Don Kautonen (2016726, MBKV20SY)

MANAGING FINANCIAL RISKS FOR MATERIALS IN ELECTRICAL NETWORK INVESTMENTS

Master's thesis

Master of Business Administration

International Business Management

2024

South-Eastern Finland
University of Applied Sciences

South-Eastern Finland University of Applied Sciences

Degree title	Master of Business Administration
Author(s)	Don Kautonen
Thesis title	Managing Financial Risks for Materials in Electrical Network Investments
Commissioned by	Despro Engineering Oy
Year	2024
Pages	56 pages, 9 pages of appendices
Supervisor(s)	Jagat Kunwar, Senior Lecturer

ABSTRACT

This thesis explores material risk management practices within the Finnish electrical utilities sector, aiming to provide an understanding of the challenges and opportunities in this critical industry. Through theoretical frameworks and empirical findings, the study identifies key areas of concern, focusing on the financial struggles faced by utilities due to material risks during the years 2021-2023.

Through a literature review, a survey with commercial banks and a pragmatic inductive research approach, this study aims to find opportunities to increase value. Findings from the survey of 77 Finnish electrical utilities reveal that over half of the participants reported that material price volatility between 2021-2023 affected their investment decision. The absence of financial hedging and significant percentage facing unexpected risks highlights the necessity for more resilient strategic risk management methods.

This thesis contributes to understanding current risk management practices and proposes strategic recommendations for implementing new technologies and advanced risk management practices.

Keywords: risk management, electrical utilities, material risks, price instability, digitalization, financial tools, cybersecurity threats

CONTENTS

1 INTRODUCTION

The entire society is dependent on functional electricity networks (Wallnerström 2008, 11) and electricity network investments in Finland follow Electricity Market Act 588/2013, which is regulated by the Finnish Energy Authority. There are 77 different electricity network utilities in Finland, which control electricity distribution in regional monopoly state via medium-voltage and low-voltage systems. This thesis will focus on the financial material risk management practices in electricity network investments in Finland.

1.1 Background

Materials are integral to investment frameworks, which inherently carry financial risks. Effective management of these risks is relevant upon their timely identification. The backdrop of financial instability, notably post the mid-September 2019 Repo Crisis (Anbil et al. 2020) and the subsequent COVID-19 pandemic, has intensified systemic and liquidity risks within the financial sector (Rizwan et al. 2020). This turbulence highlights the vulnerability of materials, which are fundamentally linked to commodities, and from there to market fluctuations. Such volatility has precipitated unprecedented events, including the exceptional scenario of negative oil prices due to oversupply (Nawaz 2020), and a dramatic escalation in aluminium prices, with a 240% increase observed from April 2020 to March 2022 (Indexmundi 2022).

In Finland, the consequences of these global trends were visible, as the average electricity price surged by 50% throughout 2022 (The Energy Authority 2023a). The European Union market, in 2023, grappled with an inflation rate exceeding 10.1%, causing a climate of uncertainty that compelled numerous companies to significantly adjust their pricing strategies upward (European Central Bank, 2023). This narrative describes the complex interplay between material costs and broader economic forces, highlighting the critical need for intelligent financial risk management in the face of volatile commodity markets.

1.2 Development settings

This research navigates the complex landscape of financial risk management within the materials in electrical network investments in Finland. At its core, the study aims to explain the intricate dynamics of financial risks associated with material investments in the electrical grid. To find new market areas for the commissioning company, current methods are examined. Prevailing risk management methods may not recognize all relevant uncertainties, that could for example be part of global supply chain risks, transforming technology risks and market volatility risks. On the other hand, integrating new risk management methods to existing systems and processes may be found challenging due to resistance for change and possible need for education, which may provide business opportunities for the market in general. For the commissioning company, it is valuable to recognize risk-related market momentum. Thus, the primary goal in this thesis is to shed light on effective risk management practices answering the following research question:

1. What challenges and opportunities are associated with the adoption of traditional and emerging risk management methods in material procurement and supply chain management for investments of electrical distribution utilities?

Examined factors, such as new technologies may offer possibility to enhance investment profitability. Alternatively, data analysis methods and proactive analytics for risk management can recognize risks in real-time and improve decision-making process. Resilience against market fluctuations can possibly be enhanced with new procurement practices. All these examined business areas can be seen as opportunities to increase value to financial processes, where the customer receives value via strategic business development activities.

The significance of navigating with this research question is highlighted by the volatile nature of material costs, which is a critical component of electrical network investments. This volatility introduces a layer of financial risk, which

without a proper management can severely impact the viability and cost-efficiency of these critical infrastructure projects. Therefore, the study is not just an academic exercise, but a practical exploration aimed at enhancing the financial stability and investment operational efficiency at Finland's electricity network utilities.

1.3 Research methods

To explain the complexities of financial risk management in materials for electrical network investments, this thesis uses a multi-faceted research methodology designed to offer both theoretical insights and practical perspectives. The approach encompasses a comprehensive literature review, a survey conducted with commercial banks on financial risk management products for commercial purposes, and an analysis of financial instruments.

The initial phase of the research is based in a literature review, drawing upon seminal works such as John C. Hull's "Fundamentals of Futures and Options Markets" published in 2017 and Frederic S. Mishkin's "The Economics of Money, Banking, and Financial Markets" published in 2004. This foundational work aims to establish a solid theoretical understanding of different financial risk management tools and their applications. The literature review serves to limit the research scope and define the subject area, ensuring a focused investigation into the relevant aspects of financial risk management in electrical network investments.

Building upon the theoretical groundwork, the research progresses to empirical exploration, starting with a dialog-based survey among nine commercial banks to gauge the financial risk management products available for commercial utilization. This phase aims to bridge the gap between theory and practice, offering insights into the practical applications of risk management strategies in the financial sector.

Following the quick commercial bank survey, the research uses the Research Onion framework by Mark Saunders et al. (2012) to structure the empirical study

which is a comprehensive approach encompasses six layers of research design. This methodological framework ensures a systematic investigation, grounded in a philosophical understanding of the research problem, and guided by a logical sequence from the formulation of research questions to data collection and analysis.

In conducting the survey and interviews, ethical considerations are essential. The research adheres to Saunders guidelines (2012), ensuring that participants are treated with respect, their contributions are valued, and the integrity of the research process is maintained. This commitment to ethical research practices extends to the transparency and openness of the study.

1.4 Framework and the limitations of the study

The research topic in this thesis is concentrated on the financial risk with material prices in electrical power distribution network system investments in Finland. Financial risk elements can be seen in figure 1 with a dashed line. This work does not include operational risk identification or electrical distribution system reliability centred asset management (RCAM), where system reliability or component reliability is investigated (Wallnerström 2008, 13). This thesis will not focus on any other European Union country than Finland or assume that risk management practices are similar between two separate countries. An electrical power network system is described in figure 1 and the thesis target sector is marked with a dashed line, which is electrical distribution in Finland. This thesis will be concentrated on electricity network investments and does not consider transmission, power plant or household electricity systems.

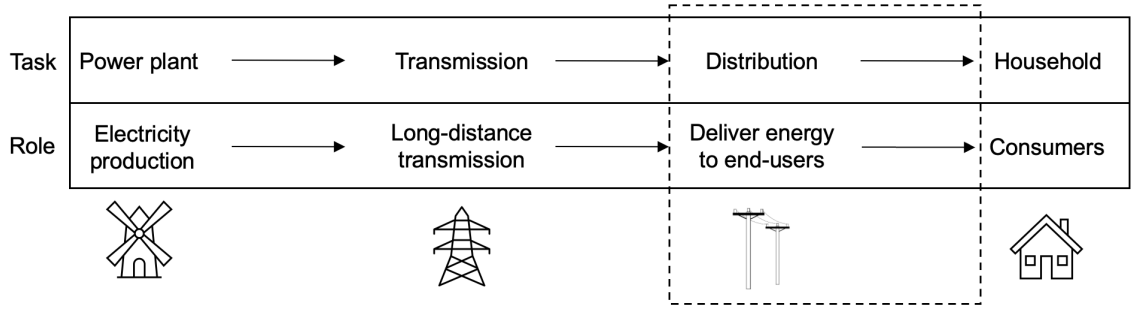

Figure 1. Electrical power network system, where thesis target sector is marked with a dashed line

Electrical distribution in Finland is operated with 77 different utilities, which are allowed to practice network management and investments. Electricity utilities deliver energy to the end-users. Investment practices might differ for example in therms of the density of the population, which is higher in Helsinki (Helsinki facts and figures 2022, 4) than in Rovaniemi (The City of Rovaniemi 2023) and therefore require different approach for a proper electrical network, but in this thesis different investment practices based on population density are not investigated. This thesis does not either consider subcontractor management or other work performance related activities. This work will be fundamentally concerned about material risks and financial risks that are involved in the investment point of view.

The framework of this study is designed to assess and analyse the financial risk management practices associated with materials in electrical network investments in Finland. To gain multiple sights to understand the topic more thorough, a triangulation model is based on three different approaches from literature, commercial banks, and survey-data from electrical utilities. This research integrates theoretical knowledge and empirical data from surveys to enhance the validity and reliability of the findings. Triangulation model is visualized in figure 2, revealing the three-angle approach that shows the study's analytical setup.

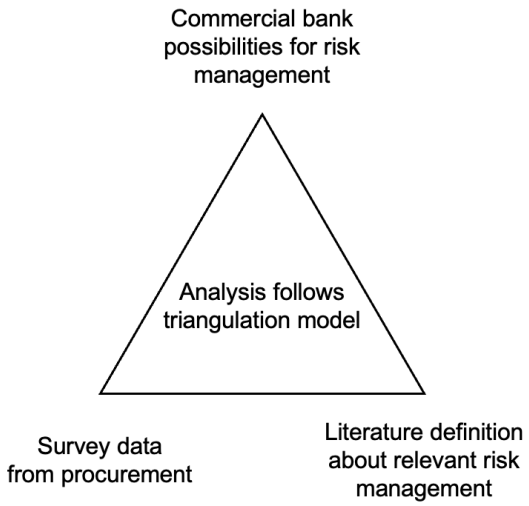

Figure 2. Implementing the triangulation model for enhanced research validity

In figure 2, a data analysis triangulation model with three different data sources is described. The thesis data collection can also be seen starting by understanding different risk management tools and models which will follow literature definitions about the usage of those tools. After that, a survey is constructed and executed by reliable research methods. This is followed by the analysis and conclusions about possible alternative options.

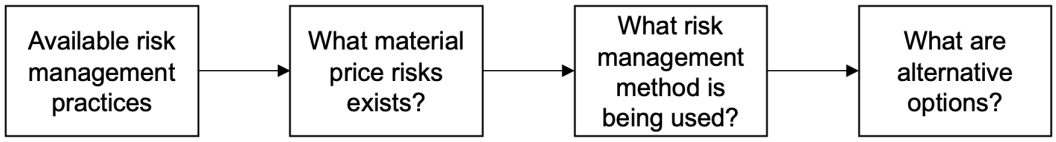

Figure 3. Sequential exploration of risk management practices in electrical network investments: A four-part framework

Figure 3 illustrates the structured approach of the thesis, beginning with the definition of available risk management practices and progressing through the identification of material price risks, the assessment of current risk management methods in use, and the exploration of alternative risk management options. This sequential exploration ensures that the research is deeply connected to real-world applications and that the findings are relevant and actionable. The study's framework is anchored in an understanding of financial risk management tools and their practical application within the context of electrical network investments. The starting segment of the research is to define available risk management practices through an extensive review of relevant literature and survey with commercial banks. This theoretical foundation provides the basis for subsequent empirical investigation, which seeks to identify material risks and how these risks are managed in practice.

