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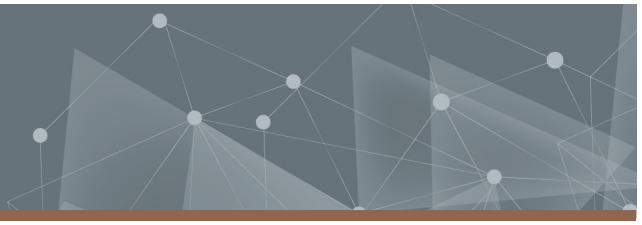

Evaluating the Value of Predictive Insights

Assessing the added value of predictive insights in the aerospace industry

Master's thesis in Quality and Operations Management

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Abstract

To manage uncertainty, business analytics and predictive models are widely used to support decision-making in industrial contexts. While existing research focuses on the development of predictive models and how such models are implemented in industrial contexts, this study aims to explore how the value of predictive insights can be evaluated and communicated within industrial organizations. The study adopts a qualitative research strategy, consisting of a literature review and an empirical case study at GKN Aerospace, based on semi-structured interviews and observations. The findings suggest that a standardized approach to quantify the value of predictive insights is not the most effective approach. Instead quantification must be done in a stakeholder-specific manner, since the value of predictive insights depends on how they are interpreted and acted upon by stakeholders. More specifically, the findings suggest that predictive insights are not valuable in isolation but through their impact on decisions and future outcomes. Additionally, the study concludes that quantification of predictive insights may be challenging in some instances where the value is not visible directly but instead emerges over time. Therefore, organizations may benefit from communicating the value of predictive insights retrospectively, to build acceptance and facilitate future initiatives in predictive analytic implementations.

Keywords: Predictive Insights, Supplier Performance, Supply Chain Analytics, Predictive Analytics

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Love Engh & Victor Nilson
Gothenburg, June 2026

List of Acronyms

Below is the list of acronyms that have been used throughout this thesis, listed in alphabetical order:

DD	Dollar Days
DP	Data Paradox
KPI	Key Performance Indicator
LV/HC	Low Volume, High Complexity
OEM	Original Equipment Manufacturer
RQ	Research Question
SCA	Supply Chain Analytics
SCM	Supply Chain Management
SDT	Self-Determination Theory
SM	Sensemaking
VOI	Value of Information
XP	Extreme Programming

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Introduction

1.1 Background

Predictive methods based on business analytics are widely used to support decision making in both everyday life and in different industrial contexts. Predictions are often used to forecast future outcomes and manage uncertainty, thereby supporting value creation and contributing to risk mitigation activities. This study examines how predictive insights are evaluated and communicated in an industrial context.

A research gap has been identified in the area of predictive analytics. A systematic literature review focused on predictive analytics and supply chain management, revealed that existing academic research tends to focus primarily on model development and technical accuracy, while industrial research tends to focus on the implementation process. Consequently, less attention is paid to how predictions are evaluated and communicated in an industrial context. Ultimately, this highlights the need for research that bridges academic and industrial perspectives, enabling a more holistic understanding of how predictive analytics actually create value.

This chapter introduces general concepts related to business analytics and predictions, and presents GKN Aerospace as the case company, to situate the study in an industrial context. Noteworthy is that supplier performance and reliability plays a critical role in ensuring production continuity and delivery reliability in the manufacturing industry. As a result, suppliers are a central element of the studied context, highlighting the focus on supplier-related predictions.

1.1.1 Predictive Analytics and Supply Chain Resilience

Traditionally, most of the research regarding inventory management and production planning in supply chain management have been conducted under normal working conditions (Svensson, 2000). This meant not taking into account unplanned events in the supply chain that could have an effect on the expected flow of materials and components. These unplanned events is typically referred to as supply chain disruptions, since they disrupt the normal flow of goods and materials within a supply chain. One of the main concerns for manufacturing companies is the financial and operational risks associated with these supply chain disruptions (Craighead et al., 2007).

The operational risks associated with supply chain disruption exist due to complex supply chain structures, resulting in disruptions easily propagating throughout the supply chain. It could result in a downstream propagation of the inability to fulfill demand, referring to the *ripple effect* (Dolgui et al., 2020). Another phenomenon is the *bullwhip effect*, which refers to how small fluctuations in downstream demand may result in progressively larger demand distortions and inventory swings as orders move upstream in the supply chain (H. L. Lee et al., 1997).

To mitigate the impact of supply chain disruptions, organizations increasingly rely on predictions to promote supply chain resilience and business decision-making (Aljohani, 2023). Predictions can be both qualitative and quantitative (Jonsson, 2008). In work situations qualitative predictions are used all the time, when decisions are made based on prior knowledge of similar experiences. If problems of similar types have been encountered before, more accurate an informed decisions can be made in the future. This is what is referred to as the qualitative type of predictions. On the contrary, when hard data points, such as historical supplier delivery performance, are retrieved and analyzed to predict the future, that is a quantitative prediction, sometimes referred to as predictive analytics.

Predictive analytics enable the analysis of both historical and real-time data to identify patterns, generate forecasts, and identify potential risks and opportunities before they happen (Aljohani, 2023). Consequently, the main idea behind predictive analytics is to enable proactive identification of risks and opportunities, instead of a reactive management, ultimately allowing proactive action. As proposed by Perera et al. (2019), accurate forecasting results in significant financial savings, higher competitiveness, and ultimately improved customer satisfaction.

Although predictive analytics serves as a valuable forecasting method, it does not operate independently of human judgments. Both the development of predictive models and the interpretation of their outputs are influenced by assumptions and experiences of the decision-makers (Perera et al., 2019). Consequently, the value of predictive analytics in supply chain planning does not only depend on technical accuracy, but also extends to how predictions are understood and acted upon in organizations. A wide variety of existing literature is covering the potential of predictive analytics to mitigate disruptions and enhance supply chain resilience, but

fewer publications cover how the value of predictive insights is quantified and acted upon. This highlights the importance of examining predictive insights not only as a technical tool, but also as support for decision-making, that is influenced both by organizational and human assumptions and beliefs.

1.1.2 Introduction to GKN Aerospace

The empirical research for this study has been conducted at GKN Aerospace, which is a global multi-technology leader in the aerospace industry (GKN Aerospace, n.d.). At present, GKN Aerospace has 32 manufacturing locations in 12 different countries in which they serve over 90% of the world's aircraft and engine manufacturers. GKN specialize in developing and delivering aerostructures and engine systems, consisting of structures and systems such as motor components, aircraft parts and other structural systems. The company targets multiple market segments and is therefore organized into three different business lines: Civil Aircraft, Defense Airframe, and Engines (GKN Aerospace, n.d.). The scope of this study is limited to the Engines business line, where they develop and manufacture advanced engine components for civil and defense aircraft, as well as space launchers and industrial gas turbines.

GKN Aerospace maintains a large and global supplier base. In the engines segment alone, GKN Aerospace collaborates with approximately 3 200 suppliers over several different continents (M. Arvemark, personal communication, February 19th 2026). The supplier network is geographically divided across North and Central America, Europe, the Middle East, and Asia, with suppliers predominantly located in the United States and Europe. GKN Aerospace engages with multiple suppliers for every product, contributing to a complex supply structure within the company's manufacturing operations.

GKN Aerospace was acquired by Melrose Industries PLC in the year of 2018 (Melrose Industries PLC, 2018). Melrose is a global aerospace and defense business listed in the UK (Melrose Industries PLC, n.d.). They work with providing advanced aerospace components and systems to major original equipment manufacturers (OEMs) across the civil and the defense market. At the time of the acquisition GKN Aerospace assets represented approximately 85% of Melrose's group sales (Melrose Industries PLC, 2018).

The aircraft manufacturing industry is sometimes described as a cottage industry, mainly due to the way in which the industry is operating, manufacturing small production volumes with reliance on craftsmanship rather than mass-production. Because of extreme safety requirements, complex engineering, and lower demand (compared to the automotive industry), the aircraft industry focuses on low-volume, high-complexity (LV/HC) products (McKinsey & Company, 2024). Because of the extensive safety requirements and the complex engineering involved in manufacturing most of the components, the supply chain consist of several specialist suppliers that create complex and difficult-to-replicate parts. The extensive safety requirements, combined with the lack of suppliers that create these specialized parts, results in a supply chain of long lead times. Furthermore, the low demand comes from a

small customer base, so if a single account orders more or less than expected, and the production precedes as planned, the impact of an inaccurate forecasting will be magnified.

Figure 1.1 below illustrates the main actors in the supply chain that surrounds GKN Aerospace, with particular focus on the Engines business line. In the supply chain, upstream suppliers provide raw materials, semi-finished products and specialized components that are required for the manufacturing of aerospace engine components. Within the supply chain, GKN Aerospace acts as an intermediate actor by designing and manufacturing advanced structures and components for aircraft engines. In this context, GKN Aerospace operates as a Tier-1 supplier, by delivering complex and highly engineered components directly to engine OEM:s. These OEM:s are responsible for the assembly and integration of complete aircraft engines, which are subsequently delivered to aircraft OEM:s for final assembly. Consequently, the engine OEM:s are Tier 1 customers to GKN Aerospace, and the aircraft OEM:s are Tier 2 customers to GKN Aerospace. A more thorough description of the concept of supply chain tier structure is provided in section 2.1.2.

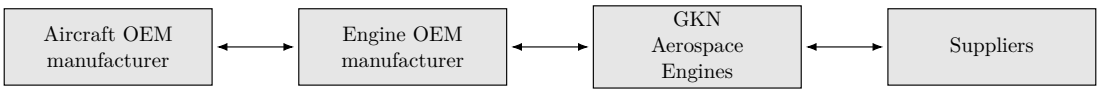

Figure 1.1: Overview of the supply chain actors surrounding GKN Aerospace Engines

1.1.3 Prior Initiatives at GKN Aerospace

A prior project has been conducted at GKN Aerospace to explore the potential of using predictive analytics, by predicting supplier performance. The previous project focused on a specific product and its associated suppliers, where historical supplier performance data was collected and analyzed. Based on this historical data, statistical and mathematical models were developed and trained to identify patterns in supplier behavior and performance, to provide predictions of future supplier delivery performances. This project was, at the time, intended as a proof-of-concept to demonstrate the potential of such models as a compliment to experience-based predictions of suppliers. The results showed promising predictive capabilities, with error margins as low as around 2,5%.

This master's thesis builds upon the prior conducted project by extending the scope from quantitative evaluation to a qualitative investigation of the practical applicability. While the previous project primarily demonstrated predictive performance, this study considers how such predictive models can create practical value for industrial organizations such as GKN Aerospace.

1.2 Project Aim

The number of forecasting tools has increased thanks to the implementation of AI tools and machine learning. Therefore the availability of more accurate forecasting and predictive analytics has increased. With GKN Aerospace as our case company, we therefore seek to examine how to evaluate and communicate the value of predictive insights on supplier performance. An illustration of the value creating window as a result of having predictive insights, is presented in fig. 1.2 below. Ultimately, this window creates an opportunity for improved decision-making which would not have been accessible without predictive insights.

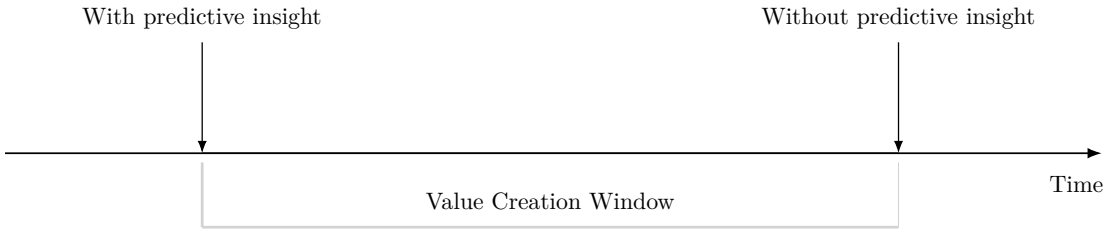

Figure 1.2: Illustration of the value creation window enabled by predictive insights

1.3 Specification of Research Questions

This thesis has two research questions. The two research questions are structured to reflect two consecutive analytical steps. The first research question focuses on identifying and quantifying organizational value, by addressing in what ways predictive insights on supplier performance may create value, and how such potential value can be quantified in a manufacturing context. Consequently, the second research question builds on the first research question by focusing on how organizations can translate and communicate the value. Together, the two research questions distinguish between identifying value and enabling its practical use in industrial decision-making.

RQ1: *In what ways can the business value of predictive insights on supplier performance be evaluated in an industrial context?*

RQ2: *In what ways can business value from predictive insights on supplier performance be communicated to decision-makers to support early and proactive actions?*

1.4 Delimitations

This is a case study at GKN Aerospace and the empirical data collection is concentrated in Sweden, focusing specifically on their business segment Engines. The study does not aim to represent GKN Aerospace's global operations or their supplier network as a whole. Furthermore, this delimitation is meant to allow for a deeper and more thorough understanding of predictive insights on suppliers, and its connected business value. Additionally, by limiting the study to the Engines segment of GKN Aerospace's global operations, this study is manageable for the available time period given. This delimitation also allows for an easier and more logical sampling selection of the interview participants, as access to GKN Aerospace's global operations would have implied extensive sampling challenges otherwise. Consequently, the findings from this study should be interpreted within the geographical and organizational boundaries of this scope. Nevertheless, the goal with this study, is to generate insights that should be applicable for both GKN Aerospace's global operations, as well as for other industrial organizations.

Moreover, the study will take place in an environment characterized by a high level of confidentiality. As a result, certain internal data and information have therefore been anonymized and in some cases excluded entirely. The consequences of the degree of confidentiality, therefore results in some of the findings being presented at a more general level.

2

Theory

This chapter presents the theoretical foundation for the study by introducing key concepts and frameworks related to supply chains, risk management, value of information, development processes, human motivation, and organizational acceptance. The purpose of this chapter is to provide the reader with a conceptual basis to enable better understanding of the analysis and interpretations of the empirical findings.

2.1 Supplier Structures and Performance in Supply Chains

This section introduces concepts related to suppliers, supplier structures, and supplier performance in supply chains. Ultimately, this sections aims to provide the reader with a better understanding of suppliers and supply chain structures.

2.1.1 Suppliers and Their Role in Supply Chains

Suppliers makes up an essential part of supply chains by acting as a provider of materials, components, and services that are required for production and delivery of the end products. Suppliers acts as more than a transactional part in supply chains, as suppliers often are an important part of supply chain networks, where information-sharing and coordination with suppliers influence how the entire supply chain is performing Chopra and Meindl (2016). In other words, suppliers do not only contribute to cost efficiency for organizations, but they also have a crucial role in other aspects such as product quality, and innovation capabilities. Researchers widely agree on that suppliers are critical to organizations overall competitiveness (Chopra & Meindl, 2016).

As a result of globalization, the overall level of complexity in supply chains has increased. Therefore, building and maintaining strong supplier relationships is crucial for organizations to maintain strong overall supply chain performance (Chopra & Meindl, 2016). Organizations often rely on geographically dispersed supplier networks. While dependencies in such geographically dispersed supply chains can enhance flexibility and offer access to specialized capabilities, they also imply risks such as increased vulnerability related to supply chain disruptions and a more limited supply chain visibility (Chopra & Meindl, 2016).

Suppliers are usually evaluated based on measurable performance indicators, sometimes referred to as Key Performance Indicators (KPI:s). The performance indicators that suppliers are usually evaluated upon consists of factors such as quality, process development, and customer service performance (Jonsson, 2008). By evaluating suppliers based on such metrics, organizations are able to better assess and track supplier performance over time. Additionally, as more and more data becomes easily available in supply chains, the possibility of analyzing historical performance data allows for an even better understanding of supplier behavior.

2.1.2 Supplier Tier Structures

Supplier tier structure refer to how suppliers are organized into hierarchical tiers within a supply chain. The concept of supplier tier structure describes the position and role of all suppliers within a supplier network, and how the suppliers relate to each other (Jonsson, 2008). These tiers are typically categorized in numbers such as Tier 1 suppliers, Tier 2 suppliers, Tier 3 suppliers, and so on depending on the total number of different levels of suppliers. More specifically, the Tier 1 suppliers deliver products or services directly to the focal firm, while Tier 2 suppliers provide products or services to the Tier 1 suppliers (Jonsson, 2008). Consequently, the Tier 3 suppliers supplies raw material or other more basic components to the Tier 2 suppliers. To clarify, the term "focal firm" refers to the analyzed organization, and its definition is relative to the chosen perspective. Therefore, in this study, GKN Aerospace is considered the focal firm. This tier-structure is further exemplified and illustrated in fig. 2.1.

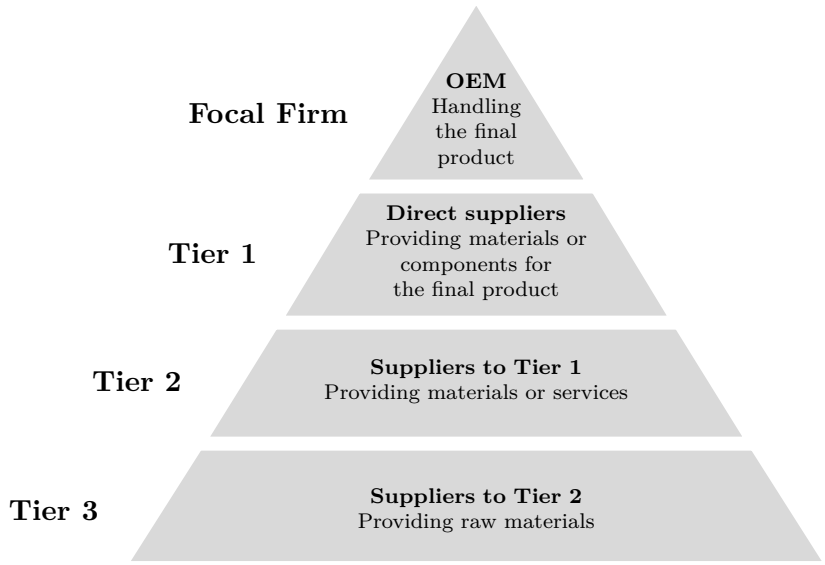

Figure 2.1: Overview of an example of the supplier tier structure

Since GKN Aerospace is considered the focal firm in this study, its Tier 1 suppliers are those that provide products or services directly to GKN Aerospace, while the Tier 2 suppliers refer to those organizations that are supplying the Tier 1 suppliers with inputs. The same reasoning applies to the Tier 3 suppliers, which are supplying GKN Aerospace's' Tier 2 suppliers with, for example raw materials or more basic components. This structure of tiered suppliers highlights how supply chains consist of several interconnected organizations that together, within the overall supply chain, contribute to the final product (Jonsson, 2008).

Naturally, the number of tiers is large in complex industries. This consequently results in longer and more fragmented supply chains, with an extensive supply chain complexity (Mena et al., 2013). In other words, as the number of tiers increases, it becomes increasingly difficult to maintain an overview of the entire supply chain (Mena et al., 2013). Moreover, since the different tiers of suppliers are working together for the final product or service, supply chains contain organizational interdependencies (Jonsson, 2008). Therefore, the performance of one supplier in a supply chain network, most likely affect the performance of other suppliers in the supply chain. Moreover, if one supplier experiences disruptions in its operations, that particular disruption often cascades further in the supply chain and affects other actors in their operations. As outlined in section 1.1.1, this is typically referred to as the *"ripple effect"* (Dolgui et al., 2020). In theory, multiple suppliers from different supplier tiers may rely on the same upstream sources, such as raw material providers for example. This can create industry bottlenecks, as disruptions at a single upstream source may influence several suppliers across different tiers (Jonsson, 2008).

