



How AI can help forecasting in purchasing

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Abstract:

Since the industrial revolution, there has been notable progress in technological innovation, leading to the transformation of many manual tasks and processes that had previously been limited by human physical capabilities for decades. In today's AI-dominated landscape, businesses heavily rely on AI and machine learning technologies. Within various industries, AI has become inseparable from operations, particularly in enhancing business forecasting- the process of predicting sales, managing stock levels, and optimising product and service sales timing. Despite the widespread adoption of AI in business, there are concerns about its potential negative impacts. Before the advent of AI forecasting, traditional methods were employed for business forecasting. This thesis aims to explore both the positive and negative aspects of AI forecasting in procurement, comparing it with traditional methods to determine which yields more accurate forecasts. The study utilises qualitative analysis and a documentary review approach, drawing data from various online sources. The findings indicate that AI-based forecasting outperforms traditional methods in accuracy. Additionally, while searching data for the study, it was found that many companies are investing in AI to streamline their overall business operations.

Keywords: Artificial intelligence (AI), Technologies, Forecasting, Purchasing, Demand forecasting, machine learning.

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1 Introduction

The term "Artificial Intelligence" (AI) is frequently employed to characterize the capacity of machines to emulate and execute tasks similar to those achievable by humans (Biswas & Patra 2023). Running a business nowadays means making tough choices, especially about what products to sell to make the money. Predicting what customers will want to buy, called demand forecasting is hard, especially with supply chain issues and changing trends. Getting this prediction right helps with buying products, setting prices, hiring staff, and growing the business (Chase, 2009). In recent years, artificial intelligence has advanced rapidly, changing the way companies see and comprehend marketing (Bahameish, et al., 2022). In the contemporary era of technological advancements various industries, including businesses, are incorporating artificial intelligence into daily operations to enhance efficiency and streamline activities (Biswas & Patra, 2023). While the advantages of AI have been widely extolled, it is imperative to acknowledge that each domain presents its own challenges. Procurement companies often struggle with figuring out the best suppliers in their area, deciding which ones to assess, exploring potential market partnerships, and considering mergers and acquisitions (Bahameish, et al., 2022). The utilization of AI-driven forecasting holds the potential to elevate customer satisfaction by minimizing instances of product unavailability. Machine learning and AI have the potential to enrich data analysis by revealing intricate patterns and trends that humans might miss. This capability can result in enhanced prediction accuracy, improved forecasting, and better decision-making (Bharadiya, 2023).

1.1 Problem statement

Forecasting is the act of predicting what will happen in the future. Whenever we try to guess or estimate what might occur down the line, that's forecasting (Bahameish, et al., 2022). In business, forecasting is used to predict things like how much demand there will be for a product or how many sales they make to customers. But it's more than just guessing about sales – it involves thinking about broader issues. Forecasting is a crucial part of business because it helps us make decisions that will hopefully lead to positive results in the future (Chase, 2009). If the predictions are off, it can lead to making wrong decisions that put a company in a tough spot when it comes to meeting demand in the market (Pham, 2019). Companies need to pay closer attention to how predicting demand and buying things are connected. It's crucial to understand clearly how purchasing and

forecasting work together to make a business successful. Artificial Intelligence (AI) has the potential to change how to predict and what to buy. Despite people recognizing this potential, there's still a gap in understanding how exactly AI can help with the challenges of predicting what to buy. So, this study will try to figure out how AI can be used to make business's purchasing predictions more accurate, minimize risks, and better manage the stuff they buy.

1.2 Aim of the study and Research questions

This study aims to read previous studies regarding forecasting and study how it is using artificial intelligence (AI) to improve its future demand for the products by the use of an AI forecasting tool. It seeks to understand what business owners consider the most effective aspects of AI compared to traditional forecasting methods. The thesis will focus on answering specific research questions to analyse and demonstrate how AI contributes to better business forecasting for future demand. I have formulated research questions that aim to be investigated and solved to address the overarching problem, focusing on providing insights into the question of "how." Also, to evaluate the accuracy of AI-based forecasting models compared to traditional forecasting methods, RQ2 being the main one.

RQ.1 What are the potential effects of AI adaption in purchasing forecasting?

RQ.2 How accurate are AI-based forecasting models compared to traditional forecasting methods?

1.3 Demarcation

In this thesis project, my primary focus is evaluating the accuracy of Artificial Intelligence (AI) tools within the realm of purchasing forecasting and investigating their tangible impact on organizational efficiency. The study specifically concentrates on the study of different industrial reports in various sources that has adopted AI in their forecasting practices, aiming to understand how these tools contribute to day-to-day operations. Through a thorough assessment, this research seeks to provide valuable insights into the effectiveness of AI tools in optimizing purchasing strategies and overall organizational effectiveness.

2 Theory

This segment is linked to the theoretical foundation of the research, focusing on topics such as Purchasing, AI procurement, Demand forecasting, and Machine learning. It also delves into the comparison between Traditional and AI-based forecasting. The objective is to construct a fundamental framework that will facilitate the analysis and discussion of results in the fifth chapter. The primary purpose of this second chapter is to acquaint the reader with the theoretical principles that influence the research, laying the groundwork for a thorough exploration of the subject matter.

