraud detection and e.g. flagging and addressing potential high-risk accounts (Tucker et al., 2017). Plaschke et al. (2018) give AI's auditing capabilities as an example: an AI engine can go through millions of records quickly, recognizing patterns that humans could not otherwise discover while working around the clock, seven days a week.

In value-added services, AI's greatest capabilities are in financial forecasting and planning (Beiranvand, Bakar, & Othman, 2012; Plaschke et al., 2018; Sher et al., 2018; Ye, 2017). As with periodic reporting, in the future you're not only able to generate forecasts periodically (like many CFO functions still do) but in real-time. AI enables automatic gathering and cleaning of data for analyses and consolidation and validation for budgets and forecasting inputs without any need for manual work (Plaschke et al., 2018). Ye (2017) and Fukuda (2016) add a prescriptive element to forecasting. AI, together with RPA and AA, can identify and integrate relevant data in the market environment, for example websites, for decision making purposes and can offer recommendations or financial analysis based on the analysis. In a world where information is available for everyone at the same time, being the first one to act is critical. Other use cases

are portfolio management, where selection of assets or assessing risk position is increasingly more complex (Beiranvand et al., 2012), financial simulation (Ye, 2017), contract screening and text analysis for assessment of corporate financial risk (Fukuda, 2016). When tasks become more strategic than transactional (compare RPA), AI can produce more value. Many of the tasks where AI is currently employed fall to the more strategic side of tasks like auditing, risk management and treasury (Chandra et al., 2018). However, even with the current technology AI can go only so far. Activities, like business development, are still too complex with too little rules, for AI to succeed in.

4.2.3 Advanced analytics in the financial function

Analytics now influences almost every aspect of major corporations' decision making, strategic analysis and forecasting activities (Griffin & Wright, 2015). Whereas analytics used to be the tool of choice for few initial innovators and early adaptors, it is now in fact, a ubiquitous tool for any business that wants to remain competitive (Davenport & Harris, 2007). In many aspects, analytics is a well-adopted tool of all businesses of any sizes. There are multiple definitions for analytics and its sub-concepts. For example, Davenport & Harris (2007) define business analytics as the use of data, information technology, statistical analysis, quantitative methods, and mathematical or computer-based models to help managers gain improved insight about their operations, and make better, fact-based decisions. Then there is advanced analytics which is the autonomous or semi-autonomous examination of data or content using sophisticated techniques and tools, typically beyond those of traditional business intelligence to discover deeper insights, make predictions or generate recommendations (Gartner, 2018a). Compared to business analytics, advanced analytics includes a wider array of different tools and capabilities and introduces a more advanced aspect to business decision making.

Advanced analytics can be further divided into three dimensions of domain, orientation and techniques (Holsapple, Lee-Post, & Pakath, 2014). In the context of this thesis, the domain is business management and the techniques vary depending on the application. However, orientation's three dimensions are interesting for this discussion. Holsapple et al. (2014) classifies the three dimensions as descriptive, predictive and prescriptive analytics. Descriptive analytics answers to the question as to what happened. This is the most common type of analytics in business environment. (Appelbaum, Kogan, Vasarhelyi, & Yan, 2017) It is the simplest version of analytics and is based on historical data and most often appears in business analytics as well. Descriptive analytics, according to its naming, is typically characterized by descriptive statistics, KPIs, dashboards and other types of visualizations (Dilla, Janvrin, & Raschke, 2010). Gartner (2014) also recognizes a fourth dimension between descriptive and predictive analytics: diagnostic analytics. However, Holsapple et al. (2014) include diagnostic analytics in the first dimension. Predictive analytics, on the other hand, is the next step taken from knowledge acquisition from descriptive analytics (Bertsimas & Kallus, 2014) and answers the question of what could happen or what is expected to happen. Predictive analytics is characterized by predictive and probability-based models, forecasts, statistical analysis and

scoring models and is often seen applied in managerial accounting, i.e. value-added services of the financial function. (Appelbaum et al., 2017) While this form of analytics also uses historical data to make its calculations, it uses that data to calculate probabilities for future events. Finally, prescriptive analytics, the most advanced of all Holsapple et al. dimensions. Prescriptive analytics answers the question of what should be done given the descriptive and predictive analytics results. It offers the optimization approach that goes beyond descriptive and predictive analytics and recommends one or more solutions with probable outcomes (Appelbaum et al., 2017; Bertsimas & Kallus, 2014; Holsapple et al., 2014) Prescriptive analytics can further be divided into two branches: 1) decision support where decision making is not automated and human influence is require and 2) decision automation, where decisions are automated and data directly leads to actions without human input (Gartner, 2014).

Due to the varying definitions, advanced analytics is widely understood as umbrella terminology for multiple other tools and techniques, some of which have been identified as individual technologies in this thesis as well. For example, Gartner (2018a) classifies data and text mining, machine learning, pattern matching, forecasting, visualization, semantic analysis, network and cluster analysis, simulation and neural networks under advanced analytics. Depending on the source and context, some may also categorize OCR (a form of analyzing images and determining patterns), master data management, big data and even AI as subcategories of advanced analytics.

Cloud, big data and the competitive business environment continue to drive business to realize new, actionable insights and better outcomes (Appelbaum et al., 2017) which is why advanced analytics has received much attention during the last couple of years. And not for nothing: top performers in the business world apply much more analytics to guide their business decision making process than low performers, which is telling of the success that advanced analytics can provide (Davenport & Harris, 2007; LaValle, Lesser, Shockley, Hopkins, & Kruschwitz, 2011). Moreover, the overwhelming majority of the success is accounted by analytics' applications in financial management, budgeting and planning. The top performers that have understood the true potential of advanced analytics are benefiting from it much more than their competitors. Analytics based on quantitative financial data alone are utilizing only a fraction of all available data, since most data is qualitative (Basu, 2013). And qualitative data is where advanced analytics differentiates from other technologies.

As opposed to other disruptive technologies, advanced analytics (especially descriptive analytics) is adopted quite widely. For example, in Duke University's 2018 study, 67 percent of European CFOs say they have a basic or professional understanding of advanced analytics, although only 19 percent say explicitly that they have or are adopting the technology (Koedjik et al., 2018). Additionally, LaValle et al. (2011) say that top performers apply analytics to financial management and budgeting, operations and strategy and business development above all else. Baril et al. (2018) also say that advanced analytics is a top priority investment item for CFOs, especially with analytics with a

predictive or prescriptive focus. However, there are still several challenges that advanced analytics keeps facing when introduced to new businesses: complex data extracts, data fluctuations and duplications, data security weaknesses and multiple tools and languages (Appelbaum et al., 2017). This is supported by the findings in chapter 3 on poor master data quality, which is often the case in the financial function. According to Appelbaum et al. (2017), poor data quality can negatively impact the management accountant's work, by e.g. rendering forecasts in error and subsequently leading in misled business decisions.

Most commercial and academic literature recognize more opportunity in value-added services for advanced analytics, but there are obviously several use cases for advanced analytics application in the core processes. For example, the preparation of financial statements, a core task for financial accountants, can be simplified by applying AA, often complemented with other technologies. Accountants work is dramatically simplified when year-end sales figures can be aggregated into useful numbers from the underlying data. Instead of relying on traditional sampling techniques to perform tests on details, automated processes, powered by AA, can examine entire populations for unusual patterns and anomalies. As users require more advanced real-time reporting, they also what audited financial statements on demand, necessitating a shift from traditional sample-based auditing to continuous auditing by exception, where data analytic techniques direct auditor attention to instances where data does not match the auditor's expectations. (Richins, Stapleton, Stratopoulos, & Wong, 2017) Advanced analytics can also be used in process mining, a practice of analyzing business process related data to identify bottlenecks and inefficiencies. Addressing such issues can, in some cases, dramatically increase efficiency and productivity, also in financial accounting.

In value-added services, the primary objective of advanced analytics is in performance analysis and forecasting and all dimensions of advanced analytics can be employed. Descriptive analytics can be employed in business performance analyses, specifically salesman analysis, sectoral and periodic performance analysis (Ye, 2017). These are still rather basic use cases. Appelbaum et al. (2017) suggest ratio analysis that compares return on equity (ROE) and return on investment (ROI) with historical data, which gives managerial accountants insight on the corporations growth. Additionally, similar numbers can be benchmarked against competitions and visualized in interactive tools. Predictive analytics, on the other hand, accumulate on historical data and estimate possible future events. In most cases, it is applied to predict future financial performance by employing e.g. support vector machines (SVMs) and artificial neural networks (ANN) to mention a few. Predictive analytics can also be used in clustering data into different classes which can reveal relationships between objects or parameters that would otherwise go unnoticed (Appelbaum et al., 2017). This can be used to identify segments, competitor strategy or possibly market trends which can be used by management in steering the company to a profitable direction. Prescriptive analytics can be used to recommend solutions and evaluate their likely outcomes. For example, to reduce costs

while maintaining product quality in a reasonable area, it's possible to select raw material vendors with reasonable price and appropriate quality, use qualitative sources like articles or social media in vendor selection or even explore new markets, products and customers (Appelbaum et al., 2017).

The potential benefits of advanced analytics are plentiful. Firstly, operational efficiencies can be improved by increasing transparency, identifying relationships and causations and addressing them. Customer experience can also be improved from four aspects: delivery time, delivery quality, performance and service and end-customer incurred costs (Appelbaum et al., 2017). CFOs can also use advanced analytics in tapping into new business models. For example, a mobile networks company can identify slots where they have overcapacity and rent it to the highest bidder or a financial services business expand their services after identifying new opportunities in their client-base.

4.2.4 Other technologies supporting corporate CFO

In this chapter, the other technologies identified in the literature review are introduced. Many of the technologies are related to each other or are derivatives of the previously presented technologies. This chapter also presents some use cases for the technologies in the CFO function and what kind of benefits and challenges their adoption entails.

Big data

While the hype of big data has already somewhat faded away, it is still one of the prominent disruptive technologies for the financial function. Big data generally describes datasets that contain volumes of differently structured data that traditional technology and information systems are inadequate to process and analyze (Sledgianowski, Gomaa, & Tan, 2017; Vasarhelyi, Kogan, & Tuttle, 2015). Big data is often described with the four Vs: volume (large volume of data), veracity (data from different sources increasing the likelihood of uncertainty in the data), velocity (analysis of streaming data) and variety (analysis of different types of data structures, such as structured, semi-structured, and unstructured data) (Zhang, Yang, & Appelbaum, 2015). The volumes of data keep growing as corporations implement new information systems which during the last few years have skyrocketed the need for processing power and storage. Bhimani & Willcocks (2014) say that the amount of data doubles every 18 months whereas it takes approximately 23 months for the processing capabilities to double. Such dramatic growth of data has also introduced new challenges to master data management, which was recognized as an individual focus area for CFOs by Tucker et al. (2017).

Big data's is closely relation to other disruptive technologies makes the definition of its specific, individual use cases more complicated. Producing value with big data often requires advanced cloud computing environments to support value-creation with analytics. If there are predictive or prescriptive elements in the value-chain, different machine learning algorithms are also employed, sometimes already with some elements of AI. In literature, the reference to big data often includes the presumption of application of the

supporting technologies and their disruptive effect as a whole (Bhimani & Willcocks, 2014; LaValle et al., 2011; Richins et al., 2017; Vasarhelyi et al., 2015). For example, one specific use case introduced by Richins et al. (2017) in core processes context is using structured and unstructured data in measuring the quality of customer service: not only the response time (structured data) but also how customers perceive the quality (unstructured data). This not only requires the collection of the data (big data -perspective) but also analyzing the data (advanced analytics -perspective). Most of the challenges related to big data seem to stem from corporations' inability to produce value with data in the big picture, lack of sufficient data strategy and lack of supporting IT architecture (Bhimani & Willcocks, 2014; LaValle et al., 2011).

Machine learning

Machine learning is an integral part of advanced analytics, especially in predictive and prescriptive analytics (Baril et al., 2018; Simon & Fabian, 2017; Tucker et al., 2017). Machine learning is an umbrella term for a variety of different algorithms that can be further categorized into a number of categories like supervised learning, unsupervised learning, statistics-based learning and other techniques. Supervised learning contains a few of the most commonly known algorithms like decision trees, support vector machines and neural networks. Unsupervised learning, on the other hand, contains self-organizing maps and expectation maximization algorithms. Statistics-based learning includes discriminant analysis and logistic regression and other techniques genetic algorithms to name a few. (Lin, Hu, & Tsai, 2012)

In the context of the financial function, forecasting and prediction are the main use cases for machine learning, as discussed earlier in chapter 4.2.3. For example of use cases, financial time series forecasting for stock indices or currency exchange rates (Krollner, Vanstone, & Finnie, 2010), bankruptcy prediction and credit scoring (Lin et al., 2012), identification and prevention of fraudulent financial statements (Kotsiantis, Koumanakos, Tzelepis, & Tampakas, 2006). However, implementing such sophisticated algorithms for the business' purposes require advanced technical skills and statistical understanding which is a capability many financial functions still lack.

Optical character recognition

Optical character recognition (OCR) is derivative of advanced analytics and machine learning, which allows the recognition of characters with machines (Arica & Yarman-Vural, 2002). Sometimes OCR requires reading printed or handwritten text off of paper, in which case the text must be digitized first (via a scan or a photo), or from a digital image (e.g. register plate or protected PDF-files). OCR's best use cases in the financial function are its superb speed of automating rather mundane and rule-based tasks. OCR enables fast and extensive absorption of data, automation of otherwise slow processes and subsequently better coverage and accuracy. From a technical point of view, OCR is a direct derivative of machine learning: the processing engine receives training material of data and characters recognized in the data, and the algorithm applies the training material into practice.

According to Baril et al. (2018), two of the most widely adapted technologies are advanced analytics and OCR due to their relatively painless implementation and quick payout. For example, from an auditing point of view, OCR can screen all corporate expense reports to prevent fraud instead of just a few due to the significant workload. OCR can digitize paper invoices or documents quickly, so they can be transferred into an electronic, and most importantly searchable, database. OCR also enables digitization of applications and forms of all kind for storing purposes, like contracts or agreements. OCR is often times used as an element of an RPA-function to automatically sort and analyze documents and store them.

Robo-advisors

Robo-advisors are digital platforms comprising of interactive and intelligent user assistance components (Jung, Dorner, Glaser, & Morana, 2018). In the finance industry's context, robo-advisory is an automated investment solution which engages individuals with digital tools to guide them through a self-assessment process and shape their investment behavior toward rudimentary goal-based decision making (Jung, Dorner, Weinhardt, & Pusmaz, 2017). In other words, robo-advisors are like virtual assistants that guide end users through a process and support in decision-making process. While robo-advisors imply that they offer advanced guidance or advisory, they only offer service which still requires input from the end users. Like many others, robo-advisors also are derivatives of other technologies, such as RPA and use NLP-algorithms in communicating with the user (Jung et al., 2018).

While many CFOs say that robo-advisory will not affect their business and don't see much value in adopting the technology (Koedjik et al., 2018), robo-advisors' future in the financial services sector is bright (Jung et al., 2018; Levine & Mackey, 2017). They are especially useful in helping clients make clever investment decisions from a statistical point of view and perform financial planning and portfolio management tasks. However, although rarely implemented, they could be used outside of the financial industry in explicating decision-making processes. Robo-advisors can be made useful in performing internal auditing tasks as all conversations leave an audit trail and therefore, like RPA, reduce the accountants and controllers' workload.

Distributed ledger technology

Distributed ledger is consensually shared database containing secured data verified by a large network of participants, nodes. A commonly used derivative of DLT is blockchain, which is a distributed ledger maintained by network nodes, recording transactions between nodes. Information that is inserted in the blockchain is public and cannot be modified, erased or tampered with. (Gatteschi, Lamberti, Demartini, Pranteda, & Santamaría, 2018) This is why blockchain is widely considered one of the most trustworthy and secure technologies that can securely store data due to its distributed nature (Boots & Wilkins, 2018; Hossain, 2018; Weber et al., 2016). A block of a blockchain can carry whatever data, for example small programs like smart contracts, identification data or it can be harnessed for cryptocurrencies.

While most associate blockchain with Bitcoin or other cryptocurrencies, DLT has also many other use cases in the business environment. For example, DLT can be applied in fraud-prevention in accounting and we may see regulation requirements regarding DLT's use in the future in many industries. In place of auditors sending out manual confirmations, a blockchain type of technology could enable automatic confirmations (Richins et al., 2017) which could in itself revolutionize both internal and external auditing. For example, Jun & Vasarhelyi (2017) argue that blockchain is one of the only technologies that can compete against the prospect of advanced, modern cyber-attacks in the audit industry. Corporations can also use DLT for a creating completely new business models or adding a layer of security to their existing services. DLT can be used in record and identity management to verify customer identity or e.g. validating product licenses. If a network provider has extra capacity in their network, they can broker their 5G network with blockchain rent capacity to customers forming a completely new business model (Valtanen, Backman, & Yrjölä, 2018). In the insurance business, DLT can improve the security of claim handling (Weber et al., 2016) but also support new ventures like micro-insurance, pay-per-use insurance or peer-to-peer insurance (Gatteschi et al., 2018). In payroll, DLT can be used in payslip calculation and ensuring correctness of tax calculations and payroll accountability (Nicoletti, Margheri, Lombardi, Sassone, & Schiavo, 2018). While DLT and its derivative, blockchain, are valid prospects, the true benefits in many industries are still quite ambiguous.

Cryptocurrencies

As discussed earlier, cryptocurrencies are a derivative of the digital ledger technology. The intent of cryptocurrency is to replace centralized, cash-based currency with fully decentralized, digital currency. While cryptocurrencies are not only a digital currency they also provide a more secure method to make transactions. The blockchain solves the issue of unauthorized spending by requiring cryptographic identity verification for each transaction. (Coyne & McMickle, 2017) The most commonly known cryptocurrencies are Bitcoin and Ethereum (Koedjik et al., 2018), but there are thousands of other cryptocurrencies run in public and private blockchain networks. Some may also consider airline mileage points cryptocurrencies as well, although they are often not based on blockchain technology but a centralized airline-maintained database.

In business perspective, cryptocurrencies increase the security and speed of transactions made with the corporation's stakeholders. For example, international payments could become much quicker and corporations can reach new customer segments in previously unreachable regions. By using secure cryptocurrencies, corporations can also remove the third party (financial institution, often bank) from the equation which can lead to more profitable business. However, there are currently multiple challenges in the cryptocurrency markets: the exchange rates fluctuate dramatically, there are many competing currencies and lots of other risk factors, which are currently decreasing corporations' interest in this application of DLT.

Smart contracts

Smart contracts extend the blockchain functionality to provide an additional layer of protection for both parties in a transaction. Smart contracts are contracts, whose terms are programmed into a blockchain. They are smart because the contract terms tend to be deterministic and execute automatically when certain conditions are met. (Coyne & McMickle, 2017) Smart contract are tools to enable the exchange of money, property and shares, or any asset of value in a transparent, conflict-free way while avoiding the services of a middleman (Boots & Wilkins, 2018). As a perfect example, a smart contract can withhold currency, like a Kickstarter program, and it will only release the money to the developers if the program meets its conditions, otherwise the money will be released back to the investors. Smart contract, however, removes the third-party (Kickstarter) from the value-chain as people only have to trust the secure, distributed network of nodes that maintain the smart contract.

The use cases for smart contracts can dramatically change the way the financial function operates, especially under the hood. Using the customer-vendor example, a smart contract could hold the customer payment until the customer has received and verified the goods. Following this event, the smart contract releases the payment to the vendor. (Coyne & McMickle, 2017) This adds a security layer that protects the customer, but it also protects the vendor as it discharges the vendor from liability. Recent investments in this technology have sought to apply the concepts of smart contracts to the financial, legal and even music industries in which conditional digital payments often occur, like derivatives, escrow and royalties to mention a few (Morrison, 2016). Smart contracts can replace nearly any type of agreement or contract and while they are secure and untamperable, they can also be linked to existing business processes and automatically execute when the conditions are filled.

4.3 Summary

The environment where CFOs operate has changed dramatically over the last two decades. The financial function is exceedingly pressured to improve their operational efficiencies which in practice means reducing costs (cutting FTEs and reducing spending) while expanding and improving their services (for example information accuracy, delivery speed, delivery quality). The overall business objective is to increase competitiveness in the market through these improvements in the first wave of digitalization. The subsequent waves of digitalization, namely development of CFO's service quality and reinvented value chains, are still in the horizon, although not completely out of sight either. Many corporations are looking at technological solutions as the way to accomplish cost reductions as well as service level improvements. For example, just process automation alone has proven to bring dramatic improvements in both areas.

The business environment's changes also affect the modern, digital CFO's requirements. The vast amount of data they are working with is growing exponentially and

finding the fine grains of insightful information is even harder than before. CFO's understanding of technological opportunities must also increase to respond to all above business needs. The megatrends in the financial function over the past few years have revolved around the removal of human limitations from auditing, regulatory reporting and other core processes in general with a long-term goal to automate the entire financial closing process.

From a technology point of view, the CFO function domain is quite competitive. Due to many competing solutions without any clear market leaders, CFOs seem to be anxious about getting locked down with any specific solution. This extends the adoption time but also requires technology vendors to crystallize their value proposition. Recent development in the field has been significant: while just a few years ago many vendors were still in their infancy, they have quickly developed into serious contenders for technology giants like Microsoft and IBM. In the literature review, we identified a number of different disruptive technologies in the financial function. They are presented in figure 6 in Euler's diagram which represents their relationship with each other. The diagram is based on the analysis in the previous chapters.

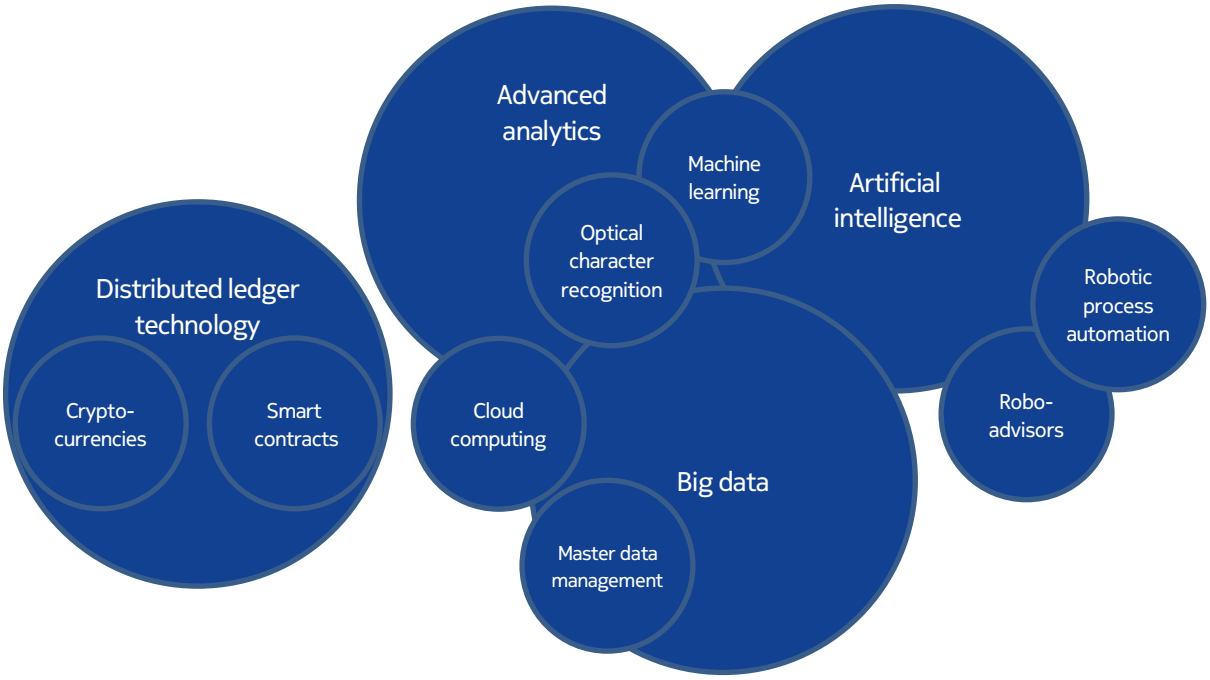

Figure 6. Euler's diagram of disruptive technologies in the financial function based on literature review

The three most dominant and topical technologies were robotic process automation, artificial intelligence and advanced analytics, respectively. Other notable technologies were big data, machine learning, optical character recognition, robo-advisors, distributed ledger technologies, cryptocurrencies and smart contracts. Some of them are related to each other quite integrally while others can be recognized as independent entities. The use cases for these technologies are extensive and only the most prominent

ones have been touched upon in the previous analysis. However, there were some characteristic use cases for each technology that were identified in the literature review. The most significant cases are represented in table 2.

Table 2. Use cases for technologies in the financial function based on the literature review

Technology	Financial function use cases
advanced analytics (AA)	- preparing financial statements - on-demand auditing - financial process mining - predictive financial estimations - prescriptive action recommendations
artificial intelligence (AI)	- transaction auditing - data cleaning and harmonization - on-going due diligence of fraud detection - financial forecasting - portfolio recommendations - contract screening
big data	- development of insightful information via analytics - increased prediction accuracy - ability to study all data instead of limited samples
cryptocurrencies	- instant international payments - secure and more profitable peer-to-peer transactions
distributed ledger technology (DLT)	- autonomous auditing - identification and authorization services - claim handling - micro-insurance - audited payslip calculations
machine learning (ML)	- financial time series forecasting - bankruptcy prediction and credit scoring - financial statement fraud prevention - any advanced forecasting or prediction analyses
optical character recognition (OCR)	- document (contract, agreement, receipt) digitization and storage - document screening and validation
robo-advisors	- decision-making process explication (portfolio management tasks, financial planning) - internal auditing (on-demand decision making assistance)
robotic process automation (RPA)	- automation of transactional GUI-tasks (accounts payable, payment generation) - increase internal audit capacity - automation of month-end transactions - reporting consolidation
smart contracts	- secure vendor contracts (with automated execution) - secure customer contracts (with automated execution)

Many technologies offer use cases that could be implemented in a number of corporations very quickly (especially RPA, AI, AA). There are also technologies that offer prospective, substantial improvements but still require wider adoption before their implementation could display increased performance (namely DLT and its derivatives, robo-advisors, some ML-algorithms). In the literature review, many offered quite direct implementation examples and even case studies for nearly all use cases. However, the statistical evidence of their current adoption status was still left unresolved.

5. ORGANIZATIONAL AND CULTURAL FACTORS IN DIGITAL TRANSFORMATION

In this chapter, we explore the organizational and cultural factors that influence the success of a digital transformation. In addition to the special characteristics of the financial functions and its potential technologies, there are still a number of other factors that play a key part in adopting the renewed ways of working and enable reaching the potential of the new solutions. While we identify challenges that the factors pose to a successful transformation, we also identify best practices and key success factors that organizations must address.

5.1 Role of organizations in digital transformations

Digital transformation may have many definitions, but in this thesis, we have defined it as the overarching effect of digitalization. In other words, digital transformation is the combined effect of digitalization of all things (Kwon & Park, 2017): strategy, organization, processes, business models and culture. Digital transformation not only considers the adoption of the disruptive technologies, but also the updated processes, new ways of working and other organizational factors that enable the full exploitation of the potential.

Much of the success of digital transformations depends on the organization adopting the technology. As discussed earlier, the success of digital transformations is a sum of many elements. Firstly, digital transformations reform the organization horizontally; in other words, they touch nearly every stakeholder in the organization such as marketing, IT, product development, or HR (Kwon & Park, 2017). Secondly, digital transformations change organizations vertically as well. A complete transformation doesn't just update the technologies and processes on the operational level but extends all the way to the top transforming everything starting from strategy and management (Kane, Palmer, Phillips, Kiron, et al., 2015). In fact, Kane et al. (2015) argue that the greatest differences between high- and low (digital) maturity companies are particularly in strategy, culture and talent development. They also say that effective digital strategies are less about acquiring and implementing the right technology than about reconfiguring the business to take advantage of the information these technologies enable. Deductively, effective strategy is instrumentally associated with digital maturity. Kane et al. (2015) findings are supported by Kwon & Park's 2017 study. Kwon & Park's (2017) study suggests that the four most important key success factors for digital transformations are human factors, technology factors, strategic linkage of IT and business as well as digital leadership in the corporation. Three of their four influential factors in their findings are directly from the organizational dimension.

When it comes to challenges, organizational factors are, expectedly, similarly influential. Barriers of success are often not related to technology but rather to organizational and cultural factors. For example, in LaValle et al. find in their study (2011) that adoption barriers organizations most often face are managerial and cultural rather than related to data and technology. Kane et al. (2015) agree in their article, arguing that it is strategy, not technology, that drives digital transformations. They identify six key success factors for digital transformations:

1. Digital strategy drives digital maturity
2. The power of a digital transformation strategy lies in its scope and objectives
3. Digitalizing organizations must build skills to realize the strategy
4. To retain a skilled workforce, leaders must also digitalize to support a fully vertical transformation
5. The digital agenda is led from the top
6. Taking risks must become a cultural norm

All factors in the list have a leadership or managerial component whereas none consider technology. Kane et al. see technology as merely the tool and the organization as the user of the tool. Even a top-of-the-line power tool doesn't guarantee success if the construction worker doesn't have the required skillset to deliver. Kane et al. also studied the top barriers based on digital maturity level (Kane, Palmer, Phillips, & Kiron, 2015). They noticed that corporations in their early digital maturity lacked the skills in management to support successful digital transformations, namely strategy and management understanding. On the other hand, while maturing organizations were also combatting capability challenges, they were more operational like security concerns and hard technology skills. Again, none of the greatest challenges are from the technology layer. Their study suggests that maturing organizations should first get their management and leadership oriented before the technology-stack. While all of that may be true, Kane et al. (2015) also say that technology can launch digital transformation and it certainly can be used in building adoption.

Even though the financial function has a powerful link to all other functions in the organization it still operates as a sub-organization of its own, with its sub-culture, proprietary tools, and ways of working. Digital transformations in the financial function must consider the same factors as any other organization, and the role of management is equally important, even when implementing robotics or an analytics tool. Disruptive technologies fundamentally change the modus operandi and thus the management must change fundamentally as well. Owens' concluded in a 2016 study, that the CFOs' expectations for technology implementations in the financial functions are high: even if the targeted future state was mediocre, the expectations were dramatically higher than if the targeted state was advanced (Owens, 2016). What this means is that organizations in their early digital maturity are placing over-expectations on technology often with insufficient focus from leadership and management.