A crucial part of the research framework is deployment of the Research Onion method by Mark Saunders et al. (2012), which facilitates a structured exploration of the research problem across six dimensions: philosophy, approach, method selection, strategy, time horizon, and data collection method. This methodology ensures a coherent and logical progression from conceptualization to execution,

pointing the study with a resilient philosophical and methodological foundation. While the study aims to provide a comprehensive analysis of financial risk management practices in electrical network investments, several limitations must be noticed. Primarily, the scope of the study is limited to the Finnish context, focusing exclusively on the practices of electricity network utilities within this geographical and regulatory environment. Thus, this may limit the generalizability of the findings to other countries. The validity and reliability of the survey data constitute another significant limitation. To mitigate potential biases and ensure the neutrality of the survey, attention has been paid to the design of the questionnaire and the selection of respondents. However, the subjective nature of self-reported data and the potential for non-response bias presents challenges to the empirical validity of the study. Furthermore, the research does not consider operational risk identification or the management of subcontractors and work performance-related activities. By focusing specifically on material and financial risks, the study limits its scope to avoid dilution of its primary objectives but also limits the depth of its mission.

2 RISK MANAGEMENT IN ELECTRICAL NETWORK INVESTMENTS

2.1 Overview of Risk Management in Electrical Network Investments

Today, the foundational role of electricity networks in societal functionality cannot be overstated. These networks are essential for powering every part of daily life, and subject to financial complexities with investment risks. Historically, the management of these risks has evolved significantly, reflecting changes in technology, market dynamics, regulatory environments, and the global economy. The concept of risk management within the context of electrical networks has become increasingly critical, not only for ensuring the viability of projects but also for maintaining financial stability within this sector. This evolution includes the importance of developing and implementing effective risk management strategies. Based on a statement given by Fingrid (2023), these strategies are essential for mitigating financial risks associated with material costs, supply chain vulnerabilities, and market volatility, thereby safeguarding project outcomes and ensuring the uninterrupted supply of electricity. As such, the study of risk management practices in electrical network investments offers valuable insights into the challenges and solutions in navigating the financial uncertainties inherent in these essential infrastructure projects.

2.1.1 Historical Context of Risk Management

The historical evolution of risk management within the energy sector reflects a dynamic adaptation to the ever-changing technological, economic, and regulatory landscapes. This adaptation has been essential in ensuring the viability and financial stability of electrical network investments. Initially, risk management was primarily concerned with avoiding catastrophic financial losses from unplanned outages or equipment failures. However, as the sector matured, the focus expanded to include the financial risks associated with volatile material costs, supply chain uncertainties, and regulatory compliance (Fingrid 2023).

Technical advancements have both mitigated and introduced new types of risks. For example, the integration of renewable energy sources has required novel risk assessment models to account for the variability in power generation (Li et al.

2020). Economically, the liberalization of energy markets has introduced price volatility and competition risks, requiring more sophisticated financial instruments to manage exposure. Regulatory changes, often driven by environmental concerns and safety standards, have necessitated updates in risk management strategies to comply with new laws and regulations (Stridbaek 2006). These shifts highlight key milestones in the sector's approach to risk management revealing the necessity of a proactive and flexible strategy. Today, risk management in electrical network investments does not only addresses traditional operational risks but also navigates financial, regulatory, and technological uncertainties, ensuring project success and sector sustainability.

2.1.2 The Role of Materials in Financial Risk Exposure

Literature from a broad spectrum of sources points out the types of material risks that electrical network investments face, ranging from fluctuations in commodity prices to supply chain disruptions. Commodity prices play crucial role in the world of electrical network investments for shaping financial risk exposure. This complexity involves the fluctuating costs of essential materials such as copper and aluminum, essential for the manufacturing of cables and transformers, and their availability on the global market. Historical events have illustrated how shortages in material supply or sudden price escalations can severely affect project budgets and timelines. For example, the unforeseen rise in aluminum prices by 240% between April 2020 and March 2022, as noted in market analyses (Indexmundi 2022), pinned the vulnerability of electrical network projects to commodity price volatility. Copper, which is widely used in electrical networks due to its excellent conductivity and durability saw its price soar more than 67 % since the third quarter of 2020 (Work Bank 2022). Such fluctuations can lead to significant financial risks, demanding sophisticated risk management strategies to navigate these uncertainties.

On the supply chain front, the importance of diversified sourcing and efficient inventory management has been highlighted as crucial for ensuring the continuous availability of materials. The global supply chain crisis by the COVID-19 pandemic has highlighted the vulnerability of relying on single sources or

regions for critical materials. The change towards multi-sourcing and the strategic use of domestic supply sources have emerged as key trends in building resilience against disruptions (Rosa 2021). A significant group of researchers contribute to supply chain risk management, presenting it as a systematic approach to identifying, evaluating, and mitigating potential disruptions within supply chains. This comprehensive view incorporates not just immediate suppliers but extends to understanding the broader network, including second and third suppliers, thereby offering a more resilient defense against unforeseen challenges (Gurtu & Johny 2021).

2.1.3 Analyzing Material Price Volatility

The volatility of material prices presents a significant financial risk to electrical network investments, influenced by a complex interplay of market dynamics, geopolitical tensions, and supply chain disruptions. The fluctuation in prices, particularly for key materials such as aluminum and copper, can dramatically alter the cost bases of projects, affecting overall investment decisions and risk management strategies. For instance, the unprecedented increase in aluminum prices by 240% from April 2020 to March 2022 (IndexMundi, 2022) show the sensitivity of material costs to market forces, highlighting the necessity for resilient financial risk management frameworks. Furthermore, geopolitical issues, such as trade disputes and sanctions, can exacerbate price volatility, while supply chain disruptions, highlighted by the global pandemic's impact on logistics and production, have laid bare the fragility of just-in-time supply models. Such volatility highlights the importance of incorporating comprehensive risk assessment methodologies that consider the full spectrum of potential market, geopolitical, and supply chain risks. Leveraging financial instruments and hedging strategies becomes paramount in mitigating the adverse effects of price volatility on project budgets and timelines, ensuring the financial stability and sustainability of electrical network investments.

2.1.4 Risk assessment practices

The assessment and management of financial risks associated with material investments in electrical networks are possible by multiple different theoretical frameworks and models. These methodologies range from quantitative models that predict price volatility and assess risk exposure, to qualitative approaches that evaluate the impact of geopolitical and supply chain factors on material availability and cost. Notably, Value at Risk (VaR) models have been widely recognized for their ability to quantify the potential loss in value of a portfolio of financial assets, offering a clear metric for risk tolerance (Jorion 2007). Additionally, the Monte Carlo simulation provides a versatile tool for modeling the uncertainty and variability of material prices, enabling decision-makers to explore a range of outcomes and their probabilities (Rubinstein 1981). On a strategic level, the application of the Real Options Analysis (ROA) offers insights into the value of flexibility in investment decisions, particularly in response to material price volatility (Dixit & Pindyck 1994). These models, among others, facilitate a comprehensive approach to risk assessment, allowing firms to navigate the complex dynamics of material investments with informed strategies that mitigate financial risks effectively.

2.2 Commercial Banking Solutions for Risk Management

Operational supply chain risk management deals with risks arising from supply chain, where utilizing tools like demand forecasting and bill of materials (BOM) are used to mitigate risks. Financial risk management uses financial instruments to hedge against market volatility and uncertainties when operational risk management focuses on efficient processes and supply chain optimization to reduce production and logistic risks (Mehta 2024).

Navigating the complex landscape of financial risks in large-scale electrical network projects necessitates a resilient arsenal of risk management tools. In this vein, commercial banks emerge as crucial allies, offering an array of financial products and services tailored to mitigate these challenges. These solutions encompass hedging instruments, insurance policies, and financial derivatives,

each designed to buffer investments against the unpredictable change of market dynamics, supply chain vulnerabilities, and other financial uncertainties. Instruments such as forward contracts, futures, options, and swaps are instrumental in hedging against the volatility of essential commodities, while credit derivatives and comprehensive insurance schemes safeguard against counterparty risks and unforeseen project delays (Mehta 2024).

In the first quarter of 2023, as part of this thesis, a survey was conducted to identify the financial risk management tools offered by Finnish commercial banks. The survey focused on a range of financial instruments, including those for hedging against commodity and currency risks, and looked into the banks' pricing mechanisms, essential factors for client understanding, minimum trade requirements, and availability of customer support for hedging positions.

The Finnish institutions surveyed include a list of nine commercial banks:

- Aktia Pankki Oyj
- Ålandsbanken Abp
- Bonum Pankki Oyj
- Säästöpankkien Keskuspankki Suomi Oyj
- Alisa Bank Oyj (FKA. Fellow Pankki Oyj)
- Nordea Bank Oyj
- OP Yrityspankki Oyj
- S-Pankki Oyj
- Suomen Asuntohypopankki Oy

The range of financial instruments identified as available for managing notional exposure and other risks includes:

- Forwards contracts
- Futures contracts
- Options contracts
- Swaps
- Structured products
- Exchange-Traded Funds (ETF)
- Index funds (mutual funds)

These tools are for companies that need to mitigate the risks associated with the volatile costs of key materials such as copper, aluminum, and plastics, which are fundamental components in the infrastructure of electrical networks. By utilizing

these instruments, companies can establish forward contracts to secure prices with suppliers or hedge notional exposure through third parties (Tamplin 2023). This strategic possibility of financial products allows firms to protect against the uncertainties of price volatility, currency volatility, and changing interest rates. To put these tools in practice, a thorough understanding of market dynamics and the commitment to identify the chosen risk management strategy is required.

Notably, in along the survey discussions with banks in Q1 2023, banks had already spotlighted an elevated risk of bankruptcies in the sector, particularly anticipated for Q3-Q4 2023, attributed to the dangers of material price volatility. This period's increase in construction bankruptcies in Finland (Statistics Finland 2023) further symbolize the reality of changing material costs on investment success. These insights not only reaffirm the vitality of commercial banking products in strategic risk management but also guide investors towards selecting tools that align with their specific risk profiles and financial goals.

2.3 Understanding Financial Risk Management

To underline the importance of risk mitigation after understanding available tools, it is important look into the financial risks within electrical network investments, where the critical role of commodity hedging, and the implementation of hedging through financial instruments is illustrated via an example. This section lays out necessary foundational elements and strategic approaches for identifying and managing the financial risks that impact the viability and success of investments in this sector. It summarizes a detailed analysis of the used methods to mitigate the adverse effects of risk factors such as commodity price volatility, currency exchange rates, and interest rate changes. Based on past research and practical examples, it will be explained how firms can navigate and control the financial uncertainties inherent in electrical network projects.

2.3.1 The Spectrum of Financial Risks

In any corporate setting, the management's approach to financial risks is indicative of their underlying risk management strategy. As Dafir and Gajjala

(2016, 58) outline, financial risks can be broadly categorized into operational and financial risks, where this thesis focuses only on the latter. Within the financial risk area, firms face a variety of challenges, including commodity price risk, interest rate risk, foreign exchange risk, and other risks, where each can be managed with different strategies.