2.1 Purchasing

The concept of purchasing lacks a precise definition. However, depending on one's viewpoint, purchasing can be seen as a process of a set of functions, a link in relationships, a profession, a component of the supply chain or a discipline. Purchasing involves buying goods and services, handling receipts, and making payments. Buying things is a crucial part of every business. It's essential because a business can't function without it. So, the success of a business relies on the person in charge of buying stuff, just like it depends on those managing other aspects of the business. Purchasing is crucial for saving costs in a strategy (Mesfin, 2007). In the larger procurement-to-payment cycle, purchasing manages tasks like creating purchase orders, receiving shipment notices, recording receipts, processing invoices, and making payments to suppliers. It's a comprehensive process that ensures everything aligns in a three-way match (Pham, 2019). Buying things is a really important part of running a business. It's the first step in getting the stuff a company needs. If the choices made while buying things are not good, it can cause problems for the whole company, like in marketing or finance. The money spent on buying things is usually a big part of a company's expenses, sometimes the biggest. So, the people who make decisions about what to buy have a big responsibility because their choices affect how well the company does financially. In simple words, what a company buys defines it, and if the buying decisions are smart, the company is more likely to do well (Mesfin, 2007).

According to Abouzeid (2021), when it comes to purchasing, there are five key objectives often referred to as the 5Rs.

Right Quality: Purchasing aims to buy items of the correct quality ensuring that the materials or products meet the required standards and specifications.

In terms of purchasing "quality" takes on a distinct meaning compared to its common usage. Typically, when we talk about quality in everyday language, we are referring to the excellent features or characteristics of something. It's about how well-made or high performing an item is.

Right Quantity: The aim is to buy just the right amount not too much and not too little, to meet the company's needs without having too much leftover or running out of what's needed. It's about finding that perfect balance. Deciding how much to buy is important in shopping for a business. Therefore, it's crucial to consider factors that add complexity to quantity decisions before making any decisions. These factors include:

- Increased quantity results in lower unit prices.
- Larger quantities lead to higher storage expenses.
- The risk of damage rises with larger quantities.
- Higher storage costs are associated with larger quantities.
- Fewer orders are placed with larger quantities, reducing ordering costs.

Right Time: Timing matters in purchasing. Acquiring goods at the right time ensures a smooth flow in production or operations, avoiding delays or disruptions. For items bought or used regularly, the "right time" refers to when the stock reaches its lowest level. Both the purchasing unit and the approving body share the responsibility for ensuring this minimum stock level is maintained.

Right Supplier: Choosing the right supplier is crucial. It involves establishing relationships with reliable and reputable partners who can consistently provide quality goods and services. To smartly assess the supply market, it is important to know the basics about potential suppliers, like where they are and what they offer. Also, understanding product details, their prices, and predicting economic conditions helps. Just sticking to the usual sources without checking competitiveness might not be the best idea for the business. Making a long-term partnership with the right supplier is not so easy because the business environment keeps changing and companies always try to improve profits. Relationships with good suppliers might not stay good forever. So, it is important to regularly check how things are going and update agreements as needed. Choosing right supplier results on the best performance of the business.

Right Price: Getting the "right price" means finding a balance between quality and cost. The main aim in purchasing is to acquire items at a price that makes sense financially and fits within the company's budget. When buying things, the usual aim is to get the lowest possible price.

Buying the right quantity at the right time is important for efficiency. Overstocking ties up money and space, while understocking can lead to production delays or unmet customer demands. Selecting the right supplier is crucial for reliability. Dependable suppliers contribute to consistent quality, on-time deliveries, and positive long-term relationships. They are essential for the overall success and reputation of the business. Focusing on the 5Rs in purchasing helps businesses to get success in their operations, maintain quality standards, and build sustainable relationships with suppliers, all of which contribute to the overall success and efficiency of the company (Abouzeid, 2021).

2.2 Procurement AI

Artificial Intelligence (AI) enables Procurement organizations to tackle intricate problems with increased efficiency and effectiveness by utilizing intelligent computer algorithms (Atwani, et al., 2022). AI can be integrated into various software applications, ranging from spend analysis to contract management and strategic sourcing. AI is changing the way we do procurement. It uses software to automate tasks, making them faster and better. Using new technologies to digitize procurement means we need new plans to change how things work in a company. If done well, these changes will help the company offer new and better ways of getting the things it needs. (Guida, et al., 2023). The future of efficient business planning lies in AI-powered demand forecasting. Procurement experts also get extra help from AI, which analyses big and complicated datasets to provide valuable insights. In simple terms, AI is like a special kind of software designed for specific tasks. Since its software, it has the power to quickly change how things are done in big organizations (Bahameish, et al., 2022).

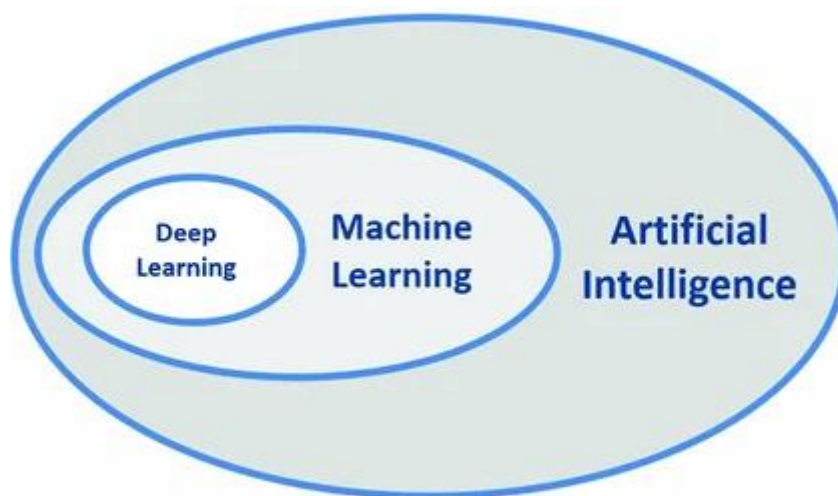


Figure 1 Artificial Intelligence, Machine Learning, and Deep Learning (Andreas, et al., 2018).