Another challenge that is associated with a multi-tier supplier structure is the risk of limited visibility and control (Chopra & Meindl, 2016). Organizations often have direct contact with their Tier 1 suppliers, but contact with Tier 2 suppliers and other suppliers further upstream in the supply chain may be more indirect and consequently also less transparent (Jonsson, 2008). As a result, the focal firm could therefore lack insights into what its sub-suppliers are doing. This limited supply chain visibility could make it difficult for focal companies to identify potential risks upstream in the supply chain. Therefore, disruptions that occur in upstream tiers may remain undetected until they have already affected downstream operations. Additionally, a more complex supplier tier structure also influence the availability and quality of information such as the access to supplier data (Awaysheh & Klassen, 2010). Generally, data is more accessible and reliable at the Tier 1 level, while good quality data is harder to obtain from sub-suppliers at upstream tiers.

2.1.3 Supplier Sourcing Strategies

Supplier sourcing strategies refer to how an organization select and manage its supplier base in order to get access to materials or services required for their operations. To clarify, and by building on the previous section, a supplier base consist of all the suppliers that a focal company uses for its inflow of materials. Furthermore, a common distinction is between single-sourcing and multi-sourcing as a sourcing strategy (Jonsson, 2008). A single-sourcing strategy implies solely relying on one supplier

for the inflow of a specific product or material, whereas a multi-sourcing strategy includes several suppliers for that product or material (Jonsson, 2008).

Each of these two sourcing strategies comes with different implications for cost, risk, and supplier relationships. As previously stated, single-sourcing involve relying solely on one supplier for specific products or services. This sourcing strategy therefore enable stronger supplier relationships, better communication, and closer collaboration with the supplier, in comparison to a multi-sourcing strategy (Jonsson, 2008). However, a single-sourcing strategy also increases supplier dependencies and implies an increased risk for potential single point of failures, which is ultimately making the focal company more vulnerable to supplier disruptions. In contrast, and as previously mentioned, a multi-sourcing strategy involve two or more suppliers for the inflow of the same goods. This sourcing strategy allow reduced supplier dependencies and therefore also potentially reduced supply risk (Jonsson, 2008). This by allowing the focal company to alternate between suppliers if needed. On the contrary, managing multiple suppliers may increase both operational costs and complexity, and the strategy may also reduce opportunities for strong and long-term supplier relationships. The choice of sourcing strategy therefore introduces a trade-off between cost efficiency and supply chain resilience, that organizations have to balance when deciding upon sourcing strategy.

2.1.4 Supplier Performance and Evaluation

Supplier performance refer to how well suppliers meet expectations and requirements that are stated by the focal organization. A solid and continuous supplier performance is critical for the focal organization, as supplier performance has direct influence on their performance (Gupta & Gupta, 2025). As supply chains have become increasingly globalized and complex, the ability to monitor, evaluate, and manage suppliers, based on their performance, becomes important for maintaining supply chain effectiveness and organizational profitability (Chopra & Meindl, 2016). By using several performance indicators as outlined in 2.1.1, organizations can assess and evaluate supplier performances in a structured and consistent way over time. This way organizations can compare different suppliers, identify potential performance trends, and better support decision-making processes related to the selection and development of future suppliers (Jonsson, 2008).

From a data analytics perspective, the possibility of evaluating supplier performance is connected to the availability and quality of historical supplier performance data (McKinsey & Company, 2024). By analyzing such past performance data, focal organizations have the opportunity to gain insights into how their suppliers behave and how well they perform over time. Ultimately this allows for identification of patterns that could indicate potential future outcomes (R. Arvidson, personal communication, January 20th 2026). Ultimately, this creates opportunities for organizations to utilize more predictive approaches, where data-driven models can be used to better forecast supplier performances and enable supporting of more informed decision-making. As a result, evaluations of supplier performance, not only provides the focal organizations with insights into past supplier performances, but

it also enable better opportunities for anticipation of future supplier performances. This goes hand in hand with the development of increasingly data-driven global supply chains, and is therefore a central aspect of this study.

2.2 Risk Management in Supply Chains

In this section, concepts that are related to risk management in supply chains are introduced. This with a particular focus on risks and uncertainties which are related to suppliers. By building on the previous section, this section highlights how network dependencies and other forms of supply chain complexity could result in different forms of risk for organizations. Additionally, this section aims to presents commonly used approaches for identifying, assessing, and managing risks, to facilitate a better understanding of mitigation activities.

2.2.1 Supplier Risk and Uncertainty

Supplier risk refer to the potential risk for disruptions or other issues that could occur to a supplier, and which would have negative consequences to the focal organization or the overall supply chain. Supplier risks can originate from different sources, including sources such as supplier delays and geopolitical disruptions (Chopra & Sodhi, 2004). As supply chains have become more global in the past decades, the exposure to supplier risks have increased, as a result of an increased level of complexity in supply chains (Chopra & Meindl, 2016). Additionally, supply chains are also characterized by uncertainties. Such uncertainty may arise from sources such as variability in demand, general supply fluctuations, or a limited visibility into supplier activities (Chopra & Meindl, 2016). As previously discussed in section 2.1.3 regarding sourcing strategies, a multi-sourcing strategy acts as a mitigation effort to decrease both supply chain risks and uncertainties, that a single-sourcing strategy implies (Jonsson, 2008).

For organizations to effectively manage their supply chain, they have to both understand what supplier risks they actually have and be able to identify further uncertainties. Additionally, organizations must not only focus on identifying potential sources of risk and uncertainties, but they must also be able to effectively address the actual level of uncertainties, to be able to make better informed decisions related to sourcing, supplier selection, and other forms of supplier management (Courtney et al., 1997). To manage all these challenges, organizations may rely on different systematic analysis approaches, in which some of these are described further in the following sections.

2.2.2 Risk Analysis

As previously mentioned, risk analysis is an important part of organizations' supply chain management. Ultimately, risk analysis acts as a way to identify critical paths among all potential risks where particular attention needs to be paid (Jonsson, 2008). This also includes clearly defining these risks. Risk analysis can involve

several steps, such as examining possible sources of risks and understanding where they could develop (Jonsson, 2008). Risks related to suppliers includes factors such as supplier reliability, geographical concerns, and other dependencies in the supply chain network (Chopra & Sodhi, 2004). Furthermore, a central aspect of risk analysis as an approach is the evaluation of how likely different risks are to occur, and the potential impact that they would bring to the supply chain (Jonsson, 2008). If organizations work to address such risk factors, they can more effectively prioritize the most impactful risks and focus their attention on mitigation efforts for the risks with the most immediate threat. All in all, risk analysis is an important part of organizational decision-making, since it enables organizations to compare different risks and understand their relative importance, to make better informed decisions. Examples of tools that are commonly used in analyzing risks will be discussed further in section 2.2.3, as well as in section 2.2.4.

2.2.3 Risk Assessment Matrix

A commonly used tool to analyze risks is the risk assessment matrix (Jonsson, 2008). This tool supports risk analysis by providing a visual representation of risks based on two factors. These two factors consists of the likelihood of a risk occurring and the potential severity of the consequences if that same risk actually occurs (Jonsson, 2008). By illustrating different risks in a clear way, the risk assessment matrix allow organizations to get a more thorough overview of different risk levels, and it also supports a more actionable evaluation of these risks. An example of a risk assessment matrix is presented in fig. 2.2.

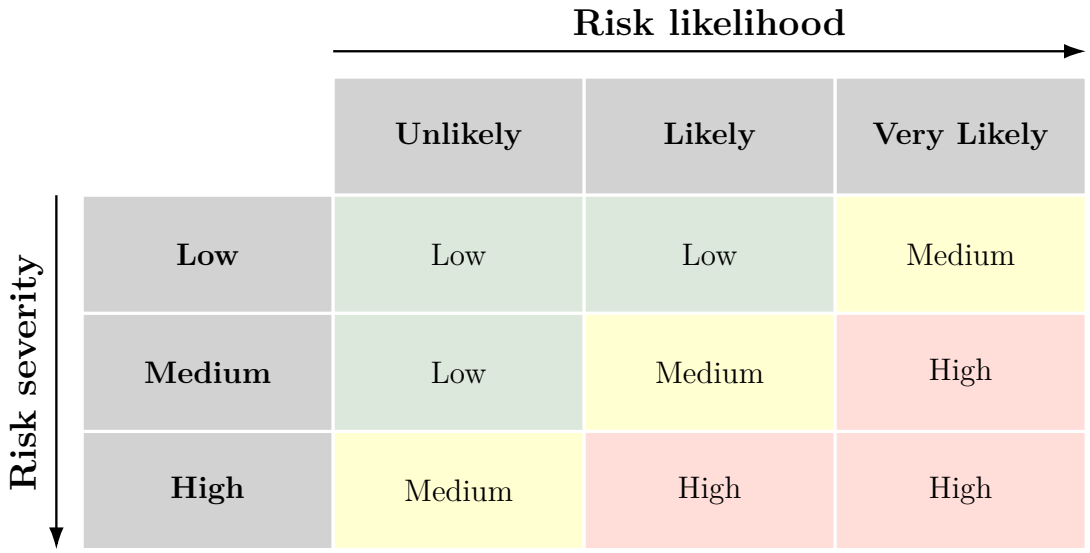

Figure 2.2: Example of a supplier risk assessment matrix, illustrating the relationship between likelihood and severity

The horizontal axis of the risk assessment matrix represent the likelihood of a risk occurring. The axis is ranging from unlikely to very likely. In addition, the vertical axis instead represent the severity of the potential consequences if the risk occurs, ranging from low to high. By combining these two factors, different risks that are identified can be positioned within the matrix. The intersection between likelihood and severity ultimately determines the overall level of the risk. The risk level of that intersection can in that way, be categorized in levels such as low, medium, or high risk. The risks that are associated with both high likelihood and high severity are the ones that are usually considered the most critical to handle, as they imply the largest potential threat to the organization. This way of categorizing risks enables organizations to prioritize risks in a more systematic way, and therefore be able to more effectively allocate its resources as a result (Hallikas et al., 2004). Ultimately, the risk assessment matrix may be used as a practical tool for decision-making processes, to assess and mitigate risks.

2.2.4 Scenario Planning

An additional way of assessing risks is scenario planning. Ultimately, scenario planning is used as an approach to plan for different potential scenarios that could develop from risks or uncertainties (Courtney et al., 1997). Instead of trying to predict a single outcome, the idea behind scenario planning, is to construct several possible future scenarios based on different assumptions about how different events and factors may evolve over time. This approach enable organizations to better understand different possible outcomes and how they would affect their operations in a more proactive way.

Due to the complexity and inter-dependencies in global supply chains, scenario planning is a particularly important approach to promote operational proactivity (Chopra & Meindl, 2016). Organizations may explore how risks could develop with time, by analyzing the different scenarios, and evaluate how their existing supply chain strategies may perform in such conditions. For example, an organization could consider several different scenarios where a supplier is disrupted, or scenarios were demand suddenly increases, and evaluate how such events would affect their operations. As previously stated, scenario planning enables an increased opportunity for proactive efforts, and it also makes it easier for organizations to more effectively identify potential weaknesses in existing strategies. Additionally, scenario planning also allows organizations to assess potential consequences of acting upon scenarios in different ways. This ultimately allows decision-makers to better understand the implications of uncertainty and support more informed and proactive decisions (Courtney et al., 1997).

2.2.5 Safety Stock and Buffers

Previous sections have illustrated how organizations may asses and plan for potential risks and uncertainties. However, organizations may utilize safety stock and buffers as more practical strategies to mitigate the impact of disruptions and uncertainties (Chopra & Meindl, 2016). Safety stock refers to additional inventory that organizations build to reduce the risk of inventory shortages, in case of possible disruptions or other events. Additionally, buffers can also include extra capacity in different parts of organizational operations. Therefore, safety stock and buffers are ultimately used as strategies to mitigate operational disruptions. Ultimately, these strategies increases supply chain resilience, but they also bring organizational drawbacks (Chopra & Meindl, 2016). To maintain additional inventory or other operational buffers, organizations must often face higher operational costs, which included expenses such as holding costs and increased capital tied up in inventory (Jonsson, 2008). Therefore, organizations must balance their operational resilience with considerations regarding their operational expenses. Ultimately, insights gained from risk analysis and scenario planning can support organizations in deciding appropriate levels of safety stock, potentially reducing unnecessary costs. This balance is important for organizations to address as both cost efficiency and operational resilience is crucial for overall profitability.

2.3 Predictive Insights and Value of Information

This section introduces concepts related to predictive insights, supply chain analytics, and the value of information within supply chain management. By building on the previous section, this section highlights how analytical capabilities and predictive insights may crate valuable information and a support for organizational decision-making.

2.3.1 Predictive Insights and Uncertainty Reduction

Organizations are increasingly adopting predictive analytical tools to benefit from more proactive and data-driven decision-making processes (Schoenherr & Speier-Pero, 2015). As previously highlighted in section 2.1.1, modern supply chains often involve complex supply chain structures. This growing complexity has increased the importance of analytical capabilities to support decision-making processes within supply chain management. To manage challenges associated with a growing supply chain complexity, organizations increasingly rely on Supply Chain Analytics (SCA), to enhance innovation capabilities and build robustness in their supply chain (Shamout, 2019).

SCA refers to the analysis of large sets of supply chain data. The review is conducted by using analytical methods and computer software to identify patterns in the data, which ultimately facilitates more effective organizational decision-making (ASCM, n.d.). By using both historical and real-time supply chain data, SCA therefore support organizations in improving visibility, monitoring operational performance, and

supporting overall supply chain planning (Kalaitzi & Tsolakis, 2022). For SCA to work properly, Kalaitzi and Tsolakis (2022) argues that organization require three sets of capabilities, including performance management resources, IT-planning resources, and data management resources. Furthermore, SCA commonly includes descriptive and predictive forms of analytics (Kalaitzi & Tsolakis, 2022). To clarify, this study focuses on predictive forms of SCA.

Within SCA, predictive analytics has become increasingly important as a result of organizations increasingly seek to improve resilience, flexibility, and data-driven decision-making in their supply chain management (Kalaitzi & Tsolakis, 2022). Predictive analytics refers to the utilization of tools such as statistical models, machine learning techniques, and forecasting methods. These tools are used to analyze historical data which allows organizations to better estimate future outcomes and the probability of potential events occurring (IBM, n.d.). Unlike descriptive analytics which is used to better understand events that have already occurred, predictive analytics is a proactive tool which enables organizations to anticipate what the future holds, prior to potential events or disruptions actually occurring (IBM, n.d.). The outputs that are generated through predictive analytics may be described as predictive insights. Ultimately, predictive analytics refers to the analytical process itself, while predictive insights refers to the actual information derived from such analytical processes. Therefore, "early indications" is equivalent to the term predictive insights.

2.3.2 Value of Information

Claude Elwood Shannon (1948), founded the field of Information Theory in his paper *"A Mathematical Theory of Information"*. Essentially, he wanted to understand information mathematically. The question was, if information is sent from one place to another, how much of that information is actually being transmitted? The central insight of his paper ended up being that communication fundamentally is about uncertainty reduction (Shannon, 1948).

Shannon (1948) suggests that if the probability of an event is high, the informational content of the message is low. Conversely, if the probability of an event is low, the informational content associated with receiving that message increases. Therefore a message could be evaluated based on the degree to which it reduces uncertainty. The informational content of a message is not connected to its usefulness. Neither is it connected to whether it is emotional, profitable, important or true. Instead, the informational content of the message is connected to how much it reduces uncertainty (Shannon, 1948).

Howard (1966) is expanding on the idea of communication as a means to reduce uncertainty in his article *"Information Value Theory"*, in which he tried to understand what uncertainty reduction is worth economically. He explain that the article *"A Mathematical Theory of Information"* measure informational content mathematically, but that it ignores consequences. While Shannon (1948) is claiming that information is about uncertainty reduction, Howard (1966) builds on it and says that

information also should be evaluated on how it changes decisions and outcomes. Consequently, Howard introduces the concept *Value of Information (VoI)*, where he states that information only has value if it improves decisions future outcomes.

Howard (1966) argues that information theory is lacking because it does not cover the value associated with information. Information can reduce uncertainty, but if the information is not acted upon and does not lead to decisions, it is not valuable in itself. The value comes from information that reduces uncertainty and that ultimately leads to decisions that affect future outcomes. This was further explained in a formula, where Howard (1966) quantifies the value of information that reduces uncertainty. This is done by evaluating to what degree the information changes future outcomes, something which is referred to as information utility, see (2.1).

$$VOI = E[U \mid I] - E[U \mid \neg I] \tag{2.1}$$

In the formula above $E[U \mid I]$ represents the expected utility when additional information is available, and $E[U \mid \neg I]$ represents the expected utility without the additional information. Howard (1966) claims that the value of information is the difference between these two. This means that even if information is uncertain, it can be of value if having that information results in improved outcomes. The formula is further used to establish the idea of clairvoyance, which symbolizes the case of best possible information. Perfect knowledge of the future before a decision is made. The idea is that if you have the best possible information, you reach the absolute upper bound of informational value. The limit can then be used to evaluate if the cost of attaining more information is profitable, judging from the maximum potential outcome that information could result in (Howard, 1966).

Kochenderfer (2015) reinforces the need for a way of quantifying the value of information by arguing that decision-making fundamentally occurs in uncertain conditions. This means that organizations unavoidably must act with incomplete information, which means that decisions inherently are probabilistic. Kochenderfer (2015) further argues that probabilistic information is valuable because it improves the decision-maker's understanding of future conditions, and because it supports more effective decisions under uncertainty.

2.4 Cost of Change

This section introduces the importance of early information in decision-making. Projects are always difficult because they involve uncertainty and perpetually evolving information. On top of that, changes that has to be done later in a project, tend to be more expensive (Paulson, 1976). Consequently, it is of value to have early information so that the most important decisions can be made in the early stages of a project.

2.4.1 Influence and Cost Over The Project Life Cycle

In the article *"Designing to reduce construction cost"*, Paulson (1976) wrestles with the importance of early decisions. The focus of the article was to, within construction projects, study the relationship between two curves; the ability to influence project cost, and the actual cumulative project cost. Essentially the observation was that early in a project, the ability to influence cost is high. However, as a project progresses and moves towards the later stages the ability to influence the overall project cost decreases, see fig. 2.3

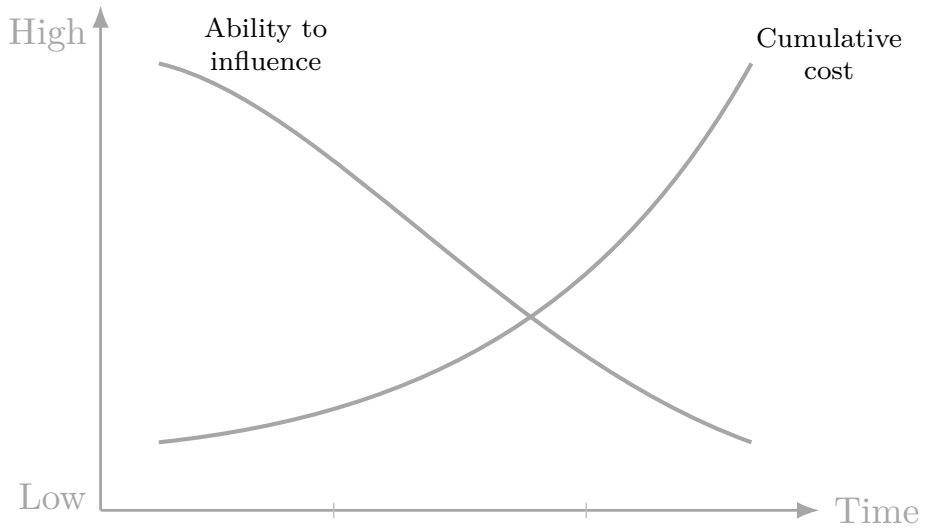

Figure 2.3: The ability to influence and the actual cumulative cost

The paradox is that the time when decisions have the most impact on project cost is when the availability of information is lowest (Paulson, 1976). In construction projects, early design decisions determine most of the future cost. It can be decisions regarding choice of material, structural designs, methods for construction, etc. When these decisions have been made and later implemented, they become increasingly expensive to change later in the process. For instance, such changes would require redesign, rework and demolition of existing structures. Paulson (1976) is therefore arguing that the real cost driver is not construction by itself, but rather the decisions made before construction begins.