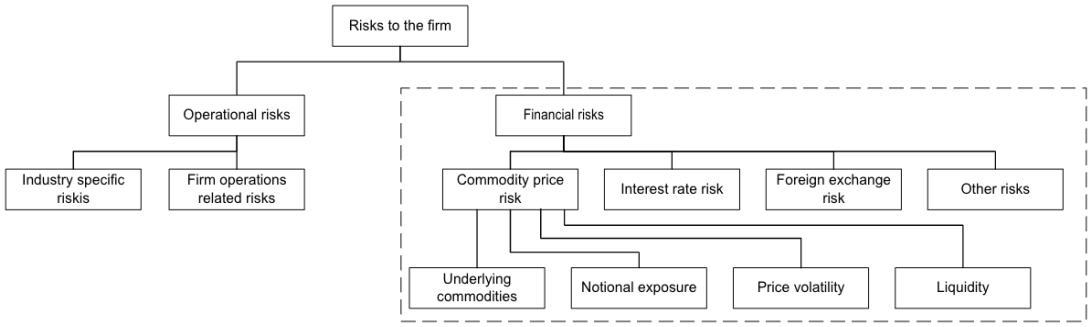

Figure 4. Identified risks that are relevant to firms (Dafir & Gajjala 2016, 58). This thesis is concentrated on the financial risks, which is marked with a dashed line

Corporate management must critically assess which risks to hedge against and which to accept as part of their business model. This decision-making process is crucial in setting investment goals and limits based on the exposure to underlying risks. Figure 4 from Dafir & Gajjala (2016) provides a visual representation of these risk categories and subcategories.

2.3.2 Commodity Price Risk and Notional Exposure

Given the tangible nature of network materials such as aluminum and copper, commodity price risks are especially relevant. This risk category belongs to the direct exposure where a firm must prepare for the changes in the prices of these commodities. For instance, securing a fixed price for aluminum cables can shield the contractor from future price hikes. Conversely, notional exposure occurs when a company enters into a forward agreement, promising future delivery of cables at a predetermined price. This can be seen as a strategic point to transfer risk to another party. The appetite for risk can also vary from one role to another. Different roles in financial risk management can be classified into hedgers, speculators, and arbitrageurs, where each role differs with distinct goals and methods of engaging financial instruments (Hull 2017, 27-34). For electrical

network investment companies, the role of a hedger is mostly describing, focusing on risk mitigation rather than speculative gains. The importance of noticing their role can be seen in the following section.

2.3.3 Illustrative example: Hedging Notional Exposure

This illustrative example considers financial tools as Hull (2017) explains in his book called Fundamentals of futures and options markets. Consider the case ElectricCon, a contractor tasked with delivering aluminum power cables valued at EUR 2 million to the investor, which corresponds to an underlying commodity value of EUR 200 000. ElectricCon's goal is to ensure that the total cost of installation remains below the Energy Authority's fixed unit price, thereby securing profit margins. In this example neither party (the investor or ElectricCon) decides to hedge any risks.

Scenario 1: Price Decrease

In a situation where the market price of aluminum decreases by 10 %, ElectricCon experiences a direct cost saving, which could increase the overall profitability of the project. Assuming aluminum represents 10 % of the cable cost, a 10 % price drop could reduce the total project cost by 1 %. On a EUR 2 million contract, this means a saving of EUR 20 000.

Scenario 2: Price Increase

Conversely, a historical increase in aluminum prices, such as the 240 % spike observed from April 2020 to March 2022, could severely impact the project's financials. A similar 10 % cost contribution from aluminum and a 240 % increase in commodity price would add an additional 24 % to the total contract cost, which is equivalent to EUR 480 000 on a EUR 2 million contract. This substantial increase could result in losses to the contractor and reduce willingness to invest in the future. The risk of notional exposure can be reduced through the use of financial instruments offered by commercial banks, such as forwards, futures, and options contracts.

Risk management with forward contract

To mitigate the risk of notional exposure, ElectricCon secures a private over the counter (OTC) forward contract at the current market price of aluminum hedging against potential price increase. The market price increases by 240 % six months later when ElectricCon is starting to buy aluminum. However, the forward contract secures that the price is not affected by that spike. The deal is executed with the agreed price avoiding excessive EUR 480 000 cost for the investment. With this contract project costs stay fixed and ElectricCon's financial reputation and reliability enhances in the market.

Risk management with futures contract

Instead of private OTC agreement, EletricCon enters into standardized exchange traded futures contract. Future contract offers similarly fixed price possibility against potential price spikes. Gains are similar to forward contracts and the key difference can be seen as the inability to customize the instrument suitable for the risk. Therefore, the product may not be exact fit for the purpose, but it is easy to define and clear to manage. Also, while choosing the future contract, the clearinghouse's involvement and third-party credit risk may have an effect on the selection of the instrument.

Risk management with options contract

With an option contract ElectricCon can buy the right to exercise a deal if market conditions are favorable. For example, ElectricCon decides to hedge the whole EUR 2 million contract by buying EUR 50,000 worth of call options with the right to buy at current price. After six months, when ElectricCon buys aluminum, and the price has increased by 240 % which in this example is EUR 480,000. Fortunately, they have the right to buy the aluminum position with the same strike price when they bought the option. This reduced the risk buy EUR 430 000 which is significantly less than the whole risk.

To effectively choose and use the appropriate tool for a specific need, it is crucial to have a thorough understanding of the risk components involved, including such as commodities or foreign currency exchanges.

In chapter two, the role of financial price risk hedging management practices for materials were assessed in electrical network investments and the essential nature of material risk in investment financial risk management was described. Available financial instruments were also determined with a survey to commercial banks, which play a crucial role in sophisticated risk management. The literature review focused on supporting sophisticated risk management practices. The risk of notional exposure was demonstrated with an illustrated example about the use of forward, future and option contracts. All examples revealed that investors can hedge notional risk with financial instruments. This exploration has not only highlighted the sensitivity of material costs to market forces but also highlighted the necessity for resilient financial risk management frameworks. After determining available financial risk management tools, a real-life scenario will be inspected in chapter three where possible value increasing opportunities are discovered.

3 DATA COLLECTION AND ANALYSIS

Part of the research question in this thesis was to explore current practices in material practices in electrical network investments. Understanding the current practices, an inductive survey was conducted with Finnish electrical network owner companies. The survey structure was based on Kimmo Vehkalahti's book about survey measures and methods (2019). Selections for the research methodology and research philosophy were based on Saunders et al. (2012).

3.1 Research/development process

3.1.1 Research methods

With describing used methodology or "modus operandi", it is revealed, how the subject area is managed by the author. Methodology is formed out of group of different thinking patterns, philosophical assumptions and beliefs, which will be supportive basis forming an understanding about the research questions and selected research methods (University of Southern California 2023). By selecting a research method in this thesis, a consistent pattern was maintained through research philosophy, research techniques and research tools. Research methods followed the figure 5 research onion by Saunders et al (2012) where all layers were examined thoroughly and chronically from outside to the core to create a research plan.

In the pursuit of a research philosophy, this study engaged with ontological questions regarding the essence of the utilities' current operations, drawing from Aliyu et al. (2015), who consider the reality of the moment. Epistemological considerations guided the investigation of what constituted knowledge within this field, as the study interrogated the truths and beliefs held about risk management, while axiological questions, informed by Vidal (2007), examined the underlying values and ethical considerations that shape management practices. This philosophical base ensured that the research captured with operational angles of risk management but also the subjective distinction that influenced them.

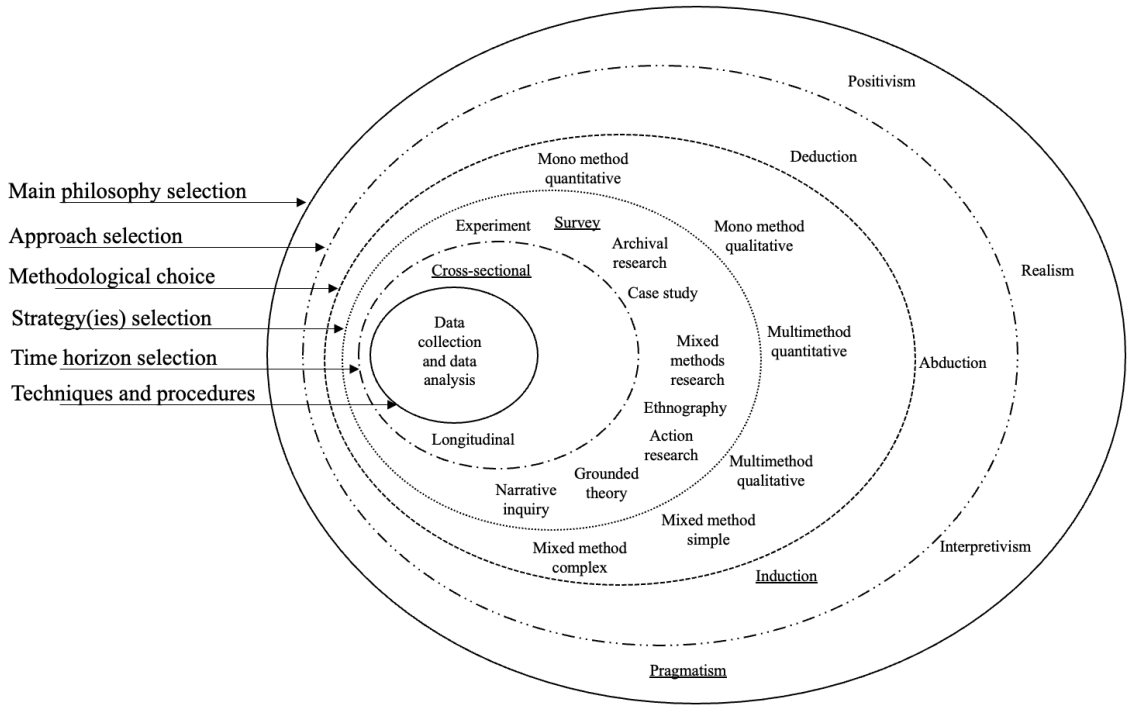

Figure 5. Research onion (Saunders et al. 2013, 161), which was used to sketch applied research methods. Underlined topics represent research decisions

3.1.2 Selected research approach

After selecting research philosophy, a research approach was selected (Saunders 2012, 143-150). With the selection of research approach, a logical structure was selected, which directed gathering data to understand complex phenomena. Also, with this, the researcher assisted to choose a proper form of research and to understand what other forms of research there are. Because in this thesis an understanding about current risk management practices in electrical network investments was created, an inductive research approach was an appropriate choice. Even though typically surveys are associated with hypothetico-deductive method, the researcher founded an inductive approach more suitable because with developed research question new theories was explained, theories generated, participant experiences were valued, and the study stayed open for new discoveries. Inductive approach was also suitable, when considering not having hypotheses for testing.

After the research approach had been chosen, a research method was selected. Research data was based on experiences from electrical utilities managers, because through the second research question alternative risk management practices were introduced and appropriate data was not available in the beginning of this research. Due to inductive research approach and to goal to create a comprehensive understanding about the current situation, the gathered data was target-group-specific. A partially integrated mixed method was chosen as a research method because clear limitations for the qualitative and quantitative decisions were required, and clear explanations were required for the research strategy, research time horizon and research techniques (Saunders 2012, 165-166). With this selection, the actual source of information was pointed straight to the relevant answerer. A single method statistical or qualitative method was limiting considering the wideness of the subject area to understand the relevant factors. On the other hand, fully integrated mixed research method was an offer to choose in the later decisions a qualitative and quantitative options to support the concept, but that would have endangered the objectivity of the research. A partially integrated mixed research method was supported also by the nature of the research, which was exploratory study, because in this thesis the main theme was to understand the nature of a possible problem and to control the route when new information appeared to form a clear understanding (Saunders 2012, 171).

3.1.3 Research strategy

To follow research onion structure, after the selection of research method, a research strategy was chosen, in other words, in which concrete way the data was gathered. This selection was linked strongly to this thesis research method and the nature of the research (Saunders et al 2012, 173-177). Because of the nature of the research the concept was conducted through questions what, who, where, how much or how many, the suitable research strategy was a survey. Also, the research did not try to identify individual factors for example via experimenting. Therefore, due to its multidimensional wholeness, conceptual phenomenon was explained through the research question where data was gathered in the survey. With the selection of a research time horizon, it was

defined that a snapshot of a single point of time was framed with a cross-sectional study and the research was not looking at a longer timeframe.