It is arguable that true success stems from organization wide digital transformation and the key factors that define its success are not technological but organizational and cultural. Therefore, digital transformations must fundamentally change how the organization is run from processes, governance, business models and ways of working. A successful digital transformation harnesses the people of the organization to execute the strategy and realize the potential.

5.2 Key success factors of digital transformation

To ensure successful digital transformations, we need to drill down to the organizational and cultural factors and determine which root causes are in the core of success. Nadeem et al. propose a digital transformation framework and argue that digital business strategy is the product of a causal interrelationship between organizational capabilities and digital strategy (Nadeem et al., 2018). Optimizing both components improves performance and competitive advantage. Nadeem et al. dimensions of digital business strategy are supported by Kwon & Park's (2017) and Bhimani & Willcocks (2014). In Nadeem et al. (2018) framework, business strategy is further divided into IT infrastructure, cross-functional integration, structural changes, adoption of technology and dynamic capabilities. Organizational capabilities on the other hand consider digital leadership, agile and scalable operations, digitally enabled customer experience, digital artefacts (such as processes, infrastructure, services and products), flexible and scalable digital platforms, internal and managerial capabilities, collaboration with partners, modularization of business processes and operational capabilities (Nadeem et al., 2018).

Kwon & Park's 2017 study identifies human resources, strategy linkage and digital leadership as the high priority constructs of digital transformation. Bhimani & Willcocks' 2014 study supports the conclusion identifying management, culture, governance and people as the most crucial organizational factors for transformation effectiveness. Similar findings are supported by Kane et al. (2015), Plaschke et al. (2018), Baril et al. (2018) research. Based on this, the key success factors for digital transformation are divided under four topics: 1) governance, management and leadership, 2) people and capabilities, 3) culture and change management and 4) business process management. Although the dimensions of Nadeem et al., Kwon & Park and Bhimani & Willcocks may not be completely MECE when combined, they collectively identify all relevant topics for the purposes of this thesis.

5.2.1 Governance, management and leadership

Governance is a collective term for a system that establishes authority and responsibility on internal entities in decision making and management, be it the IT department or a business line (Kwon & Park, 2017). In practice, governance means the establishment and monitoring of the practices and policies that steer the company and keep its components in equilibrium. With corporations' digital transformation efforts, IT governance

plays an important role. Not only has IT become increasingly important to business during the past decade (and therefore is now recognized as essential infrastructure for corporate management), but the importance of IT decision-making has grown dramatically as it sets direction, principles and standards for the future of the organization and prioritizes investments critical to digital transformations (Kwon & Park, 2017).

Therefore, IT governance is a crucial part of any corporation's toolkit as they begin implementing the digital transformation roadmap. Weill & Ross (2004) break down IT governance into five key decisions: principles, architecture, infrastructure, business applications requirements, and investment and priorities. These are the tools that IT uses in directing large scale transformations but should be considered even when transforming single functions within a larger organization. There is discussion in both academic and commercial world about which areas IT governance governs, but the discussions generally refer to similar activities as mentioned before (Kwon & Park, 2017). In addition to being an essential tool in managing change, firms with effective IT governance can generate more than 20 percent better profits when compared to firms with inadequate governance. This is quite a dramatic difference that can be achieved by implementing governance models that allow organization-wide optimization and alignment of resources

Another key success factor is the strategic alignment of business with IT. This means that the business strategy with its goals and requirements needs to be harmonized to apply information technology in an efficient and effective manner which is also why it should be of fundamental concern to management (Kwon & Park, 2017). Without the strategic linkage between IT and business, the potential cannot be reached: the technology does not comfort the businesses requirements, the adoption is very low, and the corporation spends resources on two opposing forces. Strategic linkages have a proven and measurable positive impact on organizational performance. The success of digital transformations are ultimately represented by organizational performance. (Kwon & Park, 2017) Strategic alignment optimizes the use of resources and efforts of the organization so that the value for end users of the technology is maximized. This means that the higher the level of strategic linkage between IT and business, the greater the impact of IT governance on product innovation and process innovation (Willcocks et al., 2017). In fact, Willcocks et al. (2017) findings show that even if executives' IT competencies were poor, they did not influence the quality of the end result if the strategic linkage was high.

An effective way to drive digital transformation is the management-led, top-down approach (Kwon & Park, 2017). Only with the top-down approach can management push digital initiatives beyond certain boundaries; within a unit or across units (Westerman, Bonnet, & McAfee, 2014). This approach is equally translatable for CFOs and the financial functions. Advocating and pushing the change from the top is the only effective way to realize strategy and drive the transformation. Westerman et al. recognize four areas that leadership should especially focus on.

Craft a digital vision

We've already recognized in chapter 3 that lack of vision is one of the key problems in the financial function when it comes to digital transformation. Defeating the challenge require familiarizing leadership with the opportunities and threats in the industry, identifying the most important bottlenecks and headaches in your business environment and considering which strategic assets will retain their value in the future. Once management has its bearings of the playing field, they need to develop a digital vision that states the intent and the outcome and to communicate that vision to the company. (Westerman et al., 2014)

Engage the organization

With the vision, management must lead the organization engagement effort and energize employees. Westerman et al. (2014) propose using digital technology to engage at scale, advocate transparency to reduce change resistance and to make sure everyone has a role in the organization. Activated employees are also productive: just the right fit for co-creation and crowdsourcing.

Govern the transformation

Having identified the importance of governance, management should look internally for effective practices to drive the change in the organization. Some decisions should be governed at higher levels, but organizations must learn which decisions to delegate to the operational layer to increase agility and reduce bottlenecks. Westerman et al. (2014) recommend putting someone in charge of the transformation and supporting them with governance mechanisms like committees or liaisons if needed.

Develop technology leadership capabilities

If the strategic linkage of business and IT is so critical, wouldn't it make sense to nurture the relationship to optimize the output? Westerman et al. (2014) propose assessment of the state of the business-IT relationship to make sure the trust, shared understanding and seamless partnership are in place. Management must also assess IT's capability to deliver in terms of skills and speed. They also suggest considering dual-speed IT approaches (e.g. IT unit within the financial function or a digital financial function that combines IT and CFO capabilities). But most importantly, Westerman et al. (2014) focusing the initial investments in getting a clean, well-structured digital platform that will function as the foundation for the scaled-up transformation.

Although much of this chapter considers governance, management and leadership capabilities on a general level, all of them can also be applied specifically to the CFO function's context. As discussed in chapter 3, CFOs and the financial function management are responsible for driving digital transformations within the functions and establishing a well-governed approach that is led with a clear vision. Governance, management and leadership are essentials for a successful transformation.

5.2.2 People and capabilities

People are often the most important resource for the organization – and the most valuable as well – all other functions are built to guide them to be productive. Even the greatest AI only goes so far without people monitoring and guiding it. After all, technology is used to help and enable better performance for the employees. Earlier, we identified that people and their skills are one of the success factors for digital transformations, but they can similarly also be the downfall as well.

When it comes to human resources, a key concern is the workforce's skills. Employees perform their daily tasks based on their skillset which is why it doesn't come as a surprise that maturing digital organizations do not tolerate any skill gaps (Kane, Palmer, Phillips, Kiron, et al., 2015). In Kane et al. (2015) study, more than 75 percent of respondents agreed or strongly agreed that their organizations are able to build the necessary skills to capitalize on digital trends where for early maturity entities the number plummets to 19 percent. When the environment, technologies and external requirements update at an ever-increasing clock speed, digitally maturing organizations need to make sure their workforce has the chance to get up-to-speed accordingly. While lack of skills may be a problem even for the digitally mature organizations, Kane et al. (2015) say that the major difference maker is what companies are doing about it. The top-performers provide their employees with the resources and opportunities to obtain the skills – and not just technical skills but also the business understanding and ability to conceptualize how digitalization can impact the organization and their mode of operation. It is better to be agile than to possess specific skills, they will eventually get outdated at some point. The threat of skills gap is not only an ineffective workforce but also employee dissatisfaction, which further emphasizes its topicality to management (Kane, Palmer, Phillips, Kiron, et al., 2015).

Fortunately, there are different ways to approach the issue at hand. While Baril et al. (2018) think that the skills gap will remain a conundrum with only temporary solutions, their study suggests most financial functions approach the issue by retraining staff (52 percent), rather than recruiting new staff (20 percent), or outsourcing to a third party (17 percent). They conclude that the biggest need for skillset growth is in the data analytics -sector, followed by digital leadership skills. Bhimani & Willcocks (2014) on the other hand advocate for outsourcing, and rank analytics, global business services support and cloud integration as top new service offerings for external service providers. Plaschke et al. (2018) also note that unlike many other functions, finance has many opportunities to redeploy its people to e.g. business support tasks, which enables recruiting new staff to fill more challenging positions. The reality is that not only do the tasks grow increasingly complex, but automation among other makes some positions needless which at some point inevitably leads to layoffs and changes in organizational structures and roles (Plaschke et al., 2018).

The human factor and capabilities play a significant role in the success of digital transformations. The key success factors are not only to avoid skill gaps but also to build the

right skills for the organization's needs (Westerman et al., 2014). People are the components that build an organization, hence they are the root cause for many stumbling blocks (like culture in the next chapter). The widely recognized best practices are to know when to train staff, when to recruit from outside and to provide the employees with the environment and resources that enable learning and direct them to develop the right type of intellectual capital.

5.2.3 Culture and change management

In the 1990s, organizational culture was perceived by many as perhaps the single most important element in organizational success. Although the exaggerated view has changed quite substantially, the agreement still is that culture remains central behind a range of topics that contribute to the success of digital transformations. (Alvesson & Sveningsson, 2008). Culture stems from the employees, and even with its quite abstract construction, it can and should be managed. While culture can work for the company and facilitate operations in change, it can also obstruct and hinder development.

There are many definitions for organizational culture in the academic world, but the common adaption is that organizational culture most commonly refers to ways of thinking, values and ideas of things rather than the concrete, objective and more visible part of an organization (Hofstede, Bram, Daval, & Geert, 1990). Fonseca & Domingues (2017) on the other hand define it as a pattern of shared values and assumptions within an organization which enables it to operate. Corporate culture on the other hand is a corporation's organizational culture, although many tend to summarize all kinds of other organizational 'soft' issues under the label (Alvesson & Sveningsson, 2008).

A strong culture starts from trust among employees and their commitment to business cooperation (Kwon & Park, 2017), both of which should be high in the triage for leaders. A strong culture can also lead the adoption of technology (Kane, Palmer, Phillips, & Kiron, 2015). The leaders' task is to not only to "broadcast" the culture (getting employee buy-in, involvement and adoption via engagement and empowerment) but also to facilitate cultivation of the culture so that its beneficial for the company because strong cultures have their pros and cons. The most common argument is that strong organizational culture contributes to shared goals and increases the commitment to the organization and aligns individual and organizational goals increasing productivity and organizational performance. But in highly dynamic environments, a strong organizational culture can also prevent organizations from changing as quickly as it would be required and desirable, thus losing competitive edge to more agile and innovative competitors. (Kwon & Park, 2017)

Shortcomings in culture management are one of the key barriers for transformational success and digital effectiveness (Goran, LaBerge, & Srinivasan, 2017; Kwon & Park, 2017). Goran et al. 2016 study reveals that the three key cultural obstacles clearly correlate with negative economic performance: existence of functional and departmental silos, fear of taking risks and a non-digital overall culture. Siloing results in ineffective

communication and missed opportunities and slow response time to act comprehensively. Risk aversion similarly produces missed opportunities but also hindered development as pushing oneself to the limit is not as common. Other factors that Kwon & Park (2017) recognize are poor customer focus, lack of risk management which generates fear to invest in new opportunities and timely reaction to changing customer or market demands. These are consequences of Goran et al. survey findings.

To mitigate the risk of failure, Fonseca & Domingues (2017) propose that organizational culture change should be managed both at the strategic and the operational level across the organization to effectively drive the transformation. In addition, change management should be structurally sound and systematic, from defining objective to measuring impact. A systematic approach should also be supported by leadership and the governance model. However, applying systematic and structural approach to culture (which should be as dynamic and renewable as possible to comfort the constantly changing environment) can be challenging and conflicting – especially when it is so heavily dependable in the external environment and the internal dynamics of the organization (Jacobs, van Witteloostuijn, & Christe-Zeyse, 2013). As for the barriers, Kane et al. (2015) propose promoting willingness to experiment and establishing a safe environment for failure to increase calculated risk taking. As for the silos, employees' willingness to share and collaborate should increase, but the issue should also be addressed on the organizational structure, too. As an example, corporations can pivot their organizational structure to prioritize digital programs and break silo barriers down, or set-up completely separate spinoffs outside of the legacy business and its restrictions (Edelman, Marston, & Willmott, 2015). Nonetheless, driving and developing the culture to support digital transformations is certainly not trivial and a crucial component in their success.

Especially Goran et al. findings can be reflected on the financial function. As discussed in chapter 3, culture in the financial functions is often very non-digital and due to finance's critical mission as the "head of resource management", the tolerance for risk has been mitigated as well as possible. Stereotyping, this means that the financial function is not the most transformable function, and transformations will likely face substantial change resistance. On the other hand, there is a tremendous amount of potential that can be achieved by changing the organizational culture and their approach to digital tools and ways of working.

5.2.4 Business process management

Companies, especially larger ones, are built on business processes and compliance of the processes. Consider organizations from 100 people to 300 000 people: there are processes and workflows for managing opportunities, requests and approvals and everything in between. The processes are built on the ways of working and mode of operation in the organization. In the traditional view on business process management (BPM), it is accepted that the most important task of business processes is the operationalization of corporate objectives. However, all this change when a digital transformation begins,

from ways of working, mode of operation to corporate objectives. Digital transformation can be described as a contraption that is placed on top of the organization and if the foundation (processes) don't support it, both the foundation and the contraption (digital transformation) collapse. In traditional BPM, there are certain limitations that must be solved during a transformation project, for example how BPM changes when it's in the cloud, how can we collect data to make data-driven decisions on processes and so forth.

Currently, some trends regarding digital transformation and processes can be identified in the field. From a technical point of view, the system landscape in corporations is growing more complex: the business processes and controls to support the operations are increasingly difficult to manage (Baril et al., 2018). This requires complete re-engineering of the processes to which we'll return later. From a more organizational perspective, there are some other trends that can be recognized. Due to the growing need for agility, some corporations have started development of so-called plug & play -capabilities (Nadeem et al., 2018). In practice, they refer to the modularization of business processes that enable organizations to apply them quickly and effectively when needed. Nadeem et al. (2018) also discuss operational capabilities which refer to processes and capabilities needed in sudden changes in market demand. Having these operational capabilities ready to deploy when needed increases the organization's agility to react to changes in the market. Lederer, Knapp & Schott discuss (2017) how the need for BPM in the systematic optimization of processes. For example, as opposed to the classical BPM methodology where processes are optimized based on leadership decisions, systematic optimization approaches force data to be used as the basis of optimization.

Lederer et al. (2017) analyzed the current BPM trends in their study and classified them into three functional directions or categories. Data- and social-driven BPM refer to the enrichment of the traditional BPM phases with more information and initiatives for innovation whereas case-driven BPM propose a combination of the two but alternatively an instance-by-instance approach instead of the phase-by-phase approach.

Data-driven BPM

Firstly, the data driven approach pursues to use data instead of "gut-feeling" in validating process efficiency. The origin of innovation here is technology, more specifically the information systems that control the processes (and provide data) as well as the growing level of automation (Lederer et al., 2017). Data-driven BPM enables a more systematic way to analyze system events, transactions, functions, resources and time. Lederer et al. (2017) refer to process mining as the tool that is used to evaluate the data in a meaningful manner to identify e.g. bottlenecks and violations of directives. Data-driven BPM is especially useful for the financial function do it's the transactional nature of its mission. There is lots of data to be used, often it is just not used or analyzed sufficiently to realize the benefits of process mining. With a strategic approach to data-driven BPM, CFOs can relatively easily build-in process improvements into their process portfolio during digital transformations.

Social-driven BPM

Secondly, social-driven BPM is a methodology that brings more – and different – voices from employees and other people into the process improvement activities (Lederer et al., 2017). This can be done by using social technology (like intranets or surveys) but also by face-to-face meetings. The goal is to translate front-line workers' ideas systematically into process optimization because the customer-facing teams know best about customer needs and expectations (Lederer et al., 2017). In the financial function, social-driven BPM can similarly be used in crowdsourcing the workforce's ideas in process optimization while simultaneously including them in digital transformation process and supporting commitment to change.

Case-driven BPM

Business processes in this functional direction consider inputs from both humans as well as available data, but instead of driving process instances according to the process guidelines, they use a case approach instead to increase process flexibility from what traditional BPM can provide (Lederer et al., 2017). This allows functions to spend more time and effort on certain phases if the process instance so requires and skip some parts to optimize turnaround time. For example, if process teams face an unpredictable event, they can adapt the process models on the spot by still maintaining process compliance (Lederer et al., 2017). This mode of BPM is also suggested as an implementation option during digital transformations. Much of the financial function's work is based on cases (e.g. error monitoring, expense reimbursements or financial forecast). While implementing a case-driven approach to BPM may optimize processes and lower operating costs, it also requires specialized IT-tools that support their flexibility which needs to be taken into account during the transformation.

In a modern financial function, the processes are purposefully designed to harness the collective brain power and knowledge of people (Plaschke et al., 2018). They are not, per se, optimized or designed to support machines or automation. It would be tempting to use the same process pattern for programs, like retrofitting a new technology in an existing process, Plaschke et al. say. However, BPM re-engineering should be approached from the business' point of view: led by both business and IT with an objective to optimize the process for the new tool. According to Plaschke et al. (2018), the traditional approach can capture 5 percent of the potential, but unlocking all of it requires a fundamental change in thinking.

The key success factors for is to successfully identify which processes need to be redesigned to best support the transformation, and then redesign them with a systematic approach (Lederer et al. proposals as an example). Due to the more dynamic business environment than before, agility of the processes should also be maximized to allow flexibility when needed and the ability to adapt to change. Processes can also be used in increasing staff's commitment, by design and by involvement. Finally, processes should not be based on a gut-feeling but either highly qualitative but preferably quantitative data to support the findings and optimization decisions. To yield overall improvement in

business performance, it is also argued that larger corporations would benefit from reduction of process complexity (Owens, 2016) which should be taken into account when re-engineering the processes.

5.3 Summary

The role of organizational and cultural factors in digital transformations is significant. Digital transformations often introduce new, disruptive technology to the organization which has to adopt it to realize its potential. Digital transformations change the organization horizontally (all functions and their relationships) and vertically, from the top management team to the employees deployed in the field. We also conclude that organizational factors are, in general, the greatest barriers to success of digital transformations. Therefore, even the financial function has to consider the same factors as any other organization. Digital transformations must harness the employees to execute the new strategy, which requires a fundamental change in the modus operandi.

We identified four areas for key success factors in digital transformations. According to the literature review, they were 1) governance, management & leadership, 2) people & capabilities, 3) culture & change management and 4) business process management. The first area highlights the need to lead the change and provide continuing support and governance. People and capabilities focus on supporting the organization and its employees to be ready to execute their tasks. Culture and change management discuss the inner workings of the organization and how they affect the implementation of the transformation. Finally, business process management discusses the technical setup of the organization and the digital transformation's effects on it.

The key takeaway from governance, management and leadership are about their growing importance. For example, the growth of IT's criticality to business is now unquestionable. In practice, IT governance sets the direction for the development of the organization technical capabilities as it establishes authority and responsibility over the IT-related decision-making in the organization. We also discuss the how the linking between IT- and business strategy enable true collaboration. Finally, we recognize the leadership's crucial role as digital leaders: they need to craft the vision, engage the organization, govern the transformation and develop technology leadership skills within the organization. In the financial function, digital leadership falls on the CFO and other key change agents in the financial function.

For people and capabilities, the focus is certainly on the lack of skills that organizations most often face during digital transformations. This is a challenge for both digitally mature and developing organizations. We also find that it is equally crucial to acquire the right skills: many suggest focusing on agility to acquire skills and learn instead of acquiring specific technology expertise. There are many best practices for acquiring the skills: training employees, recruiting new ones, outsourcing to third parties and even redeploying employees to other tasks. All of them have their pros and cons and are worth considering for the financial function.

Organizational culture was earlier considered the single most important element for organizational success, and it's still a significant component of success. Culture should not be considered self-optimizing, it should be managed since while a strong culture can lead adoption, it can also hinder or thwart it completely. A systematic approach for managing the change is suggested: one that flows throughout the organization from the strategic to operational level. We also discuss different methods for deploying digital transformations like spinoff companies or organizational pivoting, all of which have their specific applications.

Large organizations are built of processes and the implementation of disruptive technologies expectedly requires updating both the business and the technical process portfolio. The trends in the field are clear: increasing process complexity and more challenging business requirements require more agility: modularization of processes and building operational capabilities. Pressure for management also pushes functions toward a more systematic optimization of processes. In the literature, we identify that there are three different development directions in systematic optimization: data-driven BPM, social-driven BPM and case-driven BPM. BPM is especially important to consider during digital transformations in the financial function, because it is one of the most process-oriented functions and hence may require significant effort in reconfiguring its operations.

In table 3, we have identified the most important barriers to success regarding each area of key success factors.

Table 3. Barriers to success for organizational and cultural key success factors

Areas of key success factors	Barriers to success
Governance, management & leadership	- lack of link between IT strategy and business strategy - lack of digital leadership - lack of management-led, top-down approach to driving the digital agenda - lack of technology leadership capabilities - lack of systematic IT governance - lack of vision
People & capabilities	- lack of skills - building irrelevant skills - poor agility to learning new skills - management does not provide resources or opportunities to get training - fear of replacement by automation
Culture & change management	- existence of functional or departmental silos - risk aversion - non-digital culture - lack of risk management - culture not recognized, acknowledged or nurtured - insufficient change management before, during or after transformation
Business process management	- retrofitting disruptive technologies into old processes - lack of agility in BPM (no modularization or flexibility) - lack of operational capabilities to accommodate for unexpected situations - purely IT-led process re-engineering (lack of business' input) - lack of systematic approach to process optimization - increasing process complexity

In chapter 3, we analyzed the financial function in detail and while we recognize the recent development in the function in general, we also note that the function still has quite traditional values and ways of working. Therefore, considering the above factors, barriers and best practices are especially should be considered in conjunction with the challenges specific for the CFO function in figure 4.

6. EMPIRICAL STUDY

In this chapter, the implementation of the empirical study is elaborated on; specifically, how the survey and the analysis of its results were conducted in practice. The objective of the chapter is to describe how the theoretical framework covered in methodology is implemented. As both the survey is quite complex in terms of workflow, the chapter is divided into multiple sub-chapters that cover the implementation process in chronological order. Similarly, the data-analysis is covered chronologically, although not as abstrusely.

6.1 Survey

As previously discussed in chapter 2, the survey was implemented as a questionnaire. This allows to extend the reach of the survey beyond the limits of other survey methods, as the survey is easily distributable and demands a minimal effort from the respondent to answer to. After the initial analysis of survey methods, a questionnaire proved to be the most suitable option. Also, considering the population (CXOs and high-level corporate executives) and their poor reachability supported selecting a questionnaire. In the questionnaire, one of the objectives was to collect mainly quantitative data to remove speculation around the subject, since similar academic research have not been previously conducted in the Finnish nor Nordic markets in this extent. Quantitative data allows for maximum reproducibility of the research and therefore produces novelty value to the research community.

6.1.1 Sample design and evaluation

According to Saunders et al. (2009) designing the sample to be as representative of the population as possible is integral in ensuring the validity of the survey. Therefore, extra attention was given to this phase. Profiles that were included in the scope of the survey were CFOs and other CXOs and higher management with high linkage to digitalization or the financial function. The scope also profiles that are directly linked to the financial function from business controllers and accountants to vice presidents. The vertical extension of the scope within the financial function was done to discover information about the questions that might not be accessible to CXOs (for example, for which applications are certain technologies used). A key consideration in the sample design was that the eventual survey was only to include questions that could be answered by all members of the sample in a scientifically reliable and valid way.

The long-list of survey recipients was consolidated from multiple sources. Most of the list consisted of existing contacts of Firm X, but potential respondents were also found in a LinkedIn-analysis, from other databases but also from Talouselämä 500 -listing (referred to later as TE500) of the largest companies registered in Finland. To maximize

the response rate, the size of the recipient list was maximized as well within the limits of the responder scope. Companies that were included were large Finnish private-sector companies that could be privately or publicly owned. For the definition of large, this research referred to Tilastokeskus (2018): large companies are defined as producing annual revenue of more than 50 MEUR or employing more than 250 people. Organizations that were scoped out from this thesis were public institutions, non-profits and companies that do not conform the aforementioned criteria.

In chapter two, a good sample size for this type of research was defined as 30. This is in line with the relatively small population in the scope of the survey but simultaneously minimizes saturation in the survey results. According to Firm X's experiences with similar survey, the conversion ratio from recipients to respondents is roughly 1:15, meaning every 15th recipient actually responds to the survey. Therefore, to achieve the minimum number of respondents, the recipient list needed to contain at least 450 valid respondents. The recipient list used in this thesis included 626 relevant contacts, so as to balance out all respondents with obsolete contact information, out-of-offices and other errors that may occur. Of the 626 recipients, 520 were employed by a TE500-company, 367 by a TE100-company and 103 by a TE10-company. In addition to the recipients who receive the survey by Firm X's distribution, some respondents may have received the survey from other channels as recipients were encouraged to distribute the survey to relevant respondents within their companies.

The eventual number of respondents was 45, translating to a 1:14 conversion ratio. However, not all respondents conformed the scope criteria, and three responses were therefore left outside of the scope of this thesis. The preferred sample size of 30 was surpassed 50 percent and therefore the representability of the sample is arguably very good. The list of respondents used in this thesis is presented in appendix D. In the appendix, the criteria for firm size is the following: medium is used for companies with revenue between 50–100 MEUR, large with revenue between 100–1 000 MEUR and very large for companies with revenue more than 1 000 MEUR. Respondents without metadata chose not to provide any contact details.

6.1.2 Survey questions and survey design

The primary objective of the survey, from a research point of view, is to answer to the research questions by employing the theoretical framework as a baseline. Therefore, the structure of the survey (appendix B) is set to include sections for all research questions, namely the characteristics of the CFO function, disruptive technologies in the CFO function as well as digital transformation in the CFO function. In addition, all questions used in the survey are designed to be arguable via the theoretical framework – in other words, there are no questions included that are from outside of the theoretical framework.

The questions are further constructed under a set of categories. Section 2 of appendix B is divided to sub-categories on 1) the digital maturity of CFO, 2) digitalization triage

(the speed and prioritization of digitalization within CFO), and 3) the transformation of the CFO's role. Section 3 is sub-divided into 4) the benefits of disruptive technologies within CFO as well as 5) the technological maturity and level of technology adoption. Section 4 is sub-divided into 6) digital leadership and transformation management as well as 7) digital transformation threats and KSFs. The questions are based on these categories. On a more granular level, the questions originate from three sources: 1) deductively after the synthesis and analysis of the theoretical framework, 2) as an obscurity or topic directly identified in the theoretical framework or 3) as a question already used in the theoretical framework with a different scope and population. In the last case, the question is identical to the question used in theory to allow benchmarking across different research.

Below is a list of questions that have been used directly or partially adapted from existing research:

- Question 2: Kane et al. (2015), adapted question and answer options
- Question 11: Kane et al. (2015), adapted question
- Question 14: Koedjik et al. (2018), consolidated from multiple questions
- Question 16: Kane et al. (2015), adapted question
- Question 18: Kane et al. (2015), answer options
- Question 19: Sher et al. (2018), answer options
- Question 22: Kane et al. (2015), adapted question and answer options
- Question 23: Kane et al. (2015), adapted question and answer options
- Question 24: Kane et al. (2015), adapted question and answer options
- Question 25: Kane et al. (2015), answer options
- Question 26: Kane et al. (2015), adapted question
- Question 27: Kane et al. (2015), adapted question and answer options

As one of the objectives of the research is reduce speculation from the research area, it is essential that the answers can be treated as commensurated values (so that all values are comparable within the sample), even if they are quantitative. In practice, this means that all respondents must understand the questions in the same way and assess their company's performance as truthfully as possible. As there are questions with high complexity, some additional instructions or explanations are sometimes added (for example, see Q3 of appendix B). However, it is essential to avoid directing the respondent to answer in a specific way, which has been taken into account as well in question framing.

Due to the requirements for the survey, the survey was designed to employ specific questions types to ensure high data quality, and therefore high validity and reliability. Question types used are mainly multiple-choice questions, multiple-choice matrices and checklists. These allow setting multiple type of criteria for the questions to ensure that data is in the correct form during analysis and doesn't require too much cleaning. All content questions from Q2-Q27 were also required. To maximize the response rate, the number of content questions was kept under 30. Finally, to motivate respondents to answer the survey in its entirety, some extra steps were taken. For example, Q1 directs the

respondent to answer whether they want to receive the incentives which require providing contact details in questions Q28-Q33.

6.1.3 Survey pilot

The survey was implemented using SurveyMonkey as the administration tool. SurveyMonkey was chosen because of its set of features: question types, support for images in questions etc. Additionally, the tool also featured effective ad hoc -visualizations of the ongoing survey, which allowed to ensure that the data quality is good and if additional criteria or question parameters were required to ensure high quality data.

The objective of the piloting is to test the survey with members of the potential sample. Their role is also to validate the questions, their framing and understandability as well as clarity to ensure commensuration. Additionally, they were used to identify clear factual errors and use of terminology so that the survey is as easily approachable for the sample as possible. These also support ensuring the scientific validity and reliability of the research. The pilots also provided more information about the population and the information was used when administrating and distributing the survey to the recipients.