Therefore, resources should be put towards the early project stages such as planning and design, since decisions in these stages are directly linked to the future cumulative cost (Paulson, 1976). Essentially, it is beneficial to plan meticulously in the earlier stages of a project because later project changes require extensive funding.

2.4.2 Cost of Change in Software Development

Similar ideas to the one Paulson discussed in construction projects, have been introduced in other fields as well. In the book *"Software Engineering Economics"*, Boehm (1981) introduces the cost of change curve for software development projects. The observation was that the cost of fixing errors or making changes increased exponentially as projects progressed, see fig. 2.4

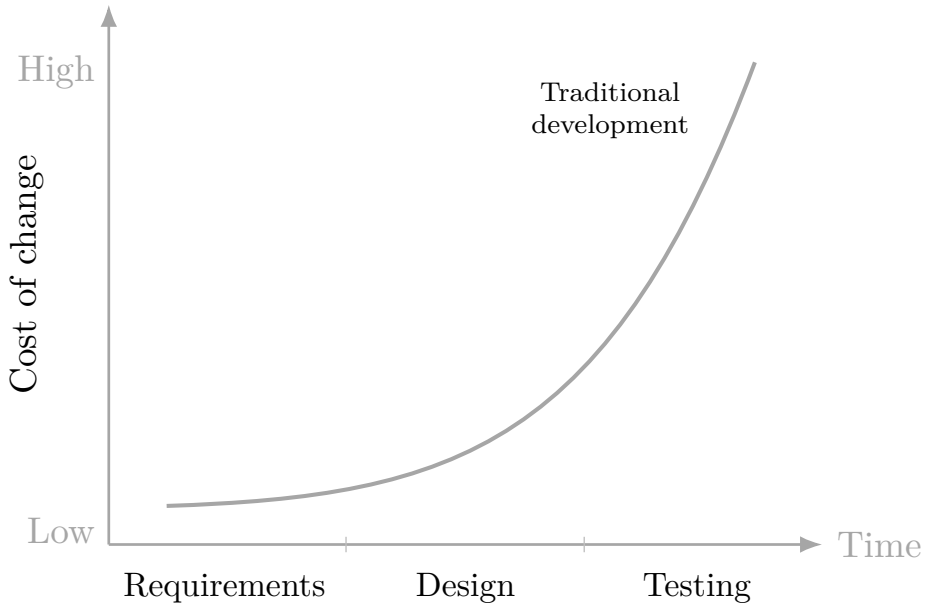

Figure 2.4: Boehm's cost of change curve

Software project are divided into multiple project stages such as requirements, design, and testing (Boehm, 1981). Roughly, it could be seen that the cost for fixing a problem during the requirement phase was 1X. Fixing it during the design phase might cost 10X, while fixing it during the later testing stage would cost 100X. This later became known as the 1-10-100 rule, saying that the later a change is introduced in a development process, the more expensive it becomes to implement.

Similar to construction projects, later changes in software are expensive because they sometimes require already completed work to be revised (Boehm, 1981). However, later changes in software also become more expensive due to integrated systems and dependencies. Meaning that if you would have to make adjustment during the later stages of a project, it would require rewriting code, re-testing systems, and updating documentation. A small change may trigger a chain of additional work.

2.4.3 Critiques and Alternative Views

In the article *"Is Design Dead"*, Fowler (2004) communicates the view that Extreme Programming (XP) could reduce the steepness of the "cost of change" curve established by Boehm. At the core of XP lies the practices of iterative testing and continuous integration, this is what Fowler claim flattens the curve, see fig. 2.5.

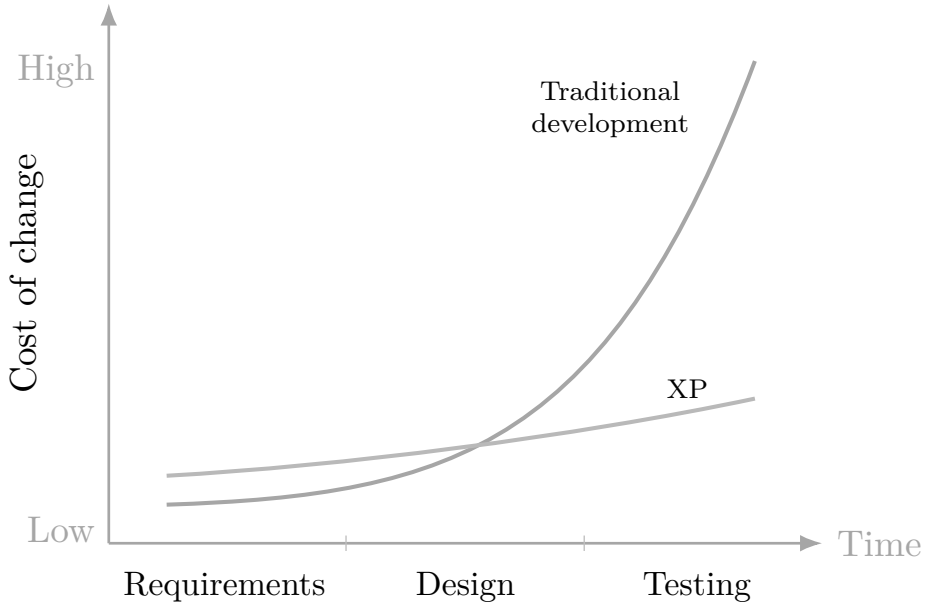

Figure 2.5: Extreme programming cost of change curve

The act of continuously testing and integrating new features within the total system, means that later stages of a project require less testing (Fowler, 2004). It also means that errors are caught at an earlier stage, making them easier to fix. As previously mentioned, a small error throughout the later stages of a traditional software development project may trigger a chain of additional work. The continuous testing and integration means that you identify these mistakes earlier and so decrease the risk of these chains of additional work to appear.

When brought together, these perspectives show how the timing of decisions and information have a great impact on project outcomes. As the cost of change increases over time, information available early in a project may have substantial value.

2.4.4 Methods for Managing Uncertainty

Projects rarely begin with complete knowledge, requirements may evolve and new constraints might be added during the development. As a result, many approaches have been developed that aim to manage uncertainty and reduce the impact of late changes.

In the book *"Revolutionizing product development"*, Wheelwright and Clark (1992) says that development means creating the future. Uncertainty is present because you need to design for a future market years ahead. Designers must be able to see the product years into the future, and it also must remain competitive for several years beyond that. One of the core concepts discussed by the authors is the "Design-build-test-cycle", where the idea is that development should be iterative, going through the cycle repeatedly until the required performance is achieved. The basic idea is this: you build, test and learn from doing so. Instead of relying on early planning,

information is generated through iteration (Wheelwright & Clark, 1992).

Similarly to the Design-build-test cycle, the concept of agile is also built around managing change (Highsmith & Cockburn, 2001). The agile methods are designed to adapt to new information and processes, rather than planning for everything that the future potentially holds. Highsmith and Cockburn (2001) emphasize that agile is about responding to change rather than planning, and it prioritizes flexibility over rigidity. Agile also focuses on short development cycles and continuous feedback from users, for information to be generated during the process and not only at the start of a project.

Since it is impossible to eliminate project uncertainty entirely, systems have to be designed to adapt to change rather than avoid it. This is why methods like the Design-build-test cycle, and concepts like agile exist. It is about understanding that uncertainty exists, and developing systems that allows you to identify these uncertainties as early as possible so that you can respond to it effectively.

2.5 Self-Determination Theory

While previous concepts and methods are used to manage uncertainty, they also rely on active participation. Additionally, to better understand people's perceptions of how to evaluate and communicate the value of predictive insights, we suggest that it is important to understand what motivates employees engage in these processes. This section therefore introduces the Self determination theory (SDT), which is a psychological theory of human motivation developed by Deci and Ryan (1985). The theory proposes that human motivation and well-being depend on the satisfaction of three basic psychological needs, and that individuals are more likely to be motivated, engaged, and perform well if these needs are supported by their environment.

2.5.1 The Three Basic Psychological Needs

According to Deci and Ryan (1985), motivation is influenced by three basic psychological needs; autonomy, competence, and relatedness, see fig. 2.6 below. The authors argue that when these three needs are fulfilled, humans are motivated to grow and perform well. Deci and Ryan (1985) describe autonomy as the feeling that ones actions are self directed, and that no external pressure is motivating you to take action. When autonomy is experienced you have a feeling of control over how you perform certain tasks. It should be said that autonomy has nothing to do with working alone, one can feel a great sense of autonomy while collaborating with multiple colleagues. Individuals are also more motivated when they feel that they can successfully meet challenges and grow their skills through learning and feedback, this is the need for competence, which empathizes that you feel capable and effective in you environment (Deci & Ryan, 1985). At last, relatedness is the need to feel connected to others and to experience a sense of belonging. People are more motivated when they feel that they have meaningful relationships with people who respect and support them.

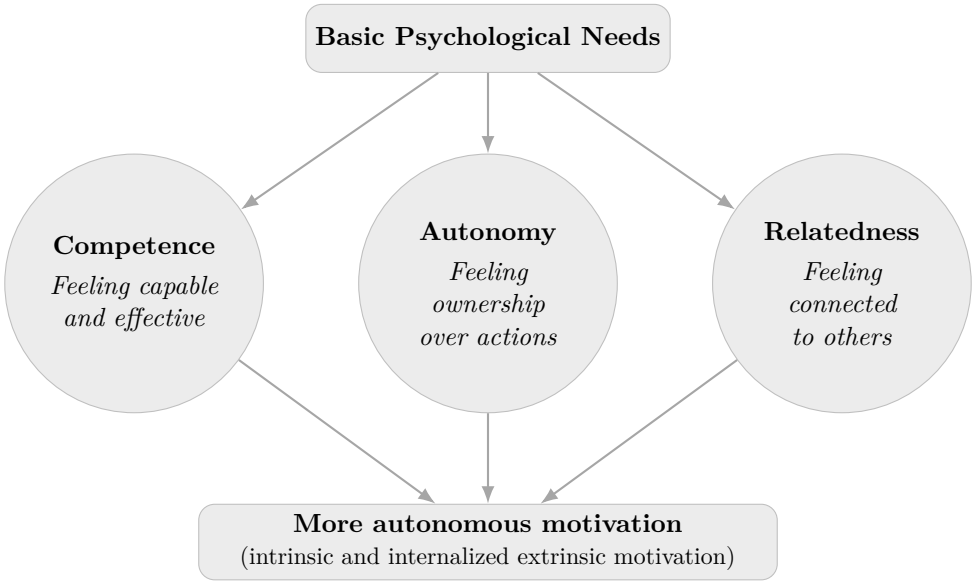

Figure 2.6: Overview of the self-determination theory and the role of the three basic psychological needs

As indicated in fig. 2.6, these three psychological needs, when fulfilled, lead to more autonomous motivation, which is motivation that comes from a sense of personal choice and endorsement (Deci & Ryan, 1985).

2.5.2 Motivation as a Continuum

Deci and Ryan (1985) claim that motivation should be viewed as a continuum spanning from non-self-determined to self-determined. As illustrated in fig. 2.7, the type of motivation changes from amotivation to extrinsic motivation, and then the most self-determined type, which is intrinsic motivation.

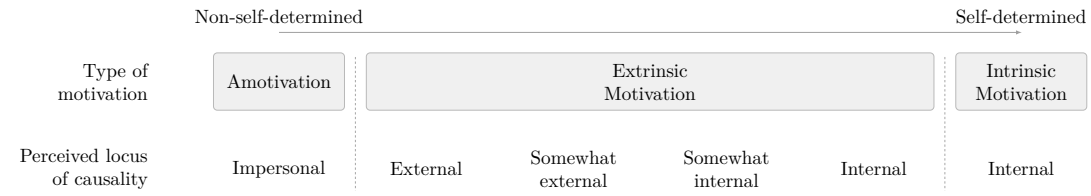

Figure 2.7: Self-determination continuum

Amotivation refer to when people aren't motivated at all (Deci & Ryan, 1985). Extrinsic motivation can be seen when people are performing tasks mainly because there is some external force making them do it. In a work environment, that could mean doing something for an external outcome such as salary, a bonus, or maybe to avoid punishment. The most self-determined type of motivation is the intrinsic motivation. That is when people do things merely because they enjoy doing them. The authors claim that when the three basic psychological needs are fulfilled,

people move across the continuum towards the self-determined side. In a work environment it is difficult to make employees feel intrinsically motivated to perform everyday work tasks (Deci & Ryan, 1985). However, as indicated in fig. 2.7, it is possible to move within the extrinsic field of the continuum, from being completely externally motivated, towards an internal extrinsic motivation. The authors believe that external motivation can become internalized, meaning it becomes self-endorsed. This is referred to as internalized extrinsic motivation. In organizational settings, SDT essentially implies that workplaces that support employees' needs for autonomy, competence, and relatedness promote higher levels of intrinsic and internalized motivation, as well as increased well being.

2.5.3 When SDT Needs are not Fulfilled

If the needs are not fulfilled Deci and Ryan (1985) describe three kinds of consequences; lower quality motivation, lower well-being, and lower performance and engagement. If the needs are not supported, the motivation becomes controlled rather than autonomous. This could mean that the motivation stems from pressure, surveillance, rewards, or punishments, instead of workers feeling that they value the work they do. That is what the authors refer to as a lower quality of motivation.

Furthermore, the well-being part focuses on how people feel when these needs are not fulfilled (Deci & Ryan, 1985). The research highlights the feelings of stress, frustration and disengagement, which ultimately can result in burnout. How people feel is also highly connected to their performance. In a work environment where employees feel controlled rather than autonomous, incapable rather than competent, disconnected rather than related, the result is lower engagement, less creativity and weaker persistence in performing work tasks.

2.5.4 Factors Undermining the SDT Basic Needs

In a work environment, the need for autonomy is often undermined through managing styles (Deci & Ryan, 1985). If employees are being micromanaged for instance, there is not room for doing things in your own way. This can be seen in companies that are using strict control systems, and excessive monitoring of it's employees, often also in combination with strong time pressure. Autonomy can also be undermined when there is a lack of decision authority. When all decisions has to go through your superior, it is hard to stay intrinsically motivated.

Competence is usually undermined when employees are doing work tasks that are either too easy or too difficult compared to their current skill level (Deci & Ryan, 1985). This can be magnified by unclear instructions, making an easy task more challenging then it has to be. A lack of feedback, may also leave employees uncertain about whether they are on the right track or not. Competence can also be undermined if expectations are unreasonably high, making the task at hand feel insurmountable. Additionally, it is hard to feel competent when requirements are constantly changing, mainly because of the time it takes to adjust to a problem and figure out your course of actions. If the requirements are always changing, you

will be stuck in a phase of uncertainty, not given the opportunity to feel a sense of competence in the task your performing.

Finally, relatedness is undermined through poor communication and a lack of support from supervisors (Deci & Ryan, 1985). Relatedness is all about feeling connected to others, that others respect and support you. If there is conflict between teams, and you feel isolated at work, you most likely will not experience positive relationships with colleagues and supervisors, which is detrimental to your well-being at work.

2.6 Organizational Acceptance of Predictive Analytics

This section introduces the concept of organizational sensemaking, discussed as something organizations engage in to create shared understanding and coordinate actions. Moreover, factors that affects organizational acceptance and trust in predictive analytics, is outlined. This includes reflections on appropriate levels of trust, as well as the concept of "algorithm aversion".

2.6.1 Information-sharing in Organizations

In the book *"Sensemaking in Organizations"*, Weick (1995) explains that organizations do not solely function through structures, hierarchies, procedures, and data bases. Instead they are constantly interpreting events, discussing the meaning of those events, resolving ambiguity to construct shared organizational understanding. This is what Weick (1995) refer to as "sensemaking" (SM), something which he claims organizations continuously engage in.

Weick (1995) explain that SM becomes especially important under circumstances of uncertainty or ambiguity. It is explained that these two terms are not to be seen as synonymous. Uncertainty describes a situation where information is lacking. On the other hand, ambiguity is when information does exist but it can be interpreted in multiple ways. Another important distinction is that uncertainty often can be reduced through obtaining more information. As ambiguity is more about not knowing how to interpret and understand information, more information can instead lead to more ambiguity. SM has therefore an even greater role in resolving ambiguity (Weick, 1995).

SM is not intended to eliminate uncertainty and ambiguity entirely, it is only what organizations do to reduce uncertainty and ambiguity. Weick (1995) claim that organizations strive toward plausibility rather than accuracy. It is known that reality is too complex, uncertain, ambiguous, and fast moving for organizations to achieve perfectly accurate understanding. Instead, through SM, organizations reduce ambiguity and uncertainty until reality is plausible enough to make a decision. If organizations would have waited for perfect accuracy, no decisions would have been made, and no actions would have been taken (Weick, 1995). However, plausibility is

not only a compromise due to the difficulty to achieve accuracy, Weick (1995) also argue that the act of SM creates organization-wide understanding and may result in coordinated action. Perfect accuracy, on the other hand, does not result in action if it is not understood by the organization and its employees.

Weick (1995) further explains that organizations do not arbitrarily discover what information means, and then achieve perfect consensus. Instead it is collectively constructed through communication, discussion, argumentation, and shared experiences. Moreover, stakeholders may also interpret the same information in different ways based on their interests, responsibilities, and organizational position. However, Weick (1995) argue that organizations do not have to achieve perfect consensus on what information means in order to act. Individuals often hold partially different interpretations and understandings, while still coordinating enough to continue acting together.

Even though organizations sufficiently manage to coordinate action, the shared organizational understanding of why those actions were taken may not emerge until afterwards. Weick (1995) explain that humans are much better at explaining the past than anticipating the future, so organizations often create coherent explanations retrospectively. Essentially, Weick (1995) is explaining that organizations first aim to construct plausible interpretations that can be acted upon. Then organizations understand uncertain and ambiguous situations more clearly by looking backward and constructing coherent explanations afterward.