When looking at the wholeness of the study, it can be discovered that the main philosophy was pragmatism and to create a comprehensive understanding about the subject area, an inductive approach was selected. The research method was partially integrated mixed method and due to the nature of the research, a cross-sectional study was executed as a survey.

3.1.4 Reliability and validity acknowledgement before the survey

To understand the significance of the results, research reliability and validity were already considered in the preparation of the research. Also, the ethicality was an important factor in the creation of understanding. In this thesis, it was noted that risk management was related to users' knowledge about the financial instruments and the courage to seek alternative options to mitigate risks. In an intellectual environment, where companies' managers create decisions on behalf of investors, it was crucial to understand this topic may be sensitive and survey responders may answer in a way that was not true in order to secure their own actions – highlighting the potential for social desirability bias. Fisher (1993) describes the impact of social desirability bias in research data validity, where he suggests that presence of such phenomena can lead to significant distortion in self-reporting survey. Therefore, it was possible to classify that it was important part of research ethics to consider such potential bias in research design to mitigate its effects. Saunders mentions effectively (2012, 191) that the research must not put anyone in danger or cause any damage to the subject group or reference networks. It was also important to include all relevant participants and they need to be well informed about all the data that was going to be gathered. In the validity point of view, results must be open and transparent, so that also all other researchers in that subject area can also repeat the study.

Investment management from planning to purchase includes several different roles. Therefore, due to many people involved in the procurement chain, a concept about social reality was essential to notice (Kananen 2017, 174). This

had an impact to the validity of the survey because it was important to choose answerers that are part of the investment organisation. This approach fits especially to an inductive work, where an understanding about something is formed, and therefore it must be evaluated, is the analyser seeing things incorrectly, or in the opposite way of thinking - are structures reliable. The research reliability must be assessed also based on the answers from the survey. Will responders give honest opinions or can they provide dishonest answers to make situations look more better, or worse based on for example socially acceptable behaviour model (Saaranen & Puusniekka 2006). Nederhof (1985) points out that the recognition and control of social desirability bias are essential for improving reliability and validity of the research results.

In drafting the survey, the ease of understanding was prioritized to ensure that responses were as aligned with the topic as possible. Which choosing question patterns and words, the goal was to reduce variance in interpretation for respondents. This approach aimed to increase the reliability of the study, but also leaving room for diverse opinions, values and experiences. It was assumed that despite the possible difference in answers, a thorough examination of the results would be possible with this questioning technique. Of course, it was important to realise the variance due to pragmatism where people can answer their own way, but the setup of question-pattern and word choices weren't relevant so that the study will be as reliable as possible. Each question aimed to serve the main concepts by converting complex terms of risk management, procurement practices and financial decision-making into concrete measurable elements.

Examples of the questionnaire questions 12, 14 and 15 listed below:

12. *Do you purchase commodity or currency hedges outside of delivery contracts? (e.g. aluminum hedges from banks) [free comment]*
14. *Have fluctuations in material prices affected your investment levels or investment plans in the past two (2) years? [free comment]*
15. *Have you considered changing your current material procurement practices due to potential financial risks? [free comment]*

Answering these questions included two phases allowing both quantitative and qualitative data collection, where the first phase was yes or no and then the

respondent was given the possibility to freely comment on the question. The aim of the survey was to describe as precisely as possible how something was. It was constructed that respondents would provide that data and this data would become one of the founding pillars for the understanding of the current state.

3.2 Data collection

3.2.1 Sampling

With the survey, electricity distribution network investment risk management practices were investigated, where survey answerers were electricity utility managers or for example a consultant, who they have trusted the main investment material selection and financial risk management. The questionnaire was conducted via online questionnaire to all electricity utilities in Finland, where the answerer could work for example as a companies' Chief Executive Officer, Chief Procurement Officer, Procurement Manager, Construction Manager, Investment Manager or someone who understood the content of their network investment processes such as contractor contracts or purchase contracts. From these participants it was possible to evaluate on going risk management procedures. The survey was asked from all electricity network utilities, to increase transparency, and reliability with widening understanding to nation-wide. A list of all electricity network utilities was found from Finnish Energy Authorities' website and in March 2023 there were 77 different electricity utilities in Finland. The advantage of selecting discretionary sample for this target-group for the survey was that the gathered data would be as concise as possible. All contact details were discovered publicly and if one did not answer, two more persons from the same company was contacted. If the electricity utility had forwarded risks via contract to for example a contractor or consultant, that company's contact information was requested. There was no limitation for the answerers role if they could identify current risk management practices. For ethical purposes, if the participant experience that the question was too private in their opinion, a possibility to not to answer to a risk management question was also provided.

3.2.2 Main Investment Materials

To understand the focus of the questionnaire for electrical network companies, it is worth pointing out the most important materials that carry the most substantial economic influence within electrical network investments. Based on Finnish Energy Authorities regulation methods (2015b), within the composition of investment materials, cables and transformers emerge as essential due to their prevalence in the investment components, accounting for 76% of the investment focus. Each investment component includes all required materials, and the investment value is determined by fixed unit prices established by the Finnish Energy Authority (Finnish Energy Authority 2015b). It is investment management's objective to maintain investment costs below these predetermined prices, as the relationship between unit price and cost differs. Based on this we can point out the relevance; how fixed unit prices affect profitability and the potential for financial loss, underscoring the necessity for strategic risk management.

Main investment components, such as cables and transformers include commodities such as copper due to its superior conductivity and thermal abilities and aluminum for its availability and economical characteristics. Understanding these components thoroughly is not essential for comprehending the overall research findings, but recognizing the involvement of commodities exposes the financial dynamics as commodities constitute a significant portion of the investment portfolio and influence the broader economic considerations of network investments.

3.2.3 Design and Distribution of the Questionnaire

Following inductive research approach, the questionnaire was designed to investigate the current state of procurement practices, explore value generation opportunities for commissioner's objectives for enhancing procurement practices and risk management strategies. Each question was derived from procurement and supply chain management theories, where risk management was in the

center of focus. Questions were guided by decision in chapters 3.1 and 3.2 with established research paradigm.

Practical orientation was towards understanding operational realities and challenges confronting Finnish electrical networks utilities. This aspect was emphasized in sections where critical material procurement was present. The inquiry into current practices and potential risks associated with the volatility of price reflected to commissioners' goals. The questionnaire underwent an iterative refinement process, incorporating feedback from preliminary expert consultations and adhering to ethical guidelines in section 3.1.4. This iterative process ensured clear questions, clarity and ethical integrity for the survey, and also maintained conducive to obtain genuine and insightful response. In short, the questionnaire followed three themes:

1. Direct inquiry into procurement practices (questions 3-10)
2. Exploration of risk management practices (questions 11-16)
3. Assessment of future directions (questions 17-18)

The complete set of survey questions is included in Appendix 1 of this thesis. The analysis combined interpretive and empirical methodologies to align with inductive research approach. Descriptive statistics made possible to see how widespread certain practices are within the industry, enabling comparison and highlighting deviations from common practices. Thematic Analysis was suitable to unpack subjective experiences related to financial risks and procurement practices.

4 RESULTS AND ANALYSIS

This chapter looks deeper into survey findings and combines information derived from chapter two to answer into the research question "*What challenges and opportunities are associated with the adoption of traditional and emerging risk management methods in material procurement and supply chain management for investments of electrical distribution utilities?*"

Survey responses are detailed in table 1. The survey topic is mentioned on the left column, middle column titled "Data" quantifies the number of "Yes" -answers and the right column "Common Themes" provides a qualitative synthesis the thematic findings.

Table 1. Questionnaire answers

Topic	**Data (Question Number), [Answered: Yes]**	**Common Themes**
Total Respondents	35 (General)	
Procurement Strategies - Direct Procurement	18 (Q4, Q6, Q8, Q10)	Considered alternative procurement practices.
Procurement Strategies - Dependent on Contractors	17 (Q5, Q7, Q9, Q11)	Considered alternative procurement practices.
Financial Hedging	0 (Q12)	No third-party hedging is used to protect against market-wide risks.
Supplier Diversification	28 (Q15)	Risk managed by supplier diversification.
Material Price Volatility Impact	20 (Q13-Q14)	Delivery challenges, Pricing dynamics, Market availability, Supply chain and Procurement strategy, Readiness for market changes
Encountered Financial Risks	29 (Q13-Q14)	Cost impact on projects, Investment decisions and delays
Expect Increase in Material Risks	33 (Q14)	Cost pass-through, Stability concerns, Future market predictions, Return to normal doubts, Risk awareness and attitudes
Satisfaction with Practices	14 (Q15-Q18)	Levels of satisfaction, Trust in supplier communications, Responsiveness to market dynamics, Operational adaptations
Supply Chain Disruptions	13 (Q15, Q17)	Less trust in supplier communications, Responsiveness to market dynamics. Doubts about the availability of materials.
Desire for More Risk Management Dialogue	16 (Q18)	Discussion demand, Industry-wide communication needs, Information availability, Practical challenges in risk discussion participation, Industry and regulation dialogue
Other topics	N/A (Q15, Q17, Q19)	Energy Authority do not consider unusual market environment conditions. Lack of trust on supply chain transparency. Lack of long-term data-management practices. Lack of resources inhouse. Cyber-security threats. New risk management technology-systems cost too much. Some items have delivery time over a year. It is assumed that high price volatility continues. Increasing own material stock level.

4.1 Findings

The response rate was 45 % (35 out of 77 utilities), which can be considered resilient because it is based on specialized segment of industry where each answer is valuable due to specific expertise of the respondent (Baruch & Holtom 2008). All respondents were involved in material procurement, underlying the universality of procurement responsibilities and aiming to the right audience with the survey. Also, the questionnaire was built around specific tactics, where answering was made as easy as possible to avoid the desire not to answer. Sector representation, which is visualized in figure 6, can be seen in balanced (Fowler, 2014) solid in procurement strategies, where 51 % of respondent companies were procuring cables themselves when 49 % depended on contractors, suggesting a balanced approach to procurement practices across the sector.

A striking 100 % absence of third party financial hedging products usage revealed a significant area for potential development in risk management practices. Supplier diversification was mentioned by 50 % of respondents as current price risk management practice. In figure 6, it is also shown that 54 % reported that material price volatility had influenced their investment levels in the past two years, highlighting the critical impact of market fluctuations. Over 80% of respondents had encountered unexpected financial material risks, emphasizing the prevalent challenge of managing such uncertainties.

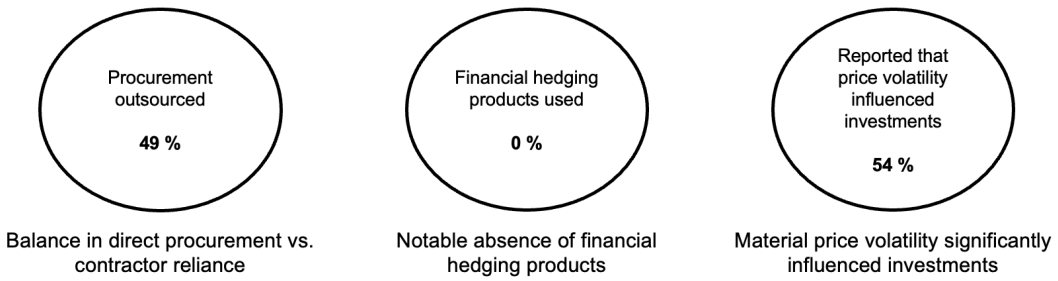

Figure 6. Survey results. Procurement practices and financial hedging

In the future half of the participants expected an increase in material risks, indicating a cautious outlook on future procurement and risk landscapes. 40 % of respondents were satisfied with their current practices suggesting a need for improved risk management and transparency with supply chains. Majority of respondents reported that one of the major problems is supply chain disruptions. For community engagement and guidance, 46 % of respondents expressed a desire for more dialogue about risk management, which reflect an industry-wide appetite for shared learning and enhanced strategies. Other important terms and themes related mainly to data-management, cyber-threats, regulatory changes and price predictability in the future.