The pilots were implemented as semi-structured interviews. There were two interviews in total. Both interviewees were working in the CFO function of a TE100-company, one of which on the operative level and the other one on a more strategic level. These selections were made to ensure the coverage of as many potential respondent profiles as possible. The interviews themselves are based on the interview structure represented in appendix A, although semi-structured interviews allow branching. First, the interviewee was given the pilot version of the survey to answer which they completed. The duration was measured, and this was used in assessing the average time it would take the respondents to complete the survey. The survey was given at the beginning of the interview in order to simulate a realistic response scenario. After the survey was completed, the interviewer proceeded to the interview questions which covered different topics from the survey questions to the topicality of the themes and the technical implementation of the survey.

After the pilots, some fixes were done to the structure of the questionnaire. Primarily, the fixes were related to use of terminology, need for additional instructions and question answering criteria to ensure data quality. The topics, framing of questions as well as the general implementation of the survey were validated which allowed to procced to survey administration quite quickly.

6.1.4 Survey administration and distribution

After the structure of the questionnaire was finalized, its distribution was started. As Saunders et al. (2009) suggests, the survey was accompanied by a cover letter from the leadership of Firm X which, among others, included a description of the research in

question, its relevancy to the recipients as well as further presentations of the incentives available upon responding.

As described in chapter 2, the incentives were a personalized report based on the findings, pre-launch copy of the white paper by Firm X as well as access to this thesis. Additionally, the cover letter included information about the study, namely about its length and respondent requirements. In retrospect, this was done well as the response rate surpassed expectations. The survey could be answered anonymously, in which case you didn't have to provide contact information which also meant that anonymous respondents opted out of the incentives. The cover letter is included in this thesis as appendix E.

The cover letter was branded as a survey by Firm X, sent with Firm X's name in order to maximize response rate with Firm X's brand recognition. However, this thesis was also mentioned in the cover letter. The deadline for responses was set at two weeks, which in retrospect was sufficient for all recipient with interest to find time to answer the thesis. Based on the pilot interviews, a need for email reminders was identified. There were three rounds of initial introductory emails of the survey and three rounds of reminders. Each reminder generated approximately 10 new respondents. Additionally, the recipients were encouraged to share the survey within their company, which means that the eventual list of respondents may include respondents from outside the recipient list defined in chapter 6.1.1.

6.2 Data analysis

As the next phase is in the empirical study, the data analysis forms an understanding of the survey results. This is an integral part of the study and is not trivial from a time or complexity point of view. The implementation of the analysis was divided into four stages like described in chapter 2: 1) preparing and processing the data, 2) initial round of analysis, 3) visualizing and presenting the data and 4) quantitative and qualitative analysis. This analysis was done with Excel, as it was the most flexible option in terms of data preparation, processing and visualization.

The process was begun by exporting the data in CSV-format from SurveyMonkey. The data was then imported to Excel, where it received a number of procedures to prepare it. For example, the initial data set included respondents that didn't match the requirements of the thesis and they needed to be removed from the data. The data was also scanned for inconsistencies or gaps that could be cleansed. If there were inconsistencies that couldn't be cleaned, the response was left out of that specific questions which results in slight variation of n in the questions in appendix C. Data preparation also included enriching the data set with other details like company revenue and industry, if that was possible. Processing the results required modifying the data into an analyzable format so that the initial round of analysis could be done. Because of the data needed to be visualized anonymously, the data needed to be processed into summarized format.

In the initial round of analysis, the general construction of the data sets was explored analyzed to get a better understanding of the type of conclusions that may need to be made. The analysis was mostly done on Excel, but some analysis was already done with SurveyMonkey's native visualization tools during data collection. This stage also generated some visualization requirements for the next phase. The basic format for the results was formed based on the initial round of analysis. The next stage, data visualization, was also performed with Excel. The data was mostly presented with bar charts or histograms as the data was mostly in summarized, quantitative format. Finally, the data was formatted into readable tables, as seen in appendix C.

In the final stage of quantitative and qualitative analyses, the results received a deeper round of analysis. Although the data is quantitative to a large extent, it cannot be analyzed statistically while retaining the analysis' reliability and validity. This is due to the sample size. While the sample size is representative of the population in terms of content and size, it is still too small for heavy statistics analysis. Therefore, the statistical analysis was left of metadata level, namely averages, modes and medians. The data set also contained some qualitative data from the open text fields. This data needed to be anonymized for presentation in this thesis as some of it revealed individual companies. In this analysis, a structured analysis on the influence of the size of the company or industry wasn't done as the sample was quite small.

In the initial round of analysis, it was also noticed that while there were multiple respondents from single company, the responses were quite saturated which means that there may not be a unified understanding of the current or target state, even within a single company. This doesn't support a heavy statistical analysis either. Although high saturation might be true for individual companies in the sample when n is very low (for example 3), saturation is low enough at $n = 42$ to make observations of trends. Therefore, it is still possible to do reliable analysis on summary level, even if n is relatively low. Further analysis of the data is done in chapter 7.

7. ANALYSIS

The empirical results of the survey are presented and further analyzed in this chapter. The chapter consists of three parts, each of which is a section of the survey focusing on a specific part of the theoretical framework. In addition to analyzing the data question by question, the results are also reflected against the theoretical framework. Further implications and underlying root-causes and meanings of the results are analyzed in chapter 8.

7.1 Characteristics of the CFO function

The first chapter presents findings related to the characteristics of the CFO function. Specifically, chapter 7.1. analyzes the current status of digitalization in the CFO function, how the CFO function perceives their state as opposed to the actual state, what the main focus and aspirations are and how the role of the chief financial officer is changing as a leader and member of the TMT. Most theoretical framework reflects to chapter 3 "Digital transformation in the CFO function", especially on how the paradigm shift -phenomenon described in the theory applies in practice.

7.1.1 Digital maturity of CFO

Kane et al. (2015) argues that digital maturity of a corporation influences how well a corporation performs and manages transformations. Therefore, it is interesting to see what the digital maturity of corporations in Finland are. In addition to surveying the digital maturity, the study also explores the waves of digitalization and where the respondents place their organizations.

Question 2: CFO function's digital maturity level

In Q2 (presented in figure 7), the data clearly indicates that the maturity status is saturated. There are some, albeit few, that perceive their organizations as very close to the ideal organization, but the mass is clearly in the lower two-thirds. The most common levels of maturity in the data set are 6 with 24 percent, 5 with 21 percent and 3 with 21 percent making up 66 percent of the total. The average is 5,19 indicating that the maturity is still developing. Analyzing the results, looks like the challenges regarding digitalization have generally been acknowledged and are currently being fixed or on the backlog. Comparing to the research by Kane et al. (2015) of MIT Management Review, with 4 800 respondents globally including respondents outside the CFO function, the results are nearly identical, although slightly less polarized due to larger sample size. The mode was similarly 6 with the second most frequent maturity level 3. The average was 5,16 – just 0,03 below the average of this survey. Not only does this validate Kane et al.

research but also explains the status of CFO function digital maturity in Finland. Interpreting the results, the digital maturity has passed its infancy although some corporations are just starting their journey.

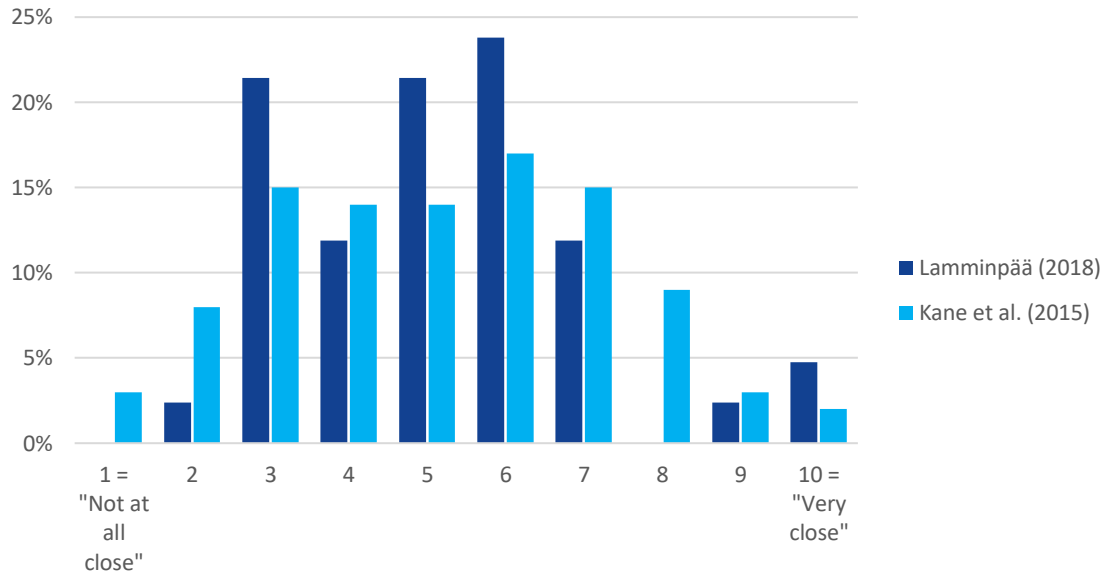

Figure 7. Digital maturity of Finnish CFO functions against a global digital maturity research by Kane et al. (2015)

Question 3: Position on the waves of digitalization

Waves of digitalization is a concept often used in B2C-world describing digital maturity. Since CFO function can also be thought of as a service provider for e.g. business functions, the wave-thinking is similarly applicable to this context. Based on theory, the hypothesis is that CFO functions are currently focused on optimizing operational efficiency; to use digitalization to improve processes and remove waste. The results confirm the hypothesis as most respondents say they are currently in the first wave of digitalization. However, rather surprisingly, many also report that their organization is in the second or third wave. Looking at the industry and size of those respondents' corporations, there isn't any clear pattern that would indicate why specific organizations consider having passed the first wave. Both second and third wave include TE100-companies as does the first wave.

Often the first wave means that the pressure to digitalize comes from the top whereas for the second and third wave the pressure (and demand) comes also horizontally, for example, from business. CFOs of corporations in the second and third wave are also often more involved with business in terms of partnership and collaboration. While most CFO functions are clearly in the first wave, the overall trend seems to be that CFO is growing into a function that can support the business in disruption.

As a summary, the digital maturity has passed its infancy in the CFO function and a few examples are already close to reaching their ideal of a digital CFO. However, most are clearly in the first third of their digitalization journey although the future looks promising. Most CFOs have been able to recognize the importance of digitalization but there are some that are yet to be convinced of the opportunities it offers. This is as true to corporations with revenue more than 1 BEUR as to 100 MEUR.

7.1.2 Digitalization triage

In the literature review, it was argued that different corporations see the need for digitalization differently. The questions in this section analyze how the need is perceived across functions and activities and how corporations are approaching the prioritization challenge.

Question 4: Time investment between core processes and value-added services

Based on the results, the division of time and effort between core processes and value-added services looks fairly even and traditional. Clearly, most CFO functions see their role as producing all finance related activities and so it should be. Neither function can really be removed from the CFO, even if more of the respondents perceive their weighting on the core processes side. Either way, it is interesting to see that the saturation is quite extensive: nearly 22 percent say they are investing more to value-added services whereas 33 percent claim vice versa. In practice, CFOs may see their roles in their corporations somewhat differently.

Question 5: Order of digitalization in CFO's sub-functions

Clearly, the respondents perceive financial accounting to be the first function within the CFO to digitize with 62 percent of all responses. This is supported by the claims made in the theoretical framework. The theory indicates that financial accounting still has lots of routine processes that have significant automation potential which is also why RPA is widely considered the most popular disruptive technology (e.g. see Q14). Often, the primary objective, especially for corporations in the first wave of digitalization is to reduce costs, optimize performance and create a leaner organization. Financial accounting is clearly the function to benefit from this first. The results also indicate that management accounting, with 24 percent, is among the top priorities to digitize. It also must consider that some corporations may see consider both functions as a hybrid in which case it is not as clear to make the difference.

Digitizing these functions clearly provides the most tangible and substantial benefits which is why they are the at the top of the triage. This may also mean that for corporations, who have already started their digitalization journey, these functions were the first to digitize. An interesting result is also that treasury, tax & legal, external reporting and internal audit received were considered as first by only 15 percent collectively. Especially with external reporting, it looks like automation of the financial closing process is not happening in the near future.

Question 6: Current and target agility of the CFO function

The hypothesis for Q6 is that the CFO is a traditional, siloed and rigid function with little agility. The data shows that the hypothesis is fairly valid. The agility is rather weak with 95 percent of all respondents reporting their CFO functions current agility as not so agile or somewhat agile. On the other hand, the future outlook shows demand for much more agility, ideally as very agile or extremely agile. However, only 20 percent say that extreme agility is ideal, and most respondents are satisfied with a "very agile organization". The need for similar agility as in IT is not required but the trend seems to be that more agility is required to keep up with the faster clock speed of the business environment.

As a summary, the transformation is visible and the CFO as a function identifies they need to perform better and more efficiently. However, it should be noted that it is not binary whether some decisions and actions are right or wrong. The hypotheses were validated regarding which functions are first to digitize and what are the key priorities. The results also show that organizations are currently not that agile but are in the process of changing although it might take some time.

7.1.3 Transformation of the CFO's role

The theoretical framework presented lots of argumentation on the changing role of the CFO as leader and as a function. From a historical point of view, the CFO has been a traditionalist, but the theory suggests that it is changing more into a financial strategist, business partner and digital leader. Given the context, it is quite interesting to examine whether the propositions of the literature hold true in Finnish corporations as it may change the nature of CFO's operations in the future substantially. The consolidated results from this section are presented in figure 8 with the averages on the commensurate scale.

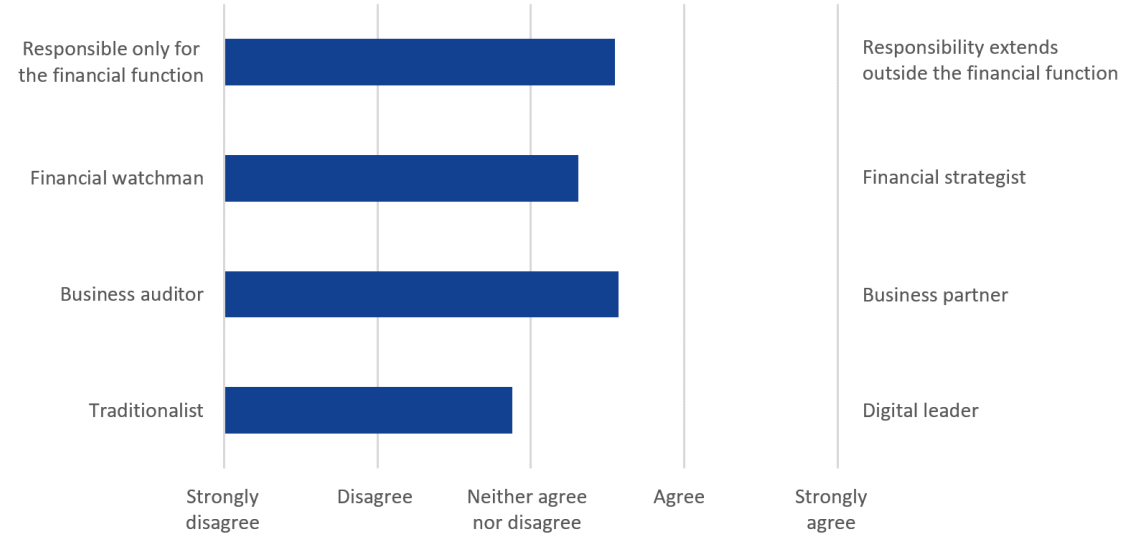

Figure 8. Consolidated results on the transformation of the CFO's role

Question 7: CFO's scope of responsibility

Interestingly enough, most respondents say that their CFO is responsible for activities also outside of the financial function. Actually, 57 percent say that CFOs' responsibility now extends beyond the financial function which surprisingly much. However, 21 percent also say that their CFO is more or less responsible for just the financial function, which is significantly less than the other way around. When reflecting on the historical context, this is a dramatic shift and subsequently suggests that the CFOs' skillsets need to expand quite rapidly. From a theoretical point of view, however, this seems to be on par with the claims by Smith & Payne (2011) and Howell (2006). What the results of this survey do not show, however, is what the new responsibilities are, although theory suggests responsibilities in internal and external digitalization, IT management and corporate leadership.

Question 8: CFO's role as a financial strategist

In terms of CFO's role as the financial watchman or strategist, the results are quite neutral which is maybe best described by the average of 3,31. While the mode is 4 with 40 percent of respondents, exactly 50 percent are neutral or lean toward a financial watchman. The hypothesis was that the mass of responses would fall to the strategist end of the scale which is neither contradicted nor confirmed. On the other hand, the CFO has been a financial watchman for decades, but it certainly seems that this is changing – at least the respondents would rather see themselves as strategists. The results could have been different if the scope included business stakeholders.

Question 9: CFO's role as a business partner

The largest part of respondents considers CFO more as a business partner (52 percent), as the theory suggests, which also validates the hypothesis. At the other end of the spectrum, 14 percent of respondents are still more inclined to say that CFO is an auditor of business. However, this does not directly define the true collaboration CFO and business as partnerships might be very intimate (two-directional relationship) or more about just providing the numbers that the business may need (one-directional relationship). The CFO's main objective is still monitor and audit the business and hold it accountable when that is required. For most companies, the change process is already ongoing but will likely accelerate in the future. After all, the benefits of a true partnership, ranging from better insight to quicker reaction to market behavior, are clear.

Question 10: CFO's role as a digital leader

From a digital CFO -context, this is the most interesting paradigm of those that were identified in the literature review. The average is lowest of all questions in this section, only 2,88, and a mode of 3 with 55 percent of respondents. The saturation is quite low, but the weighing is at the traditionalist end of the spectrum. On a higher level, the results show that CFO's still consider them more a traditionalist than a true digital leader.

This also supports the hypothesis, which indicates that claims that the transformation into a true digital leader is ongoing although still at the start of the journey.

The results in this section strengthen the understanding of the level of digitalization but also about the aspirations of the CFO function. CFO's are responsible of activities also outside of the CFO function, even to surprising extend. The emphasis, as expected, is still in the finances although CFO as a leader is transforming into a more strategic role than before. This is likely something that the business demands to increase agility but also just recently made possible due to technological advancements. Respondents do not perceive their CFOs as the ideal digital leaders but the journey into that role has clearly started.

7.2 Application of disruptive technologies in the CFO function

This chapter analyzes the survey results on the CFO function's technological enablers focusing especially on how technology provides benefits for the CFO function, what is the technological maturity and level of technology adoption in the CFO function, and how the organizations are using the technologies to create value. In chapter 4, the theoretical framework identified a number of use cases for disruptive technologies in the financial function. This chapter further validates how well adapted those use cases are, what is the actual adoption status in the Finnish market and what are the most important trends in the corporations in the scope of this thesis.

7.2.1 Benefits of disruptive technologies

The theoretical framework identifies a number of benefits of disruptive technologies for the financial function. However, it is still unclear, even on global level, what the actual use cases are. Also, the theoretical framework does not answer whether technologies have delivered on the high expectations that businesses have set for them. The results of this thesis quantify the aforementioned and remove speculation from the current status of digitalization in Finnish CFO functions.

Question 11: Importance of digital technologies and capabilities

The results indicate that while all consider, even today, technologies and digital capabilities as at least somewhat important, there is still room for growing. Currently, 60 percent of respondents say that technologies and digital capabilities are very or extremely important while 40% dub them as somewhat important. However, in three years (at the time of this study that would be 2021), 65 percent see technology as extremely important and 35% as very important. The trend is clearly that the importance of these capabilities is growing as financial functions are becoming more dependent on digital capabilities. What is more important, there are no respondents that would not recognize the value and importance of digital capabilities.

These findings are supported by Kane et al. (2015) similar global research. Although conducted in 2015, the results indicate that 76 percent saw technologies at least very important. However, the future outlook of three years (that would be 2018), the results indicated that a whopping 92% saw technologies and digital capabilities as very important. There is some incoherence between these findings, but we must take into account the bias that respondents may be inclined to indicate growth in importance for the future.

Question 12: Most important benefits of disruptive technologies

The most significant benefits are clearly related to improving processes. The two most common benefits are increased process efficiency and automated processes. Even data quality as the third most important benefit is essential to processes. These findings are in line with the general gist of CFO's development triage (e.g. results of Q2 and Q14). The second most important benefits are more or less related to improving CFO's service level and delivery quality to business stakeholders. The least important benefits are related to creating strategic advantage. It seems that investments to digitalization are not primarily based on long-term goals, which could also be due to the attractiveness of the short lead time in ROI for the technologies.

Interestingly enough, there are a number of benefits that did not get as much attention as one could expect. Cost and spend reductions were one of top three most important benefits for only 27 percent of respondents, although we must consider that cost reductions are quite indirect benefits. Also, only 1 person said that decreased number of employees is a benefit, although a substantial part of cost reductions is often due to reduced headcount, especially in digital transformation projects. Also, no-one chose increased security as a benefit, which is also an interesting observation. While the list of benefits was built based on the theoretical framework, there was no clear order of importance defined for the benefits in the literature used for this thesis. As the data indicates, there clearly is one.

Question 13: Most tangible benefits of disruptive technologies

On average, the most tangible results have been related to operational efficiency, delivery quality and operating costs. These are in line with the hypothesis, but also other data of other questions like Q12. The least tangible results, on the other hand, have been in revenue and profit as well as stakeholder satisfaction. Analyzing the results, the relatively high saturation must be considered; some have clearly had more tangible results in some areas than others. For example, for operational efficiency, some have achieved their objectives whereas others have been failed by high expectations or poor implementation to name a few possible root causes. In many cases, the results must be analyzed with regard to the previous state of the areas of interest: e.g. benefits in regulatory compliance may get relatively high tangibility because before being able to report digitally, regulatory reporting used to be very troublesome and arduous.

As a summary, technologies are considered very important for the financial function. Before, there have not been real, benchmarkable research on what the true benefits of disruptive technologies and digitalization are, which is why the results are interesting. For now, the clearest tangible results have been achieved in the first and second wave of digitalization – in process improvements – but this is expected to change as the digital maturity of Finnish CFO functions evolves.

7.2.2 Technological maturity and practical applications

This section further explores the current technological maturity and level of technology adoption the CFO function. Additionally, different practical applications of the technologies are analyzed against those identified in the theoretical framework (namely table 2 in chapter 4). This section also analyzes the importance of different selection criteria for technologies.

Question 14: CFO function's technological maturity level

The results of this question enable us to take a deep dive into the technological maturity of CFO functions, specifically, what the level of knowledge is among the respondents, how well the technologies have been adopted and what is their future outlook. The open text fields of the practical applications also enable us to discover relationships between different technologies through use cases. The average adoption rate of different technologies is presented in figure 9.

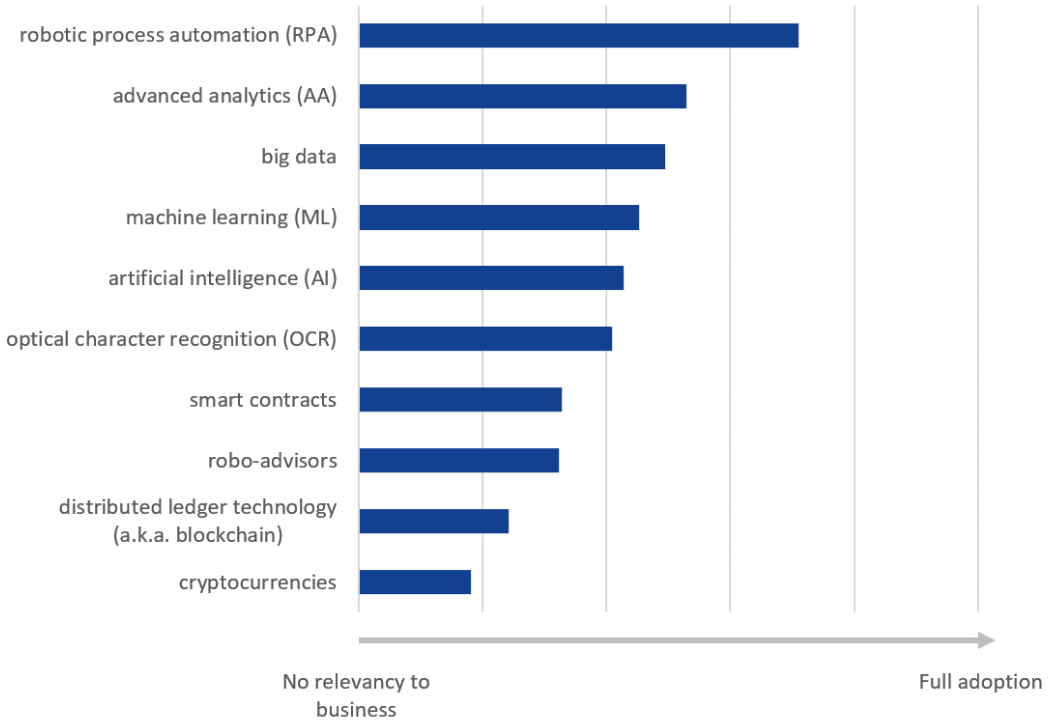

Figure 9. Average adoption rate of different technologies in the CFO function

Starting from the adoption rate, it is clear that RPA is by far the best adopted and well-known technology. This is arguably due to the potential benefits of process improvements and cost reduction which is widely argued in the theoretical framework too. RPA, although in noticeably the best adopted, is followed by advanced analytics and big data. Advanced analytics is rather surprisingly quite a bit behind RPA – in fact, 33 percent of respondents claim to start implementation earliest in a year's time. At the other end of the spectrum are the least adopted technologies: cryptocurrencies, DLT, smart contracts and robo-advisors. Even though these technologies were the least adopted on average, some corporations have already fully adopted them; for example, some respondents provided use cases of smart contracts in their corporations. Considering the quite small size of the sample, this is interesting since the theoretical framework highlights the small number of potential use cases for DLTs.

Looking at the most important technologies identified in the theoretical framework (RPA, AA and AI), AI was the least adopted technology. The general hype around artificial intelligence may be a reason behind this gap. It isn't very realistic that technologies like machine learning (a pre-requisite for adopting AI) would be less adopted than AI itself.

Comparing to the benchmark study by Koedjik et al. (2018), the biggest difference was with AI which received a much higher adoption rate in their study. Additionally, the results of this survey indicate a much higher adoption in RPA and smart contracts but significantly less in DLT and cryptocurrencies. Considering that Koedjik et al. study is a European CFO study done in March 2018, the results are interesting. The differences may be due to a smaller sample size and therefore don't directly contradict each other's results either.

As for the practical applications of the technologies, most responses were related to AA, big data, OCR and RPA. Use cases of AA were not as sophisticated as one might expect: they were purely use of descriptive analytics with no predictive analytics at all. It could be argued that the definition of advanced analytics might not be completely clear to the respondents but also that the adoption is not as high as expected based on the theory. Use cases of OCR were directly related to RPA, with most use cases mainly from financial accounting (supplier and purchase invoicing and accounts payable, to name a few). RPA, as the most adopted technology, was given several use cases by mane: mainly claims and invoice processing, accruals and even forecasting. These results were quite clear and also resonate with the findings of other questions in the study. As an interesting quirk, there were also named use cases for smart contracts, one of the least adopted technologies, which is something that was not readily available in the theoretical framework. These examples were related to automated transactions and invoicing.

Question 15: Technology selection criteria

CFO's selection criteria for technology is also very interesting, especially from Firm X or a technology vendor's point of view. The three most important criteria are user experience, integration capabilities and performance. These were quite expected results and

also validate the hypothesis. As end users of the technology, ease of use and functionalities are often the most appreciated features. At the other end of the spectrum were cloud installation, on-premise installation and technical skills. The first two are somewhat surprising because 1) some corporations still prefer on-premise against cloud and 2) cloud is not considered a very important requirement at all. However, considering that only the most important criteria could be chosen for this question, it must be noted that the results may be polarized.

In terms of technological maturity, the results are slightly surprising with CFOs' progressiveness when comparing to the theoretical framework. The results indicate clear preference to some technologies while others are not as popular as could have expected. From a technology selection point of view, respondents stress the system criteria from a platform thinking point of view – the preferred solutions are well integrateable and fit for purpose – which, in the long run, is beneficial.

7.3 Digital transformation in the CFO function

This chapter analyzes digital transformations in the CFO function from a leadership point of view, explores the results for the most significant threats to success and most common mitigation actions that corporations take to ensure the success of the expensive digitalization projects. This section focuses on the softer side of digital transformation and approaches issues from an organizational and cultural transformation perspective. The questions and analysis are based on chapter 5 with theoretical framework on digital transformation.

7.3.1 Threats and key success factors

Identifying the threats and KSFs of digital transformations is for leadership. Both must be addressed to ensure success in transformation projects. The questions in this section explore how respondents perceive the importance of transformation enablers, the most significant threats and mitigation efforts.

Question 17: Most important components of realizing value in digital transformations

The results indicate that the most important enablers are change management and business process transformation, followed by a supportive organizational culture and management skills. Overall, respondents hold all KSFs in high importance since there are only few responses indicating any KSF as not important. Therefore, it could be argued that CFOs do understand the importance of softer factors. It looks like many respondents have had experience with bad change management, poor leadership skills and an unsupportive organizational culture for digital transformations as the same topics are visible in other questions as well (see Q16, Q18) On the other hand, the theoretical framework identified IT governance and digital leadership as one of four KSFs. These

were among the least important KSFs for the respondents. The results were not very polarizing which is why the order of importance is based on the weighted average of responses.

Question 18: Most significant threats to the success of digital transformations

As the three most significant threats, the results indicate too many priorities in the CFO function, lack of clear (digital) vision and insufficient change management. This is in line with the findings from Q17. Even though the most significant threats can be concluded from data of other questions as well, their root causes cannot be determined from these results. We cannot directly analyze what other priorities there are and why the vision is unclear. What we can say, however, is that on average, the top third of the threats are organizational factors whereas the middle third are more technical, governance related. It also seems that low organizational agility is a threat (for example, many are still challenged by organizational silos), even though agility was not identified as a key success factor.

An interesting quirk is also that the lack of business case received 16 percent of votes. This is low, considering the novelty of disruptive technologies in the area. Also, some corporations may have introduced programs that fund digital initiative even without a strong business case to drive the transformation. From a theoretical point of view, Kane et al. (2015) study identified too many priorities, lack of strategy and security as the top three reasons. The results are nearly identical which confirms the hypothesis which is based on the theoretical argumentation. This also indicates that the threats are not proprietary to CFO only, but also to other functions.