2.6.2 Trust in Predictive Analytics

This section builds upon the previous section by introducing theory related to organizational trust in automated systems that contains uncertainty. Since predictive analytics also contain uncertainties, theory related to trust in computational systems relate to the trust required for predictive analytics. J. D. Lee and See (2004) describe trust in automation as an attitude that influences whether individuals are willing to rely on automated systems despite uncertainty. Additionally, J. D. Lee and See (2004) also highlights that in general, companies have come to adopt a more extensive degree of automation as a result of new technology, which has ultimately also increased the importance of trust in these systems. To clarify, according to J. D. Lee and See (2004), *"automation"* refer to technology that actively selects data, transforms information, makes decisions, or control processes.

Moreover, J. D. Lee and See (2004) argue that an effective reliance on automation depend on an appropriate calibration of trust. A calibrated level of trust mean that the users trust in automation should correspond to the actual capabilities of the automated system. More specifically, users should not have over-reliance nor being excessively skeptical towards automation. Hence, J. D. Lee and See (2004) describe automation capability as how good an organization is to evaluate the actual trustworthiness of an automation. Furthermore, an inappropriate level of trust calibration can lead to either "misuse" or "disuse" of automation (J. D. Lee & See, 2004). Misuse of automation refers to the failures that may occur when individuals rely on

automation too much without questioning its limitations. In contrast, "disuse" of automation refers to the failures that may occur when individuals reject or avoid the capabilities of an automation, by being overly skeptical. These two extremes are examples of inappropriate reliance on automation that may reduce the effectiveness of automated systems overall. Therefore organizations should aim for appropriately calibrated trust, where the reliance on automation matches the actual capabilities of the automation (J. D. Lee & See, 2004). An illustration of the relationship between trust and trustworthiness is illustrated in fig. 2.8 below.

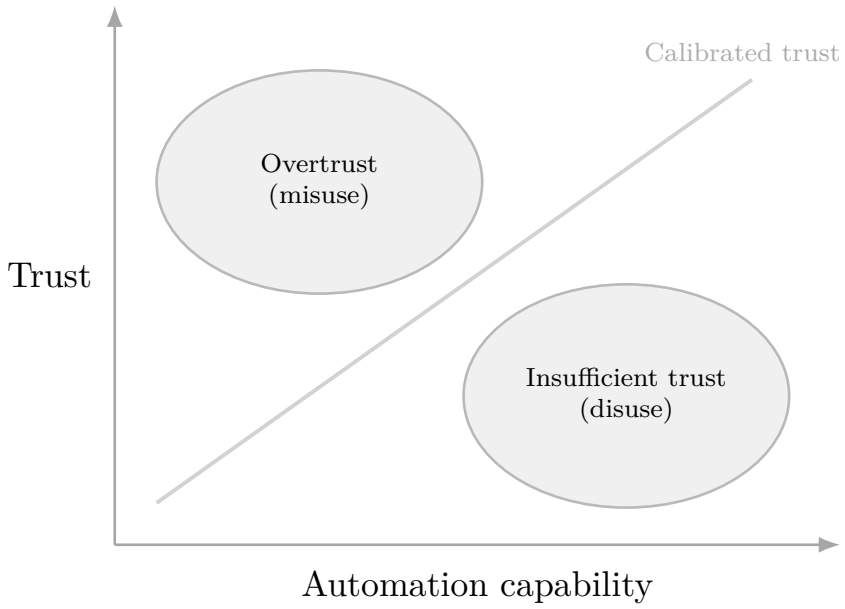

Figure 2.8: Calibration of trust in automation

Additionally, J. D. Lee and See (2004) also describe trust as a dynamic attitude, that develops and evolves through interaction and experience with automation over time. Therefore, a calibrated trust may not exist immediately, but rather develop gradually with time, as individuals become more familiar with automated systems and how they actually work. Consequently, familiarity with automation influences whether individuals develop a level of trust that correspond to the actual trustworthiness of the automation. In addition, trust is particularly crucial in situations when individuals are unable to verify or understand automated precesses themselves (J. D. Lee & See, 2004). As a result of automated systems becoming more complex, users may not always fully understand how system outputs are actually generated or how the automation process function. Therefore, factors such as familiarity may influence whether automated systems are considered trustworthy enough to rely on by users.

Moreover, J. D. Lee and See (2004) also highlight that individuals often have a greater confidence in their own ability than in the ability of automation. According to J. D. Lee and See (2004), this problem was observed even in situations where automation demonstrated better actual performance than humans did. Consequently,

the authors argue that human intuition and biases in their self-confidence may influence how much individuals are willing to rely on automated systems in practice. Naturally, such delusions are limiting how automation such as predictive analytics is actually trusted, and consequently adopted in organizations.

Similarly, research on "algorithm aversion" suggests that individuals may become unreasonably skeptical and negative towards automated systems after observing them making mistakes. This is also suggested in situations where the systems still performed better than human decision-makers (Dietvorst et al., 2014). The authors highlight that observed errors made in automated systems may influence the users' willingness to trust automated systems negatively independently if the error was made only one time. In particular, Dietvorst et al. (2014) argue that people tend to lose trust in algorithms more quickly than in human decision-makers when observations on errors are made, even when the algorithm demonstrates stronger overall performance. Ultimately, the authors suggest that "algorithm aversion" is a costly phenomenon since algorithms almost always outperform human forecasters in accuracy, but its trustworthiness still gets unnecessarily rejected. Therefore, J. D. Lee and See (2004) suggest that addressing the concept is crucial for improving organizational profitability.

2.7 Analytical Framework

The concepts and areas presented in this chapter form the analytical framework for this study. Concepts regarding supplier structures and supplier performance are introduced to provide an overview of supply chains and the inherent risk that they contain. Risk management in supply chain is then furthered outlined to elaborate on how these risks are managed in supply chain management through methods such as scenario planning, the risk assessment matrix, and safety stock. Predictive analytics is discussed as one of the branches of supply chain management, ultimately resulting in a clarification of the definition of predictive insights. To evaluate predictive insights, they are connected to the value of information, a thoroughly researched topic that concludes that information should be evaluated through the decisions it leads to, that potentially can change future outcomes.

As predictive insights provide indications of what the future might hold, the theory also captures concepts related to the timing of receiving information. Cost of change is discussed as a phenomena arguing for receiving information at an earlier stage within construction industry, since the total project cost becomes increasingly difficult to influence as the project progresses. Even though the examples brought up are mainly connected to other industries, the principle of cost related to timing can still be argued to have relevance when evaluating the value of predictive insights in the aerospace industry.

To highlight that predictive insights also are affected by human judgment, and to capture the communicational part of this study, concepts related to how humans may perceive predictive insights are included in the analytical framework. The the-

ory of self-determination captures three psychological needs required for individuals to experience inherent motivation at their workplace. Since the study aims to evaluate the value of predictive insights, it is important to understand how these needs would be affected by predictive insights. If predictive insights end up affecting how employees perceive their workplace, that would have to be taken into consideration when making an overall evaluation.

Furthermore, concepts related to organizational acceptance and trust of predictive analytics are included in the analytical framework to propose how predictive insights are perceived and communicated within organizations. These concepts adds to the more technical perspectives previously introduced by highlighting the role of human judgment and trust in the adoption process of predictive analytics. Ultimately, the analytical framework presented in this chapter provides a foundation for analyzing participant's perceptions and experiences of how to evaluate and communicate the value of predictive insights throughout the study. Additionally, the analytical framework also acts as support in addressing the two research questions of the study.

3

Methods

This chapter presents the methodology and frameworks that were used throughout the study process. It includes the study's research approach, the methods used to collect data, how the collected data was digested and analyzed, reflections on the research quality, relevant ethical considerations, as well as a clarification of the use of AI-tools. Ultimately, this chapter is presented for the reader to provide a clear understanding of how the study was conducted.

3.1 Research Approach

This section addresses the overall research approach that has been used in this study. Ultimately, the research approach provides an overview of the methodological choices that have been made, to address both the project's research aim and the chosen research questions. Both the research strategy and research design are also outlined in this section. By presenting the research approach at an overarching level, this section aims to clarify how the study was conducted in practice.

3.1.1 Research Strategy

This study has been deploying a qualitative research strategy, as the main objective of this study was to gain a more in-depth understanding of a studied phenomenon from written or spoken words, rather than measuring or testing assumptions or predefined relationships based on numerical data (Bryman & Bell, 2022). Additionally, the qualitative research strategy is supported by both ontological and epistemological assumptions. Ontologically, the study has been grounded in constructionism, which ultimately assumes that reality is continuously constructed in different social interactions. Additionally, from an epistemological perspective, the study has been following an interpretivist approach, as the study mainly aims to understand how individuals perceive and interpret the studied phenomenon.

3.1.2 Research Design

Bryman and Bell (2022) explains that a case study provides a vehicle through which several qualitative methods can be combined. This research project is a single company case study, and has analyzed GKN Aerospace Sweden as the case company. The qualitative research strategy in this study was practically implemented based on two components, a literature review and an empirical study, that was in turn made up of both semi-structured interviews and observations. The literature review has acted as a theoretical basis for the study, while the empirical study has enabled a more in-depth analysis of the studied phenomenon.

While the initial empirical literature review acted as a research foundation, enabling the development of accurate research questions and the aim of the project, the literature review was an iterative process, to support the use of theoretical frameworks and thematic data analysis. Bryman and Bell (2022) suggest an abductive research approach, shifting between inductive and deductive reasoning from both theory and empirical findings, as a means to navigate uncertainty, incomplete data, and complex problems. This approach allowed us to continually compare theory and empirical data throughout the project, and also introduce new hypotheses when new observations were made.

Figure 3.1 illustrates a schematic overview of the research process. In the initial phase of the study, the research area and the research questions were formulated and established. The purpose of the study and the research questions were then reconsidered and reformulated along with the initial reviewing of existing literature on the topic. The methods for the data collection consisted of both semi-structured interviews and a literature study, along with continuous reviewing of the findings. The final stages of the research process consisted of interpretations of the collected data as well as a condensation of the findings.

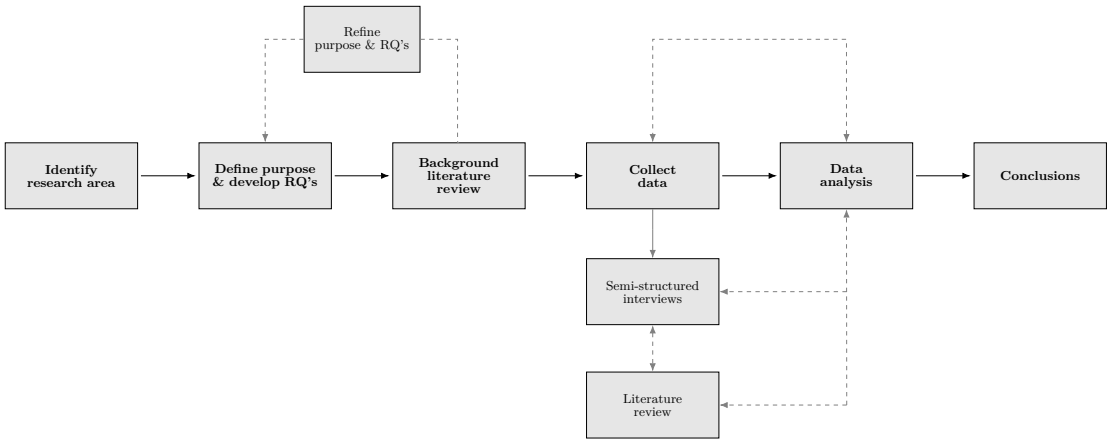

Figure 3.1: Schematic overview of the research methodology.

3.2 Data Collection

To gain insights, primary qualitative data was generated through first-hand interactions with participants. For these interactions, semi-structured interviews and a participant observation were used. An iterative literature review acted as a support function, to further develop theoretical frameworks and themes through which data could be analyzed.

3.2.1 Literature Study

As a part of the research process, a literature review was conducted to establish a research context, identify the existing knowledge on the topic, and to find potential research gaps (Bryman & Bell, 2022). To ensure a replicable, scientific, and transparent process, Bryman and Bell (2022) recommend following a systematic literature review methodology. The initial phase was to determine relevant search terms, as explained in the following paragraph. Brain storming sessions were used both internally within the research team, as well as externally in collaboration with GKN Aerospace representatives and Chalmers University librarians. Selected key search terms were then combined in multiple steps using boolean logic, as seen in Table 3.1. As a large, multidisciplinary, data base of peer reviewed literature, Scopus was the data base of choice for conducting the literature review.

Table 3.1: Stepwise development of the search string in Scopus

Step	Block	Search string	Scopus
1	A	forecast* OR prediction* OR news OR projection* OR anticipation* OR expectation* OR prognosis* OR indicator* OR analytic* OR predictab* OR "predictive analytic*"	8 994 059
2	B	negative* OR pessimistic* OR bad OR unfavorable* OR challenging OR risk*	11 166 888
3	C	value OR "business value" OR "decision making" OR decision* OR benefit* OR beneficial* OR "good outcomes" OR outcome*	18 919 384
4	D	supplier* OR "supplier performance" OR "supplier risk" OR "supply chain*" OR "supplier reliability"	311 449
5	A + B + C + D	Final combined search string	5 071

As indicated in Table 3.1, search terms related to prediction are included to capture studies focusing on future outcomes as an initial step. In step 2, search terms related to negativity are included to capture literature focusing on the negative aspects of these outcomes. In step 3, search terms related to value are used to capture literature focused on potential benefits gained from knowing about future outcomes. In step 4, search terms related to suppliers are used to capture literature in the context where GKN Aerospace could gain potential value. As a final step, these search strings were combined into one search resulting in 5 071 search results.

These results were then further filtered by the number of citations, selecting the top 200 cited studies. Scopus counts citations by tracking references solely within the Scopus data base. Using Scopus export function the 200 selected studies were transferred to Mendeley, the reference manager software used for this project. All 200 studies were analyzed in Mendeley, evaluating relevance through titles and abstracts. The 30 studies that we found most relevant to the research project were further analyzed by thoroughly reading the entire texts. From these 30 studies, only 5 were determined relevant to the study, however still not fully capturing the aim of this project.

Furthermore, to make up for the limited access to relevant literature, the snowball method was used as a way to identify additional literature to support the research project. This method is also referred to as citation chaining, allowing searching the references and citations of the literature selected in the systematic review (Wohlin, 2014). Moreover, the study progressively diverged from the negative aspects of future outcomes used in the initial literature review. Therefore, literature covering negative aspects were excluded from the study, and additional literature was added throughout the research process through snowballing on previous literature.

3.2.2 Interview Study

The interviews that were conducted throughout the study acted as the empirical data collection. The main objective with these interviews was to attain information specific to the case company GKN Aerospace, relevant to the studied phenomenon. As the initial phase of the interview study, we were provided with six interview participants that were considered particularly interesting to the study. More specifically, these participants were provided upon recommendation from our GKN Aerospace supervisors. Since the interview participants were actively selected by the supervisors, the sampling method consisted of a purposive sampling strategy (Bryman & Bell, 2022). Additionally, as part of the interviewing progress, snowball sampling was used to allow participant recommendations for additional interview participants that were considered relevant to the study. Consequently, these participant recommendations resulted in an additional seventeen interviews, and a total of twenty three interviews throughout the research project.

To obtain a broad understanding of the studied phenomenon in the context of GKN Aerospace, a diverse selection of interviewee backgrounds within the company was prioritized. This included interviewing participants in both operational roles such as buyers, and participants of strategic roles such as directors and vice presidents. Additionally, one of the interviews was conducted with an external participant from a related industry within the broader manufacturing sector.

All interviews conducted throughout the research project were conducted with a semi-structured layout. This approach was chosen since semi-structured interviews are an applicable method to ensure structured and thematic interviews while allowing deeper exploration of different participant perspectives (Bryman & Bell, 2022). A set of pre-defined questions were therefore prepared to guide the interviews and ensure thematic consistency, while allowing flexibility through follow-up questions to enable deeper exploration. This set of questions, used throughout the interview process, is attached in Appendix A. To clarify, the interview guide was primarily used during the first interviews. However, throughout the interview process it was decided to deviate from the interview guide to better capture relevant insights answering the two research questions. Moreover, the interviews were conducted either in person or digitally, depending on participant availability. With consent, the interviews were audio-recorded and subsequently transcribed for a thematic analysis, described in the following section. Additionally, both researchers participated in all interviews. One researcher conducted the interview by asking questions, whereas the other researcher focused on audio-recording and transcription.

After each interview, the audio-recording was transcribed using automated transcription software. The quality of the transcriptions was then manually controlled by listening back to the recordings and reading the transcriptions simultaneously. The transcriptions were then further reviewed, and discussed by both researchers, to ensure accuracy prior to the thematic analysis. Where clarifications were found necessary, follow-up communication with participants was conducted.

Table 3.2: Overview of interviews conducted at GKN Aerospace as part of the empirical data collection, including organization, business area, date, duration, and interview setting.

#	Organization	Business Area	Date	Duration	Place
1	GKN Aerospace	Procurement processes and IT development	5/3-2026	47 min	Office
2	GKN Aerospace	Operational excellence and performance improvements	6/3-2026	49 min	Online
3	GKN Aerospace	Supplier relations and procurement planning	11/3-2026	43 min	Office
4	GKN Aerospace	Corporate strategy and business transformation	12/3-2026	48 min	Office

#	Organization	Business Area	Date	Duration	Place
5	GKN Aerospace	Procurement processes and tools optimization	13/3-2026	52 min	Office
6	GKN Aerospace	Business modeling and market analysis	17/3-2026	48 min	Office
7	GKN Aerospace	Market analysis and strategic planning	17/3-2026	51 min	Office
8	GKN Aerospace	Supply chain processes and tools optimization	18/3-2026	49 min	Office
9	GKN Aerospace	Digital transformation and digital strategy	19/3-2026	1 hr 11 min	Online
10	GKN Aerospace	Corporate strategy and business transformation	19/3-2026	47 min	Office
11	GKN Aerospace	Operational procurement and site-level supplier management	19/3-2026	51 min	Office
12	GKN Aerospace	Strategic sourcing and supplier strategy development	20/3-2026	44 min	Office
13	GKN Aerospace	Supply chain and procurement governance and organizational design	20/3-2026	45 min	Office
14	GKN Aerospace	Product area strategy and business operations	24/3-2026	51 min	Office
15	GKN Aerospace	Global sourcing and commodity strategy	24/3-2026	57 min	Office
16	GKN Aerospace	Procurement and supplier management	24/3-2026	49 min	Office
17	GKN Aerospace	Product area strategy and business operations	26/3-2026	1 hr 1 min	Office
18	GKN Aerospace	Research initiatives within procurement processes	26/3-2026	49 min	Online
19	GKN Aerospace	Business line strategy and transformation	31/3-2026	45 min	Office
20	GKN Aerospace	Quality management and supplier development	1/4-2026	56 min	Office
21	GKN Aerospace	Strategic procurement and supply chain management	1/4-2026	51 min	Office
22	GKN Aerospace	Market intelligence and strategic planning	1/4-2026	48 min	Online
23	External company	Production planning and supplier coordination processes	9/4-2026	52 min	Online

3.2.3 Observations

Throughout the study, observations were carried out in form of several site visits, one tour of the production facility, and continuously working at the company site. Being a qualitative research, it is important to collect detailed descriptions of the made observations. Bryman and Bell (2022) suggest three types of field notes to collect descriptive details. Mental notes were used in situations when being seen taking notes was inappropriate. Jotted notes were used to keep memory of information to be written up later, since detailed note taking in front of people can make them self-conscious. Full field notes were then used to make detailed descriptions of observations as promptly and fully as possible. This also involved initial interpretation of the collected data, which simplified the data analysis process.