2.2.1 Machine Learning

Machine learning helps us predict how things will behave. It's really useful in solving problems related to planning and forecasting in the business and supply chain (Atwani, et al., 2022). Machine learning (ML) techniques, a component of artificial intelligence (AI), are crafted to autonomously learn from data without explicit programming. They possess the ability to decipher intricate patterns, detect correlations, and offer forecasts or suggestions based on past data. Within the realm of business intelligence, these algorithms are utilized to unveil concealed data patterns, conduct sophisticated data analysis, and furnish valuable insights to aid decision-making processes (Bharadiya, 2023).

The utilization of machine learning in procurement involves employing self-learning automated algorithms to address specific challenges and enhance operational efficiency (Pasonen, 2020). Through machine learning (ML) procurement processes can achieve optimal outcomes in terms of both quantity and overall financial impact. In recent years, machine learning has attracted significant attention, primarily driven by the growing accessibility of data and advancements in computational capabilities. Machine Learning (ML) is a subset of artificial intelligence that empowers machines to learn and make predictions by leveraging their experiences, which are derived from different available data (Kiefer, et al., 2019). Machine learning is like teaching computers to learn from experience and make sense of data using special algorithms. It grew from traditional statistics and artificial intelligence. Big companies like Amazon, Microsoft, Google, and Facebook have played a big role, making machine learning one of the coolest things in computer science in recent years (Edgar, 2017). The fundamental framework of machine learning encompass deep learning, culminating in the creation of artificial intelligence. Machine learning serves as a key methodology for artificial intelligence, enabling machines to learn without explicit programming (Pasonen, 2020). In machine learning, specific algorithms, such as Naive Bayes or Multiple Linear Regression are employed to perform various tasks. According to Kaifer, Over 5,000 academic publications in the field of AI forecasting have been catalogued by ISI (International Science Indexing), indicating a growing interest in the application of AI within the realm of forecasting.

2.2.2 Deep Learning

Deep learning is a subset of machine learning that focuses on learning hierarchical representations of data through deep neural networks. It is behind many things that can do jobs without people having to do them. It helps with tasks like thinking and doing things physically on its own (Kiefer, et al., 2019). Deep learning makes it easier to work with messy data like text and images by automatically figuring out what's important. It saves time by skipping some of the steps that usually need human input. Deep learning presents a potent method capable of addressing marketing challenges using classification and regression algorithms (Pasonen, 2020).

2.3 Demand Forecasting

In business terms, forecasting refers to the process of estimating or predicting future events or trends based on historical data, analysis, and relevant information. Demand forecasting specifically focuses on predicting the future demand for a company's products or services. It involves analysing various factors that can impact sales, such as market trends, customer behaviour, economic conditions, and competitive dynamics (Sanders, 2017). The goal is to generate a reliable estimate of the quantity of products or services that customers are likely to purchase over a specific period. Businesses can make informed decisions about pricing, promotions, and product launches with the help of accurate demand forecasts, ultimately enhancing profitability and maintaining a competitive edge. Precise demand forecasting ensures that the right products are available when customers need them, resulting in heightened customer satisfaction and increased loyalty (Chase, 2009). As outlined in a report by Grand View Research, the worldwide demand forecasting market reached a valuation of USD 3.6 billion in 2021. Projections indicate an anticipated compound annual growth rate (CAGR) of 10.3% from 2022 to 2030, signifying an expected expansion in market size over this period.

Regardless of the goals, there are fundamental principles in forecasting that remain true. These principles guide operators in knowing what to anticipate from forecasts. The key principles include:

1. Forecasts are not always perfect.
2. Group forecasts tend to be more accurate than individual ones.
3. Short-term forecasts are generally more accurate than long-term predictions (Pham, 2019).

2.4 Sourcing

"Sourcing" is a term often used in purchasing and supply chain management. The strategic sourcing process is more extensive than just buying things – it involves a comprehensive approach to managing the purchasing function within an organization. This approach is part of a modern and integrated supply chain management strategy (Badenhorst, et al., 2018). Sourcing is like a journey that starts by looking for new suppliers before making a choice. This involves doing research on the market where these suppliers operate (Johnsen, et al., 2019). In purchasing and supply chain management, people often use the term "strategic sourcing." This process goes beyond simple procurement and is more extensive. It is an outcome of strategically developing the purchasing function in an organization, following a modern, integrated supply chain management approach. Sourcing is essentially the purchasing activity within the broader and more contemporary frameworks of supply management and supply chain management (Badenhorst, et al., 2018).

2.5 Traditional vs AI Forecasting

Traditional demand forecasting methods heavily depend on historical data and statistical models, a process that can be time-consuming and have more errors. Traditional procurement has heavily relied on manual tasks (Hansun, et al., 2022). The BluePi article explores traditional forecasting methods in demand planning which highlights the crucial role of accurate forecasting in business transformation. According to Hansun (2022), various traditional forecasting methods are employed in the supply chain industry some of them are explained briefly below:

Moving Averages (MA): This technique smoothens historical data to discern trends better, applicable to different time periods like weekly, monthly, or quarterly. For instance, a 3-month moving average calculates the average of the past three months' data points. The Moving Average (MA) is a widely used method for predicting future values in time series analysis. In this research, we focus on two types of Moving Averages: the Weighted Exponential Moving Average (WEMA) and the Hull Moving Average (HMA) (Hansun, et al., 2022).

Weighted Moving Averages (WMA): Like regular moving averages, this method assigns different priorities to each data point based on its importance in the chain. Recent data points may be given more weight, reflecting their potential impact on future demand.

Exponential Smoothing: This technique assigns more weight to recent data points while still considering historical data, making it useful for forecasting data with significant randomness or noise.

Regression Analysis: A statistical technique that identifies relationships between variables, regression analysis helps identify trends in historical data and predict future demand.