Question 19: Current risk mitigation activities

The actions to mitigate the threats are almost as expected. The most common action is improvements in processes, which is explainable with the popularity of RPA, first wave digital maturity and the potential that processes improvements can deliver. However, the bottom three indicate that the objective with digital transformations is to get quick wins and grab the low-hanging fruits instead of making long-term investments into the future. This finding is also in line with other results of this survey (e.g. Q12). It could be argued that the priority for businesses is to get more proof of the technologies' potential and solve the obvious issues before making long-term, strategic digitalization investments.

As a summary, CFOs clearly recognize the need for the softer side in digital transformations, organizational nurturing via change management and leadership. The significant threats are similarly related to the organizational side of the transformations, which is a conclusion that is supported by the theoretical framework. The actions to mitigate risks are well-considered but the results indicate that there is still a lot of work to be done. Although the challenges have been recognized, they haven't been sufficiently addressed yet.

7.3.2 Digital leadership and transformation management

As the last section of the survey, the state of digital leadership and transformation management is examined in the financial function. Leadership, especially its involvement in the transformation of an organization, was identified as one a critical element of success in the theoretical framework. There is no prior academic research in this area from the Nordic countries, let alone Finland, which makes it especially interesting to survey the current status.

Question 16: Communication effectiveness of digital strategy

The keyword in analyzing the results of this question is communication: how well the digital strategy is communicated to the organization. The saturation of the data is fair. While neutral responses are frequent, we can still see that 32 percent think communication is poor and 29 percent think the opposite. This are not promising results, not for digital strategy nor business strategy. After all, the objective of strategy is to provide information about the direction of the corporation for everyone. It should be crystal clear for every employee where the organization is headed which not only improves performance but also employee satisfaction and project success. Similar findings were reported earlier when lack of clear vision was identified the second most significant threat for CFOs' digital transformation success in Q18.

When benchmarking these results against Kane et al. (2015), we can see that Kane et al. data leans heavily toward a well-communicated strategy (see figure 10). Nearly 50 percent agree or strongly agree while only 27 percent disagree or strongly disagree. Even here, the data is quite saturated. A separate digital strategy for the CFO function is still somewhat unfamiliar for Finnish corporations which is visible here as well (we must consider that the Kane et al. study was done three years prior).

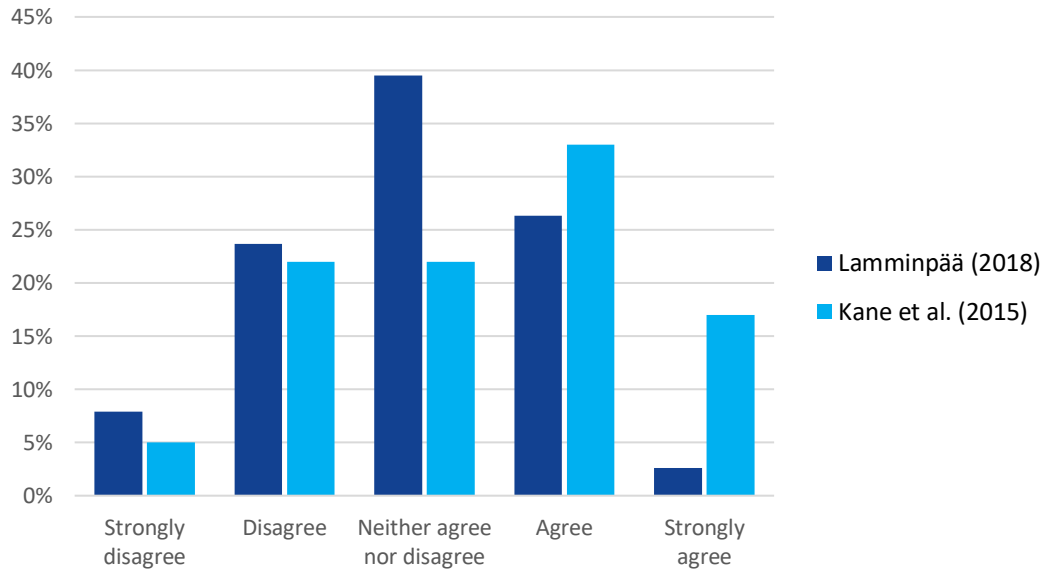

Figure 10. Results of Q18 on how well the digital strategy in the respondents' organizations has been communicated

Question 20: Leadership's level of involvement in digitalization

The results indicate that leadership of Finnish CFO functions is quite intimately involved with the organization's digitalization efforts, initiatives and programs. This is almost surprising, considering that many other findings would demand for more leadership involvement. When assessing the answers, we must note that much of the sample is from leadership, which means that they are assessing their own performance. However, nearly 80 percent of respondents say that leadership is involved, and no respondents disagree with the statement which is also interesting. If what the data indicates is correct, management buy-in is surprisingly strong in CFO digitalization.

Question 21: Primary owner of digitalization initiatives in the CFO function

The primary owner of digitalization within CFO is clearly the CFO function itself as 61 percent of the respondents selected the financial function. IT department was rated the second highest – something that the theoretical framework adamantly advises against. Although nearly a quarter of respondents said the IT function, which is rather high, the trend that the responsibility is shifting to the CFO is promising. The optimal owner of a transformation project is the function itself as it drives better leadership involvement, success and adoption. Higher management owned only 13 percent of digital transformations.

Question 22: Confidence in readiness to respond to digital trends

The overall trust in CFO function's readiness to respond to digital trends is relatively high. There are few respondents who disagree with the statement, with nearly 50 percent agreeing that they are confident with the readiness. This tells us that the respondents believe that the resources and capabilities are there to carry on with a transformation. However, the results do not directly indicate how well the change is being implemented. Relative to Kane et al. (2015) benchmark study, the results of this survey indicate somewhat better readiness. This may be affected by the sample size or the scope of the survey.

Question 23: Confidence in leadership's understanding of digital trends

The respondents have relatively firm belief in their leadership's understanding of relevant digital trends and emerging technologies. There are virtually no opposing views, although the results do conflict with, for example Q14, where quite many say they are not familiar with the technologies identified as most relevant for the CFO in the theoretical framework. However, the key message that these results convey is that the trust of understanding is there, which in the end of the day is also important. The results are in sync with those of Kane et al. (2015).

Question 24: Organization's level of digital skills and experience

The results on the overall skillset and experience are mixed. While 43 percent say that they have sufficient skills and experience, there are 57 percent that do not agree with the

statement. What's even more interesting, is that the results are nearly identical with the benchmark 2015 study with only 5 percent variance. Overall, the results show that most organization's still need to work to get their CFO workforce's skillset and experience to the required level. This is not a trivial task, considering the number of corporations with the problem, even with just Finland in scope. On the other hand, there are quite a few respondents who say that their workforce does possess the necessary skills.

Question 25: Beneficial skills in improving CFO performance

Taking into account the results of Q18, lack of skills was identified as a top-3 threat by only 26 percent of respondents which contradicts other findings in the theoretical framework. However, this question explores whether organizations could benefit from specific capabilities or skills and more than half identified lacking skillsets. The two most important skills which could benefit the CFO function are ability to conceptualize new innovations and technical skills (Q17 identified as least risky). Kane et al. (2015) research supports these findings which also highlight the organizations' increased need for agility and transparency.

Question 26: Opportunities to learn and develop skills

Related to the corporations' investments in developing their employees' skills, the results show that a substantial part of the corporations provide great resources for self-development. Comparing to the benchmark study, the weighting of these results has undeniably moved towards more investments in learning and skill development. Still, 34 percent of respondents do not agree that their organization is investing enough, which is quite a bit, considering that most organizations already require advanced digital skillsets from their employees in day-to-day tasks.

Question 27: Leadership's skills and experience to support digital transformations

The results are quite polarized as 64 percent of respondents say their leadership has sufficient experience and skills to lead digitalization efforts in the CFO function. The sample does include respondents from higher management and operational level, but it must be considered that polarization may be biased due to reluctance to criticize self or superiors. However, 36 percent still say that they do not agree with the statement. Comparing to the Kane et al. 2015 study, the benchmark results are clearly more saturated with 54 percent not agreeing with the statement.

As a summary, the results show that while most corporations' financial functions think they are doing a good job, they still identify lots of potential for development, especially in digital strategy and vision, but also in skill development. Most of the results in this sections were benchmarkable with an existing Kane et al. (2015) study. Some results are identical while most more or less confirmed this thesis' hypotheses based on Kane et al. results. None of the results strongly contradict any previous research which also provides some validation for the results of this thesis.

8. DISCUSSION

Digitalization and digital transformations in large corporations are not trivial undertakings – they carry a lot of risks and their success is heavily dependent on several factors. In this chapter, the results of the survey are discussed from the perspective of the research questions defined in chapter 1. Specifically, the focus is on the status of digitalization in CFO functions of Finnish corporations, the technological enablers improving the CFO function's performance and the organizational and cultural factors enabling digital transformations. The chapter also synthesizes the theoretical framework with the findings of the survey that are presented in chapter 7. This allows to review the findings made in the theoretical framework against those in this survey. Additionally, this chapter presents perspectives from the survey that the theoretical framework does not address hence providing novel information about a previously unexplored field by academic research.

8.1 Current status of digitalization in the CFO function

A status analysis is often started with defining what is currently being done and how are the current efforts perceived. In the context of defining the status of digitalization in the CFO function, it is therefore natural to begin by defining the digital maturity level of the CFO function. Defining the digital maturity level tells us how people perceive their corporations (and simultaneously explicates the status) but it can also be used as a baseline of maturity to examine the importance of other factors.

As analyzed in the previous section, the digital maturity of Finnish CFO functions is low to intermediate which is on par with what the theory lets us expect. Finnish financial functions have clearly started their digitalization journey, but it is still in its early stages. On average, most CFO functions are focused on activities of the first wave of digitalization but some, even in larger corporations, have already reached more advanced levels of digitalization. Therefore, it would make sense to expect that there is some sort of correlation with the level of digital maturity and focus in waves of digitalization.

A further analysis proves this expectation to be true. While a larger sample size in the survey may have produced clearer results, the results arguably prove that there is correlation between the two (see figure 11). Low maturity organizations are most often on the first wave; focusing mostly on operational efficiency and process optimization. However, there can also be more mature organizations that still identify the first wave as their focus area. The second wave is mostly for organizations with intermediate, developing maturity. They are focusing on improving CFO's service quality and business partnership. The third wave, as the most advanced wave, is only occupied by highly matured CFO functions. The findings support the earlier hypotheses.

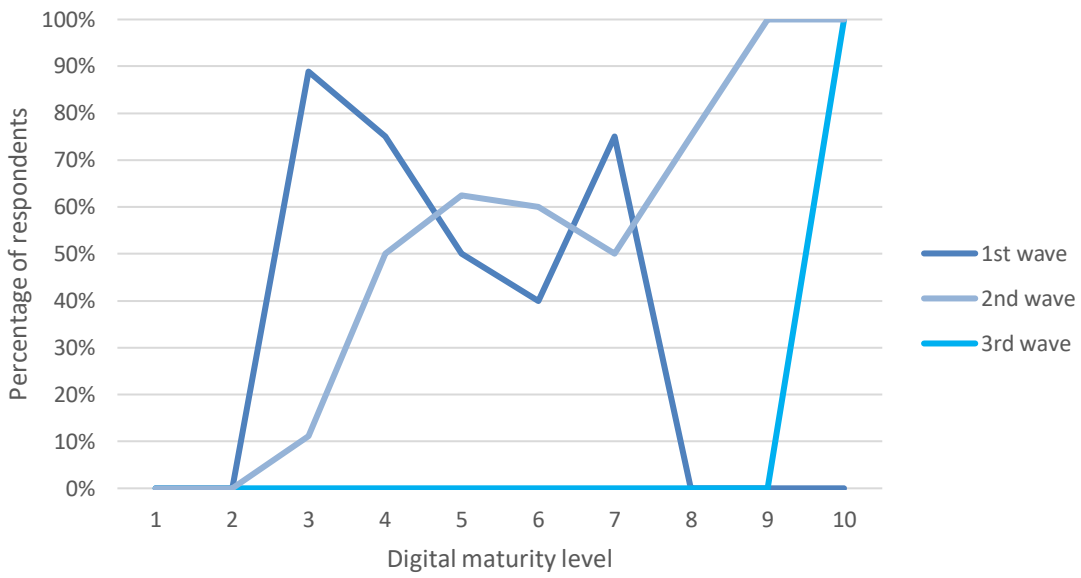

Figure 11. Finnish CFO functions' waves of digitalization against their digital maturity level of the CFO function

Digital waves are gradual steps for organizations, and every organization must pass through each step individually – there aren't shortcuts. This is why most corporations currently occupy the first and second wave, not the third. This also supports the findings about the early digital maturity.

In the theoretical framework, the paradigm shift for CFO is believed to be clear: the competitiveness must increase which incurs pressure for cost reductions and higher quality CFO services. In practice, CFOs need to provide better, more accurate real-time information (Howell, 2006). This is also clearly visible in the results as they indicate that the CFO is transforming into a more agile, business partner and strategist role. Fabich et al. (2011) and Tucker et al. (2017) also argued that CFO is more involved in corporate digitalization efforts and that an intimate business partnership has a strong value proposition for corporations. This is also supported by the results of this survey. A more intimate partnership allows the financial function to, in the lack of a better analogy, play together for the same team with the business. It also enables the financial function to be more agile and react to rapid changes in the business environment even better. Denford & Schobel (2012) argued that CFO will grow more involved in IT management. The results indicate that while the dependency on IT is higher (and quite naturally CFO will be involved in IT management on some level), CFO is not re-absorbing the CIO/CTO-role although their mutual relationship will likely deepen.

The theoretical framework also presented arguments that the responsibility of the CFO will extend outside the financial function (Baril et al., 2018; Bhimani & Willcocks, 2014). The findings show that CFOs are required to take more responsibility than before. Also, this simultaneously supports the CFOs' transformations into financial strategists as they extend their financial influence over a more substantial part of the organi-

zation. Finally, Haffke et al. (2016) claim that CFOs are becoming internal digitalization leaders and claiming some of the responsibility from IT and the CDOs. This is a rather optimistic view and the results do not explicitly support the argument. CFO is digitalizing because they need to, not because they are the best option to assume the extra responsibility.

We can also see that, on average, the digital maturity level grows as CFOs adopt new ways of working. In practice, this means that to fully turn the financial function digital, the CFO's behavior and responsibilities must change. Additionally, their knowledge and understanding of digital capabilities and technologies must grow exponentially. Growing digital maturity also means that the CFO must become a true business partner, assume the role of a financial strategist and become a digital leader (see figure 12).

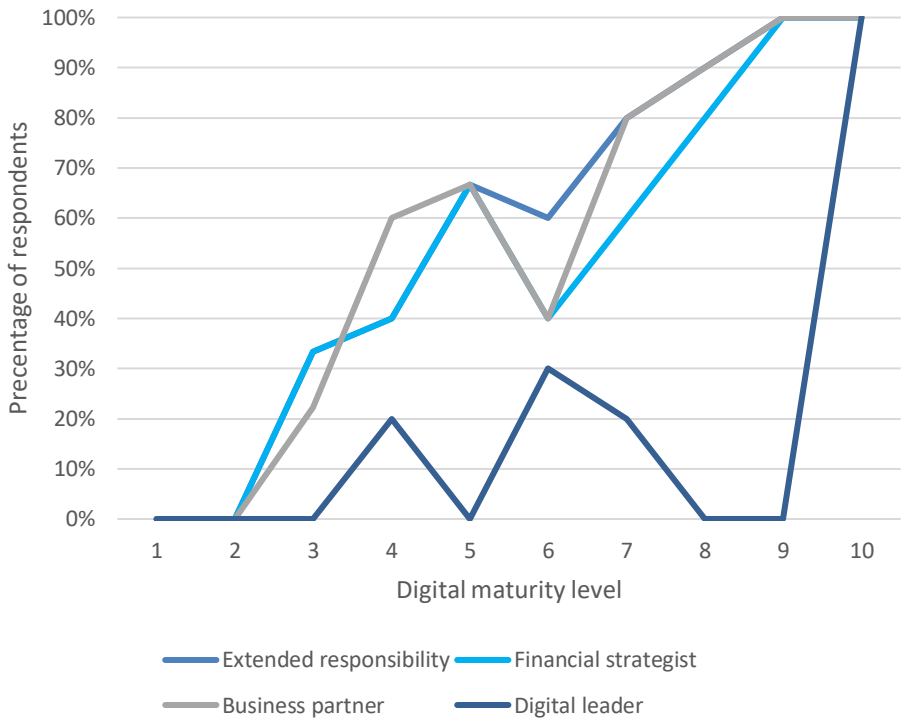

Figure 12. Correlation between the CFO role's transformation and the digital maturity level of the CFO function (respondents who answered "agree" or "strongly agree")

However, this also means that adopting the changing paradigm will eventually require digitalization: a financial strategist requires a fully digital, modern CFO function to execute their role. A business partner must be able to offer business the services that only digitalization can offer, and a digital leader will eventually turn the CFO function digital. While a larger sample size could potentially reduce variance in the results, the general trend is strongly visible.

8.2 Technological enablers in the CFO function

Analyzing how technology can help to improve the CFO function requires us to better understand the development requirements for the function. That helps us to identify the

areas where technology may be of help and subsequently explore what the most useful technologies and use cases would be. As discussed, the focus of CFO functions is in the first and second wave of digitalization; in improving operational efficiency by reducing costs and automating processes (first wave) and expanding services with improved delivery quality (second wave). However, while the third wave will likely start making its way to the CFO function during early 2020s, some pioneers have already implemented quite advanced, disruptive pilots. Currently, it seems, that technology is seen as the tool to solve cost reduction and service improvement challenges. On the other hand, the theoretical framework places quite high expectations for the future – from removing human interference in some invoicing processes to even automating the entire financial closing process.

There are multiple benefits for CFOs to go digital. For one, the processes that the financial function must run are growing increasingly complex and they are still mostly manual (Baril et al., 2018) hence there is lots of slack. This is especially true in the financial function where processes are heavy and time-consuming. For example Plaschke et al. (2018), Lederer et al. (2017) and Nadeem et al. (2018) all present arguments why process automation and optimization is the most profitable way to employ technology for most CFO functions. Not only would the benefits be limited to cost reductions through e.g. process mining, but also include improving the delivery speed and quality. The results of this research support the claims of the theoretical framework. Process improvements are by far the most important benefits that respondents see in adopting disruptive technologies followed by the improved service level and delivery quality. The least important benefits are strategic advantages. What's interesting about this is that most other functions, especially business functions, are digitalizing especially because of the strategic advantage it creates. This is applicable to both B2B and B2C -businesses from customer service to marketing. It seems that one reason for CFOs to disregard the strategic advantage is that disruptive technologies are still in the process of proving themselves and that they can produce tangible results.

The tangibility of the benefits is key, especially for the financial function and especially in the private sector. Use of resources will often need to be justified with rational, tangible outputs (ROI). For digitalization in the financial function, there is little content in the theoretical framework. The literature review didn't produce any clear or quantifiable benefits with evidence that the results of this study could be benchmarked against. However, in the results of the survey indicate that the most important tangible benefits are related to the first and second waves with operational efficiency, delivery quality and operating costs as the most significant tangible benefits. The least tangible benefits, however, are revenue and profit as well as shareholder satisfaction. They go hand in hand as shareholders are mostly interested in profit only and the value chain from process improvements to profit gains is quite indirect. The benefits have been tangible enough for the technologies to prove themselves in many CFO functions as more and more investments are directed to digitalization. Therefore, we can expect the implementation of such disruptive technologies to only accelerate in the future.

Another part of digital maturity discussed in chapter 8.1 is technological maturity. As opposed to technical or technology maturity (meaning how mature a specific technology is), technological maturity can be defined as the dependency of business on technologies, the speed with which businesses adopt technologies and the ways businesses are making use of technologies. As an example, technologically mature organization may use prescriptive analytics on a daily basis where an immature organization may be doing only basic reporting. The theoretical framework doesn't provide much details on the current technological maturity of the CFO function. All existing research is mostly commercial and often contradictory. The theoretical framework, however, indicates that the most important technologies in the financial function are RPA, AI and AA, respectively.

The results indicate that the technological maturity in Finnish CFO functions is not as high as the theoretical framework suggests. Firstly, the Finnish market is often a few years slower in adopting new trends which may be due to many reasons, but secondly, the financial function is also somewhat behind other functions, argues Koedjik et al. (2018). Digitalization efforts are also often different in the financial function due to their triage: CFO, as a process-oriented function, offers a lot of opportunities for RPA instead of other trendy technologies like artificial intelligence or blockchain. As opposed to what the theory lets one expect, the promise of AI is yet to be delivered in Finland – there are more profitable use cases available with less complex technologies. This will likely change later after basic processes have been automated and the focus is shifting toward the third wave of digitalization. However, we can already see that the dependency on technology in the CFO is fairly high and it's expected to grow in the future.

Finally, in the theoretical framework, Chandra et al. (2018) argue that value-added services are more probable to digitize first. The findings of this thesis are somewhat different. Firstly, CFOs are generally more focused on the core processes of the financial function and find lots of potential for process improvements, especially in financial accounting, that disruptive technologies could address quickly. The use cases identified in by the respondents are very similar to those presented in table 2. The theoretical framework seems to be somewhat more optimistic about the technological maturity as the use cases presented are more complex than those reported by the respondents. For example, in literature, the applications of advanced analytics had mostly predictive or even prescriptive elements while in the respondents' corporations the applications weren't as sophisticated. There was also little use of AI in practice, whereas the theoretical framework painted a picture of a more widely adopted technology. The technologies that did match in terms of complexity of use cases are RPA and OCR and somewhat surprisingly some DLT-related applications (even though they were the least widely adopted technologies). The practical applications have a few things in common: they are often the low-hanging fruits with tremendous benefits and exploitation potential, they are fairly quick to implement with short lead time for ROI and they are simple and support building a solid digital foundation. Considering the challenging development requirements of the CFO, the implementation of these use cases make sense.

8.3 Cultural and organizational factors enabling digital transformations

Identifying the cultural and organizational factors that enable digital transformations is not simple. There are as many ways to implement digital transformations as there are different organizations. To be able to find at least some generalizable guidelines or best practices, one must first acquire a thorough understanding of potential hindrances, threats or challenges in order to form a structured approach to identify the enablers. In the literature review, four areas of key success factors in digital transformations were identified and sets of barriers to success for each of those areas. The key success factor areas are 1) governance, management and leadership, 2) people and capabilities, 3) culture and change management and finally 4) business process management. In addition to the areas of key success factors, some digital transformation challenges were identified in chapter 3 that have been found to be specific for the CFO function. These challenges were further divided to 1) management and leadership challenges, 2) technology and process challenges and 3) organizational and cultural challenges. Identifying as many potential root causes as possible allowed to form the survey questions so that they convey as truthful presentation of the reality as possible. Furthermore, this enables the analysis of which CFO specific factors are the most important and allow to form an understanding of the root causes to design mitigation actions.

For challenges related to management and leadership, the theoretical framework presented multiple examples. As the most important challenges, the following were identified:

- lack of linking between digital vision and strategy
- insufficient communication of digital strategy
- competing financial priorities
- lack of ownership of digital initiatives
- lack of mandate and leadership buy-in
- lack of digital leadership
- lack of IT governance

The results of the survey validate nearly all key threats. The digital vision and strategy are often poorly defined and even worse, they are not communicated sufficiently to the employees. Analyzing the responses against digital maturity level, the results indicate that a well-communicated strategy is an essential building block of digital maturity (figure 13). Poor strategic design and communication, on the other hand, may also contribute to the fact that the CFO function develops a lot of competing priorities, which in fact was identified as the most significant threat to success. To ensure the success of digital transformations, digitalization must find its place on the leadership agenda. There is a genuine lack of digital leadership in the CFO function. Many CFOs haven't become the digital leaders their organizations need which is also affecting the success of the transformations. However, the results show that the leadership is relatively well-involved in digital initiatives and CFOs most often own their digital projects, which would indicate

that leadership buy-in and support is sufficient. The only issue is the vertical strategy communication. Interestingly enough, IT governance is not seen as such an important factor as the theory argues, which will eventually have to change as digital platforms grow more complex.

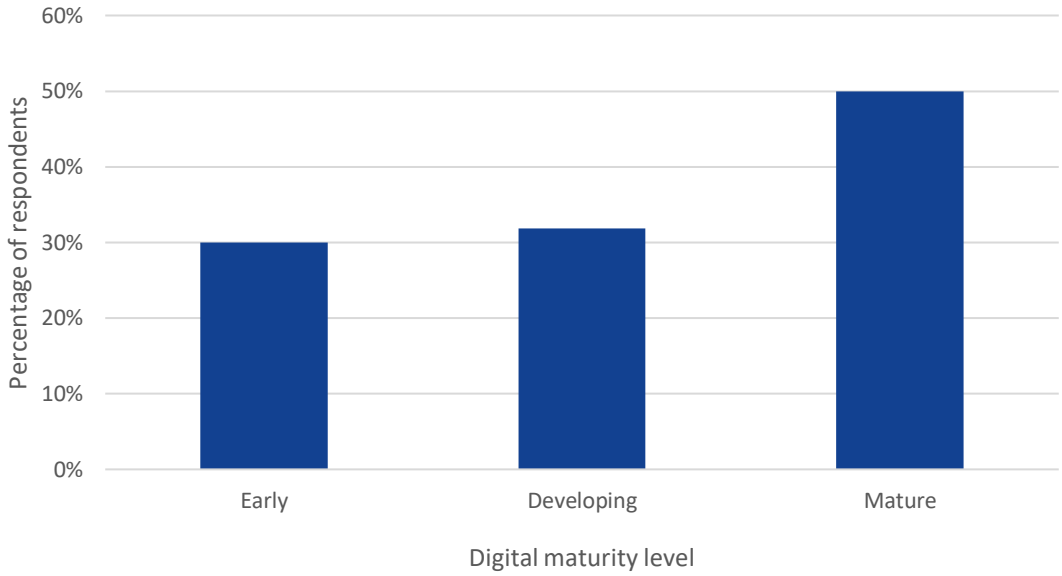

Figure 13. Correlation between well-communicated digital strategy and the digital maturity level (respondents who answered "agree" or "strongly agree")

As for organizational and cultural factors, the theoretical framework presents strong arguments that they are often the greatest barriers to success in digital transformations. In the literature review, the following were identified as the most important challenges:

- insufficient change management
- change resistance
- significant skills gap
- poor agility to learn new skills
- lack of resources and support to develop skills and capabilities
- complex and obsolete operational model
- existence of organizational silos

Again, the theoretical framework's arguments are proved valid. Insufficient support of change in the organization is perceived as one of the most significant threats to success by the respondents. While the results of the survey don't directly implicate change resistance, it can still be considered relevant as it is a direct by-product of poor change management. Additionally, change management was also identified as one of the most important mitigating actions as the probability of success can be greatly improved with a well-led transformation program. Lack of skills was highly emphasized by the theoretical framework, but the respondents don't see it as such a critical issue. For example, technical skills were considered the least important factor for success in digital transformations. However, this does not directly mean that skills (even technical ones) are not important in the respondents' organizations. A more in-depth analysis of the data on the

digital skills and capabilities' importance against the digital maturity level reveals that there is a strong correlation (figure 14). In fact, good digital skills and capabilities of the workforce and leadership, as well as the opportunities to learn new skills are directly proportional with the digital maturity indicating that digital capabilities are absolutely key in digitalization.

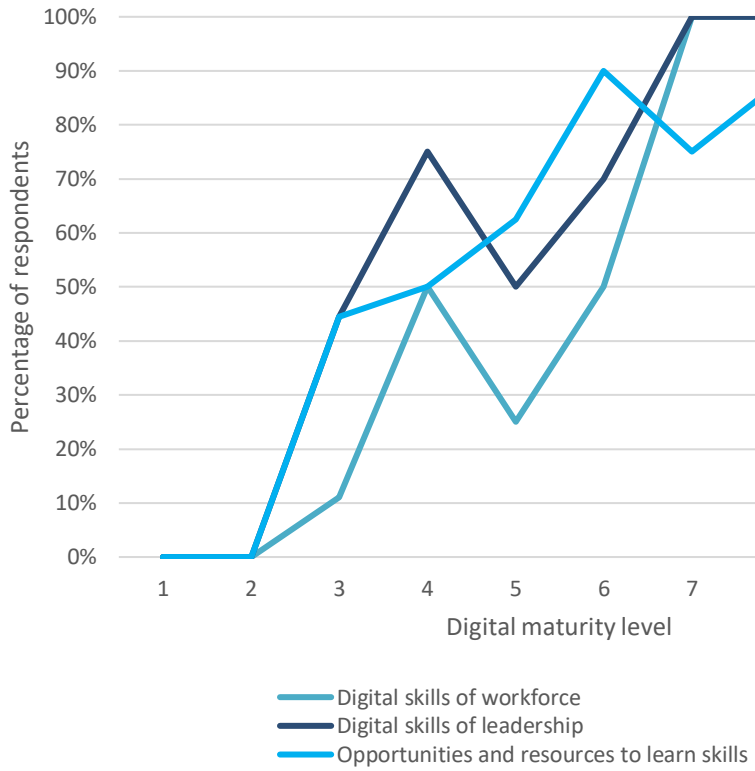

Figure 14. Correlation between digital skills and capabilities as well as opportunities to learn new skills and the digital maturity level (respondents who answered "agree" or "strongly agree")

As part of the organizational challenges, complex organizational structure, operational models and lack of agility were identified as a considerable threat. CFOs want to become even more agile in the future, as most identify their current agility as low or intermediate. Agility is especially required in cases where digital transformations span across multiple service lines, corporate functions and teams, as they often do. Not only is this a question of organizational structure and governance but also leadership.