3.3 Data Analysis

The abductive research approach has allowed us to iteratively move between literature and empirical findings, to be able to compare our findings with existing literature. Therefore, data was reviewed and analyzed continually throughout the project. A thematic analysis was carried out on the transcribed interviews to identify overarching themes. According to Bryman and Bell (2022), themes are recognized as representing patterns or meanings, relating to research focus, building on existing familiarity with data, and providing the basis for understanding the data. Identifying such themes helped enable a theoretical contribution to the literature relating to the research focus.

The thematic analysis of the data, based on Braun and Clarke (2006), involved six stages. The initial stage included familiarizing with gathered data. Following that, the data was dissected to generate initial codes through patterns and meanings in the data collection. The third stage used the generated codes to search for common themes to be reviewed in stage four. As part of the reviewing process, identified themes was controlled by relating them back to specific data extracts. This was done to ensure there was sufficient data to support identified themes, and to merge themes where they overlapped. The themes were later defined and named to enhance clarity in stage five, and then used to produce a final report in stage six.

3.4 Research Quality

According to Lincoln and Guba (1985), qualitative research requires alternative quality criteria to those that are typically used in quantitative research. As proposed by Lincoln and Guba (1985), a framework consisting of four quality criteria was used throughout the study to address the quality and trustworthiness. Trustworthiness consists of four quality criteria in the form of credibility, dependability, transferability, and confirmability. The following sections describe these criteria further and how they were applied throughout this study.

Firstly, credibility means that the research is carried out according to good practice, and that findings are truthfully grounded in the empirical material collected (Bryman & Bell, 2022). In this case study, both primary and secondary data such as interviews and independent literature, were used to study the phenomenon from different perspectives, ultimately enhancing the project's credibility. Additionally, interpretations from the empirical data collection were reviewed by the interview participants, giving them the opportunity to read through the findings. This to ensure that perspectives were represented as the interviewees properly intended, and also to act as an opportunity for both feedback and potential clarifications. As described by Bryman and Bell (2022), this approach is referred to as respondent validation, and was ultimately used to enhance the study's credibility.

Secondly, dependability refers to the extent to which the research process is documented in a transparent and traceable manner (Bryman & Bell, 2022). In this study, dependability was supported by a clear description of the project's methodology, consisting of the research strategy, research design, data collection procedures, and the data analysis process. Further methodological decisions has been documented and provided in the report to ensure consistency and traceability throughout the entire research process. Thirdly, transferability refers to the extent to which the findings of a study may be relevant and applicable to other contexts beyond the studied case (Bryman & Bell, 2022). This study has focused on developing a deep understanding of a certain research problem at one specific case company. Nevertheless, efforts were made to support transferability. These efforts consists of detailed descriptions of the organizational context and the specific GKN Aerospace case setting, to enable readers to assess the relevance of the findings to other contexts.

Finally, confirmability refers to the extent to which the findings are shaped and influenced by objectivity in the empirical data, rather than the researcher's biases or personal assumptions (Bryman & Bell, 2022). In this study, confirmability was supported by recording and transcribing all interviews where consent was given. This approach has enhanced transparency and reduced reliance on the researcher's memory or subjective interpretations. Additionally, the systematic literature review approach limited the researcher's bias during selection of appropriate literature to include in the study, since the filtering of articles was done systematically rather than intuitively by the researchers (Bryman & Bell, 2022).

3.5 Ethical, Societal and Ecological Considerations

The data that was collected from the interviews and observations, involved sensitive information about GKN Aerospace and its representatives. Therefore, ethical, societal and ecological considerations has been carefully taken into account throughout the entire research process.

Firstly, participating in the study was completely voluntary, and all participants were informed about the purpose of the study prior to their actual participation. Additionally, informed consent was ensured before the interviews took place, and

all participants were made aware of their right to withdraw from the study at any point in time. To ensure confidentiality and anonymity for the interview participants, no personal information was collected or documented during the process of the study. Moreover, the documented material, such as interview recordings and interview transcripts, were handled with care and stored securely throughout the process, and access to research data was limited to solely the researchers and their respective supervisors. Consequently, particular attention was paid to avoid disclosure of sensitive information that would have potentially affected the organization or participants negatively if leaked.

From a societal perspective, insights from predictive analytics could potentially influence both the perception of suppliers and inter-organizational relationships, as well as the work environment for the workforce. This aspect was acknowledged, but reflections on further societal consequences fell outside the scope of this study. Additionally, ecological considerations were addressed indirectly through improved predictions and decision-making in supply chains, since better proactive handling of potential supplier disruptions could potentially contribute to a more efficient use of resources and therefore reduced waste of materials. However, a more detailed assessment of these types of environmental impacts also fall outside the scope of this study, and will therefore not be discussed further.

3.6 Use of AI Tools

Generative AI tools were solely used in a limited capacity to support the writing process. These tools were primarily used for language improvements to improve clarity and enhance the readability of the study. Additionally, the AI-based and transcription tool, WhisperX, was utilized to convert audio-recorded interviews into written transcripts to facilitate the data analysis process. This transcription process was carried out locally on the researchers computers, to ensure participant's confidentiality.

The AI tools used in this study were not used to generate findings, conduct analyses, or formulate conclusions. All research design decisions, analytical work, interpretations, and conclusions were developed by the authors, who take full responsibility for the accuracy and integrity of the content in the study.

4

Results

This chapter presents the empirical findings that have been collected from the conducted interviews. These results are structured in accordance with the identified themes from the thematic analysis. Ultimately, the idea behind this chapter is to provide the reader with an overview of the empirical material, prior to the subsequent discussion. The identified themes concern the perceived value of predictive insights, how such value can be quantified and communicated, potential implications of predictive insights, how predictive insights can be used in practice, and ultimately reflections on supplier relationships.

4.1 Value of Predictive Insights

Since the interviews were semi-structured to discuss the value of predictive insights, this was also one of the most prevalent themes identified in the thematic analysis. It should be emphasized that most interviews discussed not only the value of predictive insights, but also how that might look in practice. Commonly discussed was some type of digital solution that could gather information, analyze and then provide information in the form of predictive insights. Therefore the results that follows targets the value of predictive insights, however the way in which these are received and perceived varied between interview participants.

Additionally some sub-themes were identified within this overarching theme including proactivity, informed decisions, improved follow-up procedures, transparency, and organizational resilience. The following sub-sections aim to describe the findings of these themes in detail.

4.1.1 Proactivity

A commonly covered topic among the interview participants was the ability to be proactive. It was expressed by both managers and more operational workers that the lack of early information sometimes lead to situations of "fire fighting", where reactive approaches are used to deal with urgent tasks. It was expressed that the value of predictive insights could be seen in the ability to optimize planning, where information about potential future disruptions would be utilized. For instance, a participant discussed how receiving such indications would help them make deci-

sions regarding machinery maintenance and resource allocation, hence being more proactive in strategic decisions.

From a more operational standpoint, interview participants also expressed the value of predictive insights as the ability to proactively plan for the future. One of the interview participant said that *"the value lies in receiving an early warning, so that you can be proactive instead of reactive"*. When working with suppliers, this could mean that you are given the opportunity to coordinate with suppliers and provide resources at their facilities if necessary. In procurement it could also allow for better planning conditions so that buyers can adjust certain purchase orders according to predictive insights. Another participant claimed that *"the value lies in being able to push away left-handed shoes, when the deliveries of right-handed shoes are not up to schedule"*. This was a common analogy used by interview participants when describing the complexities of ordering multiple components that ultimately would end up in the same product. Better informed decisions in procurement could result in lower unnecessary inventory, and therefore also lower inventory cost.

On the customer side, it was also discussed that predictive insights connected to the supply chain, if communicated upwards within the organization, could support proactive work throughout the organization as a whole. If disruptions within the supply chain can be communicated as an early warning to costumers, they can also better adjust their demand to support the situation instead of making it worse.

To summarize, the value of predictive insights partly lies in the ability to work more proactively. This proactivity includes better being able to mitigate the risks that indications signals. This further comes from a better understanding of where to allocate resources so that the organization can contribute where it matters the most. This is linked to prioritizing, having information about potential risks provides a foundation that can guide decision-making.

4.1.2 Informed Decisions

Covered among the interviewees when discussing the value of predictive insights, was the benefit of making decisions based on data rather than on subjective intuitions. It was discovered that insights do not have to be external, but instead could be retrieved internally through using already existing data. If the information contained within the data was easily accessible, it could nudge workers into using it more frequently when making decisions. Communicating these decisions would also be less emotionally charged, due to it being based on recorded data.

As expressed by interview participants, the value of such predictive insights would be in decision-making. If data was more accessible for predictive insights, the way of working with analyzing this data could be standardized to help workers make faster and more accurate informed decisions. Mentioned during the interviews, this would also lead to the avoidance of biased decisions, and the groupthink phenomena where cohesive groups make irrational decisions due to the prioritization of consensus over critical analysis.

4.1.3 Improved Follow-up Procedures

Multiple participants discussed the value of following up on decisions made in the past. Getting retroactive information of a specific case; what information we had, how that information was used to make a decision, and what the actual outcome was, could help determine how to better act in the future. Participants from different parts of the organization, mentioned that they were unsure whether such evaluations of prior decision-making is performed at all. On the procurement side a participant said that *"currently we do not have a system that allows us to perform such evaluations of past supplier deliveries"*. Another participant expressed that *"it is hard to do follow-ups on things in the past when you are busy trying to solve the problems of today"*. Similar concerns were expressed on the strategy side, where evaluations of past forecasts often are not evaluated. One interview participant said that *"evaluations of past strategy plans are ad-hoc and based on experience, there is not a regular process on how to preform such evaluations"*.

An example that was brought up during the interviews was that; if the capacity of a specific supplier is overestimated by 10% every year, but that information is never reviewed, then an opportunity of growth is missed out on. The information is not learned from, nor something that can be used to better estimate in the future. This ties back to the results in section 4.1.2 above, that the use of data play a crucial role in enabling predictive insights. For instance, one interviewee discussed the abundance of data that exists of past supplier performances. They say that *"we have the data, but we do not use it to be able to say something about the future"*. If data was more accessible, and displayed in a way the simplifies usage, evaluation of past decisions would guide decisions made today, potentially leading to informed decisions that take past performances into consideration.

4.1.4 Transparency

Throughout the interviews, predictive insights were often discussed in combination with predictive models and computer systems that could help employees navigate through predictive insights. On this topic, the value of such systems was commonly expressed as transparency. The value comes from people having access to the system, the insights, and that everyone has access to the same information. Part of it is the ability to review a colleagues decision through a system, having access to information about the decision that was made, on what grounds that decision was made and what the outcome was. It was also mentioned how this could simplify on-boarding processes, both for new employees and for the colleagues that would support them in the on-boarding process. This transparency was also put in the light of time efficiency. If all information was in a system, there would be no need for reaching out to multiple colleagues in the search for specific information.

4.1.5 Organizational Resilience

As previously mentioned, predictive insights was hard for interview participants to grasp and answer to in the interview process. It was therefore often discussed in the context of data models and computer systems, so that answers more easily could be anchored to something tangible. This resulted in participants brainstorming to visualize what predictive insights could mean and what value it might bring. A frequently discussed concept was predictive insights as a computer system. Several interviewees confirm that there is an abundance of data, and that it can become unmanageable. If a system could act as the point where all data is stored, it could potentially further enable analyzing of data points and make correlations. This is where participants started to think that perhaps these data systems would be able to provide indications of what the future holds, and that is what they sometimes referred to when answering questions about predictive insights.

Additionally, several participants expressed that a value connected to such computer systems could be to document employee experiences and competence within the system. The system would not only make its own correlations based on provided data but also learn from correlations and decisions made by employees with several years of experience. This is what we discuss as organizational resilience, storing experience in data systems instead of relying on individuals to keep track of it and communicate it forward.

On the same topic, it was mentioned that relationships with, and knowledge of, suppliers is widely used when making decisions in the procurement organization. One participant stated that they are trying to be as proactive with suppliers as the conditions allow. It is explained that this proactivity comes from prior collaboration and experience with suppliers, that is then used to make decisions. For instance, one participant said that *"if you previously had a bad experience of a specific supplier, perhaps you are more alert next time working with that same supplier, asking specific questions to avoid the same problems that you experienced last time"*. Another participant mentioned that they have certain things that they look for when working with suppliers, things that indicate to them that the supplier might be experiencing some issues. It is further explained that these particular things are not documented anywhere, it is tacit knowledge, that they are using when performing their job. However, it was discussed that there are several individuals within the organization who are performing similar jobs, that would gain great benefits from knowing how their colleagues view certain things. This is again where the value of such data systems appear, in documenting the knowledge of workers that is common sense to them, but perhaps not known of if you ask their colleagues. Moreover, the importance of documenting knowledge in systems rather than relying on individuals, was emphasized to ensure that the organization does not run into problems if these highly skilled individuals one day decide to leave the company.

Several interview participants mentioned that the aircraft industry have been experiencing a shortage in competencies since the COVID-19 pandemic. During the pandemic, companies within industries were forced to let go of many employees, resulting in a lot of skilled engineers with years of experience were lost. Then after the pandemic when the economy had stabilized, these individuals that were fired had changed careers and were no longer willing to come back to the industry. This is discussed as further emphasizing the importance of documenting experience in systems, because you cannot guarantee that you will be able to hold on to the organizational skills otherwise. One participant specifically said that *"today we have individuals with several years of experience and long relationships with customers and suppliers. We cannot expect that this will always be the case. Therefore, it is important the we store knowledge and experience in systems and processes"*. It was further discussed how this translation of knowledge and experience into systems may have to be done sooner than later, as many of the organizations most skilled and experienced workers are getting closer to the age of retirement.

4.2 Quantifying Value of Predictive Insights

While the previous section described the perceived value of predictive insights on a more overarching level, this section focuses on how such value is understood and quantified. From the empirical data collected, three main approaches for assessing the value of predictive insights stood out, and these are presented below. Additionally, these approaches where accompanied by additional reflections on the quantification of predictive insights, which are also included in this section.

4.2.1 Monetary Value

A reoccurring finding from the empirical data is that participants seemed to find it difficult to clearly define how the value of predictive insights should be quantified. Almost all interview participants identified monetary or financial metrics as a primary means of quantifying the value. As one of the participants stated *"dollars is always a unit"*. However, and despite the general agreement, the majority of participants seemed to find it difficult to find ways to describe how the monetary value should be measured or quantified practically. While financial measures were considered important, tying these directly to predictive insights was described as challenging. One participant emphasized that *"it is not hard to understand that it is connected to monetary value, but in terms of cash I find it really hard to evaluate early or predictive insights"*.

Moreover, one participant emphasized the strong relationships with both suppliers and customers, and highlighted that GKN Aerospace is usually a partner in the engine programs, in which GKN Aerospace is providing products. Because of the partner role in the engine programs, the participant highlighted that being able to deliver as promised, is not only beneficial to ensure to not lose sales or upset the customer, but also to ensure a profitable engine program in general. According to the participant, breaking program agreements is very expensive. In addition to this,

another participant highlighted that not receiving the expected amount of inflow material, ultimately results in loss of sales. By receiving early indication of such supply disruptions, proactive actions may reduce the loss of sales, and the level of reduction in loss of sales could then be seen as a way to quantify the monetary value of these insights. Additionally, another participant stated that predictive insights could lead to a higher customer service level, and result in additional business opportunities. Therefore, this participant suggested that the experienced increase in business opportunities could be viewed as an additional way of evaluating predictive insights.

Lastly, several participants emphasized that predictive insights would have positive effects on inventory costs. They also suggested that one way to quantifying the value of predictive insights is to identify the reduction in inventory and buffers enabled by better insights, and thereby be able to more effectively quantify the monetary value of these insights.

4.2.2 Intangible Value

In contrast to the general agreement regarding the monetary values of predictive insights, interview participants expressed more varied perspectives on the intangible values of predictive insights. While many participants acknowledged its presence, their interpretations differed in terms of what such value consist of and how it shows in practice. Similarly to monetary values, participants found it difficult to effectively quantify intangible values.

Firstly, several participants emphasized that predictive insights would lead to less fire fighting, which could reduce overall workload for employees. During the interviews, it was brought up that a common situation is that you fall behind schedule and then have to reactively catch up. The catching up requires a recovery period which often involves working overtime on weekends and holidays. This perspective was illustrated by one participant, who described how late information leads to increased strain on employees: *"a significant amount of time is spent addressing the consequences of receiving information too late. While there is clearly an economic benefit to working on resolving such issues, it also puts a strain on employees. Having to re-plan, reschedule, and work overtime also comes at a cost, but in a different way. This type of value is not as easy to quantify"*. One of the participants suggested to monitor the company sickness rate over time, and try to connect the results with re-planning activities and other types of reactive work, as a way to quantify such value.

Additionally, several participants highlighted stress as a consequence of insufficient predictive insights. One of the participant stated that when disruptions occur, the focal firm often gets perceived as the "weak link" within the supply chain. This was described as leading to increased attention from other actors within the supply chain, requiring additional time and effort to manage the situation. Participants noted that such situations often are both time-consuming and demanding. The unpredictability associated with limited predictive capabilities was further described as contributing

to a constant worry, also increasing the overall level of stress for employees.

Furthermore, an additional reflection which was brought up highlighted that insufficient predictive insights is impacting both internal and external relationships negatively. A lack of information was described as hindering to the ability to deliver on commitments, which in turn may affect trust and collaboration negatively. Participants stated that this could make it more difficult to strengthen relationships with both colleagues, customers, and suppliers.

All in all, the intangible values from predictive insights were described as especially difficult to identify, as they relate to trust, collaboration, relationships, and well-being, rather than measurable performance metrics.

4.2.3 Resource Utilization

Some of the participants also described how predictive insights can contribute to a more efficient resource utilization. Limited predictive capabilities was described leading to inefficient allocation of resources such as working capital. Regarding the production, some participants highlighted how limited predictive insights might also lead to poorly timed activities. This includes maintenance, where production is stopped during periods when required materials or components are available, rather than during periods of lower operational activity. A lack of early insights was further described as the leading factor for such misaligned shutdowns of production, ultimately resulting in an inefficient use of production resources. This consideration was illustrated by one of the participants, who described how late information regarding incoming materials resulted in an inefficient scheduling of maintenance: *"if I had know about it, I would have shut down the machine for maintenance at that time instead. But we did not know about that at that point in time. Instead, the machine was scheduled for shutdown and maintenance a few weeks later, and that was when the material arrived. So when we finally received the material we had been waiting for, I had just shut down the machine. If I had known about the disrupted inflow earlier, I could have planned the maintenance at a more appropriate occasion. It was a four week stop, so that would have been ideal, but we did not have that signal".*

Additionally, participants also gave further explanations on how increased supplier insights would allow for a more flexible production planning, for example by shifting production to alternate products or processes when or if disruptions occur, rather than allowing resources to remain stalled. While the previous example focused more on production planning, participants also described how similar challenges affected personnel planning, where a lack of predictive insights was stated to result in more ad-hoc activities and a less efficient use of their human resources. One of the interviewees stated the following: *"the question becomes what to do with the personnel during that time. At this point in time it becomes more ad-hoc, and we try to solve things in reactive ways on the spot, for example by assigning people to spontaneous trainings or by temporarily reallocating them to other workflows or processes".*

Moreover, it was emphasized that predictive insights would also support a more proactive collaboration with suppliers. Earlier insights on disruptions was said to support a better prioritization in the supplier's production, helping both the supplier in their production, as well as ensuring a more favorable inflow of materials for GKN Aerospace's production. It was stated that this could help to reduce the need for safety stocking, as well as strengthen supplier relationships. Additionally, one participant also described how predictive insights could help to support suppliers more actively, for example by enabling adjustments that may reduce pressure on their operations or strengthen their ability to meet demand.