Bottom-Up Forecasting: This method starts by planning the demand for individual products or SKUs and then aggregates this data to gain an overall understanding of demand. It is commonly employed by businesses with a large number (stock keeping units).

Top-Down Forecasting: The top-down forecasting begins by estimating the overall demand for a product category and then breaks it down into individual SKUs. This approach is often favoured by businesses with limited historical data for their products (Hansun, et al., 2022).

Selecting the right forecasting method depends on the type of data and the nature of the business. It might be necessary to experiment with various techniques to discover the one that fits the best (Chase, 2009). Using traditional forecasting ways to predict how much stuff to make or buy has some problems. One issue is that these methods often rely too much on just one kind of information, like how much was sold before (past data). This makes them not very good at handling sudden changes. Another problem is that they take a lot of time and need a lot of information-gathering work. Companies have to look at old data, clean it up, and then use it to guess what will happen in the future. This can be hard for companies with less past data. Lastly, these methods struggle to quickly adjust to what's happening right now because they have to make guesses about the future based on past patterns, which might not always be right. So, businesses need to think about using more flexible methods in today's fast and unpredictable markets (Hansun, et al., 2022).

According to Hansun there are some limitations of traditional forecasting models which are mentioned below:

Lack of flexibility: These models rely on historical data and assumptions that may not reflect future conditions, making them less adaptable to changing circumstances.

Inability to handle complex relationships: Traditional models often use linear regression techniques, which may overlook complex interdependencies among variables, leading to inaccurate predictions.

Ignoring external factors: Many traditional models assume that external factors remain constant, neglecting the impact of market trends, competition, and economic conditions on future outcomes.

Limited data availability: Traditional models require extensive historical data, which may be unavailable, particularly in emerging industries or for new products.

Difficulty in handling seasonality and trends: Traditional models struggle to accurately capture cyclical patterns or evolving consumer preferences, resulting in inaccurate forecasts.

Understanding these limitations is crucial for selecting the most appropriate forecasting approach and improving decision-making. Alternative models and advanced techniques can help overcome these shortcomings. In recent times, AI-powered demand forecasting has emerged as a transformative tool for businesses. By harnessing machine learning algorithms to scrutinize extensive datasets, AI-powered demand forecasting can uncover patterns and trends that conventional methods might overlook (Chase, 2009). The traditional demand forecasting process appears to be less accurate when compared to AI-driven forecasting. For instance, an e-commerce enterprise employing AI-powered demand forecasting may analyse customer data, market trends, and external factors such as economic indicators. This enables the prediction of which products are likely to experience high demand in the upcoming weeks or months. The application of AI in demand forecasting aids businesses in optimizing inventory levels, mitigating stockouts, and ultimately maximizing profitability (Sanders, 2017).

However, the study has also found that relying too much on AI predictions can lead to big losses in business. So, it's not always a good idea to trust AI without carefully studying the market manually (Sanders, 2017). Every method has its pros and cons, and market analysts should pay attention to market trends and demand before using AI data in their business decisions. For example, In 2000, Nike implemented the i2 forecasting software with high expectations. However, after nine months, the company admitted to a significant inventory write-off amounting to \$400 million. The automated system's inaccuracies led Nike to order \$90 million worth of unpopular shoes and resulted in a shortfall of \$80 million to \$100 million on popular models like the Air Force One. This incident underscored the importance of precise forecasting and revealed the substantial costs associated with forecast errors. Despite the setback, Nike has since rebounded as an

innovation leader, emphasizing the enduring lessons learned from this experience (Sanders, 2017).

3 Method

This thesis will discuss the challenges of using both traditional and AI-based forecasting methods in different types of businesses. It also aims to check out the advantages and accuracy of the AI-based forecasting methods compared to the traditional forecasting approaches. In pursuing this objective, studying is done by doing qualitative research, by looking closely at documents. Document analysis involves a three-step process: a quick skim for an overview, a thorough reading for detailed understanding, and subsequent interpretation of the content (Morgan, 2022). This means quickly going through papers to get a basic idea, reading them carefully, and then figuring out what they mean.

3.1 Choice of method

This thesis follows a single qualitative method, specifically a documentary analysis, conducted through secondary research on available sources. There are three approaches in research; Inductive, Deductive and Abduction (Bryman & Bell, 2011). The deductive approach involves testing established theories by examining if they apply to specific instances. It includes forming hypotheses that can be confirmed or rejected during the research process. In inductive studies, theories and hypotheses are not assumed at the outset of research. Instead, the approach allows for modification and alteration of the research direction after the research process begins. Therefore, if the research goal is to address specific questions, the researcher typically adopts the inductive approach (Bryman & Bell, 2011). Lastly, the abduction approach is applied to make logical inferences and construct theories. After analysing all these theories, it can be said that this research approach is inductive, meaning it starts with observations and forms theories based on those observations this method allows for flexibility in changing the study's direction as it progresses (Bryman & Bell, 2011). The chosen qualitative method relies on non-numerical data, focusing on qualities, characteristics, and descriptions. Documentary analysis was selected to gain deeper knowledge about the topic, while interviews were not conducted due to challenges in finding suitable interviewees and obtaining accurate data, especially when using AI for forecasting purposes.