Technology is very often thought of as the main reason why digital transformations fail. The theory presented strong evidence against this, but there are still several technology related challenges that heavily influence the success of digitalization projects. For the technology and process challenges, the following were identified as the key challenges:

- increasing system architecture complexity
- system integration requirements
- decentralization
- increasing process complexity
- security threats

The results show that these are clearly the least important factors to the success of digital transformations when comparing against management and leadership or organizational and cultural factors. They are still essential to address in implementation projects – the realization of a security threat can collapse nearly any company – but they are relatively easy to mitigate. For example, the integration capabilities of systems are one of top-three technology selection criteria. What is surprising, though, is that security was often not perceived as important as the theoretical framework suggests, in fact, security was the least important selection criteria of technology and the least significant threat to digital transformation success. Process-related challenges are something that CFOs consider themselves experts in and their importance is certainly not underestimated. However, addressing different process optimization models in detail is not included in the scope of this survey which is why the results don't indicate any practical solutions. The challenges and their validity assessment are presented in table 4.

Table 4. Threats to success for digital transformations discovered in the theoretical framework and their validity assessment based on the survey results

	Threats to success (theoretical framework)	**Validity assessment (survey results)**
Management and leadership challenges	insufficient communication of digital strategy	5 (strongly valid)
	competing financial priorities	5 (strongly valid)
	lack of digital leadership	5 (strongly valid)
	lack of linking between digital vision and strategy	4 (fairly valid)
	lack of ownership of digital initiatives	3 (neutral)
	lack of IT governance	2 (fairly invalid)
	lack of mandate and leadership buy-in	1 (strongly invalid)
Technology and process challenges	increasing process complexity	4 (fairly valid)
	increasing system architecture complexity	3 (neutral)
	system integration requirements	3 (neutral)
	decentralization	3 (neutral)
	security threats	1 (strongly invalid)
Organizational and cultural challenges	insufficient change management	5 (strongly valid)
	change resistance	5 (strongly valid)
	existence of organizational silos	5 (strongly valid)
	complex and obsolete operational model	4 (fairly valid)
	significant skills gap	3 (neutral)
	poor agility to learn new skills	2 (fairly invalid)
	lack of resources and support to develop skills and capabilities	2 (fairly invalid)

As the last major element, the theoretical framework suggests that digital leadership and transformation management have a significant role in organizations' adoption of disruptive technologies. Too often, the misled assumption is that once the technology is bought and the solution is implemented by a consultant, it will instantly start creating value and paying back the investment (LaValle et al., 2011; Nadeem et al., 2018). Adoption is not a decision or action, it is the result of a series of goal-directed activities that strengthen the desired behavior.

The theoretical framework presented strong arguments that digital transformations change organizations substantially. They affect organizations horizontally, spanning across functions and teams (think integrations across functions, cross-functional development teams and strategy implementation in tandem), but also vertically from the strategic to operational level (think communicating the digital strategy, engaging implementation projects at grass-root level and enforcing target behavior on operational level). This means that the leadership must be able to manage both directions in digital transformations.

Analyzing the results shows that this type of digital leadership is not a role many CFOs have fully adopted yet. Its importance is often downplayed, yet most of the identified threats and challenges are direct root causes of poor digital leadership. For example, lack of digital vision, poor communication and even competing financial priorities can be traced to leadership. The results show that leadership involvement is good – although it must be considered that the sample may be biased as the respondents are not likely to implicate themselves – but that is not equivalent to being a digital leader (as the results also show). A digital leader is the vanguard, visionary and trailblazer who lays out the roadmap and leads the way.

The results also indicate that the digital leadership and the leaders' skillset, experience and understanding (all of which are essential to a digital leader) have a strong correlation with the digital maturity of the CFO function (see figure 15). It is arguable that in order for the CFO functions of Finnish corporations to grow their digital maturity, their leadership must also step up, learn the skills and capabilities and acquire the required knowledge and understanding to lead the transformation.

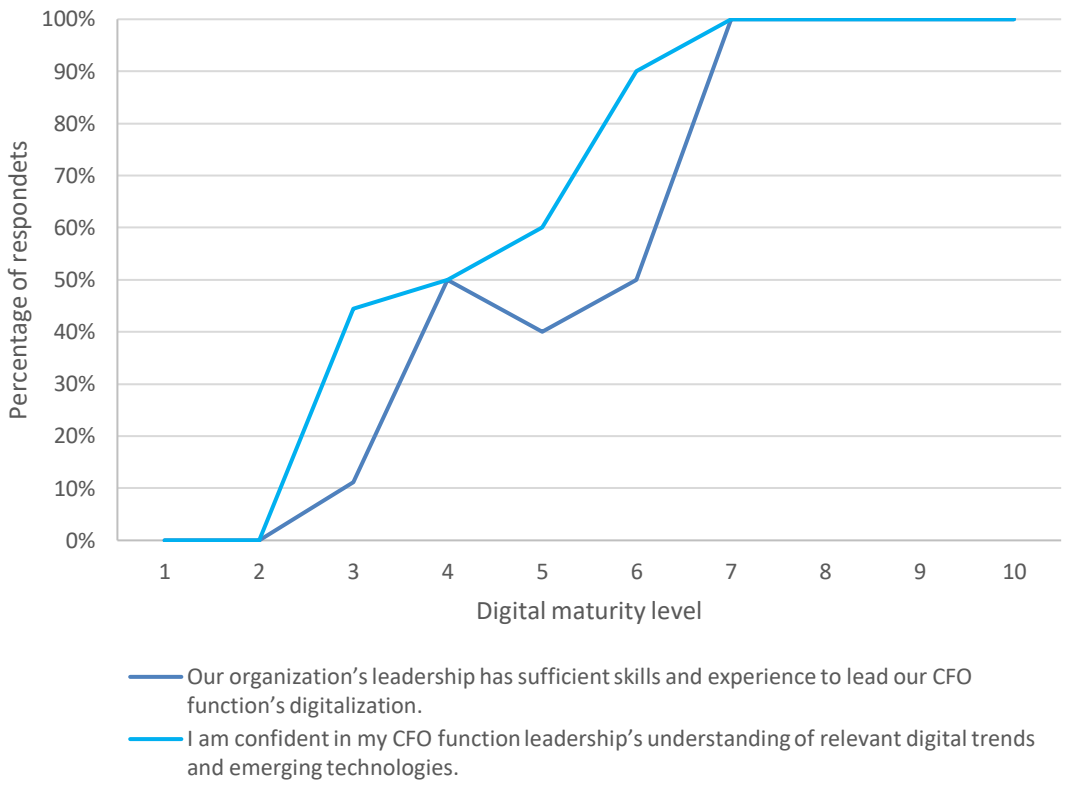

Figure 15. Correlation between leadership's skills and understanding of digitalization and the digital maturity level (respondents who answered "agree" or "strongly agree")

Digital transformations must harness the employees to execute the strategy in order to fundamentally change the modus operandi. In practice, this means that the leadership of the financial function must be involved with digitalization programs, nurture the organizational culture in the transformation process and support the change both vertically by flowing the digital agenda to the operational level but also horizontally across teams (within the CFO function) and functions (outside the CFO function). Otherwise, CFOs themselves risk becoming the greatest barriers to success of digitalization. That's why digital needs to be in the DNA of every CFO.

9. CONCLUSIONS

In this chapter, the summary of the findings made in the chapters 7 and 8 is presented. The summary also provides answers to the research questions. Additionally, quality evaluation of this research is conducted from several angles and its limitations are discussed. Finally, the recommendations and guidelines for future research in the area are provided.

9.1 Summary

The objective of this thesis is to research and provide insights of the current status of digitalization in large Finnish corporations. To better understand the context of the subject, a literature review was conducted on the theoretical framework. This was used to form a questionnaire-survey, which was validated with interviews and then conducted on a sample of financial function employees from the target group. The sample included respondents from the strategic level to the operational level from large Finnish corporations. Based on the results, an analysis was conducted. The answers to the research questions below are based on the conclusions drawn from the survey results as well as the literature review:

What is the status of digitalization in the CFO functions of Finnish corporations?

The status of digitalization in the CFO functions of Finnish corporations can best be gauged by defining the digital maturity of the organizations. Digital maturity indicates the status an organization has achieved in terms of digitalization, including the concrete progress in the areas of strategy, organization, culture, technology and management (Wolf & Strohschen, 2018). The results of this survey indicate that the CFO functions of Finnish corporations have a low to intermediate maturity. The conclusions are on par with the hypothesis based on the theoretical framework. Most CFO functions are currently on the first or second wave of digitalization, meaning that they are focusing on improving operational efficiency and quality of CFO services to other corporate stakeholders, respectively.

As a sub-category of digital maturity, technological maturity is identified as a new parameter. Technological maturity is trifold: it can be defined as the dependency of business on technological solutions, the speed of technology adoption and the level of sophistication in use cases. The technological maturity of CFO functions in the scope of this thesis is relatively low as well; especially when benchmarking against their counterparts in other European corporations. The focus of adoption is on slightly less complex technologies that are mostly filling the needs of organizations on the first wave of digitalization – technologies like robotic process automation and optical character recognition. The speed of adoption is slightly slower than the benchmark study as well and, on average, the use cases are less sophisticated. For example, most use cases of advanced

analytics in Finland can be categorized as descriptive analytics whereas on a European level, many CFO functions have adopted predictive and prescriptive analytics.

The data also shows that there is a substantial paradigm shift happening in the role of the chief financial officer; both in the literature review as well as in the survey. The CFO's responsibilities are being extended outside the financial function and they are assuming the roles of financial strategists and business partners. Also, although slowly, the CFO is claiming responsibility as a digital leader. The results indicate, that there is a clear correlation between the transforming CFO role and the digital maturity level. While correlation does not equal causation, it is arguable that the more developed the CFOs' roles are, the higher the digital maturity of the CFO functions, and vice versa. From a managerial point of view, digitalization can best be driven with a modern CFO who encourages the financial function to deliver value to business. This paradigm shift will likely become a strong driver for digital transformations in many CFO functions.

How can technological enablers improve the CFO function's performance?

The global over-arching megatrend is to completely remove human interference from financial processes to achieve greater efficiency with better delivery quality and less errors (Sher et al., 2018; Vanmali, 2017). The results from this survey indicate that most use cases for disruptive technologies in the context of Finnish corporations' CFO functions are from the first and second waves of digitalization. In practice, this means that financial functions are focusing on reducing costs and automating processes as well as expanding services with improved delivery quality. The disruptive technologies that are best adopted across the sample are robotic process automation and advanced analytics, followed by big data, machine learning and artificial intelligence. The results show that these are considered technologies with the most profitable use cases as there are lots of low-hanging fruits to be collected with substantial benefits and exploitation potential. They are also fairly quick to implement, provide a short lead time for ROI and support building a firm digital foundation which is why many have prioritized their implementation.

The most important benefits of disruptive technologies in the CFO function are related to process improvements and improved delivery quality. The least important benefits, however, are related to gaining strategic advantage. These findings match exactly those made in the theoretical framework. Similarly, the respondents identify increased operational efficiency and cost reductions as the most tangible benefits and revenue and profit as the least tangible. The results indicate, that by employing disruptive technologies, CFO functions can automate a significant part of their routine tasks (of which there are a lot in such a process-oriented function) thus reducing costs and improving process efficiency. They can also improve data quality and transparency dramatically which further supports the implementation of other, more complex solutions. Based on these findings, it is arguable that we can expect the implementation of digital transformations to only accelerate in the future as the results indicate that many technologies have been able to prove their potential in CFO functions of Finnish corporations.

From a managerial point of view, disruptive technologies can offer tremendous improvements in operational efficiency and in improving delivery quality. CFO functions focusing on solving these types of issues should assess the potential for process automation and analytics. However, none of the true potential can be achieved without sufficient investments in getting the digital foundation in order – i.e. an integrated system architecture with high quality data and aligned business processes. While the upfront implementation costs may seem high, the survey results show that their lifetime value is still manifold.

How can organizational and cultural factors enable digital transformation in the CFO function?

The theoretical framework argues that organizational and cultural factors are often the most significant in ensuring the success of digital transformations (Kane, Palmer, Phillips, Kiron, et al., 2015; LaValle et al., 2011; Nadeem et al., 2018). The findings from the survey confirm this hypothesis. The most important challenges in management and leadership in the context of digital transformations are too many financial priorities for the CFO leadership, insufficient communication of the digital strategy and lack of digital leadership. For example, the results also show that there is a clear correlation between the communication of digital strategy and the organizations' digital maturity levels. However, the digital strategy should be in place to provide a roadmap for the entire organization, not just for the leadership, hence its sufficient communication is paramount. Additionally, Finnish CFOs, on average, are yet to assume the role of a true digital leader. The results also indicate that there is a clear correlation with the understanding of digitalization, digital skills and capabilities and experience of digital leaders and the digital maturity level. A skillful, self-invested digital CFO can dramatically increase the success rate of digital transformations. Both of the aforementioned challenges contribute to a poorly defined digital agenda and digital strategy thus adding more complexity to the triage of the CFO function and competing financial priorities.

In terms of organizational and cultural challenges, the most significant are insufficient change management, change resistance and the existence of organizational silos. This finding is strongly supported by the theoretical framework. For example, insufficient change management was identified by the respondents as one of the most significant threats to digital transformation success. It is arguable that adoption (the value-creating goal of digital transformations) comes only with proper change management. Change management is also the most important mitigating action to enable success of digital transformations. In general, the organizational agility is considered fairly weak in the CFO functions which contributes to the development of organizational silos. Agility is especially important in horizontal and vertical business process transformations which are considered fundamental to the success of digital transformations.

The theoretical framework also presents compelling argumentation that there is a significant skills gap with digital skills and capabilities in the CFO function, on both strategic and operational levels. While the results indicate that technical skills are often the least

important of all key success factors, there is also a clear correlation with a skilled workforce and a high digital maturity level.

9.2 Research evaluation and limitations

When evaluating the quality of research, the factors of quality can be divided into four categories: construct validity, reliability, external validity and internal validity (Yin, 2009). These four factors of quality were considered throughout the study when conducting the literature review, interviews, survey and analysis and their assessments are provided in this chapter.

Yin's construct validity describes (2009) the research operationalization. In this thesis, the construct validity was ensured by using multiple data sources. First, the literature review, that consists more than 100 different sources, explored the theoretical framework to build the framework for the survey. The validity of the survey was then confirmed in interviews with potential respondents of the sample. The data for the analysis was collected with a questionnaire-survey with an approved sample of 42. Due to the relatively small size of the population, the sample size is considered large enough to make valid conclusions and claims. There are some limitations as well. The survey could have been shared within the recipients' organizations which means that respondents were from both strategic and operational levels. The data does not indicate the background and possible bias of the respondents which had to be taken in to account in the analysis.

Reliability considers quality and repeatability of the research execution so that the reliability of the conclusions is preserved (Yin, 2009). In this thesis, the reliability was ensured with including a detailed documentation of how the research was conducted. This is done in chapter 6. Additionally, to ensure transparency, all related documentation and data are added as appendices. The data and its analysis are added in summary format to preserve the anonymity of the results. There is also a list of respondents, although it has also been anonymized. There are also some limitations to the reliability. Due to the novelty of the area of research, there is little academic research available. Most research focused on CFO digitalization is commercial or partially commercial. However, this was considered in the theoretical framework and this type of research was only used after a meticulous reliability and validity assessment.

External validity assesses the generalizability of the results (Yin, 2009). In terms of this thesis, the generalizability is relatively good as the survey sample is a substantial part of the population. The sample represents multiple industries, corporations with revenue from the entire spectrum within the limitations and multiple teams within the financial functions. Also, the results are mostly comparable against multiple existing research which opens avenues for benchmarking studies. However, there is no academic research from Finland or Nordics on the topic, which is why the assessment of external validity relies on the synthesis of findings from multiple research.

Internal validity refers to establishment of non-spurious causal relationships (Yin, 2009). In practice, the criticism is directed to the unavoidable subjectivity of the conclusions made by the researcher. The researcher must always do decisions that may, in some case, affect the validity of the research. The internal validity was ensured by addressing all possible viewpoints in the theoretical framework and analysis, and collection of findings in MECE-lists.

To conclude, all corporations are different and there aren't identical organizations of the exact same parameters with uniform behavioral models. Therefore, the data can only be analyzed to a certain point and the findings can only be generalized so far. The population size in Finland is relatively small so the analyses will always include drawing conclusions from quite a small amount of data. However, the ulterior motive of this research is to also remove speculation by supplying numbers to a previously unresearched area and to provide more information of how the CFO function is making use of disruptive technologies in practice. This thesis succeeded well in this by removing speculation with reliable data. Among others, this thesis benefits the scientific community by providing novel, academic research in the area from Finland but also in a Nordic context. The research is easily reproducible and can therefore be benchmarked well. The results also provide important information about the current digital maturity that can be benchmarked later on to analyze how it has developed. There are also numerous benefits for different private sector companies. Firstly, the CFO functions in the scope (and outside the scope) get improved understanding of their status and can better assess their future digitalization roadmap. This thesis familiarizes companies with several different use cases and value creation models of disruptive technologies. Finally, the benefits that this thesis has for consultancies, like Firm X, and technology vendors are obvious.

9.3 Suggestions for future research

There are multiple directions for future research that can be derived from this thesis. Firstly, there are several areas in the scope of this thesis that are yet to be studied thoroughly. As an example, there is little research available for the value creation models of disruptive technologies in the financial function which would be very beneficial for future research. Also, there are options to take deep-dives to multiple perspectives that this thesis discusses. Due to the broadness of the scope (which was selected to improve the understanding of what affects digital transformations in the CFO function), it was not possible to investigate each of the focus areas in such detail as they could be. For example, the different technologies and their applications are very interesting to the CFO function and could be addressed in a thesis of their own. There are also options to use different research strategies. While the results of this thesis are relatively well generalizable, there is clearly demand for company-specific case studies. A case study can provide in-depth analyses and specific information on company-level and thus deliver a more accurate assessment of digital maturity.

The results indicate that there is certainly a need to focus on how organizational and cultural factors affect digital transformations. There is certainly a greater need to understand the correlation between change management and organizational culture and technology adoption. Also, business process transformation, which is a significant field of study in itself, offers multiple avenues of research just within the financial function. As mentioned before, there are also options to focus on different technologies and their use cases but also on how digital leadership can enable digital transformations.

The scope of this thesis also introduces some limitations to the results. If the sample size were larger – e.g. with a focus on a larger geographic area like the Nordics – the variance in the results will decrease and the results could be analyzed more easily without the need to do such extensive bias review. However, the sample size very satisfactory for this thesis considering the size of the population. An additional suggestion is to review the roles one would like to include in the sample. This thesis included all respondents from business controllers to CFOs which meant that survey needed to be generally applicable for different roles, however, more specific knowledge could potentially be analyzed if the survey focused on a specific group.

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APPENDIX A: INTERVIEW TEMPLATE

1. What is your assessment of the length of the survey?
    a. Duration in minutes?
    b. Length in number of questions?
    c. Was the length expressed clearly in the introductory texts?
2. What is your assessment of the introductory texts?
    a. Are the incentives stated clearly?
    b. Do you think the respondents will require anonymity for their responses?
3. What is your assessment of the incentives and how do they resonate with the population?
4. Were you able to answer all questions?
    a. Do you think respondents with different profiles could answer as well?
5. Were the questions framed well?
    a. Were there questions where you would have wanted to select multiple answers instead of the limitation?
    Was it hard to make a difference between two options?
    b. Were there options that were clearly missing?
    c. What did you think about the number of different options?
    d. Did all questions have a N/A or "don't know" options, if that was applicable?
    e. Were the option scales used clearly?
    f. Were the option scales positioned correctly so that there was not weighing on the spectrum?
    g. Would you rather have answered open-ended questions?
    h. Were there questions that were too closely related to each other?
6. What did you think about the ending of the survey?
    a. Are there respondents that would like to give additional feedback?
7. What is your assessment of the three themes and topics used in this survey?
    a. Was there a specific theme that was missing?
8. Were all relevant technologies covered?
9. What is your assessment on the measurability of the survey?
    a. Does this survey remove speculation from the topics well?
10. From a technical point of view, are there some factors that should be considered during the analysis phase?
    a. Are there some biases that you identify in the target population when considering the questions in this survey?
11. How would you describe the different profiles in the target population?
    a. How willing are they to answer this survey?
    b. Are they interested in a specific aspect rather than the general coverage of the survey?
12. What kind of people and profiles should we include in the target population?
    a. Can you describe specific functions?
    b. Can you describe specific titles?
13. How would you approach the sample?
    a. Via email or telephone?
    b. What is the best time to engage the sample in order to maximize open ratio?
    c. What would you like to get in exchange for spending the (approximately) 15 minutes on the survey?
14. Anything else you would like to add?

APPENDIX B: STRUCTURE OF THE QUESTIONNAIRE

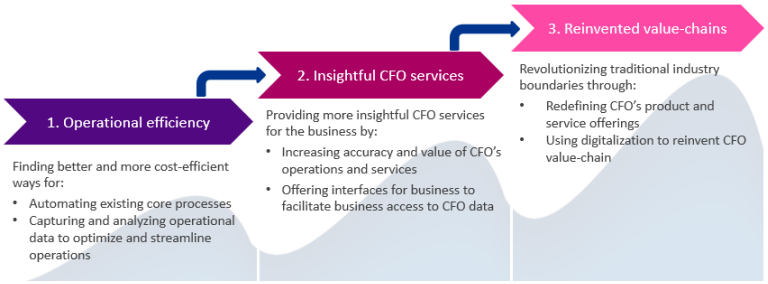
Section 1: Introduction

1. **Question**: Would you like to receive a personalized report based on your answers?
   Additional instructions: If yes, please provide your contact details at the end of this survey to receive the report.
   Required: Yes
   Format: Multiple choice
   Options:
   - Yes
   - No

Section 2: Characteristics of your organization's CFO function

2. **Question**: Imagine an ideal CFO function transformed by digital technologies and capabilities that improve processes, performance, and drive new and value-generating business models. How close is your CFO function to that ideal?
   Required: Yes
   Format: Multiple choice
   Options:
   - 1 = Not at all close"
   - 2
   - 3
   - 4
   - 5
   - 6
   - 7
   - 8
   - 9
   - 10 = "Very close"

3. **Question**: Which of the three waves of digitalization best describes your organization's current digitalization efforts?
   Additional instructions:



   Required: Yes
   Format: Multiple choice
   Options:
   - 1st wave: Optimizing operational efficiency in CFO function
   - 2nd wave: Improving financial insight provided for business
   - 3rd wave: Reinventing CFO value-chains & offerings

4. **Question**: How does your organization invest the available time and effort between running core CFO-processes and CFO's value-added services?
   Additional instructions:
   Examples:
   Core processes: external reporting, bookkeeping etc.
   Value-added services: cost accounting, financial forecasting, investment calculations etc.
   Required: Yes
   Format: Multiple choice
   Options:
   - 1 = "Mostly core processes"
   - 2
   - 3 = "Both in equal amount"
   - 4
   - 5 = "Mostly value-added services"

5. **Question**: Based on your assessment, which of the following elements of the CFO function will digitize first? Select one.
   Required: Yes
   Format: Multiple choice
   Options:
   - Financial accounting
   - Management accounting
   - Treasury
   - Internal audit
   - External reporting
   - Tax and legal

6. **Question**: Assess the agility of operations in your CFO function and in the ideal CFO function.
   Required: Yes
   Format: Multiple choice matrix
   Criteria: Each row must have one answer
   Column options:
   - Not at all agile
   - Not so agile
   - Somewhat agile
   - Very agile
   - Extremely agile

   Rows:
   - Current CFO function
   - Ideal CFO function

7. **Question**: The role of the CFO and the CFO function is transforming. Based on your assessment what is the current role of the CFO/CFO function in your organization?
   Additional instructions: Role 1: Responsible only for the financial function vs. Responsibility extends outside the financial function
   Required: Yes
   Format: Multiple choice
   Options:
   - 1 = “Responsible only for the financial function”
   - 2
   - 3
   - 4
   - 5 = “Responsibility extends outside the financial function”

8. **Question**: The role of the CFO and the CFO function is transforming. Based on your assessment what is the current role of the CFO/CFO function in your organization?
   Additional instructions: Role 1: Financial watchman vs. Financial strategist
   Required: Yes
   Format: Multiple choice
   Options:
   - 1 = “Financial watchman”
   - 2
   - 3
   - 4
   - 5 = “Financial strategist”

9. **Question**: The role of the CFO and the CFO function is transforming. Based on your assessment what is the current role of the CFO/CFO function in your organization?
   Additional instructions: Role 1: Business auditor vs. Business partner
   Required: Yes
   Format: Multiple choice
   Options:
   - 1 = "Business auditor"
   - 2
   - 3
   - 4
   - 5 = "Business partner"

10. **Question**: The role of the CFO and the CFO function is transforming. Based on your assessment what is the current role of the CFO/CFO function in your organization?
    Additional instructions: Role 1: Traditionalist vs. Digital leader
    Required: Yes
    Format: Multiple choice
    Options:
    - 1 = "Traditionalist"
    - 2
    - 3
    - 4
    - 5 = "Digital leader"

Section 3: Technology enabling the CFO function

11. **Question**: How important are digital technologies and capabilities to your organization?
    Required: Yes
    Format: Multiple choice matrix
    Criteria: Each row must have one answer
    Column options:
    - Not at all important
    - Not so important
    - Somewhat important
    - Very important
    - Extremely important

    Rows:
    - Today
    - Three years from today

12. **Question**: Select three (3) most important benefits of technology for your financial function.
    Required: Yes
    Format: Checklist
    Criteria: Must select three options
    Options:
    - Cost and spend reductions
    - Decreased number of employees
    - Increased process efficiency
    - More accurate estimations
    - More automated processes
    - Increased CFO function clock speed
    - Improved delivery quality
    - Improved data quality
    - Improved competitiveness
    - Improved transparency
    - Mitigated risks
    - New business opportunities
    - Improved security
    - Other (please specify) (text field)

13. **Question**: Has your organization achieved tangible results in the following areas after implementing digital technologies?
    Required: Yes
    Format: Multiple choice matrix
    Criteria: Each row must have one answer
    Column options:
    - Don’t know
    - Strongly disagree
    - Disagree
    - Neither agree nor disagree
    - Agree
    - Strongly agree

    Rows:
    - Operating costs
    - Revenue and profit
    - Operating efficiency
    - Delivery quality
    - Customer satisfaction
    - Stakeholder/shareholder satisfaction
    - Regulatory compliance
    - Security

14. **Question**: Has your organization's financial function adopted or developed a pilot with the following technologies? Please provide a use case if you have adopted or piloted.
    Required: Yes
    Format: Multiple choice matrix
    Criteria: Each row must have one answer
    Additional functionalities: Respondent is able to provide text input for each row
    Column options:
    - Don't know or not familiar with technology
    - Will not impact our business
    - Implementation within 5 years
    - Implementation within 1 year
    - Currently working to adopt/pilot
    - Already have adopted/piloted

    Rows:
    - advanced analytics (AA)
    - artificial intelligence (AI)
    - big data
    - cryptocurrencies
    - distributed ledger technology (a.k.a. blockchain)
    - machine learning (ML)
    - optical character recognition (OCR)
    - robo-advisors
    - robotic process automation (RPA)
    - smart contracts

15. **Question**: Select three (3) most important criteria when selecting a technology.
    Required: Yes
    Format: Checklist
    Criteria: Must select three options
    Options:
    - Security
    - Integration capabilities
    - Required technical skills
    - Possibility to install on-premise
    - Possibility to install on cloud
    - Performance
    - User experience
    - Vendor references
    - Life-cycle costs
    - Independence from external consultants
    - Other (please specify) (text field)

16. **Question**: Our organization's CFO function has a clearly communicated digital strategy for the future.
    Required: Yes
    Format: Multiple choice
    Options:
    - Strongly agree
    - Agree
    - Neither agree nor disagree
    - Disagree
    - Strongly disagree

Section 4: Digital transformation in the CFO function

17. **Question**: Assess the importance of the following components in realizing the value of digital transformations in the CFO function.
    Required: Yes
    Format: Multiple choice matrix
    Criteria: Each row must have one answer
    Column options:
    - Don't know
    - Not at all important
    - Not so important
    - Somewhat important
    - Very important
    - Extremely important

    Rows:
    - Digital leadership
    - IT governance
    - Technical skills
    - Management skills
    - Organizational culture
    - Change management
    - Business process transformation

18. **Question**: Select three (3) most significant threats for success in digital transformations.
    Required: Yes
    Format: Checklist
    Criteria: Must select three options
    Options:
    - Too many priorities
    - Lack of clear vision
    - Lack of digital strategy
    - Lack of business case
    - Security concerns
    - Current IT landscape
    - Lack of skills
    - Lack of digital leadership
    - Existence of organizational silos
    - Insufficient change management
    - Lack of organizational agility
    - No tolerance for risk taking
    - Current organizational culture

19. **Question**: What is your company currently doing to facilitate the digital transformation in your CFO function?
    Required: Yes
    Format: Multiple choice matrix
    Criteria: Each row must have one answer
    Column options:
    - Don’t know
    - Strongly disagree
    - Disagree
    - Neither agree nor disagree
    - Agree
    - Strongly agree

    Rows:
    - Process improvements
    - Business model transformation
    - Employee training
    - Talent recruitment
    - Improve innovation capabilities
    - Invest in emerging technologies

20. **Question**: Our leadership is involved in the digitalization efforts, initiatives and programs.
    Required: Yes
    Format: Multiple choice
    Options:
    - Strongly agree
    - Agree
    - Neither agree nor disagree
    - Disagree
    - Strongly disagree

21. **Question**: Who is the primary owner of digitalization initiatives in your CFO function? Select the most suitable option.
    Required: Yes
    Format: Multiple choice
    Options:
    - IT department
    - Financial function
    - Center(s) of Excellence
    - Higher management
    - No one
    - Someone else, who? (text field)

22. **Question**: I am confident in my CFO function's readiness to respond to digital trends.
    Required: Yes
    Format: Multiple choice
    Options:
    - Strongly agree
    - Agree
    - Neither agree nor disagree
    - Disagree
    - Strongly disagree

23. **Question**: I am confident in my CFO function leadership's understanding of relevant digital trends and emerging technologies.
    Required: Yes
    Format: Multiple choice
    Options:
    - Strongly agree
    - Agree
    - Neither agree nor disagree
    - Disagree
    - Strongly disagree

24. **Question**: Our organization's employees have sufficient skills and experience to execute our organization's digital strategy.
    Required: Yes
    Format: Multiple choice
    Options:
    - Strongly agree
    - Agree
    - Neither agree nor disagree
    - Disagree
    - Strongly disagree

25. **Question**: Our CFO function's performance could be improved if our employees possessed the following skills. You can choose more than one.
    Required: Yes
    Format: Checklist
    Options:
    - Ability to conceptualize new innovations
    - Willingness to experiment and take risks
    - Ability to work in distributed, digitally-savvy teams
    - Technical skills
    - Willingness to share and collaborate
    - Other (please specify) (text field)

26. **Question**: Our organization provides opportunities and resources to learn new skills related to digitalization.
    Required: Yes
    Format: Multiple choice
    Options:
    - Strongly agree
    - Agree
    - Neither agree nor disagree
    - Disagree
    - Strongly disagree

27. **Question**: Our organization's leadership has sufficient skills and experience to lead our CFO function's digitalization.
    Required: Yes
    Format: Multiple choice
    Options:
    - Strongly agree
    - Agree
    - Neither agree nor disagree
    - Disagree
    - Strongly disagree

Section 5: Contact details

28. **Question**: Name
    Required: No
    Format: Text field

29. **Question**: Company
    Required: No
    Format: Text field

30. **Question**: Job title
    Required: No
    Format: Text field

31. **Question**: Email address
    Required: No
    Format: Text field

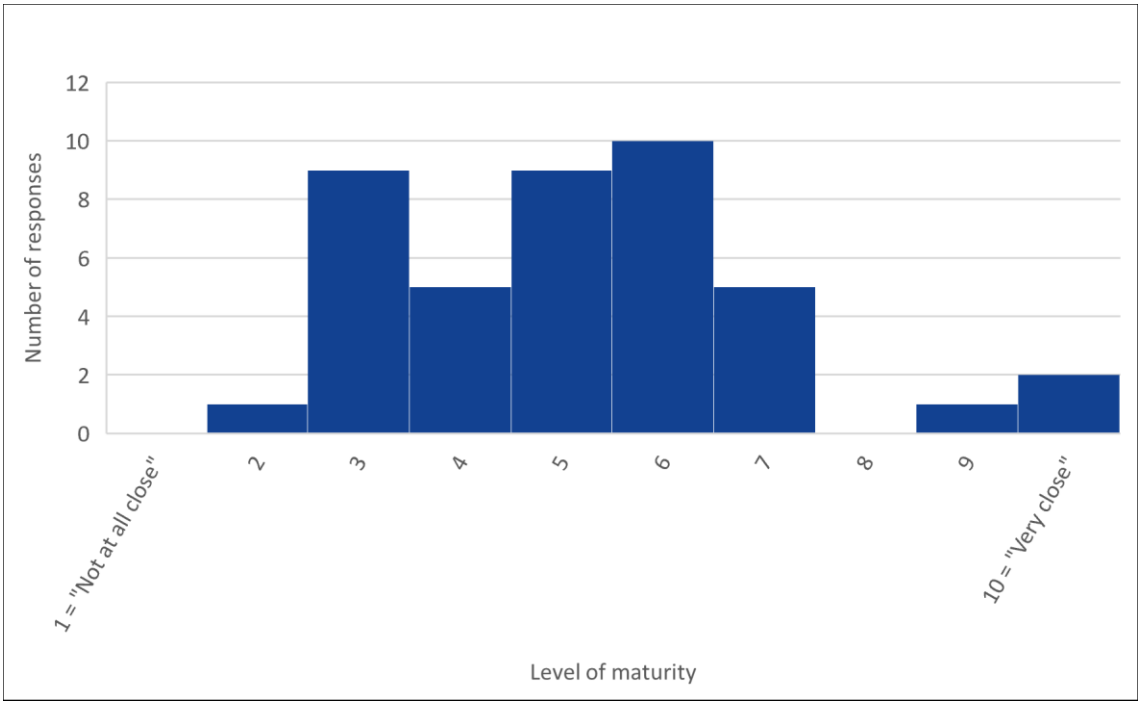
32. **Question**: I am willing to provide clarifying answers via email
    Required: No
    Format: Multiple choice
    Options:
    - Yes
    - No

33. **Question**: Any questions or feedback you would like to give?
    Additional instructions: We try to answer all queries and suggestions if possible.
    Required: No
    Format: Text field

APPENDIX C: SURVEY RESULTS

Question 2.