Lastly, these factors of resource utilization were presented as more tangible and easier to quantify compared to the intangible values, presented in the previous section. This since the utilization factors can be linked to more measurable indicators, such as machine utilization rates, production downtime, and workforce allocation. Some participants suggested that such metrics could be used to capture improvements in resource efficiency over time.

4.2.4 Additional Insights

Another reflection that was brought up by a few participants was the suggestion of asking who you are actually creating value for, rather than solely focusing on how to quantify the value of predictive insights. As the participant explained, *"we try to frame it around who we are creating value for, and that there are more stakeholders to create value for than just the shareholders. You cannot only focus on one stakeholder, because then the others disappear. You have to create value for all three in order to have a successful business"*. To clarify, the three stakeholders the participant referred to was employees, customers, and shareholders. The main idea behind this, as the participant explained, was to more easily be able to both identify, quantify, and communicate the value. Additionally, another important takeaway was that more value may be delivered to the intended stakeholder if the provider is aware of who will receive the final value.

Connected to predictive insights, the stakeholder perspective was also suggested as an important starting point for better understanding and quantifying value. One participant implied that value may be easier to identify, quantify, and communicate when the relevant stakeholder and intended outcome is clearly defined. Different stakeholders were described as associated with different types of value, such as financial performance, operational stability, employee well-being, or supplier relations and collaboration. One participant further outlined this perspective by describing how certain components or products may have a very limited significance for GKN Aerospace, while simultaneously being of high criticality for the customer. As the participant stated, *"financially, it makes absolutely no difference for us but the customer cares very much and require this product"*.

Moreover, an additional reflection that several of the participants discussed and reflected upon, was how certain forms of value may not be easy to quantify in the present, but instead emerge over longer periods of time. Different examples that

were brought up included organizational reputation, employer attractiveness, and increased trust from shareholders. Participants described how different initiatives may create obvious value in practice, but at the same time be difficult to justify in monetary terms beforehand. One of the participants stated that *"it is much easier when you beforehand can say, I invest one million now and then earn three million as a result later. Organizational reputation and trust are softer values"*. Additionally, another participant stated that improved forecasting and financial predictability could strengthen trust from shareholders, by creating a perception of better organizational control and stability. Ultimately, that could increase financial means from shareholders for future investment initiatives.

Lastly, the external interview participant suggested another way to quantify value, that had been implemented at their organization. This approach included the unit "Dollar Days", originally proposed by Eliyahu M. Goldratt in his management book "The Goal" (1984). As the participant explained, the idea behind what they refer to as "sekdagar", was to translate the cost of delays into a measurable financial unit by multiplying the number of delayed days by the value of the actual affected product or component. According to the participant, the same logic could also be applied to situations where materials arrive earlier than needed and remain unused due to disruptions or delays in the inflow of other materials used in the same production process, ultimately resulting in unnecessary inventory. The participant further described how this approach had been used to evaluate safety lead time and supplier predictions by connecting delivery performance to financial consequences. By financially quantifying how delays translate into "sekdagar", the organization has increased its ability to understand and communicate the value of their predictive insights.

4.3 Communicating Value of Predictive Insights

While the previous two sections have focused on the value of predictive insights and how such value can be evaluated, this section instead focuses on how participants described the implications and opportunities related to communicating the value of predictive insights. An important takeaway from the previous section was that the ability to quantify value was described as an important factor to effectively communicate the potential benefits of predictive insights.

4.3.1 Adaptation to Stakeholders

As previously mentioned in section 4.2.4, a reflection that was brought up by several participants was that communicating the value of predictive insights often depend on who the intended stakeholder is. Participants described that different stakeholders are associated with different forms of value, meaning that predictive insights might need to be communicated in different ways depending on the recipient of the information. As the participant stated, this could include value in form of financial performance, customer satisfaction, or employee well-being. Additionally, also brought up in section 4.2.4, one participant exemplified this by stating that

organizations do not create value only for shareholders, but also for customers and employees. Hence, focusing solely on one of the three dimensions of stakeholders, could neglect overall value.

4.3.2 Translating Value

An additional important factor when communicating the value of predictive insights seems to be how such information is translated and packaged for allowing an effective communication. Participants stated that by only communicating technical terminology regarding models or abstract data that they generate, employees will most likely have a hard time understanding, and potentially accepting predictive insights. Being able to better translating the value gained from the use of predictive models, into more understandable metrics, participants described that the value of predictive models becomes easier to communicate and justify.

Moreover, as highlighted in section 4.2.4, one participant implied that intangible value might be more difficult to communicate than insights that explicitly can be quantified. As a result of this, one of the participants described that previous intangible initiatives have benefited from being divided into smaller deliverables. Doing so helped with communicating progress and building organization wide acceptance. The participant continued explaining that if it is difficult to communicate the value of an initiative in advance, it might not be approved organizationally. Previously this has been dealt with by not establishing a project for the initiative, but instead charging it as overhead. As the participant suggested, such value must be communicated retroactively to build acceptance for a project. Further reflections on how to build acceptance is discussed in the following section.

4.3.3 Building Acceptance

Several participants described that the use of predictive analytics as a tool, probably would require strong organizational acceptance before becoming integrated into real decision-making processes. Participants described that predictive insights might be perceived as uncertain, abstract, and difficult to justify when their long-term value is hard to quantify. Therefore, this section explores how participants viewed the acceptance of predictive analytics as an organizational tool.

It was brought to our attention that several participants consider both predictive analytics as a field, and more practical work with predictive models as an unfamiliar area in general. Hence, it seems as employees have not gotten used to the idea of working with such tools, and have therefore not started to build any form of trust to them. One of the participants made a parallel to getting to know a new person, naturally you cannot trust a stranger.

Furthermore, the external participant stated that the predictive models used in their operations initially performed with a quality which was lower than desirable, but since the performance of the model was still better than their previous human efforts in anticipating future events, there was no logical reason not to use the model. Or

as the participant stated, *"you have to relate to the position that you are actually in"*. However, this approach to predictive analytics has met resistance from other participants, who suggests that they believe that several years of confirmation of models outperforming humans is required for building trust and acceptance.

Moreover, several participants introduced the comparison between predictive models and the development of self-driving cars as a way to reflect upon organizational trust and acceptance on the introduction of new technology. As one of the participants put it, *"if you just look at the discussion about self-driving cars, if one of those ever crashes I think people are putting a significantly greater burden on AI than they would have done if a person had crashed the car. If that ever happens I think you need to start building trust from square one again, there are a lot of emotions and a need for control involved"*. Another participant added to this perspective, by reflecting on how organizations would tolerate error margins of models. As this participant put it, *"would you dare to ride in a self-driving car if you were aware that it had an existing margin of error? So far there are higher demands on computers than on humans, but we are on a journey of maturity"*.

In contrast, several of the participants had contradictory reflections. One of the participants stated that, *"weather forecasts are also based on mathematical models, which are definitely not always right. But we still use them"*. An additional reflection from another participant implied that predictive models perhaps should not be viewed differently from other forms of data which is already used in decision-making. As the participant explained, they do already trust and rely on data presented in tools such as Excel, despite such data also contains errors and limitations. The participant further argued that data from predictive models instead would rely on processed and cleaned data, which potentially could be considered more reliable.

Ultimately, several participants also emphasized that for building acceptance for predictive models, it is of great importance not to present the models as revolutionary technologies. Instead, participants emphasized that they should be integrated into existing work practices. One participant highlighted that predictive models should instead be communicated as an additional support for decision-making, instead of something revolutionary or something intended to replace employees. This way, the participant suggested that new technology probably would become more welcomed within the organization. Lastly, according to the participant, organizational acceptance is more likely to develop organically when employees are allowed to gradually work with the tools in practice and observe their usefulness over time.

4.4 Implications of Predictive Insights

As previously mentioned, predictive insights were discussed in parallel with the idea of a computer system that could store data, enable analysis on data, and display predictive insights. These insights can include indications of potential future events, risk levels, and potential action items that could mitigate risks and future outcomes. This concept was used for participants to have something tangible to anchor their

answers to. When discussing this concept not only values were identified but also implications of using such systems to receive predictive insights. In this section, the implications of predictive insights that were explored throughout the interviews are discussed in detail. Three sub-themes were identified as; data quality, use of data, and additional implications.

4.4.1 Accessibility of Data

During the interviews the use of data was discussed thoroughly. Multiple participants claimed that the organization both produce and use large quantities of data, making it difficult to know what exists and what does not. It is also expressed that employees have an hard time figuring out who to turn to for specific data. One participant said that they once were told by a colleague that the data they were looking for did not exist, only to later find out that it did. They had just asked the wrong person.

A prevalent topic among participants have also been the way in which data is currently stored throughout the organization. It has been explained by several participants that there are no overarching system that stores all data in a format that makes it easy to use. An interviewee said that *"it is difficult to use the data when it is stored in an excel file somewhere that no one knows of"*. Another topic that was brought up was data sensitivity. Even if you have access to large quantities of data, you have to be certain that you are allowed to use it. There is a risk that the data you need to use contain sensitive information that you are not even allowed to share internally. This is an implication, making data not only more difficult to use, but also makes the use of organizational data more time consuming.

4.4.2 Data quality

If a system is supposed to enable the analysis of data, to create predictive insights that are later used to make decisions, it is important to know the data quality. One interview participant said that *"the quality of the data being used, that is the challenge"*. Another participants said that we need to know if the data is good enough, but then again, what is good enough? It is discussed how data has to be purposely collected, it has to be in the correct format, and specific data rules have to be determined and implemented to deal with outliers.

Furthermore, even though many participants explained that an abundance of accessible data exists, others argue that compared to other industries we are looking at very few data points. This is explained to be the case because of the low volume industry the organization operates in, and because of the sensitive data discussed in section 4.4.1 above. This would mean that even if you have high quality data, if the data points are scarce and does not provide the full picture, the result would be incomplete models.

Another topic regarding the quality of the data that was discussed in interviews was the input. Several interviewees expressed a concern that individuals may insert data in different ways, inhibiting the system from providing accurate insights. For instance, one participant said that buyers have their individual procedures and ways of inserting information, which could potentially become an issue related to data quality. Further, if everyone does not insert data, or if all relevant data is not included, the system would experience data gaps that would be detrimental to the quality of the insights it provides.

4.4.3 Additional Implications

Some additional implications involve how to get employees to use the system. One participant stated that in order for these systems to be implemented, there has to be a demand from the employees that are going to use it. Otherwise the implementation process will face resistance. As previously mentioned, if everyone does not use the system or if the way data is inserted is not organizationally aligned, the system could fail. Therefore, resistance to the models could be detrimental to the implementation of predictive models.

Another topic of concern among participants was the ability to translate knowledge and experience into data points. Phrased by one interviewee as *"how do you translate soft values such as experience into hard data points that can be used in a computer model?"*. Another participant explained that when working with suppliers there are a lot of soft values they take into consideration. For instance, they mentioned that one might look at the supplier personnel. How many years have they been working at the company? How old are they? What experience do they have? Will they still be at the company within 10 years? Another interview participant questioned how to break down gut feeling to include that in a model, something which they explained is important in their work.

Multiple participants mentioned that an implication of predictive insights could be when they differ from what employees believe. One participant said that *"people may have an idea of what the monitor is going to say, and when that does not end up being what the monitor actually displays, you want to know why"*. Another participant states that *"sometimes you might not just want to see the most important information on a dashboard, you want to understand the underlying reason for why that dashboard says what it does"*. This was further discussed throughout the interviews as something that could lead to wasted time, and ultimately a problem correlating with the acceptance of predictive insights, which is discussed in section 4.3.3.

Lastly, one implication discussed regarding predictive insights in general was how they will affect employee motivation. A participant phrased it as follows: *"if you did not have predictive insights, would you try harder?"*. This was brought up as theoretical question that would have to be discussed before implementing the use of predictive insights. If people are wired to see predictive insights as a certain, they might not work toward mitigating what the insight is indicating. In connection to

this, the certainty of these insights were discussed. They are predictions and should therefore be viewed as that, something that can help us gain understanding of a still uncertain future. If we view it as anything else but that, it was implied that we might run the risk of becoming lazy, stop thinking ourselves all together.

4.5 Predictive Insights in Practice

This section aims to introduce the participants ideas on how the work with predictive models may be introduced more in more practical ways. Even though the practical work with predictive models is not necessarily an aspect that is stated in the aim of the study, or directly addressed in the research questions, insights regarding the practical work are found valuable for understanding participant perceptions of predictive insights. Therefore, reflections on where predictive tools should be introduced in the organization and how the insights should be used, is brought up in this section.

4.5.1 Potential Areas for Predictive Tools

Throughout the interviews it has been discussed where predictive insights could create the most value. A majority on the interview participants have confirmed that they see the greatest potential in having such insights within procurement and when working with suppliers. One perspective covered was that they are working with over 2000 suppliers, making it difficult to keep track of all information. On the customer side they are only working with a handful, which may be more manageable and not in need of as much predictive insights. On the customer side there are also less things to predict as future sales are already established 5 years in advance.

Additionally, one participant stated that the predictive insights more precisely should be implemented at operational levels of the procurement organization. It was explained that a buyer might have a limited perspective of the overall operations when they are placing their purchase orders, it was the participant's belief that having predictive insights could help buyers widen their perspective.

More specifically, a participant emphasized the importance of predictive insights reaching the right destination, which was believed to be at a more operational level in the organization. The participant was particular in how important it is that predictive insights are explored operationally, prior to the insights reaching management. As the participant stated, *"that is usually the problem with global dashboards, it may result in micro-managing, ultimately crating a headache for all involved parties"*.

4.5.2 Addressing the Uncertainty of Predictive Information

One additional area which was brought up by several participants was the concern of how to balance early insights with correct information, more specifically when one should act on predictive insights or wait for more certain information at a later point in time. As one of the participants stated, the optimal scenario would be to receive information which is both as correct as possible while also receiving it at an early stage, however that is often not achievable. Reflections on the balance between correct information versus early information will be illustrated further in this section.

Some participants emphasized the importance of receiving information that is correct rather than early. As one of the participants stated, *"when making decisions, you would optimally want information as recent as possible, as early information increases the risk of missing relevant insights or making decisions based on outdated information. Therefore, I believe that data should be collected as late as possible prior to making decisions"*. Another participant also suggested that early insights could also create negative consequences to an organization if actions would be made based on incorrect or false signals. Additionally, the participant also emphasized that organizations might receive early indications that are actually theoretically correct, but still should not necessarily trigger immediate action, as such reactions may disrupt the supply chain or unnecessarily affect suppliers. Participants explained that excessive sensitivity towards early signals, could potentially contribute to bullwhip effects within the supply chain.

As previously stated, some participants considered correct information more important than early indications. However, the majority of participants suggested the opposite, in which they emphasized that early indications are more important to their work than correct insights at a later stage. The main idea behind this seemed to be due to extensive lead times in GKN Aerospace's supply chain. One of the participants emphasized this by saying *"early information should be prioritized, as lead times and operational cycles are so long that the earlier an indication can be received regarding what requires further investigation, the better"*. Another participant elaborated on the same reasoning and stated, *"it is the supplier lead time which determines the importance of the foresight of the insight"*.

In addition to the reflections regarding lead times, participants also suggested that earlier information would support a more proactive way of working. As one participant stated, *"often, the information received is more about understanding what has already gone wrong, or understanding consequences afterwards. I want actionable information that I can act proactively on"*. Another participant added to this reflection by saying, *"we have KPI:s for our suppliers but they are based on late deliveries and at that point, the actual damage is already done"*. Additionally, another participant further highlighted that a relatively small number of products often account for a significant share of operational impact. Early indications for such products were therefore described as particularly important.

Ultimately, some participants highlighted the trade-off between correct and early information. One of the participants shared that we, as an organization, need to question what level of correctness that should be required for acting on predictions. As the participant stated, *"there are two extremes, it is not possible to predict certainty, but in contrast, it is not possible to predict randomness either"*. Therefore, the idea is to understand when predictions are too early or too uncertain to act upon, and when it is too late to predict things. According to participants, the challenge lies in determining at what point predictions become sufficiently reliable to act upon, without losing the benefits associate with early indications.

4.6 Supplier Relations

Since the project is targeting the procurement side of the organization, the work with suppliers was frequently discussed. It was brought up how this work is performed and what the collaboration looks like from different perspectives. The most in depth topics were the communication with suppliers, and common implications that are experienced when working with suppliers.

4.6.1 Communication

Several interview participants stated that the work with suppliers is difficult. It is difficult to identify warning signals or indications of supplier disruptions as they are generally keeping such information to themselves. One participant informed that relationships with suppliers are crucial to achieve transparent and honest communication. Another participant said that it is important to nurture and foster these relationship because of the scarce amount of suppliers providing certain products in the industry. To maintain good relationships with suppliers, it was expressed that one cannot listen to every indication that is received. If purchase orders are adjusted to every new piece of information that arrives, the suppliers could easily grow tired of the buyer, which ultimately could harm the relationship.

Participants are saying that they try to work proactively, keeping their ears to the ground, but that it is difficult if the supplier is not collaborating. You do not always receive the information before it is too late. This is also discussed by another interviewee who said that *"often it feels like we are looking at the consequences of a supplier issue that they have known about long before we heard of it"*. Building on this, the value of communication is brought up by one participant who said that *"you do not get information that a supplier will be late in their deliveries unless you ask for it"*, emphasizing the current need for active communication when transparency does not exist.

It is also communicated in the interviews that it depends on the supplier. One supplier may be more transparent in their work than the other. Some suppliers intentionally keep their information to themselves to avoid customers conducting on-site inspections at their production facilities to *"check on them"*. Another interview participant explained that in some cases the management team of the suppliers do

not even know that they are having problems in their production. In those cases, one can get a change just by providing the numbers to the people in charge.

4.6.2 Implications when working with Suppliers

Even though there are improvement areas in how the work with suppliers is performed, several implications of doing so were brought up. Commonly discussed was the organizations ability to affect suppliers at all. Some suppliers are large, and GKN Aerospace's parts may represent only a fraction of the suppliers' sales. Therefore, some suppliers are difficult to negotiate with, and it is definitely difficult to demand that they change their ways of working. Further complicating things is the lack of suppliers mentioned in the section 4.6.1. Since GKN Aerospace is working with complex products, most of the ordered parts are hard to replicate. Several interviewees claimed that some suppliers pretty much have monopoly in manufacturing their products. This is what further complicates negotiation with suppliers, when a supplier is inalienable to GKN Aerospace, but GKN Aerospace is not important to the supplier. Then it becomes of extra importance to foster supplier relationships and to *"not rock the boat"* as one participant phrased it.

Additional implications refer to the type of problems that suppliers commonly experience. One participant mentioned that *"it is rarely the case that the problems we experience with suppliers are connected to capacity. Most often it is the result of unpredictable quality deviations"*. They continued by explaining that it can happen to any supplier. They sometimes have suppliers who have been flawless for years, and then out of nowhere, they start experiencing issues.