3.1.1 Documentary analysis

Documentary analysis is the process of investigating and reviewing information written down on paper or stored digitally. It helps us to learn more and to gain a broader understanding of a topic by looking at existing data (Morgan, 2022). Researchers often check previous studies and include that information in their reports. Imagine it as examining things in different ways (Hennink et al., 2020). Qualitative research document analysis is about understanding data to find meaning and gain knowledge. It involves steps like looking at different documents (Morgan, 2022). As mentioned already this thesis is done based on the use of secondary data. Various kinds of documents exist, categorized by their source and retrieval method. Public records, such as annual reports and strategic plans, are official documents released by organizations detailing their activities. Personal documents, like social media posts and emails, capture individual viewpoints and direct involvement in a situation or event. Physical evidence, including items like flyers and posters, denotes tangible documents discovered during the study process (Morgan, 2022). This study focuses solely on one document type- public records. These documents consist of research-based publications, blogs, news, articles, and magazines published by various authors and are not confidential. They address the research question about AI implementation in forecasting processes in business and traditional forecasting methods. The reports that discuss accuracy, challenges, and related aspects are considered foundational. According to John Scott (2014), the sources used in documentation analysis must adhere to specific criteria outlined below:

Authenticity- The documents are authenticity means being genuine, real, and true to its origin or nature.

Credibility- The documents should be from trustworthy sources that follow the rules of fairness. They should not be altered to align with the researcher's desired outcomes or for the researcher's personal gain.

Meaning- The documents must be clear and easy to understand, so they make sense. They provide facts that help interpret the data. It's important for both the researcher and anyone reading the study to easily grasp what the sources are saying.

Representativeness - Representative data means that the information reflects the study accurately by including relevant and typical details from the original source. In simpler terms, the data should capture the key aspects of what we are studying.

3.2 Data sources

The primary sources of the available data originated from various open-access online platforms on the internet which include different journals, books, articles, magazines, news, and research papers. According to Patton (2015), any text-containing document can serve as a resource for qualitative analysis. All information is attributed to the respective authors with due credit during usage. Given that this is a qualitative study conducted through different available secondary data and research, the information is deemed authentic and sourced from reliable channels.

Table 1. data sources

#	Document Name	Document type	Author	Relevance	Obtained from
1	Pros and Cons of Artificial Intelligence in Supply Chain Forecasting	Article	Pro outsourcing LTD	Procurement and outsource company	https://www.linkedin.com/pulse/pros-cons-artificial-intelligence-supply-chain-forecasting/
2	Journal of purchasing and supply management	Journal	Michale, Federico, Antonella, Stefano	Research agenda	https://www.sciencedirect.com/science/article/pii/S1478409223000079?via%3Dihub
3	Retailers Forecast Demand with AI and Data Analytics	Magazine	Autumn Whitefield-Madrano	Data analytics	https://biztechmagazine.com/article/2024/02/retailers-forecast-demand-ai-and-data-analytics
4	Review and analysis of artificial intelligence methods for demand forecasting in supply chain management	Article	Mario, Fabian, Daniel	Analysis of AI for demand forecasting	https://doi.org/10.1016/j.procir.2022.05.119
5	Brief overview of traditional forecasting method	Blog	Faster Capital	Overview of traditional forecasting method.	https://fastercapital.com/topics/brief-overview-of-traditional-forecasting-methods.html#:~:text=Traditional%20forecasting%20techniques%20have%20long,methods%20for%20manv%20financial%20analysts
6	Decoding the synergies of AI and ML in demand forecasting excellence	Blog	Ali Kidwi	Data science	https://www.polestarllp.com/blog/ai-ml-driven-demand-forecasting-excellence
7	How AI demand forecasting Works	News	Mike Richardson	Data analysis	https://www.inventory-planner.com/ai-demand-forecasting/#:~:text=Data%20Dependency%20and%20Quality,.Unforeseen%20Patterns
8	Machine Learning and AI in Business Intelligence: Trends and Opportunities	Journal	Jasmin Praful Bharadiya	International Journal of Computer (IJC)	https://www.researchgate.net/profile/Jasmin-Bharadiva-4/publication/371902170_Machine_Learning_and_AI_in_Business_Intelligence_Trends_and_Opportunities/links/649afb478de7ed28ba5c99bb/Machine-Learning-and-AI-in-Business-Intelligence-Trends-and-Opportunities.pdf?origin=journalDetail&tp=evJwYWdIIjoia m91cm5hbERldGFpbC.I9
9	Ikea Improves Forecast Accuracy with AI-Powered Demand Sensing.	News	Alicia Esposito	Retailer touch point network	https://www.retailtouchpoints.com/topics/data-analytics/ai-machine-learning/ikea-improves-forecast-accuracy-with-ai-powered-demand-sensing
10	A comparative study using deep learning and traditional machine learning methods.	Article	Birim, S., Kazancoglu, I., Mangla, S. K., Kahraman, A.,	Annals of operation research	https://link.springer.com/article/10.1007/s10479-021-04429-x

			& Kazancoglu, Y.		
11	Review of Machine Learning Applications in Demand Forecasting	Article	Aamer, A., Eka Yani, L. P., & Alan Priyatna, I. M	Data analysis	https://www.researchgate.net/publication/346800958_Data_Analytics_in_the_Supply_Chain_Management_Review_of_Machine_Learning_Applications_in_Demand_Forecasting

3.3 Analysis of the data

To achieve a clear and appropriate result, received data will be analysed by using qualitative data called the thematic analysis approach and a table is employed to assist the analysis process. For the study, a style of thematic analysis called template analysis is applied which has been widely used in different research (King, 2004). Template Analysis is a way of studying information that focuses on organizing it hierarchically. It keeps things structured when analyzing text data but also allows for flexibility to fit the needs of a particular study (King, 2004). King (2004) outlines several stages in his article as follows:

Familiarization with data- Review and become acquainted with all the accounts to be analysed. For smaller studies, consider reading through the entire data set, and for large studies, select a subset of accounts to start.

Preliminary coding- In this step code the data by highlighting elements contributing to understanding.

Theme organization- Organize emerging theme into meaningful clusters. Establish relationship between them including hierarchical and lateral connections.