Imagine an ideal CFO function transformed by digital technologies and capabilities that improve processes, performance, and drive new and value-generating business models. How close is your CFO function to that ideal?



Statistical metadata

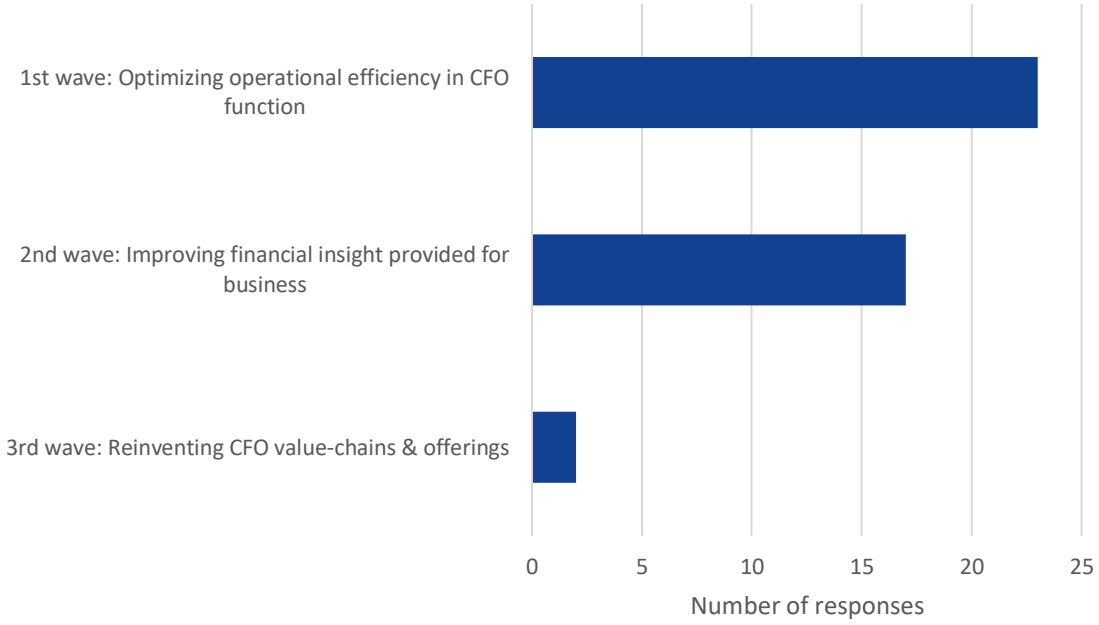
variable	value
n	42
average	5,19
mode	6
median	5

Summarized data

variable	*amount*	*percentage*
1 = "Not at all close"	0	0 %
2	1	2 %
3	9	21 %
4	5	12 %
5	9	21 %
6	10	24 %
7	5	12 %
8	0	0 %
9	1	2 %
10 = "Very close"	2	5 %

Question 3.

Which of the three waves of digitalization best describes your organization's current digitalization efforts?



Statistical metadata

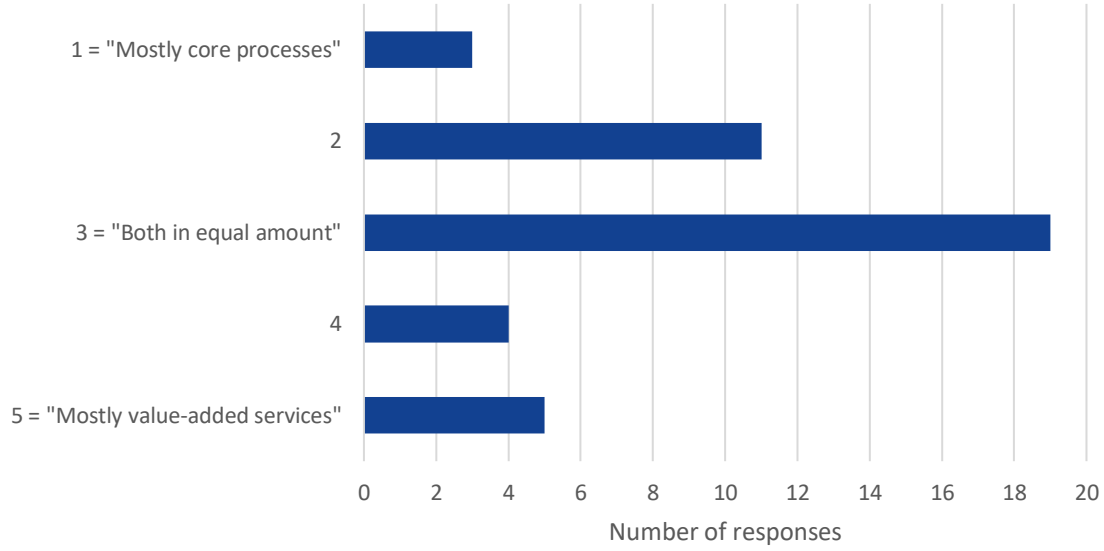
variable	value
n	42

Summarized data

variable	*amount*	*percentage*
1st wave	23	55 %
2nd wave	17	40 %
3rd wave	2	5 %

Question 4.

How does your organization invest the available time and effort between running core CFO-processes and CFO's value-added services?



Statistical metadata

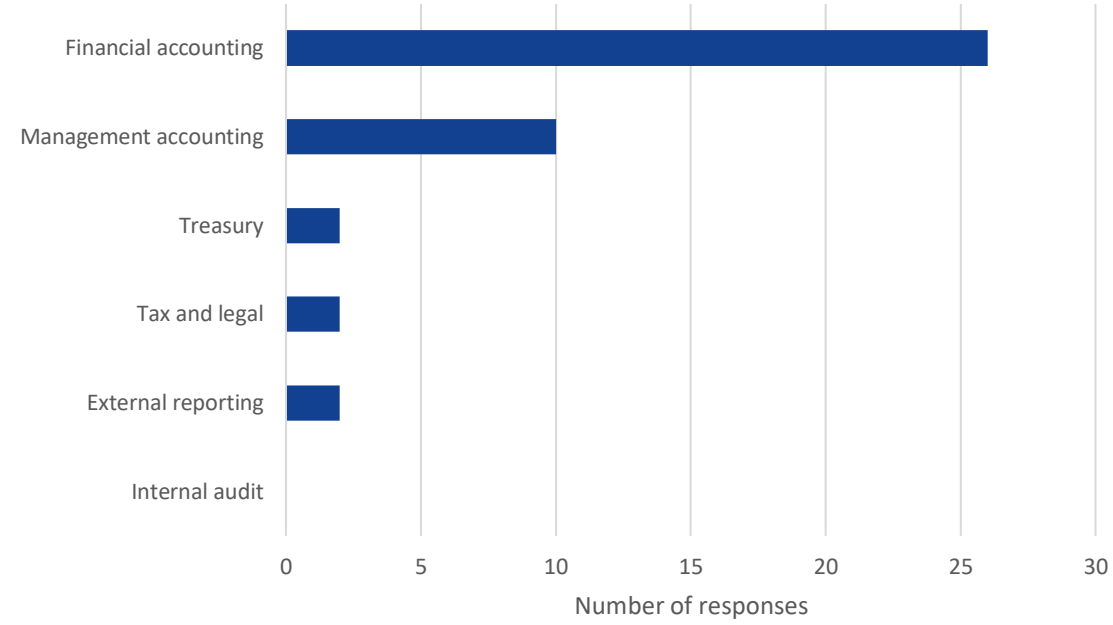
variable	value
n	42
average	2,93
mode	3
median	3

Summarized data

variable	*amount*	*percentage*
1 = "Mostly core processes"	3	7 %
2	11	26 %
3 = "Both in equal amount"	19	45 %
4	4	10 %
5 = "Mostly value-added services"	5	12 %

Question 5.

Based on your assessment, which of the following elements of the CFO function will digitize first?



Statistical metadata

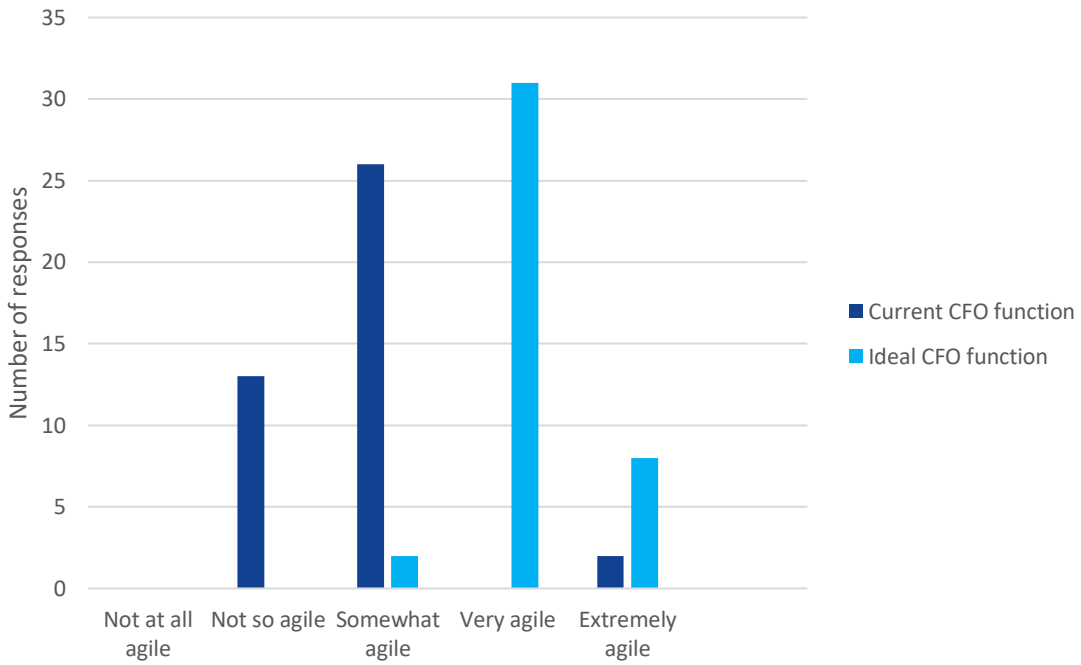
variable	value
n	42

Summarized data

variable	*amount*	*percentage*
Financial accounting	26	62 %
Management accounting	10	24 %
Treasury	2	5 %
Tax and legal	2	5 %
External reporting	2	5 %
Internal audit	0	0 %

Question 6.

Assess the agility of operations in your CFO function and in the ideal CFO function.



Statistical metadata

variable	**value**
n	41

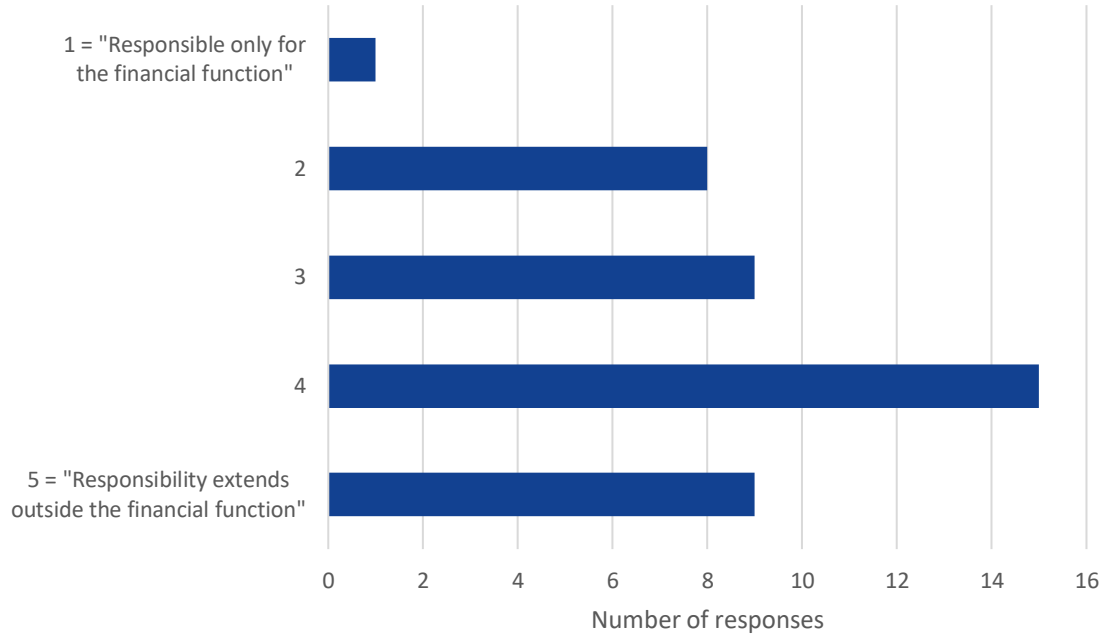
Summarized data

	Current CFO function		***Ideal CFO function***	
variable	*amount*	*percentage*	*amount*	*percentage*
Extremely agile	2	5 %	8	20 %
Very agile	0	0 %	31	76 %
Somewhat agile	26	63 %	2	5 %
Not so agile	13	32 %	0	0 %
Not at all agile	0	0 %	0	0 %

Question 7.

The role of the CFO and the CFO function is transforming. Based on your assessment, what is the current role of the CFO/CFO function in your organization?

Role 1: Responsible only for the financial function vs. Responsibility extends outside the financial function



Statistical metadata

variable	**value**
n	42
average	3,547
mode	4
median	4

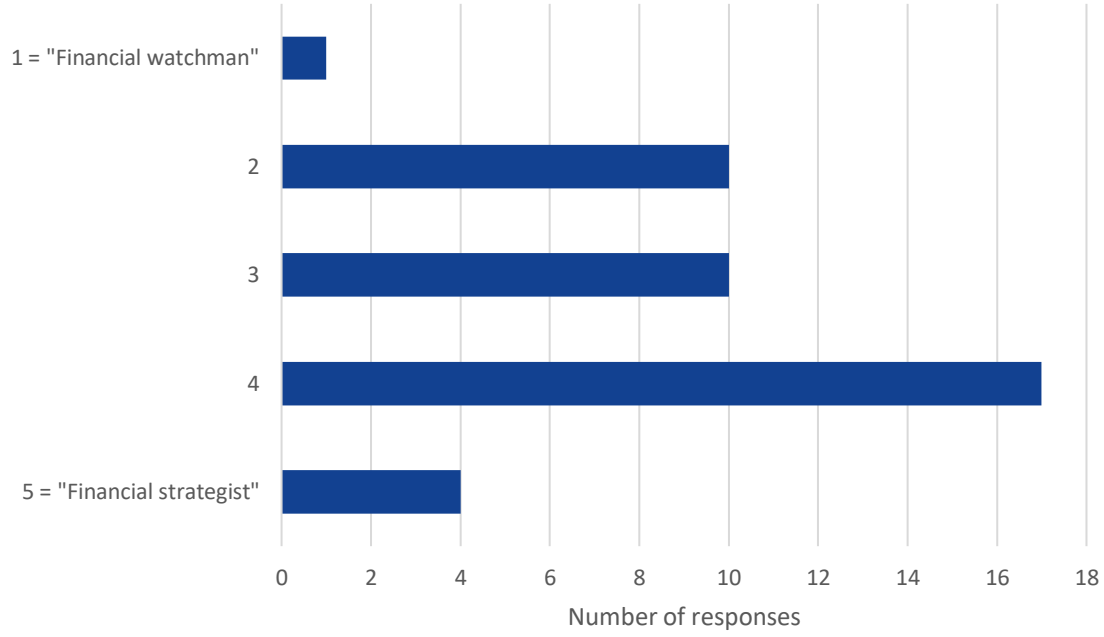
Summarized data

variable	*amount*	*percentage*
1 = "Responsible only for the financial function"	1	2 %
2	8	19 %
3	9	21 %
4	15	36 %
5 = "Responsibility extends outside the financial function"	9	21 %

Question 8.

The role of the CFO and the CFO function is transforming. Based on your assessment, what is the current role of the CFO/CFO function in your organization?

Role 2: Financial watchman vs. Financial strategist



Statistical metadata

variable	value
n	42
average	3,309
mode	4
median	3

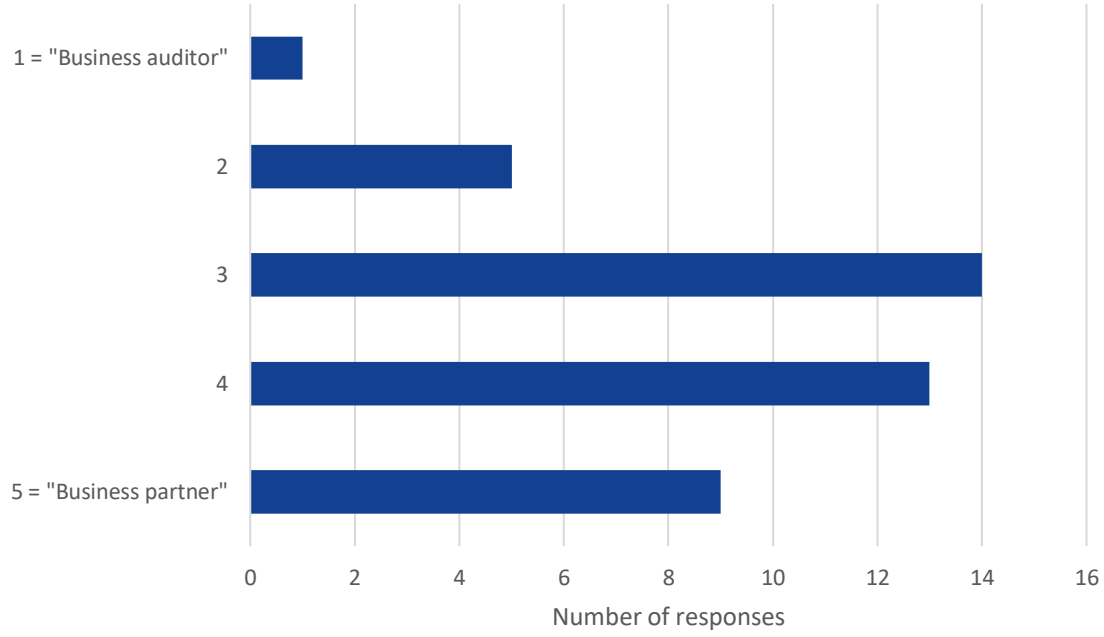
Summarized data

variable	*amount*	*percentage*
1 = "Financial watchman"	1	2 %
2	10	24 %
3	10	24 %
4	17	40 %
5 = "Financial strategist"	4	10 %

Question 9.

The role of the CFO and the CFO function is transforming. Based on your assessment, what is the current role of the CFO/CFO function in your organization?

Role 3: Business auditor vs. Business partner



Statistical metadata

variable	value
n	42
average	3,571
mode	3
median	4

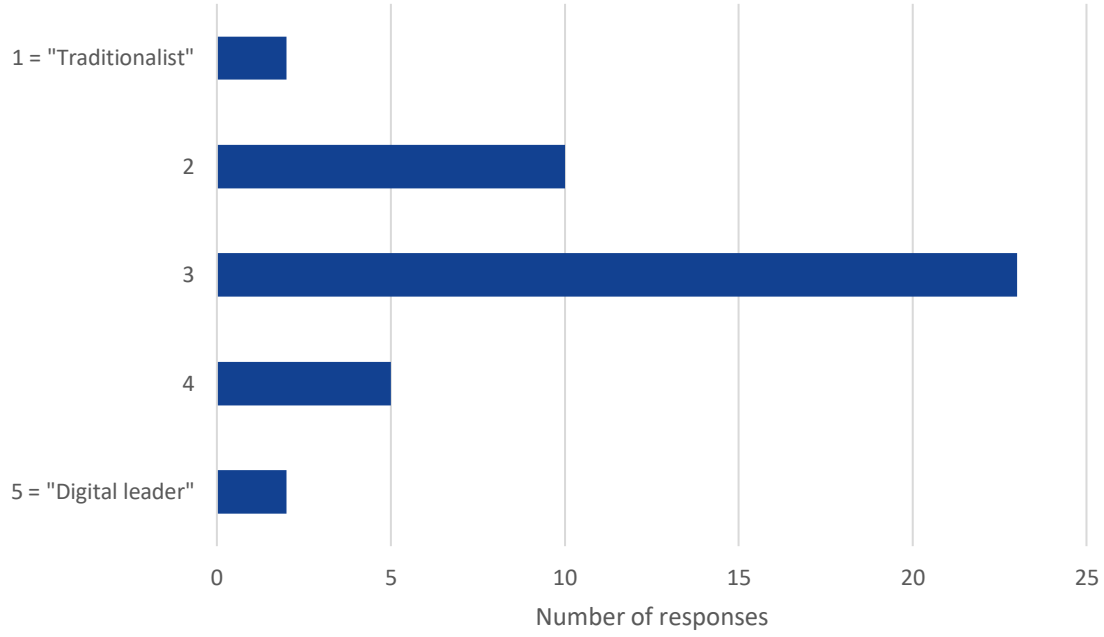
Summarized data

variable	*amount*	*percentage*
1 = "Business auditor"	1	2 %
2	5	12 %
3	14	33 %
4	13	31 %
5 = "Business partner"	9	21 %

Question 10.

The role of the CFO and the CFO function is transforming. Based on your assessment, what is the current role of the CFO/CFO function in your organization?

Role 4: Traditionalist vs. Digital leader



Statistical metadata

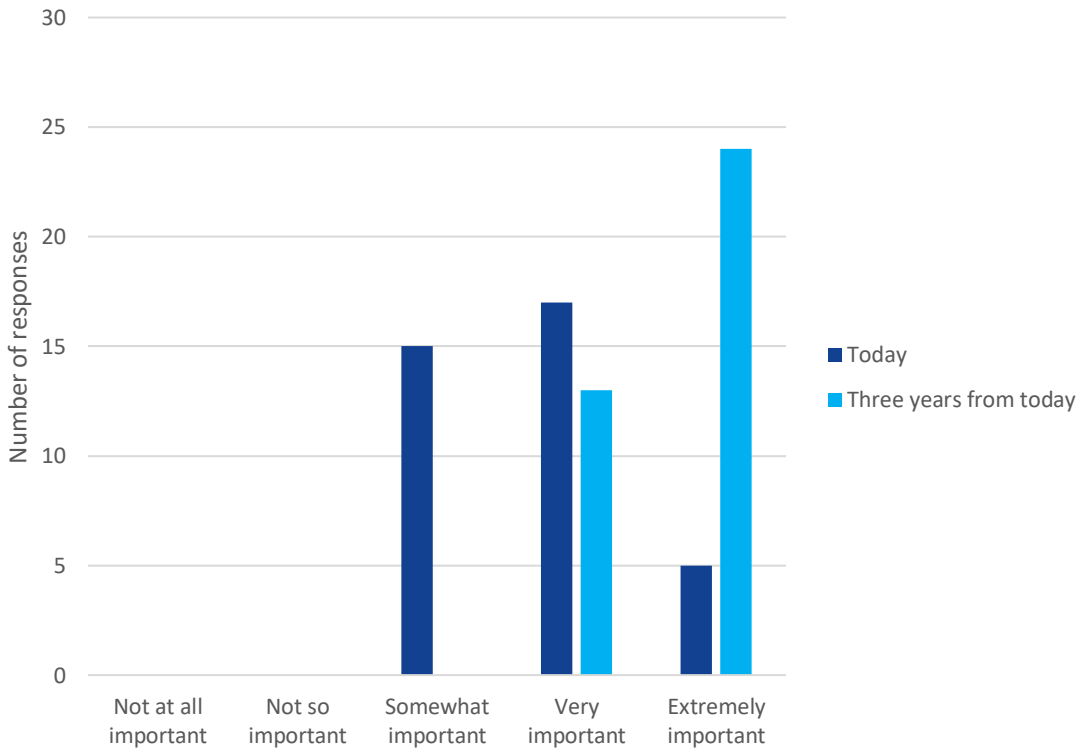
variable	value
n	42
average	2,880
mode	3
median	3

Summarized data

variable	*amount*	*percentage*
1 = "Traditionalist"	2	5 %
2	10	24 %
3	23	55 %
4	5	12 %
5 = "Digital leader"	2	5 %

Question 11.

How important are digital technologies and capabilities to your organization?



Statistical metadata

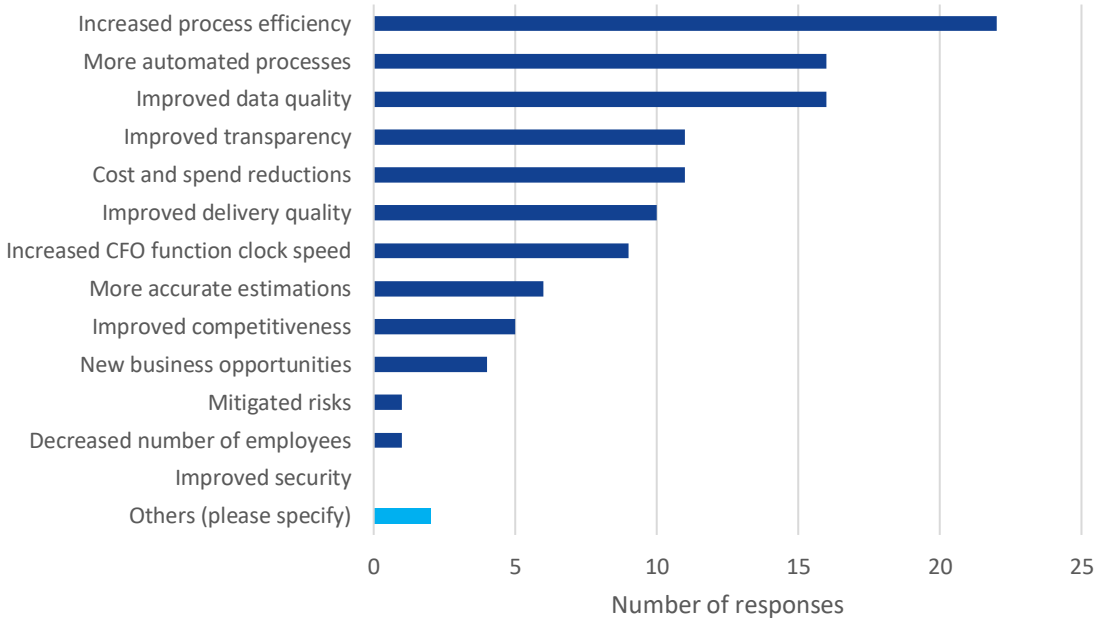
variable	**value**
n	37

Summarized data

	Today		***Three years from today***	
variable	*amount*	*percentage*	*amount*	*percentage*
Extremely important	5	14 %	24	65 %
Very important	17	46 %	13	35 %
Somewhat important	15	41 %	0	0 %
Not so important	0	0 %	0	0 %
Not at all important	0	0 %	0	0 %

Question 12.