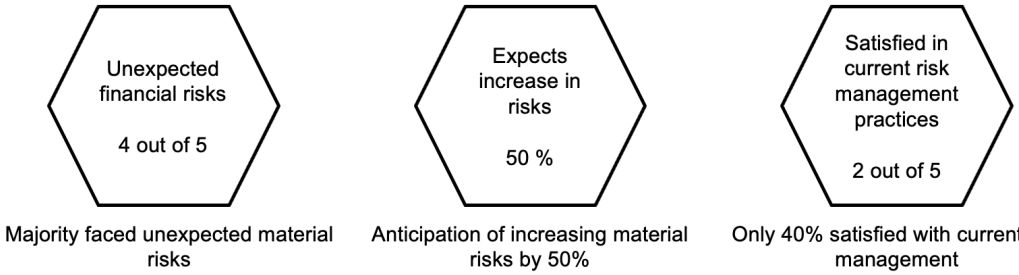

Figure 7. Survey results. Risk management challenges and satisfaction levels

It can be seen that the sector is actively grappling with the challenges of material procurement and risk management, yet evidently ready for evolution and improvement. Absence of financial hedging with significant percentage of facing unexpected risks confirms the necessity for more resilient strategic risk management methods. The mixed satisfaction levels with current practices and notable call for increased discussion signal a sector at a crossroads. There it can been seen a demand to refine its approach towards procurement risk management.

Based on survey results, utilities were owning the risk management problem instead of sharing it with the network. Stakeholders, such as customers, regulatory entities, and communities were not mentioned as risk management party in any response. Instead, Finnish Energy Authority was mentioned several

times as restrictive and troublemaking party which causes problems to investment practices. These findings offer quantitatively grounded insight into risk managements state with Finnish electrical network utilities.

4.2 Overview

To understand the current state of procurement practices and risks, the data in the survey forms a complex picture. With a response rate capturing nearly half of the targeted utilities, the findings provide a significant snapshot of the industry's current state. It is also important to state that over half did not respond, thus there might exist different practices that this thesis does not capture. A balanced difference in procurement practices is evident, with a near-even split between companies procuring cables directly and those relying on contractors, reflecting diversity in operational strategies.

The collective absence of financial hedging products usage amongst respondents highlights a critical gap in the current risk management frameworks, highlighting an opportunity for strategic development. Moreover, the influence of material price volatility is notable, with more than half of the utilities acknowledging its impact on investment decisions over the last two years, illustrating the tangible effects of market dynamics on strategic planning. The survey also surfaces a widespread experience of unexpected financial risks, with a majority having confronted such challenges, signaling the need for more resilient risk management approaches. Looking forward, the anticipation of increased material risks by half of the respondents demonstrates a cautious viewpoint towards future risk management in the sector.

Despite the current challenges, the satisfaction level with existing risk management practices and the desire for increased discourse suggest a readiness within the sector to adapt and enhance existing protocols. The utilities' call for greater dialogue and knowledge-sharing points to a collective pursuit of improved practices and strategies.

4.3 Risk management

A current practice among the surveyed utilities is the strategic diversification of suppliers to mitigate the risk of supply chain disruptions. This approach is widely recognized for its effectiveness in ensuring the continuity of operations, even when faced with unforeseen challenges. Additionally, the survey highlights an emerging trend towards digitalization in risk management processes. Utilities are increasingly leveraging data analytics and advanced monitoring systems to predict and manage risks proactively, marking a shift towards more technologically driven strategies.

The effectiveness of these practices varies, with traditional methods offering stability and predictability, while newer, technology-driven approaches provide enhanced flexibility and responsiveness. The diversification of suppliers, for instance, has been recognized for its role in minimizing dependencies, thereby reducing vulnerability to market or geopolitical instabilities. Meanwhile, digital tools are mentioned for offering real-time insights, allowing utilities to adapt to risks more dynamically. However, the adoption of such technologies also raises questions about cybersecurity risks, highlighting the balancing between modern and traditional risk management strategies.

Practices and pain points in table 1, as reported by the survey respondents, align with the current theories and literature on risk management, which emphasize the importance of a multifaceted approach. According to Bailey et al. (2019), successful risk management in the utilities sector necessitates a balance between traditional risk aversion tactics and the adoption of innovative technologies. The traditional risk aversion includes elements of historical precedence and conventional tools (Tversky & Kahneman 1974), whereas innovative risk management include emerging technologies, adaptation to market dynamics and evolves the attribute agile (Sheffi 2005). This blend not only protect against immediate threats but also prepares organizations for future uncertainties. The responses thus mirror the theoretical consensus that risk management must evolve continuously to address both existing and emergent risks effectively.

4.4 Common patterns

When considering the results from the survey, common patterns emerge from the data, suggesting standard practices existing in the field. For example, a majority of utilities may report similar approaches to handling procurement, such as a preference for in-house procurement versus outsourcing. However, there is notable variation in the reasons behind these choices, reflecting the complexity of the investment decision-making processes that are influenced by factors like company size, market position, and risk appetite. These patterns were not identified in the study, which might provide valuable insights into the industry's norms and outliers, which could be indicative of innovative practices or areas needing improvement.

Significant deviations in the data are particularly enlightening as they may point to pioneering strategies or unaddressed challenges within the sector. For instance, if a minority of respondents would employ advanced financial instruments for risk management, this could indicate either a cutting-edge approach not yet widely adopted or a lack of knowledge and resources in the broader industry. Identifying such deviations is crucial for understanding the full spectrum of risk management practices and for highlighting potential areas for further research and development. Implementing financial hedging tools are clearly a point for improvement.

The survey also uncovered a gap between the reported practices and the full spectrum of strategies discussed in academic and professional risk management literature. While some utilities were at the forefront of adopting cutting-edge technologies and methodologies, others appear to lag, relying predominantly on conventional practices. This disparity suggests that while the sector, as a whole, recognized the value of advanced risk management strategies, it was not implemented industry-wide.

Figure 8. Integrated Approach to Risk Management Strategies

Figure 8 was generated to illustrate various risk management strategies recommended based on survey findings and theory. These recommendations serve to direct utilities in improving their resilience against material risks, ensuring not only their survival but also their ability to succeed in an increasingly uncertain world. The adaptation and implementation of these strategies will be essential for utilities to successfully navigate the complexities of today's energy landscape.

4.4.1 Effectiveness of Current Practices

In assessing the effectiveness of current risk management practices among Finnish electrical utilities, it is imperative to consider the complex nature of risk mitigation efforts. The survey responses have demonstrated a spectrum of practices, from traditional risk aversion strategies to more innovative approaches leveraging new technologies. The effectiveness of these practices can be evaluated through several lenses:

- cost effectiveness,

- implementation complexity, and
- the tangible reduction in risk they afford.

The economic feasibility of risk management practices is a critical consideration for utilities, which can be seen at the last line in table 1. The survey revealed a conscious effort among respondents to balance the cost of implementing risk management strategies against the potential financial impact of unmitigated risks such as supply chain disruptions, market volatility and dependency on one supplier, but these risk management systems were also seen too expensive. According to Alicke et al. (2016) and Aghai-Khozani et al. (2022), the adoption of advanced analytical tools for predicting supply chain disruptions represents a significant upfront investment. However, literature supports that such tools can lead to substantial long-term savings by avoiding costly emergency procurements and project delays. It is still noteworthy that even if some companies are keen to adopt cutting-edge risk management technologies, the complexity of implementing these systems poses a significant obstacle. This includes the technical deployment and the training of personnel and the integration with existing processes. Case studies from the literature indicate that a phased implementation approach can mitigate these challenges, allowing utilities to gradually build competencies and integrate new practices with less disruption (Tomlin 2006).

The common theme in supply chain disruption mentions about the uncertainty of material availability, which suggests that there is room for improvement, particularly in adopting more advanced, data-driven risk assessment tools. Benchmarks (Hachmi et al 2022) suggest that leading utilities worldwide are increasingly relying on predictive analytics and artificial intelligence to anticipate and mitigate risks, which looks like a trend that Finnish electricity utilities could benefit from exploring further.

Additionally, the data also points to a notable gap in the engagement of stakeholders within the risk management process. This lack of engagement with customers, regulatory entities, and communities can lead to a disconnect between the utility’s risk management efforts and stakeholder expectations,

potentially undermining the utility's social license to operate. Williams (2018) advocates for a more inclusive approach to risk management that actively seeks input and collaboration from all relevant stakeholders.

Raw data was collected from a survey for Finnish electrical utilities, where responses included traditional risk management practices and some interest towards new innovative risk management models. Data was categorized into quantitative findings and qualitative themes. From there a spectrum of traditional risk tactics was formed. Then again the theory part of this thesis formed the other side of the spectrum, technology-driven solutions, where data-analytics steered towards predictive risk modelling. Obstacles among this spectrum were found to be industry specific protocols, different supply-chain management strategies and cyber-threat defense mechanism. The whole spectrum represents a range of methods that utilities can employ to manage risks. This also indicates that there is no on-size-fits-all approach and instead utilities tailor their approach based on following circumstances and operational context of investments. Based on the theory and survey data, to visually represent the risk management strategies utilized by Finnish electrical utilities, figure 9 was generated to illustrate a spectrum of methods ranging from traditional risk aversion tactics to cutting-edge technological solutions.

Figure 9. Illustration of the diverse array of risk management strategies employed by Finnish electrical utilities

Each end of the spectrum represents distinct approaches, with icons or symbols denoting the specific methods employed. This visual aids in understanding the

varied landscape of risk management within the sector. The methodologies in question span a broad spectrum, from traditional risk aversion tactics, such as physical protection and insurance policies, to more contemporary approaches that take advantage of new technology and data analytics for predictive risk modeling. The survey responses point out to a landscape where risk management practices are as varied as the utilities themselves, each tailored to the unique challenges and operational contexts of the responding entities. This variance highlights a sector characterized by a dynamic interplay between established protocols and the adoption of innovative solutions aimed at addressing the evolving nature of risks, from cyber-threats to supply chain vulnerabilities.

4.4.2 Gaps in Existing Risk Management Approaches

An examination of the analysis data and related theory reveals distinct gaps in the risk management strategies employed by Finnish electrical utilities. These gaps, spanning from risk identification to mitigation, highlight areas ripe for development and refinement.