Initial coding template- based on a subset of the data develop an initial coding, this may involve analysing a portion of the accounts and drawing together the initial template.

Application of the template- in this stage, initial template is applied to additional data. Template can be modified as per the need, inserting new themes or receiving existing one based on fit with fresh data.

Finishing up- The final steps of template analysis, finalization is done as per the project's requirements. Despite the term "final" there is always room for flexibility. If further adjustments or deeper insights are needed the researcher can always revisit and refine the template. It is dynamic process that allows for continuous improvement and a thorough understanding of research questions at hand (King, 2004).

3.4 Validity and reliability

In qualitative research, reliability refers to how trustworthy the methods and data produced are (Roberts et al., 2006). Reliability in research means that if we do the same test or study multiple times, we should get similar results each time. It is about making sure the information gathered is consistent, stable, and repeatable (Brink, 1993). This applies not only to what people say but also to how well the researcher collects and records information accurately (Roberts et al., 2006).

Research validity is crucial in ensuring that the findings are useful and trustworthy (Roberts et al., 2006). It is all about making sure that the information and findings are accurate and truthful. Maintaining detailed notes about decisions made throughout the process enhances the project's auditability and, consequently, contributes to its reliability (Brink, 1993). Methods for enhancing reliability include prioritizing peer-reviewed works, examining citations, promoting diversity in sources, and ensuring relevance to the research question contributing to the overall reliability of the study (Roberts et al., 2006).

In this qualitative thesis, the focus is on ensuring validity and reliability. The research design is strong, rooted in a thorough literature review and relevant theories to boost validity (Morgan, 2022). Findings are validated through data triangulation, member checking, and peer review. Reliability is upheld by sticking to a consistent methodology, transparent data analysis, and, when needed, inter-coder reliability. An audit trail and prolonged engagement add to the reliability of interpretations. Multiple data sources and reflexivity are used to minimize biases (Roberts et al., 2006).

3.5 Ethics

Using documents that already exist as a type of data raises fewer ethical worries compared to other qualitative methods, according to Merriam and Tisdell (2016). When using existing information (secondary data) for the thesis, we should always be ethical. During the data research, the researcher must be sure about those sources which are allowed to be used (Hennink et al., 2020). There are basic ethical principles that help guide research in the right direction. These include respecting people's independence, doing good, non-maleficence (avoiding harm), and being fair to everyone (justice) (Vanclay et al., 2013). These principles are universal, meaning they apply everywhere, regardless of differences in nationality, culture, law, or economics. So, everyone involved in human research

should understand and follow these principles (Hennink et al., 2020). It's important to always think about the ethical aspects when looking at information. Understanding and following ethical rules in qualitative research keeps participants safe and makes the research better (Vanclay et al., 2013).

Regarding this study, the principles of objective research are followed, with a conscious effort made to minimize personal opinions in the analysis. The work have been conducted independently, without any affiliation with a specific company. Relevant information was sourced from various online platforms, and proper credit has been given to the respective authors whenever possible. Moreover, documents were sourced from various open-access public platforms, ensuring that all relevant principles of research ethics were upheld throughout the study.

4 Results

This chapter presents the findings derived from the sources examined in the research. It highlights the central focus of the study, which revolves around two specific research questions which are mentioned earlier as, RQ1 and RQ2. These questions likely serve as the guiding framework for the investigation, directing the collection and analysis of data. Through analysis of diverse online resources, this study has taken form and structure in it.

RQ.1 What are the potential effects of AI adaption in purchasing forecasting?

The effects of AI adaptation in purchasing forecasting can indeed have both positive and negative aspects. Further explanation is provided below regarding both the effects of AI adaptation in purchasing forecasting. Initially, let's explore the potential positive impacts of integrating AI into purchasing forecasting, as outlined below.

Inventory management

AI-powered algorithms play a crucial role in inventory management by analysing vast amounts of both historical and real-time data. This analysis leads to improved accuracy in demand forecasting, a key aspect of effective inventory management. By pinpointing patterns, trends, and seasonal changes, AI models can make more precise predictions, reducing errors in forecasting. This optimization helps businesses maintain optimal stock levels, ensuring that products are available when customers need them. Ultimately, this availability enhances customer satisfaction, reinforces positive brand perception, and

fosters loyalty among consumers. Additionally, ensuring optimal production and inventory management is crucial for businesses to avoid both shortages and excess stock. By closely monitoring production and stock levels, companies can maintain fully stocked shelves, thus minimizing financial losses. This proactive approach also helps prevent revenue loss due to missed sales opportunities or wastage of goods. McKinsey says that using AI for forecasting in supply chains can cut errors by 20 to 50 percent. This can lead to a big increase in efficiency, up to 65 percent, because there are fewer times when products are out of stock or sales are lost (Document 3).

Improved productivity and performance

Implementing AI demand forecasting methods can significantly enhance the productivity and performance of a business by leveraging advanced algorithms and data analytics to predict future demand with higher accuracy. Alicia Esposito's article in Retail TouchPoints (Document 9) discusses that Ikea Retail, a division of Ingka Group, has seen notable advancements through the integration of artificial intelligence (AI) technology to predict customer demand. Partnering with Inter Ikea Group and Blue Yonder, they've implemented AI-driven demand sensing, which analyses short-term demand patterns using various data points such as customer insights, market events, and even weather forecasts.

This technology has yielded impressive outcomes, especially following a successful trial in Norway in 2020. Since then, it is said that it has been widely adopted, leading to enhanced forecast accuracy and increased productivity among employees. With more precise planning tools, Ikea Retail has improved product availability and operational efficiency, enabling employees to concentrate on strategic tasks. In Ikea Portugal, forecast accuracy has seen a 5% enhancement (Document 9).