Select three (3) most important benefits of technology for your financial function.



Statistical metadata

variable	value
n	38

Summarized data

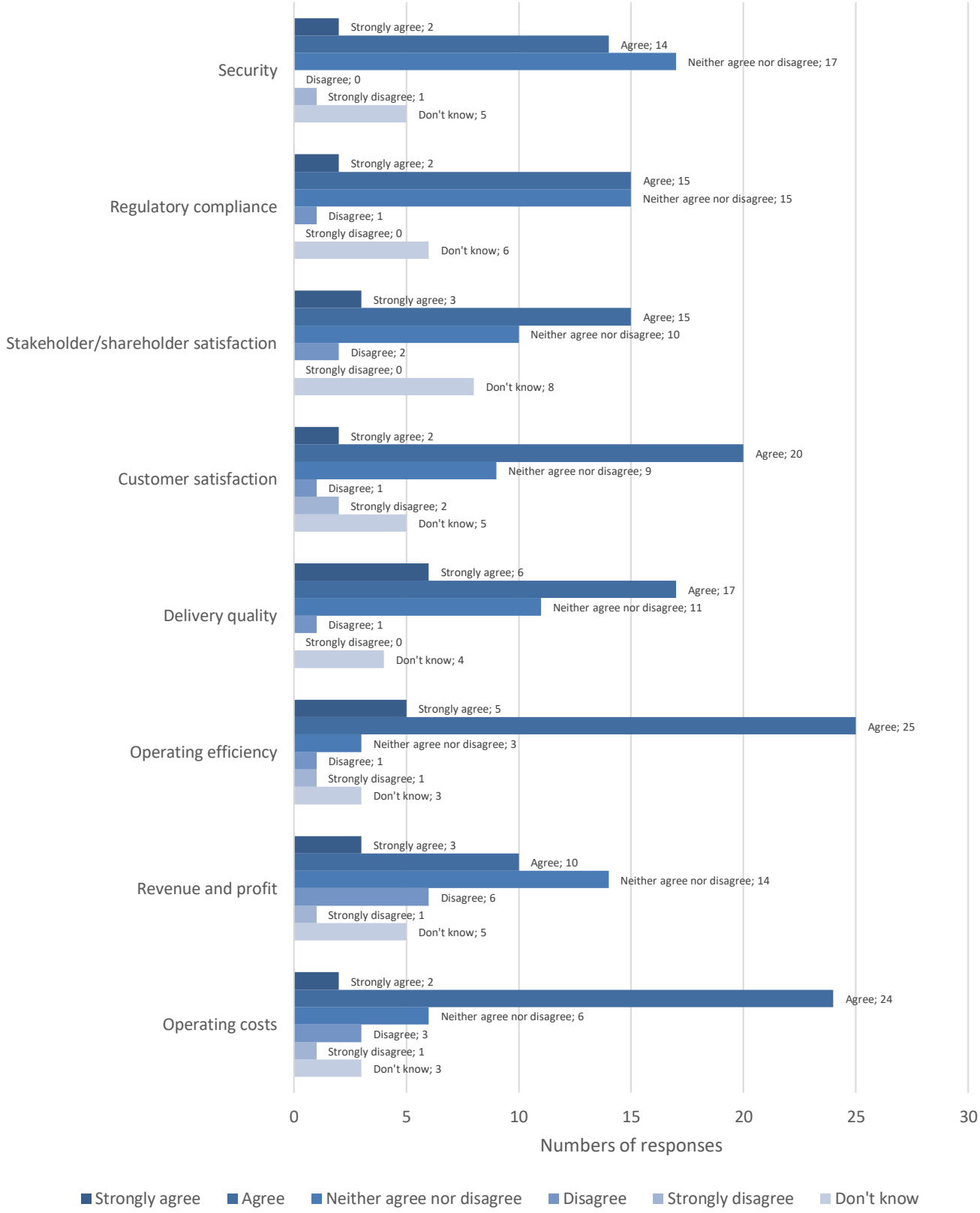
variable	*amount*	*percentage*
Increased process efficiency	22	54 %
More automated processes	16	39 %
Improved data quality	16	39 %
Improved transparency	11	27 %
Cost and spend reductions	11	27 %
Improved delivery quality	11	24 %
Increased CFO function clock speed	9	22 %
More accurate estimations	6	15 %
Improved competitiveness	5	12 %
New business opportunities	4	10 %
Decreased number of employees	1	2 %
Mitigated risks	1	2 %
Improved security	0	0 %
Others (please specify)	2	5 %

Answers to open text field questions

variable	*text field*
Others (please specify)	Ability to be more proactive than reactive to support business
Others (please specify)	Improved analysis capabilities

Question 13.

Has your organization achieved tangible results in the following areas after implementing digital technologies?



Statistical metadata

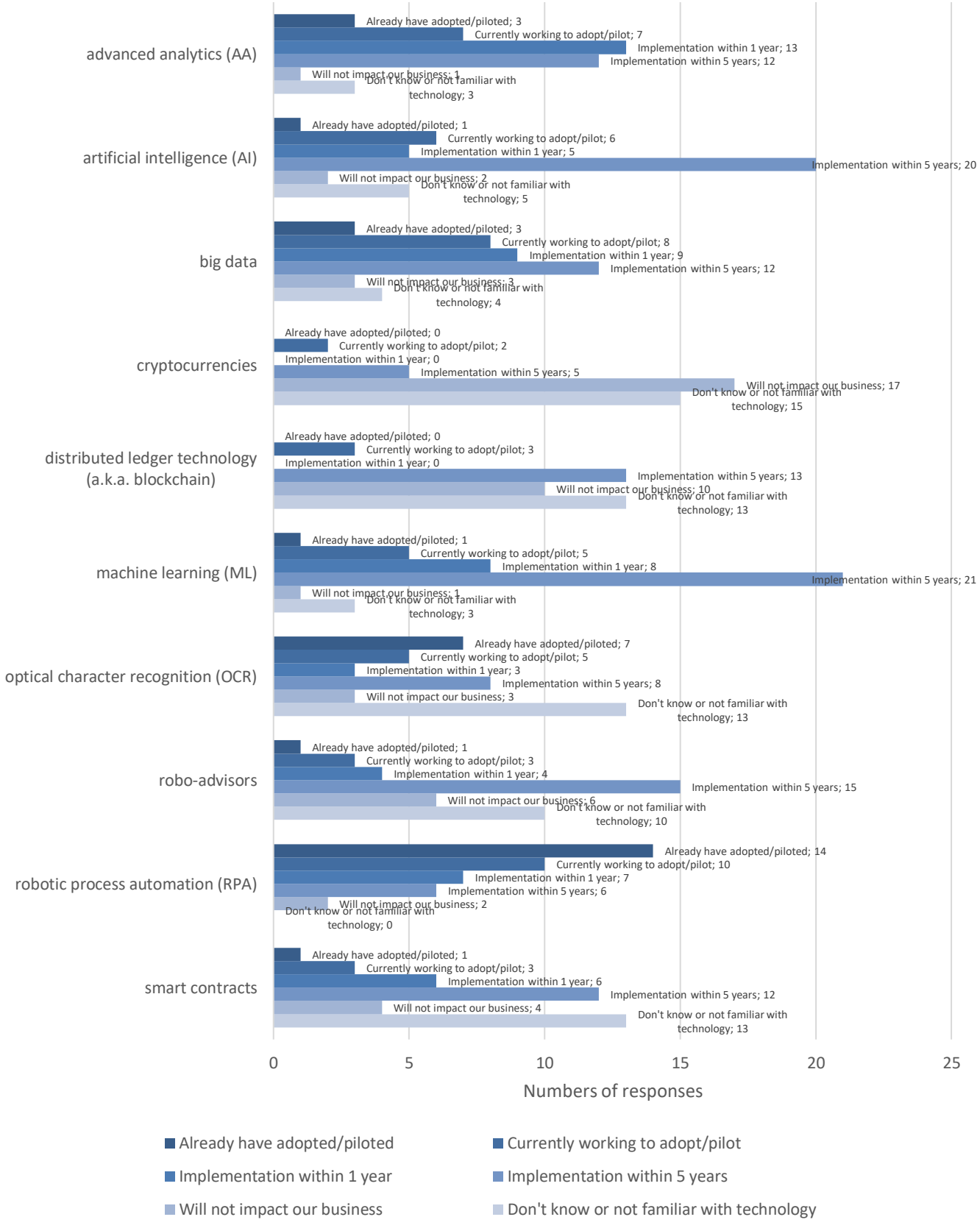
variable	value
n	39

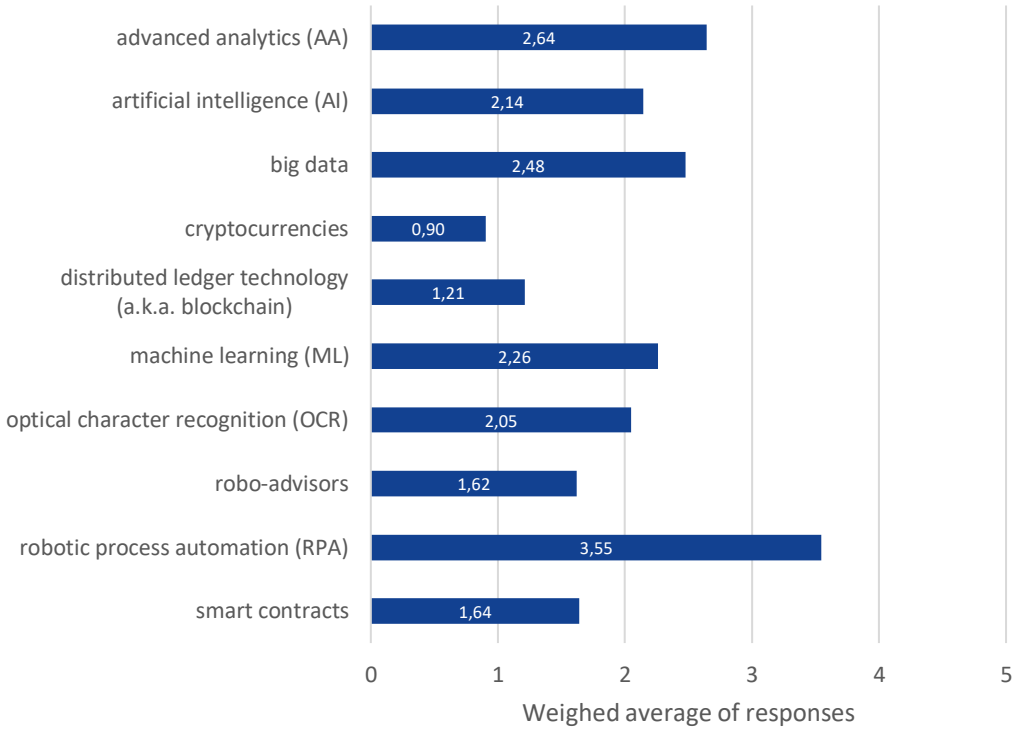
Summarized data

	amounts					
variable	Don't know	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Security	5	1	0	17	14	2
Regulatory compliance	6	0	1	15	15	2
Stakeholder/shareholder satisfaction	8	0	2	10	15	3
Customer satisfaction	5	2	1	9	20	2
Delivery quality	4	0	1	11	17	6
Operating efficiency	3	1	1	3	25	5
Revenue and profit	5	1	6	14	10	3
Operating costs	3	1	3	6	24	2

Question 14.

Has your organization's financial function adopted or developed a pilot with the following technologies? Please provide a use case if you have adopted or piloted.





Statistical metadata

variable	value
n	39

Summarized data

	amounts					
variable	Don't know or not familiar with	Will not impact our business	Implementation within 5 years	Implementation within 1 year	Currently working to adopt/pilot	Already have adopted/piloted
advanced analytics (AA)	3	1	12	13	7	3
artificial intelligence (AI)	5	2	20	5	6	1
big data	4	3	12	9	8	3
cryptocurrencies	15	17	5	0	2	0
distributed ledger technology (a.k.a. blockchain)	13	10	13	0	3	0
machine learning (ML)	3	1	21	8	5	1
optical character recognition (OCR)	13	3	8	3	5	7
robo-advisors	10	6	15	4	3	1
robotic process automation (RPA)	0	2	6	7	10	14
smart contracts	13	4	12	6	3	1

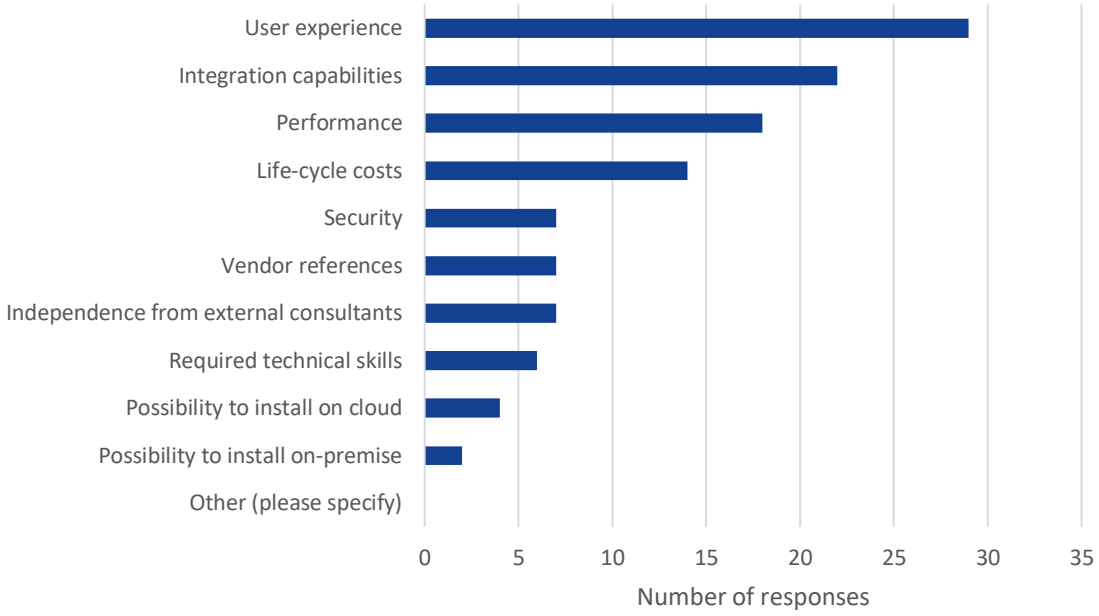
	percentages					
variable	Don't know or not familiar with technology	Will not impact our business	Implementation within 5 years	Implementation within 1 year	Currently working to adopt/pilot	Already have adopted/piloted
advanced analytics (AA)	8 %	3 %	31 %	33 %	18 %	8 %
artificial intelligence (AI)	13 %	5 %	51 %	13 %	15 %	3 %
big data	10 %	8 %	31 %	23 %	21 %	8 %
cryptocurrencies	38 %	44 %	13 %	0 %	5 %	0 %
distributed ledger technology (a.k.a. blockchain)	33 %	26 %	33 %	0 %	8 %	0 %
machine learning (ML)	8 %	3 %	54 %	21 %	13 %	3 %
optical character recognition (OCR)	33 %	8 %	21 %	8 %	13 %	18 %
robo-advisors	26 %	15 %	38 %	10 %	8 %	3 %
robotic process automation (RPA)	0 %	5 %	15 %	18 %	26 %	36 %
smart contracts	33 %	10 %	31 %	15 %	8 %	3 %

Applications of the technologies if adopted or piloted

variable	*application*
advanced analytics (AA)	pricing related
advanced analytics (AA)	regulatory reporting
advanced analytics (AA)	product-based turnover view
advanced analytics (AA)	route optimization
artificial intelligence (AI)	responding to customer queries
artificial intelligence (AI)	posting
big data	consumer insight data (not structured part)
big data	reporting, forecasting
big data	understanding customer needs
big data	medical data
distributed ledger technology (a.k.a. blockchain)	digital transactions in selected complex cases
machine learning (ML)	understanding customer needs
machine learning (ML)	software robots
optical character recognition (OCR)	RPA (UiPath) incorporates OCR, OCR used for invoicing (accounts payable processing)
optical character recognition (OCR)	purchasing invoices
optical character recognition (OCR)	communicating with customers/processing transactions
optical character recognition (OCR)	supplier invoice handling
optical character recognition (OCR)	purchase invoice management
optical character recognition (OCR)	scanning
optical character recognition (OCR)	scanning invoices
robo-advisors	chat
robo-advisors	customer interface chatbot
robo-advisors	customer service chatbot
robotic process automation (RPA)	finance, HR, procurement and 1 business are use RPA
robotic process automation (RPA)	several active RPA implementations in e.g. salary process and financial forecasting
robotic process automation (RPA)	in SSC service processes
robotic process automation (RPA)	several back-end processes
robotic process automation (RPA)	several pilots ongoing
robotic process automation (RPA)	several processes in invoicing, bookkeeping etc.
robotic process automation (RPA)	several processes
robotic process automation (RPA)	travel claims, quality control, testing
robotic process automation (RPA)	tax reporting
robotic process automation (RPA)	many cases like accruals
robotic process automation (RPA)	invoice processing
robotic process automation (RPA)	multiple small use cases
smart contracts	automating transactions
smart contracts	invoicing

Question 15.

Select three (3) most important criteria when selecting a technology.



Statistical metadata

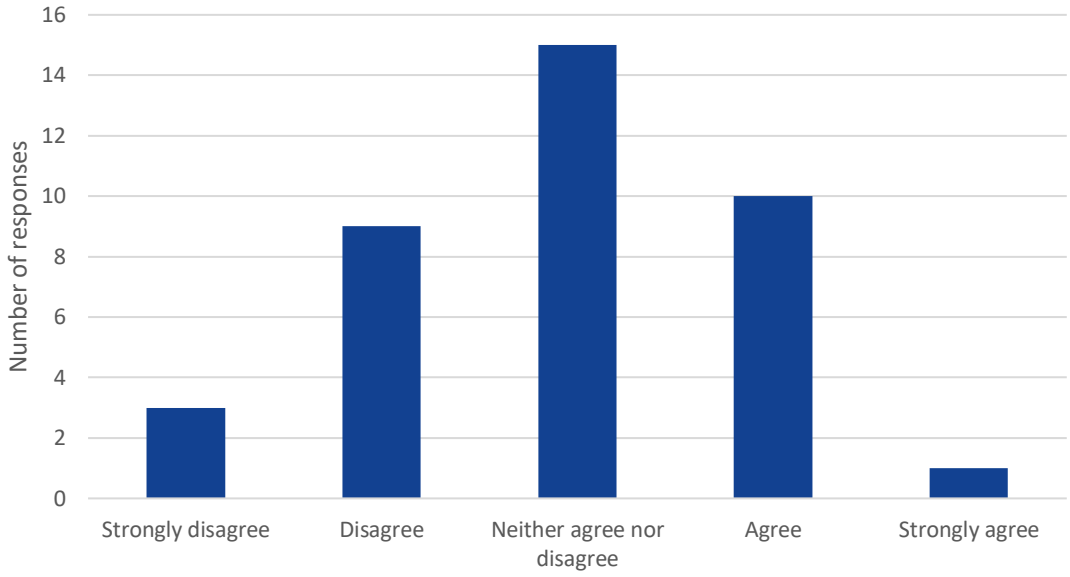
variable	value
n	39

Summarized data

variable	*amount*
User experience	29
Integration capabilities	22
Performance	18
Life-cycle costs	14
Independence from external consultants	7
Vendor references	7
Security	7
Required technical skills	6
Possibility to install on cloud	4
Possibility to install on-premise	2
Other (please specify)	0

Question 16.

Our organization's CFO function has a clearly communicated digital strategy for the future.



Statistical metadata

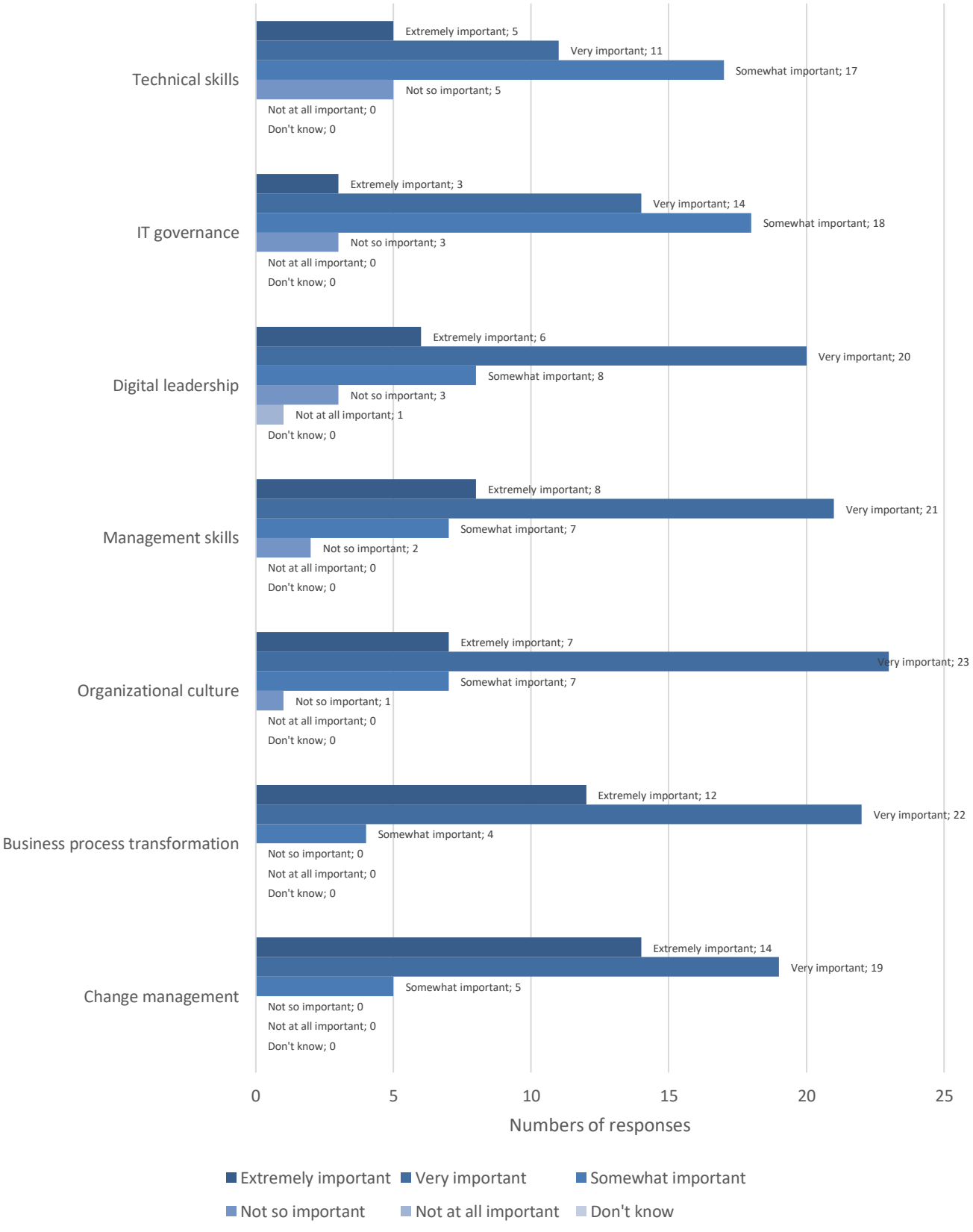
variable	value
n	38

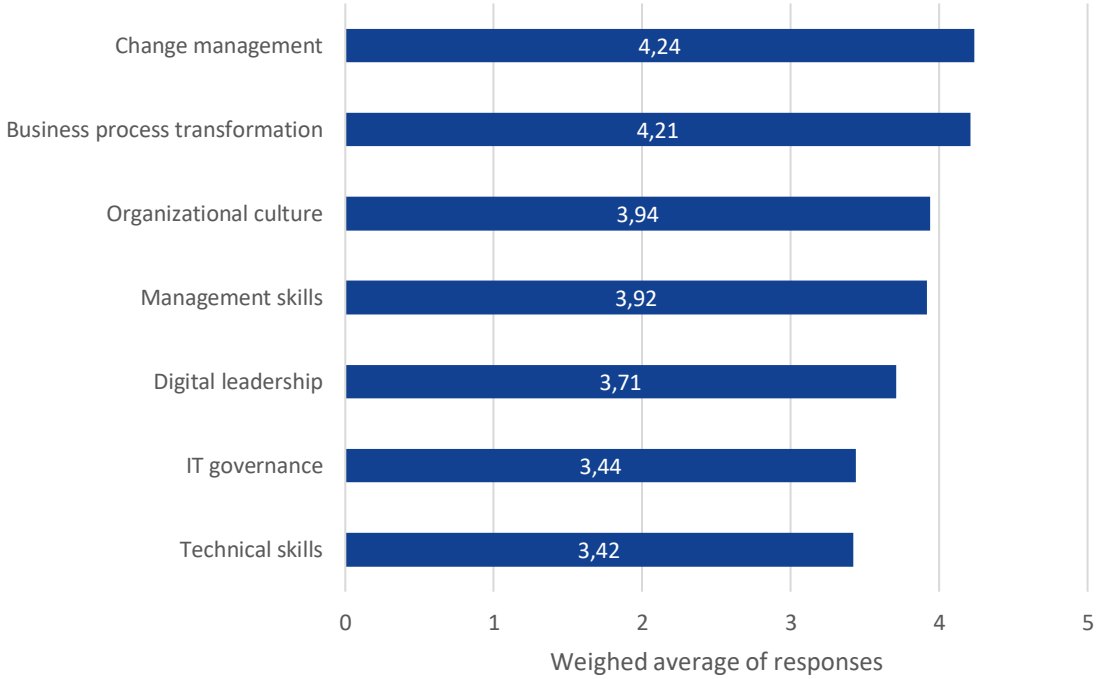
Summarized data

variable	*amount*	*percentage*
Strongly agree	1	3 %
Agree	10	26 %
Neither agree nor disagree	15	39 %
Disagree	9	24 %
Strongly disagree	3	8 %

Question 17.

Assess the importance of the following components in realizing the value of digital transformations in the CFO function.





Statistical metadata

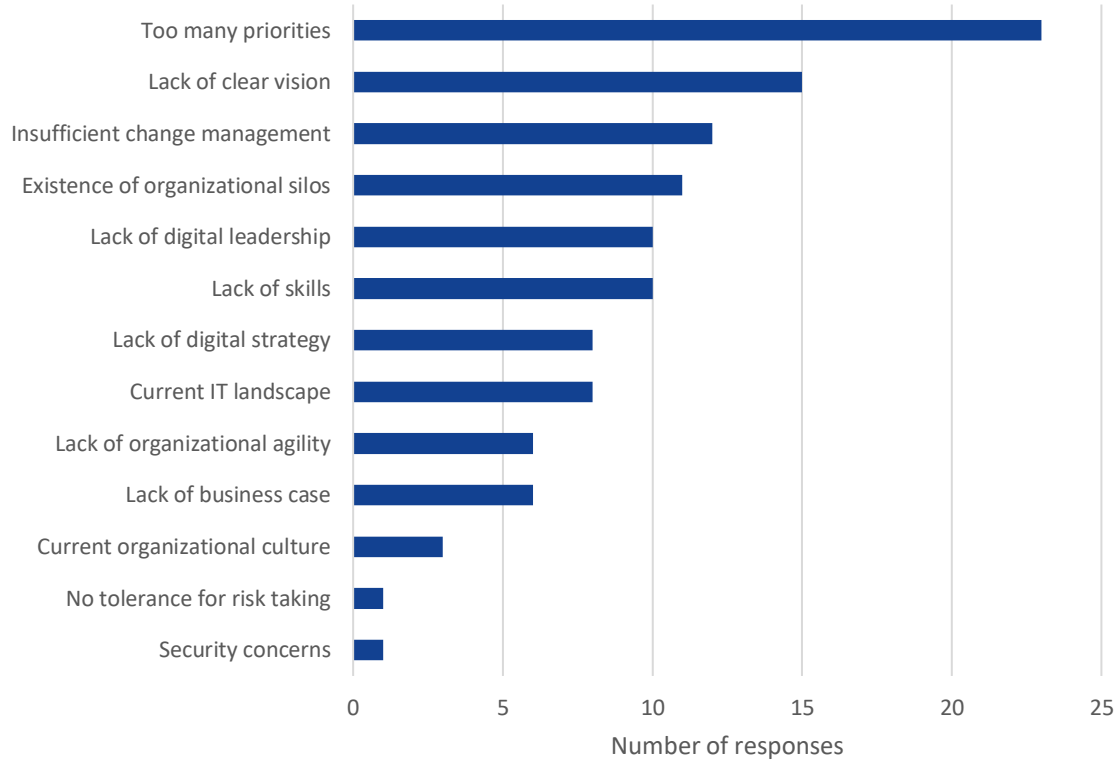
variable	value
n	38

Summarized data

	amounts					
variable	Don't know	Not at all important	Not so important	Somewhat important	Very Important	Extremely important
Change management	0	0	0	5	19	14
Business process transformation	0	0	0	4	22	12
Organizational culture	0	0	1	7	23	7
Management skills	0	0	2	7	21	8
Digital leadership	0	1	3	8	20	6
IT governance	0	0	3	18	14	3
Technical skills	0	0	5	17	11	5

Question 18.

Select three (3) most significant threats for success in digital transformations.