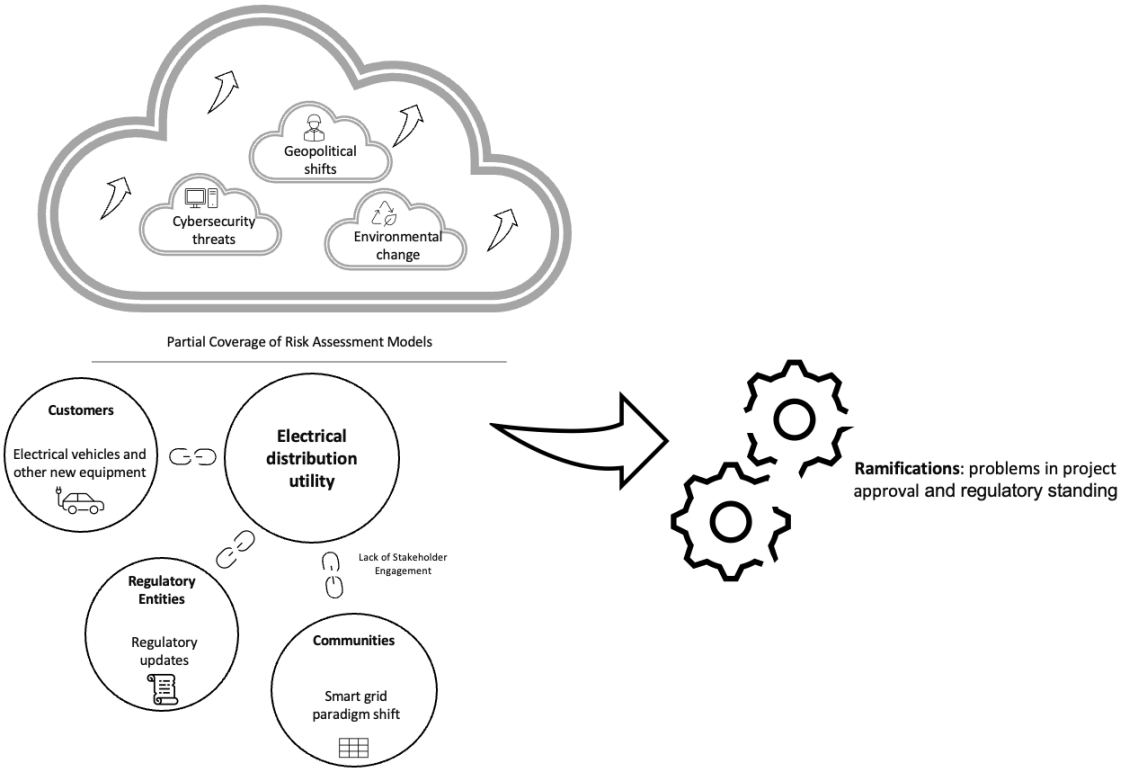

Figure 10. Visualization of identified gaps in existing risk management approaches

In figure 10 the visualization consists of a diagram divided into three sections, each representing a different gap in existing risk management approaches. The first section is represented by a cloud, the second section is located at the bottom left, and the third section is depicted by a wheel on the right.

A significant deficiency within current practices is the partial coverage of risk assessment models. While traditional operational and financial risks are well-addressed, emergent risks such as cybersecurity threats, environmental changes, and geopolitical shifts often lack adequate attention. According to Smith & Petley (2017), the fast-paced evolution within the energy sector necessitates risk management models that are as dynamic as the risks themselves. What comes to incorporation of novel risks, the survey findings reveal a shortfall in the strategic incorporation of emerging risks. Despite an awareness of the implications of digital transformation and environmental sustainability, concrete strategies for embedding these considerations into long-term strategic frameworks are lacking. This emphasize the critical need for risk management frameworks to be agile, allowing for the integration of new and evolving risks. It

cannot be understated that risks in the future, may be entirely different than risks in the present.

4.5 Identification of Alternative Risk Management Strategies

Based on the gathered information, on the risk management within Finnish electrical utilities, the identification of alternative strategies is a necessity driven by the rapidly evolving landscape of risks confronting the sector and not only an exercise in academic speculation. The reason behind the pursuit of these novel approaches lies in the imperative to bridge identified gaps in existing frameworks, adapt to the dynamic nature of risk factors, and leverage the transformative potential of emerging technologies.

The continuous evolution of risk landscapes, characterized by the emergence of new threats such as cyber-attacks, climate change impacts, and geopolitical shifts, demands a proactive and forward-thinking approach to risk management. Traditional methods served their purpose in the past, but may not suffice in addressing these contemporary challenges in the future. The gaps identified in current practices, which range from the underestimation of non-traditional risks to the lack of agility in response mechanisms, highlight the urgent need for utilities to expand their risk management repertoire.

Yet, emerging technologies offer unprecedented opportunities for enhancing risk management capabilities. Blockchain, artificial intelligence, and the Internet of Things (IoT), among others, provide innovative tools for improving transparency, predictive accuracy, and operational resilience. The strategic integration of these technologies can transform risk assessment, monitoring, and mitigation processes, enabling utilities to not only anticipate and respond to risks more effectively but also to do so in a manner that supports sustainable and efficient operations.

5 CONCLUSIONS

The survey responses provide a valuable snapshot of risk management practices among Finnish electrical utilities. They reveal that the sector is both grounded in proven strategies and open to innovation, reflecting a broad understanding of risk management's complex nature. As utilities continue to navigate the complex landscape of risks, the ongoing evolution of their risk management practices will be crucial for sustaining their operations and achieving long-term resilience. This analysis highlights the importance of bridging the gap between theory and practice, urging utilities to integrate the latest risk management insights and technologies to enhance their effectiveness and adaptability.

5.1 Key results and findings

The survey responses shed light on the material risks confronting Finnish electrical utilities, with a particular emphasis on supply chain disruptions, price volatility of essential materials, and regulatory changes. These risks are not just theoretical concerns but have tangible impacts on the operational efficiency, financial stability, and strategic planning of these utilities. For instance, supply chain disruptions can lead to project delays and increased costs, while price volatility can significantly affect budgeting and financial planning. Regulatory changes, on the other hand, can necessitate costly compliance measures and adjustments to business models, posing challenges to long-term sustainability. The current risk management practices within the sector, as revealed by the survey, express a varied level of effectiveness in addressing these financial risks. While some utilities have implemented comprehensive risk management frameworks that include diversification of suppliers, strategic stockpiling of materials and others rely more on reactive measures.

The effectiveness of these strategies is contingent upon the utility's size, resource availability, and the specific nature of the risks they face. The survey indicates that while these practices are generally effective in mitigating risks, there are opportunities for improvement, particularly in adopting more proactive and integrated risk management approaches. The real-world consequences of these

material risks highlight the need for utilities to continuously evaluate and enhance their risk management practices. It is evident that a one-size-fits-all approach may not be sufficient given the diverse and dynamic nature of the risks involved. Therefore, utilities must strive for a more tailored approach, taking into consideration their unique risk profiles and the changing external environment, where process refinement is the key.

5.2 Managerial implications

5.2.1 Concrete strategical implications

Based on literature review and empirical data, to effectively manage financial risks associated with material investments, utilities should increasingly turn towards sophisticated risk assessment tools and innovative financial instruments for hedging purposes. These strategies, as outlined by scholars such as Aven (2016), emphasize the importance of leveraging technological advancements to predict and mitigate risks more accurately. However, the implementation of these strategies often encounters obstacles such as technological limitations, organizational inertia, and regulatory challenges. To overcome these barriers, fostering a culture of innovation within the organization and engaging in proactive stakeholder dialogues are essential, as discussed by Kahneman and Tvesrky (1979) in their seminal work on prospect theory and risk management.

Moreover, diversifying supply chains and exploring renewable energy sources have emerged as essential strategies for enhancing operational resilience. The significance of investing in workforce training to adapt to new risk management tools and practices cannot be overstated, echoing the sentiments of Porter (1985) on competitive advantage and the value chain. The role of cross-functional teams in integrating emerging trends and the potential of partnerships with technology firms in accessing cutting-edge solutions are also highlighted as critical components of a comprehensive risk management framework. The broader implications of these findings for the sector's approach to risk management point towards the necessity of adaptive strategies that can protect in constantly changing risk landscape. Future research, as suggested by the works of Taleb

(2007) on the impact of rare events, should focus on developing more resilient and flexible risk management models that can respond to volatility and uncertainty.

5.2.2 Suggested Improvements in Risk Management

While considering the survey results and mirroring the literature review, to enhance the strategic approach to risk management, it's crucial to identify specific improvements, such as adopting new financial instruments, refining forecasting models, and integrating advanced technologies like AI and blockchain. These steps are designed to improve risk prediction and mitigation, with traditional practices like procurement management also playing an essential role.

Recommendations for utilities based on the survey findings and the analysis of current risks and management practices include the following:

- Leveraging technology for better risk prediction and management, including advanced analytics for supply chain monitoring and the possible use of blockchain for increased transparency.
- Build and keep up strong partnerships with suppliers to ensure reliability and negotiate flexible terms that can accommodate fluctuations in demand and supply.
- Beyond traditional risk mitigation techniques, considering innovative approaches such as collaborative risk sharing with other utilities or investing in alternative materials and technologies.
- Conducting comprehensive and frequent risk assessments to identify emerging risks early and adjust risk management strategies accordingly.
- Involving all stakeholders, including suppliers, regulators, and customers, in the risk management process to ensure a holistic approach and foster a culture of risk awareness.
- Ensuring that staff at all levels are equipped with the knowledge and skills to identify and manage risks effectively.

- Engaging with regulators and industry bodies to shape policies that mitigate industrywide risks and promote a stable operating environment.

The implementation of these enhancements requires a structured roadmap. This includes the integration of new practices, tools, and technologies into existing risk management frameworks, supported by comprehensive analyses like SWOT, Porter's Five Forces, and PESTEL, to fully understand the utility's strengths and market dynamics. Additionally, recognizing cultural differences is vital in customizing these strategies effectively. Incorporating advanced technologies such as asset management registers, blockchain, and AI tools, alongside virtual storage solutions, can significantly maintain the utility's risk management capabilities. This multi-faceted approach ensures a resilient, adaptive strategy that not only addresses current gaps but also positions the utility for future challenges and opportunities.

5.2.3 Prospective Risk Mitigation Techniques

After identifying gaps, the thesis seeks into the prospective risk mitigation techniques, spotlighting alternative strategies that, while not widely adopted within the surveyed Finnish electrical utilities, hold significant promise according to both literature and case studies from other sectors or regions. This exploration is particularly relevant in light of chapter two, where a comprehensive overview of financial instruments and commercial banking solutions for risk management was presented. Here, the discourse was extended by introducing and evaluating innovative risk mitigation techniques that could complement or enhance the current financial strategies employed by the utilities.

The investigation into material risk within electrical networks highlighted the criticality of managing price volatility and supply chain disruptions. Building on this, alternative risk management techniques such as predictive analytics for commodity prices, blockchain for supply chain transparency, and diversified renewable energy sources emerge as potential solutions. These approaches not

only offer a buffer against the identified risks but also align with the evolving technological landscape and sustainability goals of the utilities.

Leveraging big data and machine learning models to forecast commodity price trends can provide utilities with a proactive stance on budgeting and procurement strategies. This technique, detailed in studies by Chen (2021) and Ameur (2023), allows firms to anticipate market movements and adjust their hedging positions, accordingly, thereby reducing their exposure to price volatility. Implementing blockchain technology can enhance the transparency and efficiency of the supply chain, as explored by Torres (2023). By providing a tamper-proof ledger of transactions, blockchain enables utilities to track the provenance and flow of materials in real-time, mitigating risks associated with supplier reliability and geopolitical disruptions. Diversifying energy sources to include a broader mix of renewable options can reduce dependency on volatile fossil fuel markets. Research by Bolinger (2009) suggests that investments in solar, wind, and hydroelectric power not only mitigate financial risks associated with commodity prices but also contribute to the utility's sustainability targets.

Integrating these alternative techniques requires a strategic approach that considers the utility's specific risk profile, operational capabilities, and long-term objectives. Collaboration with technology providers, investment in research and development, and stakeholder engagement are critical steps in adopting these innovative practices. By embracing these alternative risk mitigation techniques, Finnish electrical utilities can enhance their resilience to the multifaceted risks presented by material price volatility and supply chain disruptions. The strategic integration of predictive analytics, blockchain, and renewable energy diversification, grounded in a thorough understanding of market dynamics and supported by relevant case studies and literature, offers a forward-looking approach to risk management in the sector.