Cost reduction

Utilizing technology like AI and data analysis can help businesses figure out where to store their products so they can sell them better and save different costs. When companies use AI in their supply chain, many executives say it helps them save money and make more sales. According to recent industry data, integrating AI in the supply chain has led to reduced costs for 61% of executives and increased revenues for 53%. By aggregating data across different segments of the e-commerce supply chain, businesses empower their teams with timely and informed decision-making capabilities (Document 3).

Improved accuracy

Machine learning and AI algorithms can examine past sales records, market patterns, and other important factors to predict future demand with precision (Document 1). AI-driven algorithms have the capacity to examine extensive volumes of both historical and current data, facilitating heightened precision in demand prediction. They do this by spotting trends and patterns in the data. This helps businesses make better guesses about how much of a product should have on hand (Document 8). Machine learning and AI allow organizations to look at huge amounts of data right away, giving them useful information for making decisions quickly. This helps businesses stay flexible and react fast when things change in the market (Document 1). With AI's help, organizations can spot new trends, opportunities in the market, and what customers like. This gives them the power to come up with new ideas, create new products or services, and stay ahead of other companies in fast-moving markets. AI programs can see things in the data that people might miss, making their predictions more precise and helpful for businesses which ultimately increase accuracy in the overall performance (Document 8).

Below are the **negative** aspects associated with implementing AI-based forecasting tools in business, as derived from various sources referenced in the provided table.

Ethical Concern

When businesses create AI without considering what's right or wrong for its forecasting purpose, it can lead to serious problems. Ethics and morals, which are important for humans, are tricky to include in AI. As AI gets more advanced, there's a worry it might become so powerful that it could harm entire business decisions. Ethical concerns with AI include issues like privacy, where personal data might not be kept safe, bias in algorithms, which can lead to unfair treatment, and the risk of AI being used for harmful purposes.

However, document 8 mentioned that the Organizations are prioritizing fairness, accountability, and transparency to tackle potential biases and prevent adverse impacts. These developments in machine learning and AI within business intelligence are reshaping how organizations analyze data, interact with customers, and uphold ethical and transparent AI practices. When AI learns from biased information, it can end up making unfair decisions. To be fair, organizations need to find and fix biases in AI, making sure everyone is treated equally no matter their race, gender, or age. This means carefully picking and checking the data used to teach AI. Since AI often uses lots of

personal data, it's important to keep it safe and follow privacy rules. Organizations should use strong security and privacy methods to protect people's information.

Inability to forecast new product demand

AI models alone might encounter difficulties in accurately forecasting demand during substantial market fluctuations, like holiday seasons or unforeseen events, resulting in inaccurate predictions and inventory mismatches (Document 7). AI mostly learns from what happened in the past. But some unexpected things can happen that have not been seen before so AI might struggle in this situation to predict new happenings. AI forecasting may struggle to predict the impact of human interventions and actions, such as changes in policies, regulations, or innovations, which can significantly influence future events and data trends in new markets.

Overreliance on historical data

The primary function of AI in forecasting hinges heavily on the historical data it encompasses, a factor that can occasionally pose challenges. Accurate and pertinent data is imperative for AI-driven demand forecasting. If the historical data utilized for training the AI model is incomplete, erroneous, or fails to reflect current market dynamics, the resulting forecasts may prove unreliable (Document 7).

Overreliance on past data can present a dilemma and be tricky for AI models. It learns from what happened before, but sometimes new things happen that it hasn't seen before. When that occurs, the AI might struggle because it doesn't have past information to help it out. This makes it hard for AI to handle new situations or changes in the market that haven't happened before (Documents 1 and 8).

RQ.2 How accurate are AI-based forecasting models compared to traditional forecasting methods?

Accurate forecasting creates value in terms of predicting the next purchases, avoiding under/over-stocking, sale opportunities, new product planning, operational efficiency, customer satisfaction, competitive pricing, and cost reductions (Document 7). Forecasting in a business is a critical hurdle for impacting customer satisfaction and inventory management. Accurate forecasting enables retailers to align customer needs with inventory levels effectively, while inaccurate predictions result in dissatisfied customers and excess stock (Document 3). Despite the abundance of data on customer purchasing behaviour, extracting meaningful insights can be challenging. However, artificial

intelligence offers a solution by analysing vast amounts of data and identifying essential patterns to improve forecasting accuracy (Document 11). Utilizing artificial intelligence (AI) and machine learning (ML) can boost forecasting precision through advanced modelling techniques (Document 4). The data analysis conducted at Sampoerna University of Indonesia regarding the utilization of machine learning in demand forecasting determined that machine learning algorithms offer improved accuracy and reduced computational burden compared to conventional forecasting models (Document 11).

While accurate forecasts are desired, they can be costly to obtain and may not always be feasible. Sometimes, improving performance through other means, such as reducing lot sizes or increasing flexibility, might be more effective. A Cost-benefit analysis is necessary for choosing the right forecasting system. Accuracy is based on different factors like average time to delivery, average daily sales, available data, seasonal demand, data quality, and forecasting techniques (Document 4). Sometimes, imperfect forecasts significantly affect inventory systems, impacting stock, availability, and total costs. Various studies have attempted to quantify the effects of forecast errors, with mixed results. Forecast bias and random deviation can have different effects on supply chain performance, with positive bias leading to excess stocks and negative bias causing lost sales. Deliberate biasing of forecasts may sometimes improve system performance but carries risks and may not be practical in many cases (Document 11). After conducting a thorough comparative literature review, the author concluded in the same article that machine learning algorithms exhibit superior accuracy compared to traditional models.