Statistical metadata

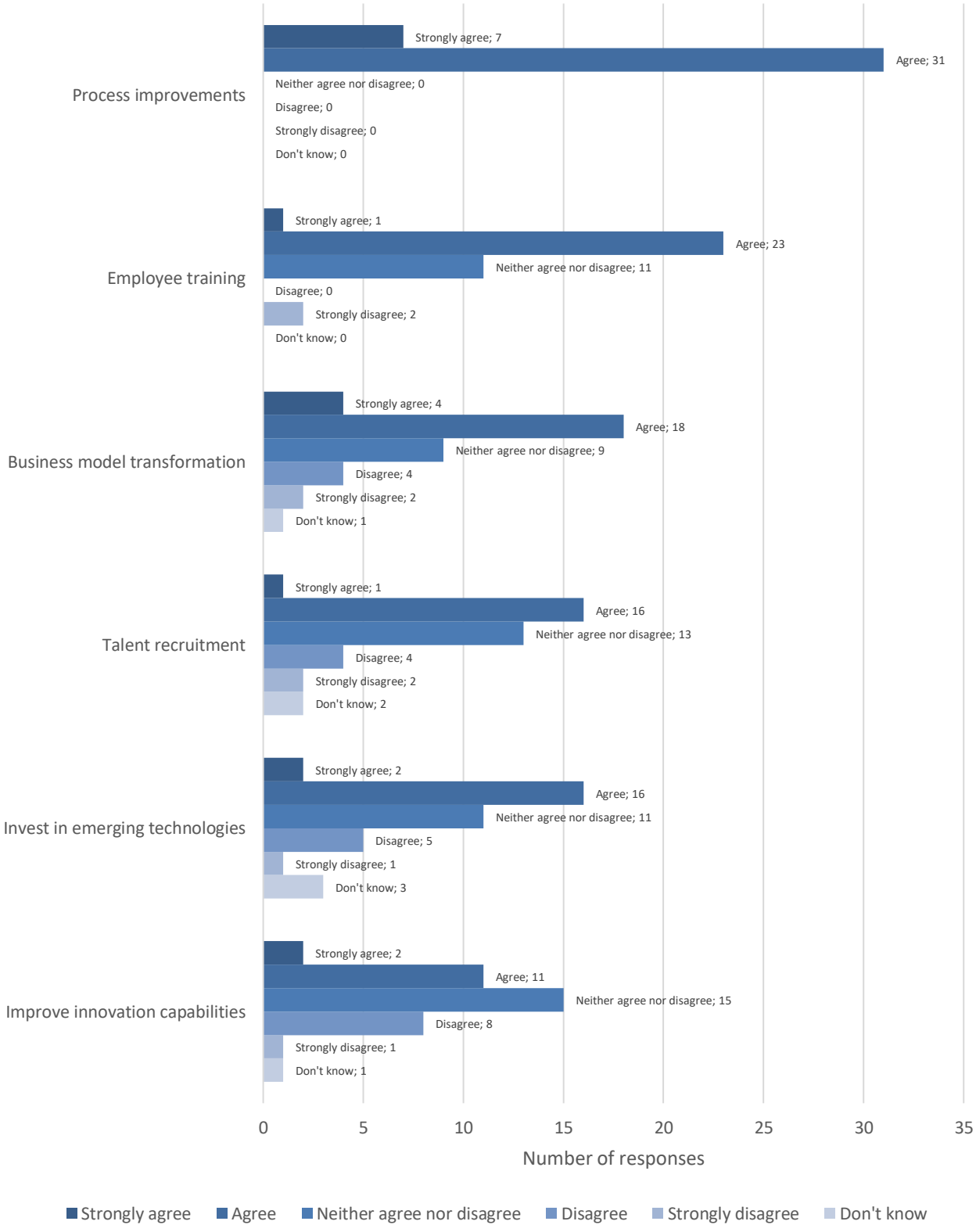
variable	value
n	38

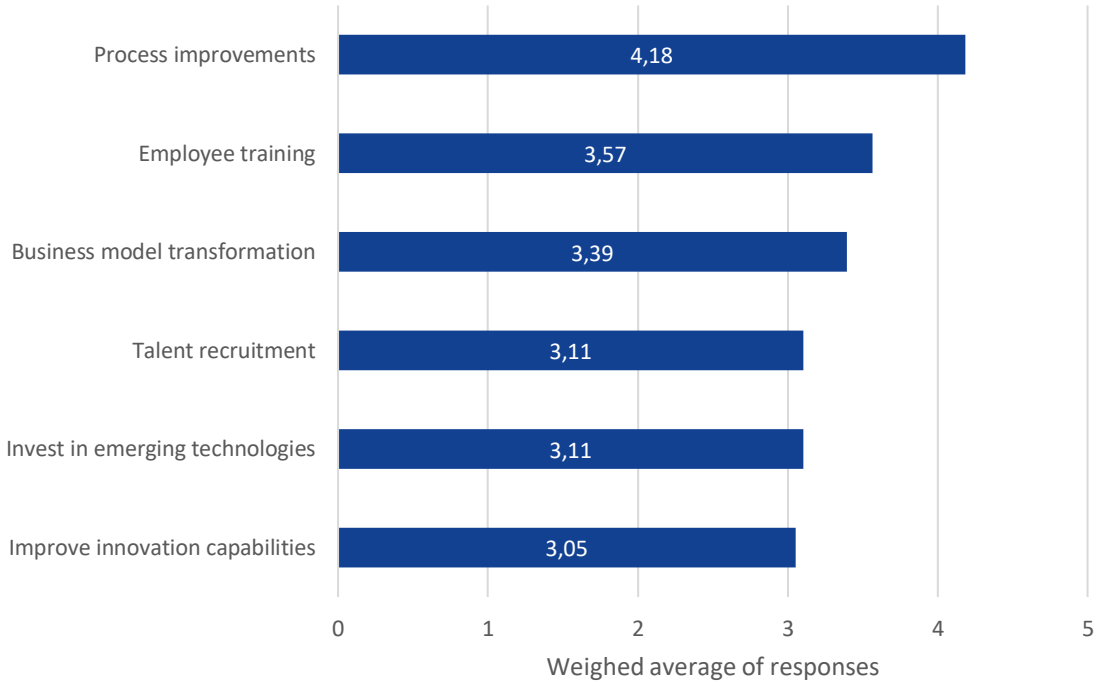
Summarized data

variable	*amount*	*percentage*
Too many priorities	23	61 %
Lack of clear vision	15	39 %
Insufficient change management	12	32 %
Existence of organizational silos	11	29 %
Lack of skills	10	26 %
Lack of digital leadership	10	26 %
Current IT landscape	8	21 %
Lack of digital strategy	8	21 %
Lack of business case	6	16 %
Lack of organizational agility	6	16 %
Current organizational culture	3	8 %
Security concerns	1	3 %
No tolerance for risk taking	1	3 %

Question 19.

What is your company currently doing to facilitate the digital transformation in your CFO function?





Statistical metadata

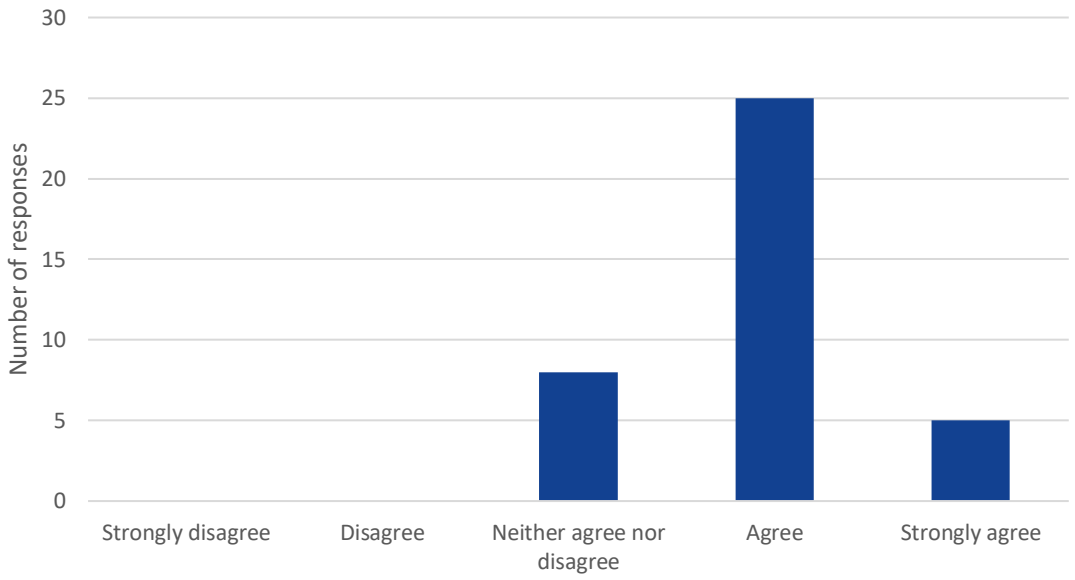
variable	value
n	38

Summarized data

	amounts					
variable	Don't know	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Process improvements	0	0	0	0	31	7
Employee training	0	2	0	11	23	1
Business model transformation	1	2	4	9	18	4
Talent recruitment	2	2	4	13	16	1
Invest in emerging technologies	3	1	5	11	16	2
Improve innovation capabilities	1	1	8	15	11	2

Question 20.

Our leadership is involved in the digitalization efforts, initiatives and programs.



Statistical metadata

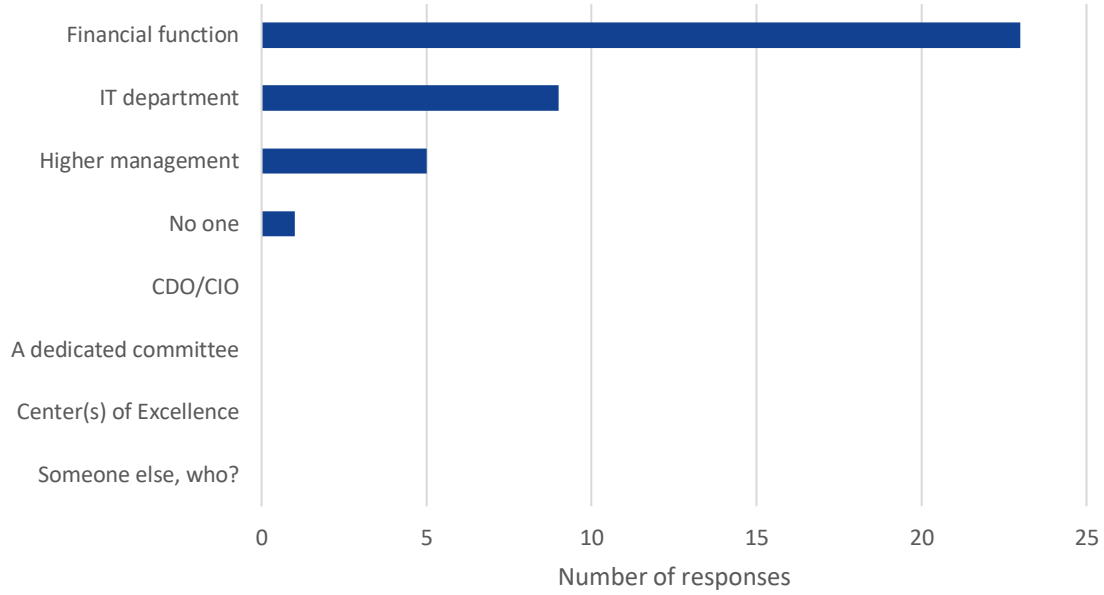
variable	value
n	38

Summarized data

variable	*amount*	*percentage*
Strongly agree	5	13 %
Agree	25	66 %
Neither agree nor disagree	8	21 %
Disagree	0	0 %
Strongly disagree	0	0 %

Question 21.

Who is the primary owner of digitalization initiatives in your CFO function? Select the most suitable option.



Statistical metadata

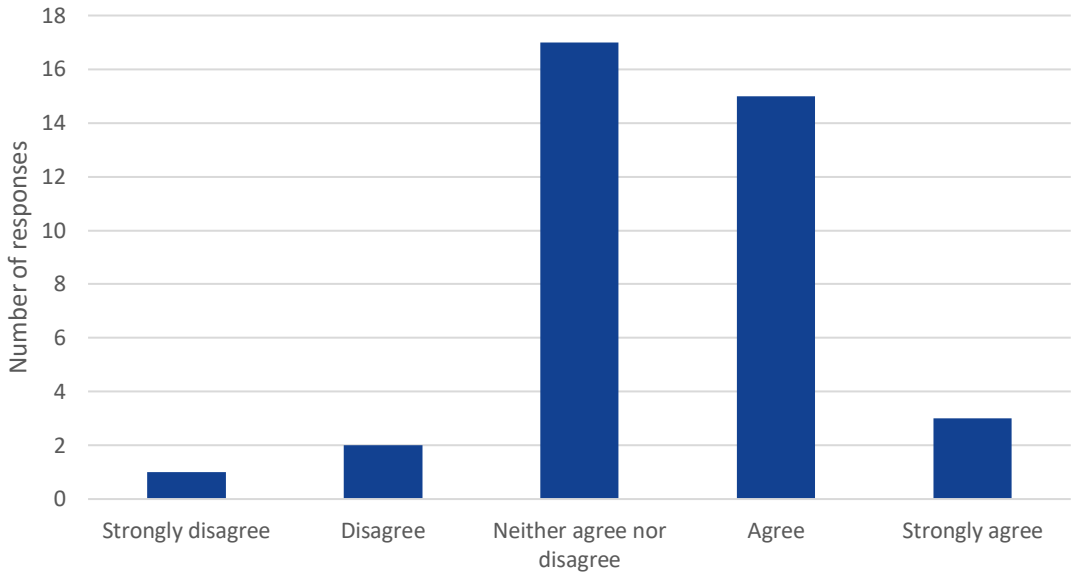
variable	value
n	38

Summarized data

variable	*amount*	*percentage*
Financial function	23	61 %
IT department	9	24 %
Higher management	5	13 %
No one	1	3 %
Someone else, who?	0	0 %
Center(s) of Excellence	0	0 %
A dedicated committee	0	0 %
CDO/CIO	0	0 %

Question 22.

I am confident in my CFO function's readiness to respond to digital trends.



Statistical metadata

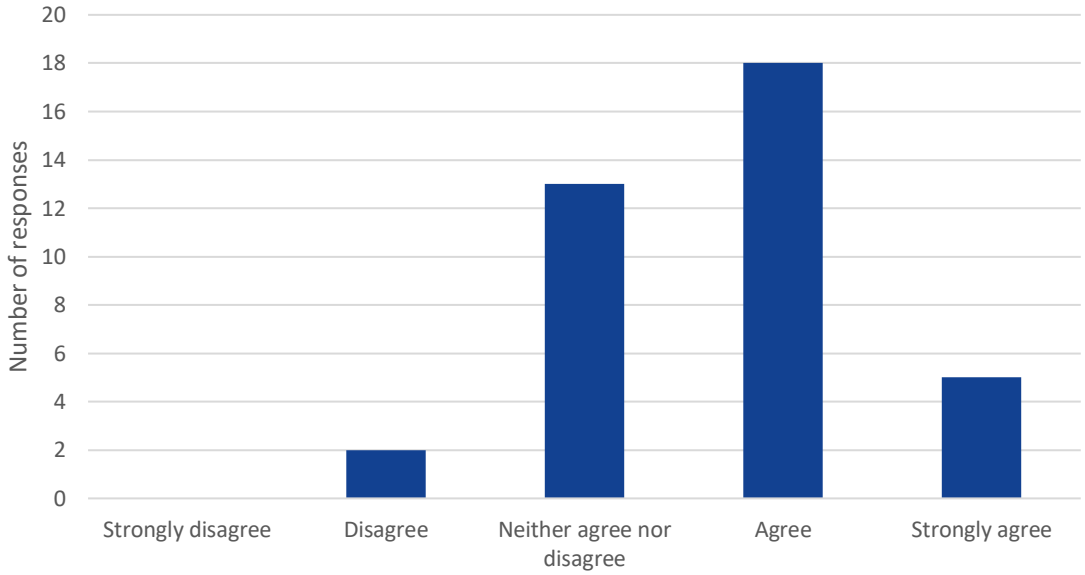
variable	value
n	38

Summarized data

variable	*amount*	*percentage*
Strongly agree	3	8 %
Agree	15	39 %
Neither agree nor disagree	17	45 %
Disagree	2	5 %
Strongly disagree	1	3 %

Question 23.

I am confident in my CFO function leadership's understanding of relevant digital trends and emerging technologies.



Statistical metadata

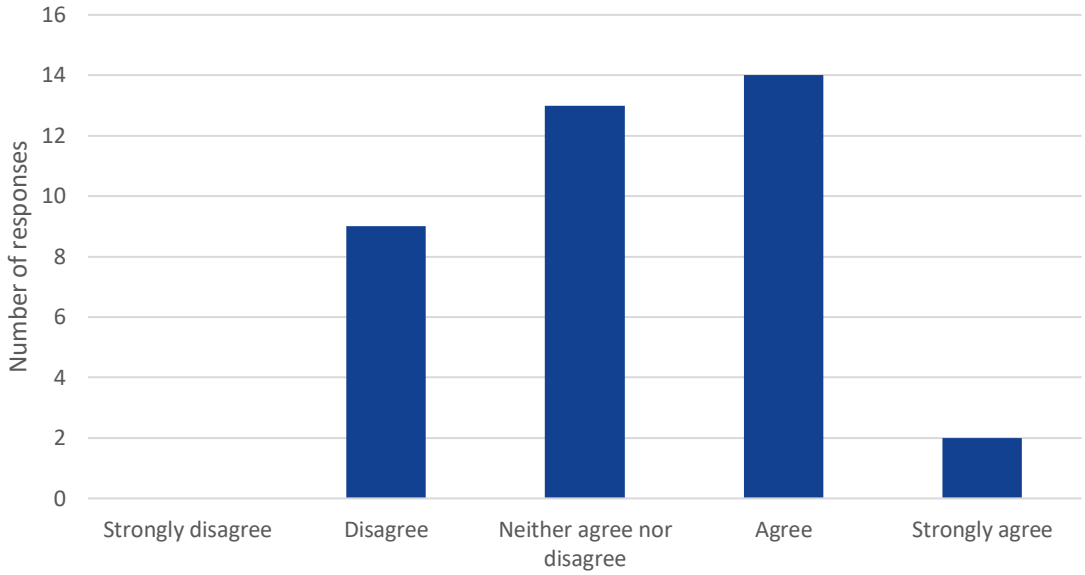
variable	value
n	38

Summarized data

variable	*amount*	*percentage*
Strongly agree	5	13 %
Agree	18	47 %
Neither agree nor disagree	13	34 %
Disagree	2	5 %
Strongly disagree	0	0 %

Question 24.

Our organization's employees have sufficient skills and experience to execute our organization's digital strategy.



Statistical metadata

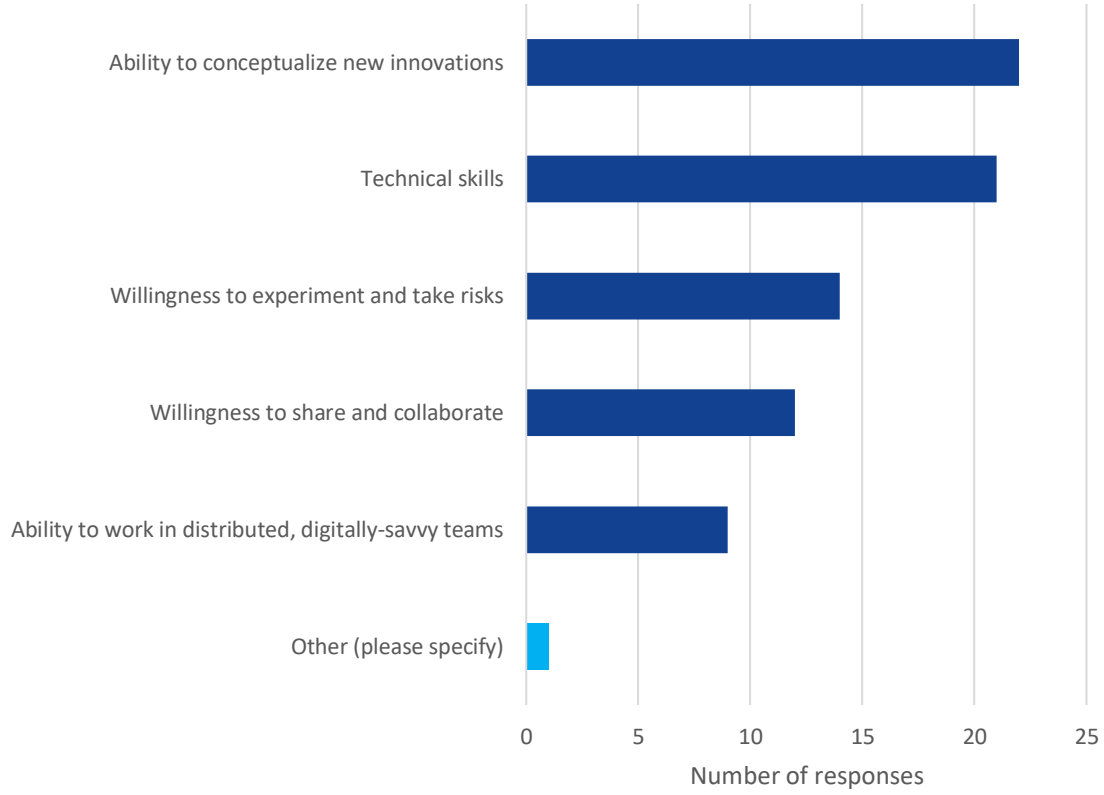
variable	value
n	38

Summarized data

variable	*amount*	*percentage*
Strongly agree	2	5 %
Agree	14	37 %
Neither agree nor disagree	13	34 %
Disagree	9	24 %
Strongly disagree	0	0 %

Question 25.

Our CFO function's performance could be improved if our employees possessed the following skills. Choose all relevant ones.



Statistical metadata

variable	value
n	38

Summarized data

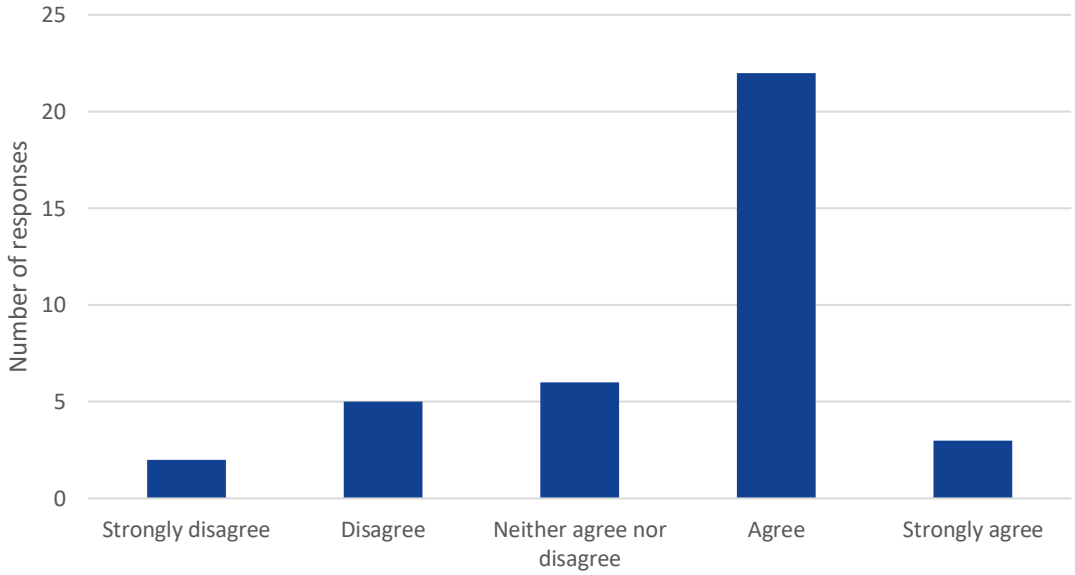
variable	*amount*
Ability to conceptualize new innovations	22
Technical skills	21
Willingness to experiment and take risks	14
Willingness to share and collaborate	12
Ability to work in distributed, digitally-savvy teams	9
Other (please specify)	1

Answers to open text field questions

variable	*text field*
Others (please specify)	Willingness to learn new things and step to the next curve

Question 26.

Our organization provides opportunities and resources to learn new skills related to digitalization.



Statistical metadata

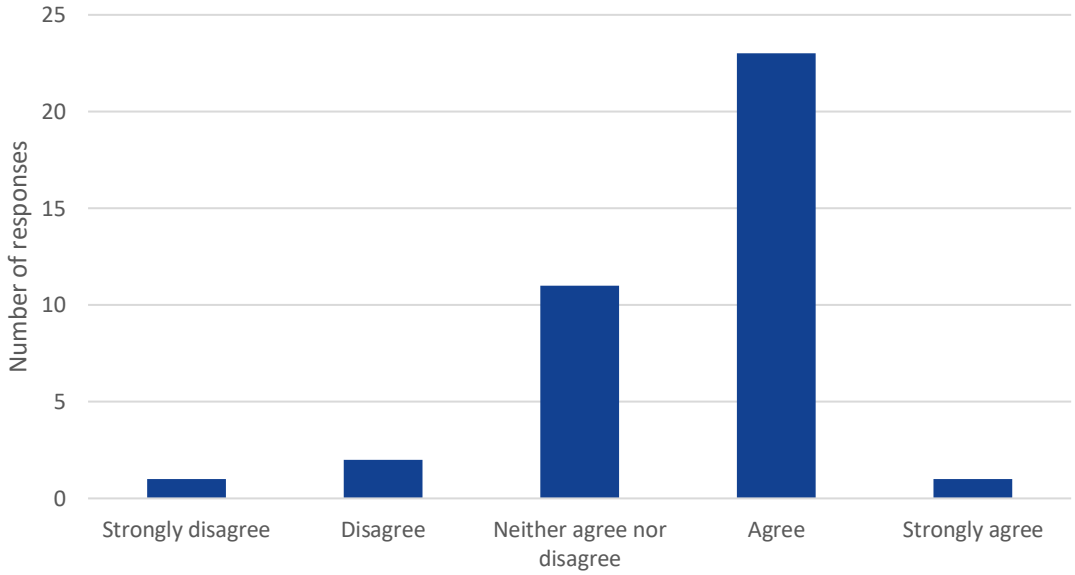
variable	value
n	38

Summarized data

variable	*amount*	*percentage*
Strongly agree	3	8 %
Agree	22	58 %
Neither agree nor disagree	6	16 %
Disagree	5	13 %
Strongly disagree	2	5 %

Question 27.

Our organization's leadership has sufficient skills and experience to lead our CFO function's digitalization.



Statistical metadata

variable	value
n	38

Summarized data

variable	*amount*	*percentage*
Strongly agree	1	3 %
Agree	23	61 %
Neither agree nor disagree	11	29 %
Disagree	2	5 %
Strongly disagree	1	3 %

APPENDIX D: SURVEY RESPONDENTS

Respondent	Position	Firm Size	Industry
Respondent 1	Manager	Very large	Oil
Respondent 2	Director	Very large	Forest
Respondent 3	CFO	Medium	Teleservices
Respondent 4	CFO	Medium	Retail
Respondent 5	Controller	Very large	Consumer services
Respondent 6	Manager	Large	Healthcare
Respondent 7	Controller	Very large	Energy
Respondent 8	CFO	Large	Wood products
Respondent 9	CEO	Large	Finance and investment
Respondent 10	CFO	Very large	Teleservices
Respondent 11	VP	Very large	Transportation and spedition
Respondent 12	CFO	Very large	Engineering and manufacturing
Respondent 13			
Respondent 14	CFO	Large	Healthcare
Respondent 15			
Respondent 16			
Respondent 17	VP	Very large	Engineering and manufacturing
Respondent 18	CFO	Very large	Oil
Respondent 19	CFO	Large	Car sales
Respondent 20			
Respondent 21	CFO	Very large	Healthcare technology
Respondent 22	CIO	Medium	Corporate services
Respondent 23			
Respondent 24	CFO	Large	Energy
Respondent 25			
Respondent 26	Controller	Large	Forest
Respondent 27	Controller	Medium	Corporate services
Respondent 28	VP	Very large	Engineering and manufacturing
Respondent 29	Director	Very large	Food products
Respondent 30			
Respondent 31			
Respondent 32	VP	Very large	Forest
Respondent 33			
Respondent 34	CFO	Large	Retail
Respondent 35	Manager	Very large	Chemicals and plastics
Respondent 36	Controller	Medium	Corporate services
Respondent 37	Director	Very large	Consumer services
Respondent 38	Controller	Very large	Insurance
Respondent 39			
Respondent 40	VP	Very large	Forest
Respondent 41			
Respondent 42	Director	Large	Corporate services

APPENDIX E: COVER LETTER FOR THE SURVEY

Subject line: **DIGITAL CFO: Benchmark your company by answering a Firm X survey**
To: **Author 1; Author 2**
Bcc: **Respondents**

The CFO is at the heart of a major digital revolution.

New, disruptive digital technologies are evolving rapidly. However, adopting them to generate tangible results is not trivial. While the technologies may offer tremendous opportunities like cost savings or performance increases, it is increasingly challenging to capture the full potential of digitalization. Firm X's Digital CFO -initiative explores new ways for the CFO to create value more efficiently with disruptive technologies, redesigned processes and more effective organizations.

This survey gauges the current status and prospects of digitalization in the financial functions of large, Finnish corporations. Respondents are among the first to receive a personalized report of the results of the survey as well as a white paper by Firm X on the topic. All responses are anonymous. The results will further be analyzed in a Firm X -sponsored master's thesis which will also be available to the respondents.

Answering the survey takes approximately 15 minutes. Deadline for responses is Sunday 14th October 2018. We appreciate your valuable input!

Access the survey now! [link to survey]

You can also share this survey within your organization. Respondents from CFOs to business controllers are in the scope of this survey. If you decide to provide Firm X with the name of your company, all responses from your company will be consolidated in the personalized report and sent to your company only. This allows you to benchmark your company's responses against the overall population of the survey. All responses are anonymous.

Timeline
Personalized reports will be sent during December 2018
White paper and related material will be sent during H1/2019

We are excited to help gauge the digital maturity of Finnish CFO functions and hope to see you share our excitement!