5.2.4 Strategic Integration of Alternative Methods

A successful integration strategy begins with a thorough assessment of the current risk management framework to identify areas where alternative methods

could offer significant improvements. For example, incorporating predictive analytics for commodity price forecasting requires aligning this new capability with existing financial risk management practices. A phased integration approach, starting with pilot projects in less critical areas, can help in navigating the effectiveness and adjusting the strategy as needed. Additionally, fostering partnerships with technology providers and industry consortium can facilitate knowledge exchange and collaborative problem-solving, ensuring that the utility is leveraging the best available solutions. Navigating the regulatory landscape is crucial for the integration of new methods, particularly when implementing technologies like blockchain. Utilities must engage with regulatory bodies early in the process to ensure compliance and leverage any regulatory guidance or frameworks that support innovative risk management approaches. This proactive engagement can also aid in advocating for regulatory changes that encourage the adoption of advanced risk mitigation technologies.

Understanding the operational impact of integrating new risk management methods is essential. This includes evaluating the compatibility of new technologies with existing infrastructure, the potential need for upgrades, and the integration with operational processes. The goal is to ensure that the adoption of alternative methods enhances operational efficiency without introducing new vulnerabilities. The practical aspects of implementing alternative risk management methods involve several key factors:

- **Cost**: Assessing the financial implications, including initial investment, ongoing operational costs, and potential savings or ROI, is critical. Cost-benefit analyses can help in justifying the investment to stakeholders.
- **Organizational Changes**: The introduction of new technologies or practices may necessitate adjustments in organizational structure or processes. Clear communication, change management strategies, and executive support are vital for navigating these changes.
- **Training and Development**: Ensuring that staff are equipped with the necessary skills and knowledge to effectively utilize new methods is paramount. This may involve developing comprehensive training programs and continuous learning opportunities.

- **Addressing Resistance**: Resistance to change is a common challenge. Addressing concerns through transparent communication, involving employees in the integration process, and demonstrating the benefits of new methods can help in mitigating resistance.

The strategic integration of alternative risk management methods into Finnish electrical utilities' operations presents an opportunity to significantly enhance risk resilience. By carefully considering the strategies for integration, regulatory and compliance issues, operational impacts, and practical implementation considerations, utilities can navigate the complexities of adopting new technologies and practices. This holistic approach ensures that the sector can continue to thrive in an increasingly uncertain and dynamic environment.

5.3 Reliability discussion and future development

In navigating the constantly changing landscape of material risk management, it is important to formulate long-term strategies that are not only responsive to current market conditions but also anticipatory of future paradigm shifts. This section outlines innovative pathways to effectively manage material risks amidst dynamic market forces and technological advancements.

With the emergence of technological innovations such as LVDC networks (Kim et. al 2017), V2G grids, and Smart grid solutions (Mwasilu et al. 2014), utilities face both opportunities and challenges. To capitalize on these advancements, organizations must adopt a forward-thinking approach that involves continuous monitoring of risk landscapes. This includes investing in research and development to enhance current efficiency, anticipate future network requirements, and explore novel components and network structures. Furthermore, fostering a culture of innovation within the organization is essential, encouraging teams to challenge existing organizational models and adapt to current problems.

The paradigm shift from fossil fuel-powered energy production to renewable sources presents significant opportunities for risk management. Variable production, characteristic of renewable energy sources, necessitates a

revaluation of traditional risk mitigation strategies. Organizations should expose strategies such as diversification of energy sources, flexible demand management, and investment in storage technologies. By embracing renewable energy and adapting risk management practices accordingly, utilities can position themselves at the forefront of sustainable energy production.

Future research endeavors should prioritize understanding the intersection of procurement practices and asset management. By integrating procurement considerations into asset management strategies, organizations can mitigate future risks and enhance resilience against market volatility. Collaboration between utilities, technology providers, regulatory bodies, and academic institutions is paramount to advancing knowledge in this domain. This collaboration should extend beyond traditional boundaries, involving diverse stakeholders in joint-research efforts, knowledge sharing, and the development of best practices.

In the pursuit of effective risk management, utilities should not operate in isolation. Collaborating with other sectors such as water infrastructure and district heating can yield valuable insights into load management strategies and risk mitigation techniques. Additionally, engaging regulatory bodies and academic institutions in collaborative discussions fosters a holistic approach to risk management, leveraging versatile expertise and diverse perspectives. While the current risk management practices of Finnish electrical utilities demonstrate a solid foundation, the survey responses, supported by case studies and literature, suggest areas for enhancement. By addressing the gaps in cost-effectiveness, simplifying the implementation of complex systems, and aiming to achieve more substantial risk reduction, utilities can elevate their risk management strategies. Furthermore, benchmarking against international standards reveals a pathway for integrating more advanced technologies and methodologies, positioning Finnish utilities at the forefront of risk management innovation.

5.4 Summary

Theoretical frameworks and empirical findings in this thesis offer an interesting viewpoint of current risk management practices within the Finnish electrical utilities sector. The survey highlighted that a majority of utilities faced financial struggles due to material risks during the years 2021-2023, with price instability and supply chain management issues. Furthermore, a notable shift has been observed towards digitalization and data management, accompanied by heightened concerns regarding price volatility, cybersecurity threats and regulatory uncertainties. The purpose of this study was to combine theoretical frameworks with empirical observations to gain a comprehensive understanding of material risk management in electrical network investments. By integrating theoretical models and practical findings, it was possible to examine how risk management practices follow traditional pattern and have faced uncontrollable risk realization. Inductive approach enabled a holistic understanding of risk management in the context of electrical network investments.

The key findings of the study indicated that risk management practices in electrical network investments were traditional. While traditional methods such as diversification and hedging against price volatility remained insignificant, newer approaches such as predictive analytics and blockchain technology will likely become part of everyday business in the future. This points out a paradigm shift towards more data-driven and technology-based strategies in risk management. This may lead to better risk prediction and management, ultimately improving the long-term profitability and sustainability of electrical network investments. Additionally, greater emphasis on collaboration among various stakeholders in electrical network investments can be expected. This could create opportunities for new innovations and improve risk management practices across the entire industry. The study revealed that risk management methods employed in electrical network investments does not differ much. These findings indicated need for development and adaptation of new innovations and technologies in the field of risk management such as third-party financial hedging.

The evolving landscape of electrical investments necessitated adaptive risk management strategies. Traditional approaches are valuable, but can be enhanced with the complemented by agile frameworks capable of responding to rapidly changing market dynamics and emerging risks. Utilities must adopt integrated risk management frameworks that capture the interconnected nature of risks and opportunities to enable informed decision-making and resource allocation. By adopting a comprehensive approach to risk assessment, utilities can identify potential threats and leverage strengths to enhance resilience and long-term sustainability. In essence, effective risk management in electrical investments is not merely about mitigating threats but also about seizing opportunities and creating value.

REFERENCES

Aghai-Khozani, A., Bull, S., Dilda, V., Mori, L., & Reiter, S. 2022. A more resilient supply chain from optimized operations planning. McKinsey & Company.

Anbil, S. & Andersson, A. & Senyuz, Z. 2020. What Happened in Money Markets in September 2019? FEDS Notes. Washington: Board of Governors of the Federal Reserve System. Available at: https://doi.org/10.17016/2380-7172.2527 [Accessed 10th Jan 2024].

Alicke, K., et al. 2017. Big data and the supply chain: The big supply chain analytics landscape. McKinsey & Company.

Aliyu, A. A. & Singhry, I. M. & Adamu, H & AbuBakar, M. A. M. 2015. Ontology, epistemology and axiology in quantitative and qualitative research: Elucidation of the research philosophical misconception. In Proceedings of the Academic Conference: Mediterranean Publications & Research International on New Direction and Uncommon. Vol. 2, No. 1, pp. 1054-1068.

Aluminum Monthly Price - US Dollars per Metric Ton. 2022. Indexmundi. Aluminum Futures End of Day Settlement Price. Nov 2017 - Sep 2022. Source. COMEX – CME GROUP. Available at: https://www.indexmundi.com/commodities/?commodity=aluminum&months=60 [Accessed 18th Dec 2023].

Aven, T. 2016. Risk assessment and risk management: Review of recent advances on their foundation. European Journal of Operational Research, 253(1), 1-13.

Bailey, T. et al. 2019. A practical approach to supply-chain risk management. Operations Practice. McKinsey & Company.

Baruch, Y., & Holtom, B. C. 2008. Survey response rate levels and trends in organizational research. Human relations, 61(8), 1139-1160.

Ben Ameur, H., Boubaker, S., Ftiti, Z., Louhichi, W., & Tissaoui, K. 2023. Forecasting commodity prices: empirical evidence using deep learning tools. Annals of Operations Research, 1-19.

Bolinger, M. A. 2009. The value of renewable energy as a hedge against fuel price risk: Analytic contributions from economic and finance theory.

Chen, Z., Goh, H. S., Sin, K. L., Lim, K., Chung, N. K. H., & Liew, X. Y. 2021. Automated agriculture commodity price prediction system with machine learning techniques.

Dafir, M. & Gajjala, V. 2016. Fuel Hedging and Risk Management: Strategies for Airlines, Shippers, and Other Consumers. West Sussex: John Wiley & Sons.

Dixit, A. K., & Pindyck, R. S. 1994. Investment under Uncertainty. Princeton University Press.

Fingrid Oyj. 2023. Comments on the draft decision regarding the fairness of pricing methods for electricity transmission network operations for the regulatory periods 2024-2027 and 2028-2031. Lausunto kuulemisesta vahvistuspäätösluonnoksesta sähkön kantaverkkotoiminnan hinnoittelun kohtuullisuuden valvontamenetelmiksi valvontajaksoilla 2024 - 2027 ja 2028 – 2031. Lausuntopalvelu.fi.

Finnish Energy Authority. 2023a. Suomalaisten kotitalouksien sähkölasku kallistui keskimäärin noin 50 prosenttia vuonna 2022. News article. In Finnish. Available at: https://energiavirasto.fi/-/suomalaisten-kotitalouksien-sahkolasku-kallistui-keskimaarin-noin-50-prosenttia-vuonna-2022 [Accessed 22nd Jan 2023].

Finnish Energy Authority. 2023b. Regulatory methods 2016–2023. Available at: https://energiavirasto.fi/en/pricing-regulation [Accessed 22nd Jan 2023].

Fisher, R. 1993. Social desirability bias and the validity of indirect questioning, Journal of Consumer Research, 20(2), pp. 303-315.

Fowler Jr, F. J. 2014. Survey research methods. Fifth Edition. Sage publications.

Gurtu, A. & Johny, J. 2021. Supply Chain Risk Management: Literature review. Risks 9: 16. Available at: https://doi.org/10.3390/risks9010016 [Accessed 7th April 2024].

Helsinki facts and figures. 2022. City Executive Office, Urban Research and Statistics. ISBN 978-952-386-132-9. Available at: https://www.hel.fi/helsinki/en/administration/information/statistics/ [Accessed 23rd Jan 2023].

Hull, J. D. 2017. Fundamentals of futures and options markets. Eight edition. Pearson Higher Education AU. England.

Jorion, P. 2007. Value at Risk: The New Benchmark for Managing Financial Risk. McGraw-Hill.

Kahneman, D., & Tversky, A. 1979. Prospect Theory: An Analysis of Decision under Risk. Econometrica.

Kananen, J. 2017. Laadullinen tutkimus pro graduna ja opinnäytetyönä. JAMK University of Applied Sciences.

Kim, H., Cho, Y., Kim, J., Cho, J., & Kim, J. 2017. Demonstration of the LVDC distribution system in an island. CIRED-Open Access Proceedings Journal, 2017(1), 2215-2218.

Li, Y., Wang, C., & Li, G. 2020. A mini-review on high-penetration renewable integration into a smarter grid. Frontiers in Energy Research, 8, 84.

Measuring inflation – the Harmonised Index of Consumer Prices (HICP). 2022. European Central Bank. WWW document. Available at: www.ecb.europa.eu/stats/macroeconomic_and_sectoral/hicp/html/index.en.html [Accessed 18th Dec 2023].