Lastly, one implication is that even if supplier relationships have been established, it can change in an instance. Several interview participants had experienced having good relationships with suppliers that were severed when the supplier had a change of owners. The experience has been that years of knowledge of, and relationships with suppliers, have been lost in the aftermath of mergers and accusations. This have been brought up as something that can undermine the motivation of working closely with suppliers.

5

Discussion

This chapter connects the empirical findings discussed in chapter 4 with the relevant theory outlined in chapter 2, while also presenting our reflections upon these insights. The discussion is divided into several sections, focusing on answering the research questions and highlighting additional findings from the interviews. Ultimately, this chapter aims to provide the reader with a deeper understanding of the findings of the study and their implications for organizations.

5.1 Evaluating the Value of Predictive Insights

Throughout the study, we have come across several interesting insights and realizations regarding the value of predictive insights. The reflections discussed by participants have been divided but a reoccurring theme has been that providing a unit or clearly quantifying the value of predictive insights is difficult. However, several valuable reflections on what type of value predictive insights bring, and how these values affects both GKN Aerospace and other stakeholders have been introduced.

Stakeholder Perspective

Firstly, the stakeholder perspective has been a prominent part of the work with reflecting upon organizational value realized from predictive insights. Before trying to quantify any form of value, the findings suggest that the most reasonable approach is to identify which stakeholder the value of the predictive insight is actually intended for. At GKN Aerospace, the stakeholder approach has already been established in their daily operations, for example when planning strategic initiatives. However, an important takeaway is to apply the same reasoning to understand how to effectively quantify the value from predictive insights. This reflection idea has emerged throughout the study, as one of the most important takeaways when quantifying the value of predictive insights.

As previously mentioned, several interesting suggestions on the value of predictive insights have been reflected upon throughout the study. The two most prominent types of value which have been reflected upon are tangible value, which is of more monetary nature, and intangible values. Connecting this reflection to the stakeholder perspective as previously mentioned, an important finding was that participants

suggested that different stakeholders are experiencing different forms of value from predictive insights. The way we see this is, shareholders are more keen to understand tangible value, expressed in financial terms to better understand the business value of how predictive insights strengthens the focal firm's ability to deliver as promised. On the contrary, the employees of GKN Aerospace seems more concerned with softer values, which is affecting how they are working on a daily basis and how predictive insights might reduce stress levels and the need for them working overtime. By addressing the third stakeholder as outlined in section 4.2.4, the value experienced by customers is more likely linked to factors such as better reliability and on-time deliveries.

Consequently, when trying to both identify and quantify the value of predictive insights, we suggest that the first step should be to clearly define for whom the value actually should be created. Kalaitzi and Tsolakis (2022) discuss how different organizational actors influence the adoption and benefits of predictive analytics. However, there seems to be a gap in how value of predictive insights has previously been discussed, compared to our reflections on the stakeholder perspective. It is our understanding that existing literature, such as Kalaitzi and Tsolakis (2022), is lacking an explicitly stated stakeholder perspective when identifying and quantifying value of predictive analytics, and potential insights from them. However, Howard (1966) argues that information is only valuable if it results in decisions that can lead to improved future outcomes. This implicitly ties back to the stakeholder perspective, as information may improve decision outcomes for one party, but not for the other. One has to determine where information is supposed to create value.

Ultimately, the findings indicate that quantifying the value of predictive insights with a single universal metric might become difficult in organizations where different stakeholders evaluate value in different ways. While outcomes expressed financially may be more important for strategic decision-making, operational stakeholders may instead experience value through improved workflow stability, or reduced uncertainty in their daily work. Therefore, this insight highlights the importance of organizations requiring multiple perspectives when interpreting the value of predictive insights.

Value Development over Time

Furthermore, the time-perspective was an additional participant reflection that we found particularly interesting. The findings suggest that certain forms of value might be difficult to quantify in the present, and that such value might only become visible over time. Naturally, more intangible and "softer" values were brought up as examples of this phenomena. Nevertheless, the findings also indicate that even though the value of predictive insights might not be possible to quantify effectively, such insights may still be of great organizational value long-term, that gradually become visible through improved reputation, increased trust from shareholders, and increased organizational stability. Therefore, we suggest that the findings indicate that organizations may risk underestimating the value of predictive insights if the evaluation rely too heavily on short-term objectives or directly measurable outcomes.

Moreover, this might potentially challenge more traditional performance evaluation approaches as discussed in section 2.1.1, where value is commonly assessed through more structured and measurable KPI:s. While such indicators are capturing direct and more short-term operational performance, the findings of this study suggest that several forms of value that are connected to predictive insights may instead develop and emerge indirectly and over longer periods of time. Consequently, we want to highlight that if organizations only look at the measurable value of predictive insights, they risk overlooking intangible values that may become measurable over time.

Value Through Operational Improvements

The findings suggest that predictive insights in general are difficult to quantify in terms of monetary value. However, if the context is niche, it becomes easier to quantify. The more precise one can be in what type of information they are trying to predict, the more straight forward it becomes trying to quantify the value of the predictions. Therefore, perhaps it is not possible to quantify the value of predictive insights in general, it all depends on the field, organization, and division in which you are in.

Throughout the interviews this was handled by applying predictive insights to the field of the interviewee, resulting in more precise ways of quantifying value. In the context of procurement, the findings suggest that the value of predictive insights can be quantified in terms of inventory reduction. More specifically, the findings suggest that an increase in the availability of predictive insights, may enable organizations to reduce their overall level of safety stock without necessarily compromising service levels. The findings also indicate that increased supply chain visibility, as a result of predictive insights, may reduce the need to compensate for uncertainty by building extensive inventory. The findings also suggest that another way to compensate for uncertainty, and build organizational resilience, is to collaborate with multiple suppliers instead of relying on a single supplier.

These participant reflections are confirmed by Perera et al. (2019), who argue that improved forecast accuracy may allow companies to reduce safety stock and thereby lower inventory holding costs, while maintaining service levels. The findings can also be connected to the information covered in section 2.2.5, where safety stock and buffers are described as responses to uncertainty and other types of supply chain disruptions. From this perspective, predictive insights could therefore create additional value by reducing the need for extensive operational buffers. Therefore, we argue that the financial savings associated with reduced safety stock and operational buffers, could be seen as a way to quantify the value of such predictive insights in a procurement-related context.

Moreover, the findings are aligned with section 2.1.3, where a multi-sourcing strategy is introduced as a way to reduce supply risk by allowing the focal company to alternate between multiple suppliers if needed. In the same section Chopra and Meindl (2016) also highlights that a multi-sourcing strategy implies increased sourcing costs, which introduces the trade-off between cost efficiency and supply chain resilience. On the contrary, the risk of using a single-sourcing strategy is presented as supplier dependencies which increases the risk of single point of failures. In our findings, we acknowledge that maintaining a multi-sourcing strategy is unreasonably expensive, and in some cases even impossible due to the quality standards of the industry. Therefore, we suggest that a way to quantify the value of predictive insights could be to view them as a bridge between supply chain resilience and operational cost efficiency, by enabling organizations to better anticipate and respond to disruptions without solely relying on costly strategies such as multi-sourcing.

From another perspective, the findings imply that predictive insights may also improve service levels, which can result in better customer relationships and an increased level of trust in the focal organization. The findings also suggests that improved supply chain visibility and more accurate forecasts could lead to a higher degree of customer satisfaction, as the organization becomes better able to deliver according to customer expectations. Ultimately, the findings suggests that such improvements could create additional business opportunities over time, as customers may potentially perceive the organization as a more attractive supplier.

This is aligned with Perera et al. (2019), who claims that improved forecasting may result in financial savings, improved customer relationships, increased customer satisfaction, and ultimately better competitiveness. In relation to previous findings regarding value development over time, this reflection also suggests that the value of predictive insights extends beyond operational savings, such as reduced inventory costs and buffers. To be specific, we argue that predictive insights also could contribute to long-term value creation through better customer relations, strong customer retention, and potentially additional business opportunities. Ultimately, we suggest that the value of predictive insights therefore potentially could be quantified through the accumulated business value of the additional business opportunities, that emerge as a result of improved customer satisfaction.

Value Through Proactive Decisions

In our findings, a prevalent way of quantifying the value predictive insights is by pointing towards proactive actions and how they change future outcomes. The information that predictive insights hold, makes it easier for decision-makers to get an overview of a situation, to understand the uncertainty, and to work through alternative outcomes. For instance, the findings suggest that receiving indications of a potential supplier delay, enable decision-makers in production to re-schedule maintenance for the time of the delay, resulting in increased production volumes. In this specific case, the quantification ultimately connects to the loss of sales experienced if the predictive insight would not have been received. Additionally, our findings highlight that a decision-maker could increase resource utilization by scheduling

operator-training when predictive insights indicate supplier delays. In that case, the value of predictive insights can be quantified by measuring the overhead documented by operators. The findings indicate that predictive insights enable proactive actions.

As we understand it, predictive insights should not always result in proactive action. Sometimes it is more valuable not to act at all. According to our interpretations, the decision-maker has to evaluate what the potential future outcomes are on every received predictive insight. This is in line with section 2.2.4, which highlights how scenario planning allows organizations to more effectively assess and quantify potential consequences of different scenarios. Additionally, section 2.2.4 further argue that scenario planning support decision-makers in making informed and proactive decisions. Therefore, the findings derived from the interviews seem to confirm what has been discovered in the field of scenario planning.

Consequently, we suggest that the value of predictive insights can be seen as the difference between the outcome achieved through proactive action and the outcome that would have occurred in the absence of such action. This can be connected to the concept of VoI, explored in section 2.3.2, where the value of information is understood as the improvement in decision outcomes enabled by additional information. It can therefore be argued that one way to quantify the monetary value of predictive insights could be the reduction of negative financial consequences such as "loss of sales", or saved operational resources depending on the context. However, as section 2.2.1 discuss, supply chains are uncertain and lack information about future events and their outcomes. This further connects to tier-structures, discussed in section 2.1.2, that tiered networks are built on inter-dependencies, where the performance of one actor may influence the performance of other actors in the network. We therefore recognize the complexity of having an accurate enough overview of a situation to be able to calculate the financial consequences of an outcome.

Value Through Relationships and Well-Being

The findings suggest that predictive insights could result in reduced workload and stress levels for employees. More specifically, the findings indicate that predictive insights may help organizations not fall behind schedule through more proactive work. As the findings suggest the present and more reactive work, often lead to employees having to work overtime or during weekends to catch up. Additionally, the findings also suggest that being the bottleneck within a supply chain network, results in extensive attention from other actors within the same supply chain. It is described that to manage such situation requires extensive time and effort. As the findings suggest, this reactive way of working puts a strain on the workforce and increases overall stress levels among employees.

The theory discussed in section 2.1.2 corresponds with the findings regarding the nestled structure of actors within a supply chain network, where the under-performance of one actor affects the entire supply chain. As highlighted in section 1.1.1, this is referred to as the ripple effect. It is our understanding that the reactive work described in the findings can be connected to SDT, as outlined in section 2.5. If employees are working re-actively, falling behind schedule, and are forced to work overtime to catch up, they may begin to feel less in control of their work situation. This aligns with autonomy discussed in section 2.5.1, as the need for managing and influencing one's work. It is believed the feeling of autonomy can be lost if employees always have to respond to emergencies and external pressure. Additionally, we recognize that constantly being the bottleneck and being pressured by other actors of the supply chain, may hinder the need for competence, also outlined in section 2.5.1. The theory explains that the need for competence refer to feeling effective and capable in one's environment. It is our understanding that employees that are often catching up and dealing with delays may feel less capable of performing their work successfully. In section 2.5.3, it is further described that not fulfilling the needs of SDT consequently leads to lower well-being among employees. Section 2.5.3 confirms the findings of the idea that reactive work increases overall stress levels, and further suggests that such stress ultimately may lead to burnouts.

Ultimately, we find that the value of predictive insights could be evaluated in terms of intangible values, such as reduction of stress levels and increased employee well-being. However, as previously discussed regarding value development over time, such value might be difficult to effectively quantify in the present, and would probably instead emerge and become visible over time. With this in mind, one insight that we have found particularly interesting connected to this topic is the opportunity to monitor sickness rate or other reasons for absence over time. By identifying trends in such data, we argue that organizations might be able to retroactively quantify the value of predictive insights by understanding how it influences more intangible values that are difficult to quantify in the present.

The Concept of "Dollar Days"

Another way to address the value connected to predictive insights, is through the concept of "Dollar Days" (DD), as originally proposed by Eliyahu M. Goldratt (1984) in the management book *"The Goal"*. From the findings, DD was probably the most concrete participant reflection regarding a quantification of the value connected to predictive insights. The findings suggest that predictive insights might be easier to financially quantify when disruptions or uncertainties can be directly translated into economic consequences. The concept of DD represents one example of how delivery delays, and subsequently unnecessary inventory as a result, can be converted into financially expressed impacts. By assessing these impacts, organizations might be able to quantify the value of the connected predictive insight. We suggest that if the use of DD is established within an organization, predictive insights could be quantified by evaluating the reduction in DD that they contribute to.

However, when reflecting upon the concept of DD, we argue that the findings show a lack of concern regarding the stakeholder perspective, which we have previously discussed. Since DD focuses on the cost of the actual product observed, low-cost components are assigned a lower value in terms of DD. This might lead to a low degree of prioritization when evaluating the value of predictive insights for low-cost components, unless they pose extraordinary long delays. Therefore, this might at first glance result in a perception that low-cost components are less important, which is a misleading intuition based on the previous findings regarding the importance of addressing the stakeholder perspective.

Additionally, the findings also suggest that the concept of DD separate components from the end product as a whole. Therefore, this may increase the risk of supply chain disruptions and additional inventory costs if the value of predictive insights would be blindly evaluated based on individual components themselves, rather than considering the supply chain process as an interconnected system. This might be particularly important in relation to the interconnected tier-structures and potential risks of ripple effects as outlined in section 2.1.2. As previously mentioned, disruptions that are affecting what seems as negligible products, might still propagate more than anticipated throughout the supply chain and create large operational consequences downstream, despite initially appearing insignificant in financial terms.

The Balance Between Early and Correct Information

Another topic that we believe add to the nuance of our findings is the balance between early and correct information. Of course it would have been most beneficial to have access to both early and correct information, but since the future inherently is uncertain, that is often not achievable. Therefore, this study explored whether an organization should prioritize having recent information that is accurate, or early indications that are more uncertain. The findings suggest that when making decisions, they benefit from being based on as recent information as possible. This is further described as a way to avoid using outdated information and ultimately avoid missing relevant insights. The findings also insinuate that it may be difficult to know whether to act on early indications, as decisions made on inaccurate signals can have negative effects on the organization. Simultaneously, the findings also imply that even if signals are accurate they should not always trigger immediate actions anyways, as excessive sensitivity to information may lead to bullwhip effects within the supply chain. It is further described that excessive sensitivity to information may place unnecessary strain on supplier relationships, as frequent adjustments can increase the workload imposed on suppliers.

Moreover, an additional finding was that long lead times create a need for receiving early information, and that waiting for more certain information may leave insufficient time to respond. The findings therefore suggest that due to these long lead times, organizations may be forced to act on more uncertain indications at an earlier stage. Additionally, the findings also suggest that early indications may affect employee motivation. It is questioned whether having insights can create dependence on analytics and weaken personal initiative and effort among employees. The

concern is that predictive insights about future events may be accepted as a certain, and therefore not lead to any proactive problem solving efforts.

As mentioned in section 2.3.2, Kochenderfer (2015) argue that organizations must act on incomplete information and that decision-making naturally occurs under uncertain conditions. However, the findings of this study partially challenge this perspective as some interview participants expressed the importance of recent and more certain information before making decisions, to avoid relying on outdated information and missing relevant insights. Moreover, another perspective from an interview participant cover that a balance also has to be achieved regarding when to act on information, no matter the uncertainty of it. In section 1.1.1, H. L. Lee et al. (1997) claim that small deviations in supply chains can cause progressively larger demand distortions and inventory swings as orders move upstream (the bullwhip effect). As we understand it, this theory confirms our findings regarding the balance of when to act on predictive insights. We argue that constantly making small adjustments every time new information is received may seem harmless, but as small deviations downstream can create larger deviations upstream, the impact of such adjustments may be detrimental to the overall supply chain.

From the findings, it is understood that for information to be actionable, it often need to be received at an earlier stage due to long lead times. While waiting for more certain information may improve decision accuracy in some cases, the findings suggest that delayed information may in other cases reduce the possibility of using the information to take action, ultimately limiting its practical value. This corresponds with the perspective covered in section 2.3.2, where Howard (1966) argues that the value of information should be evaluated based on its influence on decision-making and future outcomes. From this perspective, earlier information should be prioritized, since it can influence future outcomes even if the information Konstigt inherently is uncertain. On the contrary, if more recent information is demanded to take action, decision-makers run the risk of waiting until the information no longer is actionable, lowering the informational value significantly.

Building on the concept that long lead times create a need for early information, Paulson (1976) argues that construction projects are facing the same challenges, see section 2.4.1. It is understood that in the field of construction, the majority of project expenses are locked at an early project stage. Paulson (1976) highlights the difficulty with information being limited at the time when the most important decisions are made, emphasizing the need for early information. The findings of this study suggest that similar dynamics exist in supply chain decision-making, as lead times similarly force organizations to make decisions before complete information is available. Linked to the topic of influence reduction over time, section 2.4.2 cover how the cost of change also increases with time. The findings of this study do not directly suggest that cost of change increases over time, however they still appear to confirm the principle that timing is important. As we understand it, giving yourself the opportunity for late changes implies large operational expenses such as excessive inventory and buffers.

Moreover, from the findings it is recognized that predictive insights may be perceived as absolute, and therefore not trigger any mitigating responses within the organization. Although researchers such as Aljohani (2023), discuss predictive insights as an enabler to decision-making and proactive actions, the findings of this study partially suggest that having access to predictive information could make employees feel hopeless about future conditions, therefore decreasing the motivation to proactively mitigate future outcomes. In SDT, Deci and Ryan (1985) explain competence as the need for feeling capable and effective at work, while autonomy is described as feeling ownership over actions, see section 2.5.1. It is our understanding that predictive insights may strengthen employees' sense of competence through improved visibility and preparedness. However, excessive reliance on predictive systems could potentially reduce individual autonomy if employees become dependent on predictive insights and system guidance. We therefore argue, from and SDT perspective, that early information about the future can limit proactive actions among employees, marginalizing the value of predictive insights.

5.2 Communicating the Value of Predictive Insights

Throughout the study, we have also come across several interesting insights and realizations regarding how the value of predictive insights can be communicated. These insights consist of reflections regarding how predictive insights may be translated and communicated to enable proactive actions and establish organizational acceptance.

Translation of Predictive Insights

As discussed in *"Value Through Proactive Actions"*, the value of predictive insights is first realized when they result in actions that can influence future outcomes. Moreover, in *"The Balance Between Early and Correct Information"* it is highlighted that in order for information to be actionable, it has to be received earlier due to long lead times. However, it is our understanding that receiving information at earlier stages may be insufficient to enable proactive action. Predictive insights also have to be contextualized and translated into forms that stakeholders understand and can act upon. On the same topic, Weick (1995) claim that more information does not automatically result in actions, the information first has to be interpreted, translated and contextualized before organizations can act upon it, also referred to as sensemaking. It is our understanding that the same theory can be applied to predictive insights, as they may result in more information, but not necessarily further actions. Weick (1995) makes a distinction between uncertainty which is when information is lacking, and ambiguity which is connected to information being interpreted in multiple ways. It is our understanding that predictive insights may reduce uncertainty, however if they are not translated and contextualized, ambiguity may increase rather than decrease.