Mehta. K. 2024. What is Financial Risk Management? WallStreetMojo. WWW document. Available at: https://www.wallstreetmojo.com/financial-risk-management/ [Accessed 7th April 2024].

Mwasilu, F., Justo, J. J., Kim, E. K., Do, T. D., & Jung, J. W. 2014. Electric vehicles and smart grid interaction: A review on vehicle to grid and renewable energy sources integration. Renewable and sustainable energy reviews, 34, 501-516.

Nawaz, S. 2020. Making History: Coronavirus and Negative Oil Prices. Global Risk Insights LLP. WWW document. Available at: https://globalriskinsights.com/2020/05/making-history-coronavirus-and-negative-oil-prices/ [Accessed 10th Dec 2023].

Nederhof, A. J. 1985. Methods of coping with social desirability bias: A review. European journal of social psychology, 15(3), 263-280.

Porter, M.E. 1985. Competitive Advantage. Free Press.

Rizwan, M. S. & Ahmad, G. & Ashraf, D. 2020. Systemic risk: The impact of COVID-19. Financial Research Letters, 36, 101682. Available at: https://doi.org/10.1016/j.frl.2020.101682 [Accessed 10th Dec 2023].

Rosa, J. 2021. How Small Manufacturers Can Develop Risk Management Strategies for their Supply Chains. National Institute of Standards and Technology (NIST).

Rubinstein, R. Y. 1981. Simulation and the Monte Carlo Method. John Wiley & Sons.

Saaranen, A. & Puusniekka, A. 2006. KvaliMOTV - Menetelmäopetuksen tietovaranto. Yhteiskuntatieteellinen tietoarkisto. Available at: https://www.fsd.tuni.fi/menetelmaopetus/ [Accessed 13th Mar 2023].

Saunders, M. & Lewis, P. & Thornhill, A. 2012. Research Methods for Business Students. Pearson Education Limited. Sixth edition. England. ISBN: 978–0–273–75075–8.

Sheffi, Y. 2005. The resilient enterprise: overcoming vulnerability for competitive advantage. Pearson Education India.

Smith, L., & Petley, D. 2017. Environmental Hazards: Assessing Risk and Reducing Disaster. Routledge

Statistics Finland. 2023. Number of bankruptcies highest in 25 years in November 2023. WWW document. Available at: https://www.stat.fi/en/publication/cl7yg4d8crpbu0cuhc1rw7spa [Accessed 7th April 2024].

Stridbaek, U. 2006. Lessons from liberalised electricity markets. CESifo DICE Report, 4(2), 24-29.

Taleb, N.N. 2007. The Black Swan: The Impact of the Highly Improbable. Random House.

Tamplin, T. 2023. Derivatives Strategies. Finance Strategists. WWW document. Available at: https://www.financestrategists.com/wealth-management/investment-management/derivatives-strategies/ [Accessed 7th April 2024].

The City of Rovaniemi. 2023. Tietoa Rovaniemestä. WWW-document. Available at: https://www.rovaniemi.fi/Kaupunki-ja-paatoksenteko/Tietoa-Rovaniemesta [Accessed 23rd Jan 2023].

Torres de Oliveira, R. 2023. Blockchain and the Multinational Enterprise: Progress, Challenges, and Future Research Avenues. Challenges, and Future Research Avenues (July 3, 2023).

Tversky, A., & Kahneman, D. 1974. Judgment under Uncertainty: Heuristics and Biases: Biases in judgments reveal some heuristics of thinking under uncertainty. science, 185(4157), 1124-1131.

University of Southern California. 2023. Organizing your social sciences. WWW-document. Available at: https://libguides.usc.edu/writingguide/methodology [Accessed 12th 2023].

Vidal C. 2007. An enduring philosophical agenda.

Wallnerström, C. J. 2008. On risk management of electrical distribution systems and the impact of regulations. KTH – Royal Institute of Technology. Doctoral dissertation.

Williams, T. 2018. "The role of stakeholder engagement in effective risk management." Journal of Risk Research, 22(7), 834-850.

LIST OF FIGURES

Practices in Procuring Electric Distribution Materials - March 2023

This survey covers all Finnish electric distribution utilities and aims to improve the procurement practices of electrical distribution materials (such as cables, transformers, and transformer substations).

Significant price variations in electrical distribution materials have been observed during the years 2020-2022, which may introduce uncertainties affecting future investments. The purpose of this study is to broaden the discussion around current investment practices and explore new perspectives on cost savings.

The survey is conducted among all Finnish electric distribution utilities. Responses are treated anonymously, and data management complies with the General Data Protection Regulation (GDPR) of the European Union, ensuring that information is not shared with third parties. Stored data will be deleted upon publication.

This research is part of a Master's thesis in Business Management, which will be published in the open access repository of the South-Eastern Finland University of Applied Sciences.

There are 23 questions in total. The estimated time to complete the survey is approximately eight (8) minutes.

If you wish to receive information about the publication, please provide your email address at the end of the survey.

Questionnaire for electrical distribution utilities

1. Respondent's company name (not mentioned in the publication)
2. Company role
3. Do you participate in procurement of electrical network materials in your current job?
4. Does the electrical network company procure conductors and cables for its projects?
5. If not, who procures conductors and cables for the projects? (e.g., contractor)
6. Does the electrical network company procure transformers for its projects?
7. If not, who procures transformers for the projects? (e.g., contractor)
8. Does the electrical network company procure substations for its projects?

9. If not, who procures substations? (e.g., contractor)
10. Does the electrical network company procure other electrical network products (poles, distribution cabinets, cable accessories) for its projects?
11. If not, who procures other electrical network products? (e.g., contractor)
12. Do you purchase commodity or currency hedges outside of delivery contracts? (e.g., aluminum hedges from banks) [free comment]
13. Have fluctuations in material prices affected your investment levels or investment plans in the past two (2) years? [free comment]
14. Have you encountered unexpected financial material risks in the past two years? (e.g., price, availability, delivery uncertainties) [free comment]
15. Have you considered changing your current material procurement practices due to potential financial risks? [free comment]
16. Do you perceive financial material risks increasing in the future? [free comment]
17. Are you satisfied with the current level of financial material risk management and supply chain transparency? [free comment]
18. Do you wish for more discussion or guidance on material risk management? [free comment]
19. Do you want to comment on anything related to financial risk management practices in the electrical network industry? [free comment]
20. Do you consider the topic of this thesis essential from the perspective of investment cost management? [free comment]
21. Would you like a copy of the survey responses emailed to you now?
22. What is the respondent's job role? [optional] (e.g., project manager, CEO, procurement manager)
23. Respondent's email address [optional]
24. May we contact you if further clarification of the survey results is needed?

Sähköverkkomateriaalien hankintakäytänteet maaliskuu 2023

Tämä kysely kattaa kaikki Suomen sähköverkkoyhtiöt ja se auttaa kehittämään **sähköverkkomateriaalien** (mm. kaapeleiden, muuntajien ja muuntamoiden) **hankintakäytänteitä**.

Sähköverkkomateriaalien hintatasoissa on havaittu huomattavia hankintahintavaihteluita vuosien 2020-2022 aikana, joilla voi olla tulevaisuuden investointeihin heijastuvia epävarmuustekijöitä. Tämän tutkimuksen tarkoituksena on laajentaa keskustelua nykyisten investointikäytänteiden ympärillä sekä avata uusia näkökulmia kustannussäästöihin.

Kysely suoritetaan kaikille Suomen sähköverkkoyhtiöille. Vastaukset käsitellään anonyymisti ja tiedonhallinnassa noudatetaan Euroopan Unionin yleistä tietosuoja-asetusta GDPR, eikä tietoja jaeta esimerkiksi kolmansille osapuolille. Tallennetut tiedot hävitetään julkaisun yhteydessä.

Tutkimus on osa liiketoimintajohtamisen maisterityötä, joka julkaistaan Kaakkois-Suomen ammattikorkeakoulun avoimessa julkaisuarkistossa.

Kysymyksiä on 23 kappaletta. Vastaaminen kestää keskimäärin kahdeksan (8) minuuttia.

Mikäli haluat tiedon julkaisusta, jätä sähköpostiosoitteesi kyselyn loppuun.

1. Vastaajan yrityksen nimi *(tätä ei mainita julkaisussa)* *

2. Yrityksen rooli *

- ◯ Sähköverkkoyhtiö
- ◯ Muu

3. Osallistutko nykyisessä työssäsi sähköverkkomateriaalien hankintoihin? *

- ◯ Kyllä
- ◯ En

4. Hankkiiko sähköverkkoyhtiö projekteihinsa johtimet ja kaapelit itse? *

- ◯ Kyllä
- ◯ Ei

5. Jos ei, niin kuka hankkii projektien johtimet ja kaapelit? (esimerkiksi urakoitsija)

6. Hankkiiko sähköverkkoyhtiö projekteihinsa muuntajakoneet itse? *

- ◯ Kyllä
- ◯ Ei

7. Jos ei, niin kuka hankkii projektien muuntajakoneet? (esimerkiksi urakoitsija)

8. Hankkiiko sähköverkkoyhtiö projekteihinsa muuntamot itse? *

- ◯ Kyllä
- ◯ Ei

9. Jos ei, niin kuka hankkii muuntamot? (esimerkiksi urakoitsija)

10. Hankkiiko sähköverkkoyhtiö muut sähköverkkotuotteet (pylväät, jakokaapit, kaapelivarusteet) itse? *

- ◯ Kyllä
- ◯ Ei

11. Jos ei, niin kuka hankkii muut sähköverkkotuotteet? (esimerkiksi urakoitsija)

12. Ostatteko hyödyke- tai valuuttasuojauksia toimitussopimuksen ulkopuolelta?
(esimerkiksi alumiinisuojauksia pankeilta) [vapaa kommentointi] *

13. Ovatko materiaalien hintavaihtelut vaikuttaneet teidän investointitasoihinne tai investointisuunnitelmiinne viimeisen kahden (2) vuoden aikana?
[vapaa kommentointi] *

14. Oletteko kohdanneet yllättäviä taloudellisia materiaaliriskejä viimeisen kahden vuoden aikana?
(esimerkiksi hinta, saatavuus, toimitusten epävarmuus) [vapaa kommentointi] *

15. Oletteko harkinneet muuttavanne nykyisiä materiaalihankintakäytänteitä mahdollisten taloudellisten riskien vuoksi?
[vapaa kommentointi] *

16. Koetteko taloudellisten materiaaliriskien kasvavan tulevaisuudessa?
[vapaa kommentointi] *

17. Oletteko tyytyväisiä nykyiseen taloudellisten materiaaliriskien hallintatasoon ja toimitusketjun läpinäkyvyyteen?
[vapaa kommentointi] *

18. Toivotteko enemmän keskustelua tai opastusta materiaalien riskienhallintaan?
[vapaa kommentointi] *

19. Haluatteko kommentoida jotain sähköverkkoalan taloudellisiin riskinhallintakäytänteisiin liittyen?
[vapaa kommentointi] *

20. Onko tämän lopputyön aihe mielestäsi olennainen investointien kustannushallinnan näkökulmasta?
[vapaa kommentointi] *

21. Haluatko kopion nyt annetuista kyselyvastauksista sähköpostiisi? *

- ◯ Kyllä
- ◯ En

22. Mikä on vastaajan työrooli? *[vapaaehtoinen]*
(esimerkiksi rakennuttaja, toimitusjohtaja, hankintajohtaja)

23. Vastaajan sähköpostiosoite *[vapaaehtoinen]*

24. Mikäli kyselyn tuloksia halutaan tarkentaa, voidaanko teihin olla yhteydessä?

- ◯ Kyllä minuun voi olla yhteydessä.
- ◯ En halua, että minuun ollaan yhteydessä.