As mentioned in *"Stakeholder Perspective"*, the findings suggest that different stakeholders interpret value differently, and that greater value could be generated if predictive insights are communicated in stakeholder-specific ways. Weick (1995) has a similar stance that information is socially constructed and interpreted differently depending on stakeholder perspectives, responsibilities, and organizational position. Therefore, the same predictive insight may imply different concerns depending on the stakeholder. Translation is therefore not only meant to simplify predictive insights, it should also contextualize it so that different stakeholders can understand its value. Furthermore the findings partially suggest a concern that if predictive insights reach stakeholders who are not the intended users of the insights, it may result in leaders micromanaging the employees responsible for responding to the insights. This aligns with the SDT perspective, where very controlling managing styles are discussed to hinder the feeling of autonomy and ultimately result in lower work performances, see section 2.5.4. We therefore believe that not only the translation of predictive insights is important, but also what destination the predictive insight is sent to.

Moreover, the findings suggest that quantification may not only serve as a way to develop metrics, but also as a mechanism for improving the ability to translate and communicate the value of predictive insights. This can be strengthen by Weick (1995) who claim that SM is not solely valuable because it reduces uncertainty and ambiguity, but that SM as an organizational process of engaging with uncertainty can be valuable by itself. At the same time, the findings suggest that quantification as a mechanism for communication may be difficult as intangible forms of value, such as those described in *"Value Through Relationships and Well-Being"*, are inherently difficult to quantify. Consequently, we believe quantification alone is insufficient, the value must often be explained and contextualized to result in actions.

Furthermore, the findings suggest that even when the intended stakeholder is known and predictive insights are quantifiable, the translation and packaging of information may still encounter challenges. A concern from our finding was that oversimplification may reduce the credibility of predictive insight, as individuals may want to understand the underlying reasoning or data before taking action. Weick (1995) argue that individuals construct meaning around information based on context and interpretation. We therefore believe that quantification and simplification may improve communicability, but it also risks removing important contextual understanding. As we understand it, if translation results in oversimplification of predictive insights, employees may find it difficult to trust and accept such insights, which is linked to *"Building Organizational Acceptance"*.

Additionaly, we believe there are several ways organizations can translate value of predictive insights despite quantification limitations. The findings suggest that sometimes when it is difficult to communicate the magnitude of value created, it may instead be sufficient to communicate for whom the value is created. For instance, our findings indicate that in some cases, the fact that value is created for employees may itself be sufficiently motivating for organizational implementation. Moreover, as discussed in *"Value Development over Time"*, some forms of value may not be

immediately visible, but instead become measurable over time. This aligns with Weick (1995) who describe that organizations often create coherent explanations retrospectively, due to their inability to understand the future. We therefore believe that predictive initiatives should be pursued informally on a smaller scale until their value becomes sufficiently measurable and defensible within the organization.

Building Organizational Acceptance

How the value of predictive insights is communicated is also affecting the level of organizational acceptance, which is crucial for an effective implementation process of predictive analytics. As the findings suggest, predictive analytics as a tool would require strong operational acceptance prior to integration in real decision-making processes. This aligns with section 2.6.2, where J. D. Lee and See (2004) outlines trust as crucial for employees willingness to rely on automation under uncertainty. Therefore, considerations that affects how predictive analytics initiatives are perceived and accepted are brought up in this section.

The findings suggest that employees have limited knowledge and experience in the field of predictive analytics as a field in general, and therefore find practical work with predictive insights as an unfamiliar area. Consequently, limited trust in predictive analytics is a present issue within the organization. As the findings suggest, one participant made the comparison that building trust in predictive models could be seen as getting to know a new person, neither is trusted blindly before familiarization is established. This further led participants to believe that it might take several years before predictive analytics become fully accepted within the organization. This aligns well with J. D. Lee and See (2004), who argue that familiarity influences trust, and trust therefore develops dynamically over time. Consequently, we argue that an important part of effectively introducing predictive analytics is to ensure good communication and training opportunities, to allow a gradual understanding among employees of what these tools really are. Ultimately, efforts in familiarization among employees seem to be a crucial part of the acceptance of predictive analytics.

Moreover, the findings also insinuate that new technology often face extensive organizational resistance during early implementation stages. Just as for self-driving cars, participants expressed concerns that predictive analytics may face extensive organizational resistance if just one predictive insight would appear to indicate a questionable or false output. This aligns with Dietvorst et al. (2014), who argue that observed mistakes in automated systems may reduce the overall level of trust disproportionately. Additionally, the findings also indicate that a problem with predictive analytics is the "exposure" of error margins. From the findings, this reflection emerged from the idea that if error margins are exposed, independently of how good the models actually perform, employees may experience a lack of trust in the models, knowing that they can generate false insights. On the contrary, the findings suggest that other tools, which are currently trusted, have implicitly stated error margins. An example from the findings highlight that weather forecasts are based on predictive models, and the error margins of such modeling is repeatedly exposed

implicitly through incorrect weather forecasts. However, such predictive analytics are still commonly relied upon, which leads us to believe that it is not the error margin in itself that is concerning, but rather the unfamiliarity and limited trust associated with new predictive technologies, where the uncertainty of the models is more explicit and visible for decision-makers.

Furthermore, the findings also highlighted the importance of identifying or creating an operational need for predictive insights, rather than trying to "push" it into existing decision-making processes. For example, one participant stated that in order for predictive analytics to be organizationally accepted, there has to exist a clear demand from employees whom are going to use it, otherwise the implementation process would likely face resistance. From this perspective, the findings suggest that the acceptance of predictive analytics would benefit from introducing such tools in operations where employees already experience uncertainties or reoccurring disruptions in their daily work. Consequently, the organizational acceptance seems to depend less on how well the models actually perform in technical terms, and more on how employees perceive the insights as practically valuable in supporting their daily work. Therefore, we argue that it is crucial for organizations that are aiming for implementations of predictive analytics, to effectively identify the operational difficulties of today, and communicate how predictive insight may mitigate those difficulties. This way, employees are allowed to more clearly perceive the practical value rather than questioning the implications of predictions, ultimately supporting organizational acceptance.

On the contrary, the findings also suggest that other organizations have benefited from communicating the technical performance of their predictive initiatives throughout the organization to improve acceptance. Instead of trying to convince employees that predictive models have impeccable technological performance, our findings insinuate that organizations may benefit from clearly and transparently communicating how predictive models perform in relation to existing operational practices. From this perspective, predictive models may not necessarily need to demonstrate perfect accuracy, but rather show practical improvements compared to the current ways of working. This is very well in line with Weick (1995), who suggest that organizations often strive for plausibility rather than perfect accuracy in situations that are characterized by uncertainty. While Dietvorst et al. (2014) describe the issues with algorithm aversion as predictive analytics facing extensive resistance as a result of single failures, Weick (1995) argue that organizations do not need perfect accuracy in order to take action upon insights. We therefore believe that even if predictive models outperform existing forecasting, and can be used to achieve plausibility, there is still an evident risk of organizational resistance in case of modeling failures. We therefore want to highlight the importance of effectively communicating predictive insights in a way that emphasizes practical usefulness over technical performance.

Lastly, as previously discussed in *"Translation of Predictive Insights"*, it also important to consider how the value of predictive insights is packaged when being communicated. To build on that reasoning, the findings suggest that predictive insights may benefit from being communicated through a more humble and supportive approach, and highlights the importance of not communicating predictive insights as something revolutionary. To minimize resistance, the findings further suggest to communicate predictive analytics as an additional support for decision-making, which employees may use if perceived as valuable. This connects back to what was previously discussed regarding not pushing new practices on employees if a need does not exist. Ultimately, we argue that it is important to focus on communicating the practical usefulness of predictive analytics, rather than portraying it as the solution.

5.3 Future Research

The Data Paradox

A reoccurring theme that was identified throughout the study concerns the data which is used to develop and maintain the predictive models that ultimately generate the predictive insights. Several participants reflected on how organizations may transition towards a more data-driven decision making, which leads us to what we refer to as the "Data Paradox" (DP). We argue that it is crucial to address this paradox in order to ensure an effective and safe transition towards more data-driven decision making.

As discussed in section 4.1.5, the findings suggest that there is often an abundance of accessible data, sometimes to the extent that it might become unmanageable. This indicates that the primary challenge for developing and maintaining predictive models is not necessarily the quantity of available data. Additionally, the findings also indicate that even if large quantities of data are accessible, organizations have to ensure that they are permitted to use the data, since there is a risk that required data may contain sensitive or confidential information. Consequently, the findings suggest that the selection of data used in predictive modeling is to some extent influenced by human judgment.

Moreover, the findings also imply that it is not only the selection of data that is influenced by human judgment and intuition. It was brought to our attention that organizations themselves sometimes generate some of the data that later could be used in predictive modeling. For example, operational buyers are documenting information such as late deliveries, supplier deviations, and other incidents related to the procurement process. This documentation could later be used as input data in predictive modeling. Additionally, the findings discussed in section 4.4.2, further indicate that the quality of data often differs depending on the individual who documented the information. Potentially missed or incomplete inputs from operators were also concerns that the findings suggest could have an impact on the overall data quality.

All in all, we argue that the possibility to benefit from predictive insights is closely liked to how data is generated, accessed, and ultimately used within an organization. This subsequently leads us onto what we refer to as the Data Paradox. The idea of a potential paradox emerges from the idea of using self-generated data, largely affected by human intuition, to develop and use models for "data-driven" decision making. Our findings suggest that participants found predictive insights partly valuable since they allow "objective" data, which could reduce making decisions based on emotions, and reduce the risk of "biased" decisions. Hence, the idea of perceiving data as objective is what we find problematic. We suggest that data in itself may appear objective, but as soon as data is chosen as a way to create, use, or develop a model, we would like to question if the objectivity in data still remain. To escalate this reflection even further, when operators themselves are the ones generating the data, we would like to question whether data can even be considered entirely objective prior to selection. Ultimately, we suggest that one has to question if experiences and emotions are desired in predictive modeling to be able to make objective and data-driven decisions, and this is what we refer to as the Data Paradox.

Lastly, even though we find the DP particularly important to address, it is not an area that this study intends to analyze further. Rather, we find the paradox primarily as an interesting reflection which emerged throughout the findings regarding how predictive insights are viewed. Previous research such as Feinberg (2023) and Penn (2025) already addressed the implications of objectivity in data but we argue that existing literature, to some extent lacks the depth in how the subjectivity in data is described. As an example, Feinberg (2023) describe human influence on objective data as a result of factors such as data selection and the subsequent analysis of that data. We therefore suggest that the existing literature does not acknowledge the generation of data as a means of data subjectivity, but instead rely on data as objective until human processing. Ultimately, we suggest that future research might further explore how predictive models are influenced by human intuition and organizational assumptions in which the data is generated and maintained.

6

Conclusion

This chapter concludes the findings of our empirical research. As industrial supply chains are becoming more global and complex, organizations in recent years have started to adopt supply chain analytics to build organizational resilience and increase profitability. More particularly, predictive analytics is utilized by organizations to gain a better understanding of the future, by analyzing predictive insights. This conclusion aims to answer how to evaluate the value of predictive insights on supplier performance, as well as how this value can be communicated to organizational decision-makers to support proactive actions.

Addressing the need for predictive insights in organizational decision-making, this study highlights the need for early indications in the context of aerospace industry, due to long lead times in the supply chain. However, the study emphasizes the importance of correct information, since late mitigation efforts are often expensive, if false predictive insights are acted upon. The risk of false predictive insights increases with earlier indications, and may also magnify within the supply chain if acted upon. In contrast, organizations also have to carefully assess correct predictive insights to reduce the risk of oversensitivity and consequences such as bullwhip effects and strained supplier relationships.

Prior to questioning how the value of predictive insights may be evaluated and communicated, the study highlights the cruciality of understanding *who* the predictive insight actually intend to create value for. To effectively communicate the value, it also emphasized that one has to understand who is the receiving stakeholder. It is understood that different stakeholder experience different forms of value, and interpret predictive insights differently depending on stakeholder perspective, responsibilities and organizational position. Consequently, the study find it difficult to identify a single universal metric for quantifying the value of predictive insights on an organizational level. Therefore, predictive insights must be contextualized and communicated to the intended stakeholder and organizational context in order to support proactive actions. Ultimately, the study suggests that to satisfy employees, the value should be quantified in more intangible terms, by outlining how their daily work would be affected as a result of predictive insights. Additionally, to satisfy shareholders, the value should be quantified in more tangible and financial terms to increase their perception of organizational stability. Lastly, to satisfy customers, the value of predictive insights should be quantified in ways that highlights

operational improvements and increased reliability.

Even though the intended stakeholder is known, and predictive insights are communicated effectively, the study suggest that predictive insights are not valuable by themselves, but instead through enabling proactive actions. The insights first become valuable when they result in decisions that ultimately can influence future outcomes. Therefore, to evaluate the value of predictive insights, this study concludes it can be done through understanding the difference between the outcome achieved through predictive insights and the outcome that would have occurred in the absence of such insights. However, the findings suggest that quantifying the value of proactivity may be challenging as some values are difficult to quantify and may first emerge over time.

The time aspect is important to acknowledge when reflecting on how to quantify the value of predictive insights. As the study suggest, intangible insights are generally more difficult to understand and quantify in the present. Often, the value of such insights instead becomes visible over time. Consequently, the study indicates that organizations may risk overlooking or under-prioritizing predictive insights if they are not directly measurable in short-term outcomes. Ultimately, the study indicates that predictive insights are not less valuable if the context does not allow for direct quantification. Instead, as previously mentioned, the value of predictive insights is directly tied to the outcomes they lead to. Consequently, how easy a predictive insight is to quantify only affects how easy that value is to communicate to relevant decision-makers, not the actual value of the insight.

Furthermore, the study suggest that to be able to effectively communicate predictive insights to decision-makers, first there has to be a perceived need for such insights. As the value of predictive insights is stakeholder-specific, the need cannot be established on an organizational level. Consequently, efforts in communication should not focus on convincing usage of predictive insights, but rather on identifying a perceived need. Furthermore, it is not only of importance to identify the organizational context of demand, but also to ensure the predictive insight reaches the intended destination. The findings suggest that predictive insights should be accessed by the intended user, and not throughout the entire organization as that may result in controlled managements styles that ultimately decrease employee motivation. Moreover, when the user has been identified, the way that the predictive insight is translated and packaged should be taken into consideration. The findings suggest that oversimplification may reduce the credibility of predictive insights as individuals may want to understand the underlying reasoning and data before taking action. This also ties to the findings regarding organizational acceptance of predictive analytics.

The aspect of organizational acceptance is also crucial to acknowledge. Acceptance starts with a perceived need that must emerge from a specific function. As the study suggest, this need usually evolves over time, through interaction with, and understanding of predictive insights. Therefore, efforts in familiarization among employees is an important part in building organizational acceptance of predictive insights. Moreover, the study highlights the importance of not portraying predictive insights as revolutionary technology and a shortcut to success. Instead, organizations may benefit from a more humble approach and communicate the potential of predictive insights as a tool that potentially could facilitate daily work. Additionally, the study also suggest that communication efforts should focus less on portraying predictive models as superior, and instead focus on demonstrating their practical improvements in relation to existing operations. This way, predictive models may not necessarily need to demonstrate perfect accuracy, but rather show their practical value in comparison to existing ways of working. The study also suggest that this will build organizational acceptance over time. Finally, the findings suggest that getting approval for new initiatives may still be challenging when they are difficult to quantify, even if a perceived need exists and the intended user is identified. In such cases, it may still be sufficient to communicate for whom value is created to get approval. If that does not suffice, predictive initiatives may be pursued informally on a smaller scale until the value becomes sufficiently measurable.

Ultimately, the study suggest that initiatives in predictive insights can be seen as a continuous organizational process. We suggest that this process begins by identifying a perceived need for predictive insights. This is followed by efforts to assess and contextualize the value of such insights in relation to the intended stakeholder. Thereafter, we also argue that organizational acceptance has to be established trough efforts in communication and familiarization with predictive insights, by illustrating how they practically could be utilized in operations. When acceptance ultimately is achieved, predictive insights may support proactive actions that potentially adds to organizational value. As this process would have to emerge over time, the realized value may potentially strengthen organizational acceptance and further encourage the use of predictive insights.

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A

Interview Guide

This appendix presents the interview guide used during the semi-structured interviews conducted to collect empirical data. In the interviews we used the term *"predictive insights"*, referring to information about potential future events or disruptions. To exemplify, these events could consist of supplier delays, capacity constraints, or other potential risks.

The questions in the interview guide were designed to support the semi-structured interview format and to provide a consistent structure across all interviews while still allowing participants to elaborate on their experiences and perspectives. At the beginning of each interview, participants were informed about the purpose of the study, a background of the research project, and the voluntary nature of their participation. Approval to record the interview was requested before the interviews started.

Introduction & Ethical Protocol

- Present researchers and the project context.
- Confirm anonymity, voluntary participation, and get recording consent.
- Sign "Informed Consent" document

Context & Background

- Could you briefly describe your role and responsibilities?
  - What is your professional title and in what division?
  - What is it that you practically do?
  - How long have you held this role?
- To what extent do you personally work directly with forecasts?
  - Are these forecasts related to suppliers or internal operations?

  - Do you mainly produce forecasts, consume them, or act on their outcomes?
  - If you don't work directly with forecasts, how does forecast information typically reach you?
  - What tools, systems, or reports are involved?

Interpretation of Predictive Insights

- How do you come into contact with information about potential future problems or risks in your daily work?
  - Which specific indicators, metrics, or signals?
- When you receive information indicating a potential future issue, how would you describe that type of information?
  - What is the first thing you look for to decide whether this information is worth acting upon immediately or something that you monitor?
  - What makes you trust or distrust this type of information?
  - If you have past experience with incorrect or misleading predictions, how do these influence how you interpret future predictions?
- Who do you see as responsible for acting on predictive insights, and how does that responsibility typically play out in practice?

Quantification & Business Value

- In what ways can early information about potential problems create value in your work?
  - How is this value experienced and discussed at different levels of the organization (e.g. day to day work vs managerial level)?
- How would you describe the value of receiving early information about potential problems?
  - Time gained, cost avoidance, risk reduction?
  - What challenges do you experience when trying to connect this to business value?

Translation & Communication

- How do you typically communicate information about potential future problems with your colleagues?
  - Who do you communicate with, and through which channels and formats?
- Can you walk me through an example where such information did or did not lead to action?

Human Factor & Uncertainty

- When communicating predictive insights, how do you experience it being perceived by colleagues and managers?
  - What differences do you experience depending on roles?
- How do you believe that uncertainty related to predictive insights is handled within the organization?
  - What differences do you observe between roles when it comes to handling uncertainty related to negative predictions?
- How does the time horizon of predictive insights affect how you respond to them?

Additional Reflections & Interview Improvements

- Looking back, can you recall a situation when acting or not acting on a predictive insight had consequences?
- If you could change one thing about how potential future problems are identified or used today, what would it be?
- What do you see as the most underutilized value of predictive insights in your role?
- Looking back at what we have discussed, do you want to add anything?
- Is there anything we have not discussed that you believe is important for understanding how this type of information creates business value?
- Do you have a recommendation for interviewees that you believe could have valuable input to the topic discussed today?

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