In Birim's article, it is written that several studies were conducted to compare traditional and AI-based forecasting methods. The findings consistently indicated that AI-based forecasting demonstrates higher accuracy than traditional methods (Document 10).

Traditional order forecasting methods frequently encounter difficulties in accurately anticipating demand for new products or product lines. This shortfall may result in inventory imbalances, leading to either overstocking or understocking and consequently missing out on potential sales opportunities, it also lacks the ability to account for uncertainty and provide explanations for their predictions. This can lead to a lack of trust, transparency, and accountability in the forecasting process. For instance, they may only offer point estimates without considering confidence intervals or probability distributions.

Additionally, they may not provide insights into the underlying logic or evidence supporting the forecasts (Document 5).

AI presents a solution to these challenges by leveraging deep learning techniques. Deep reinforcement learning can optimize forecasts by learning from rewards and feedback, thus enhancing prediction accuracy. Furthermore, Explainable AI can offer transparent explanations for forecasts, such as highlighting important features or decision rules, thereby increasing trust and understanding in the forecasting process (Document 2).

Document 6 highlights that 45% of businesses have incorporated machine learning (ML) into their demand forecasting procedures, with this practice showing an upward trend. This adoption has resulted in enhanced accuracy, streamlined supply chain operations, and reduced risks. McKinsey suggests that companies leveraging AI-driven forecasting, such as demand forecasting, can reduce errors in their supply chain networks by up to 50%, ultimately leading to improved accuracy and fewer mistakes.

Table 2. A summary of the findings

No. Of Document	Published year	Findings
1	2023	Pros and cons of AI in supply chain forecasting are covered
2	2023	Benefits of AI in better adapting the procurement department
3	2034	Modern machine learning algorithms self-improve over time, learning from actions to make increasingly accurate predictions and optimize stock management
4	2022	AI methods, whether used alone or with statistical methods, enhance the accuracy of demand forecasting techniques
5	N.P	Weaknesses of the traditional forecasting model and benefits of accurate forecasting are mentioned
6	2024	ML with real-time data reflects an accurate snapshot of product demand to supply chain issues
7	2023	The benefits and drawbacks of using AI demand forecasting are covered.
8	2023	Key areas are explored to analyse business organizations to process large volumes of data efficiently,uncover hidden patterns, and make accurate predictions.
9	2024	A successful example of Ikea is mentioned resulting AI helps improve productivity and performance
10	2022	ML models predict demand more accurately. Different competitive studies are mentioned
11	2021	Different types of algorithms used in demand forecasting, ML issues in different sectors are mentioned with data and concluded by saying AI forecasting model is more accurate compared to traditional.

5 Discussion

In this chapter, an analysis and review of the results obtained from the study are provided. The exploration delves into the discoveries uncovered during the research and examines their connections with each other and with the initial theoretical background. Following this analysis, the methodology used is discussed, with a focus on identifying its strengths and weaknesses. Furthermore, alternative research methods are explored, aiming to provide more targeted and precise results.

5.1 Discussion of method

In this study, the methodology employed was a qualitative literature review and the data was analysed with the help of a thematic data analysis method. The process of data search entailed significant time investment in identifying the most pertinent articles, journals, magazines, and news from reputable sources. Extensive reading was conducted to ensure the highest quality of work. Additionally, by selecting the literature review method in this study, I also spent a long time reading and analysing documents to see if they fit well with what I was studying. Upon reflection, it became evident that incorporating interviews would enhance the accuracy of responses to the research questions. If interviews were conducted to explore the research questions, they could provide valuable insights into how business owners perceive the advancement of AI in predicting the future and enhancing overall business operations. Despite the potential benefits, challenges would exist in identifying and engaging with suitable interviewees, particularly those with expertise in the intersection of AI and business forecasting. If I were to redo the study, I would include interviews right from the start. They'd add real-life experiences and expert opinions to what we learned from reading. Alternatively, a mixed-methods approach combining qualitative literature review with quantitative surveys or case studies could provide a more comprehensive understanding of the subject matter. Such an approach would enhance the validity and accuracy of the study findings, offering a multifaceted perspective on the research questions at hand.

5.2 Discussion of result

This study focused on two main questions to find reliable answers. After analysing previous studies, it reached the expected conclusions, though with some limitations. It found that many companies are using AI for better forecasting. In essence, while traditional methods struggle with data limitations, manual processes, lack of collaboration, inflexibility, and new product forecasting, AI forecasting offers a comprehensive solution to enhance forecasting accuracy and streamline inventory management for businesses.

Chapter 2 outlined the limitations of traditional forecasting methods, including limited data, inability to handle sudden changes, manual processes, and inflexibility. The findings of this study support these theoretical arguments by demonstrating that AI forecasting offers a comprehensive solution to overcome these limitations. By leveraging AI

technologies, businesses can mitigate the challenges associated with traditional methods, leading to improved forecasting accuracy and streamlined inventory management processes. In essence, this study underscores the practical relevance of the theories, showing how AI adoption in forecasting empowers businesses to anticipate customer demand, optimize inventory management, and gain a competitive edge in the market landscape.

In the realm of forecasting, the accuracy of model adaptation hinges on several factors, including batch size, seasonal shifts in demand, competitive pricing dynamics, and more. Notably, numerous authors have concluded that the adoption of AI yields greater accuracy compared to traditional methods of business forecasting which is mentioned as table 2 at the end of the chapter.

6 Conclusion

Drawing from an extensive review of research articles, journals, and books, this study has come to some conclusions about how artificial intelligence (AI) and traditional methods are used in forecasting. This study wanted to know how good AI is at predicting purchasing trends and how it compares to older methods.

What the study found is that both AI and traditional methods have their pros and cons. Sometimes AI is better at predicting, but sometimes the old-fashioned ways work just fine. It also depends on the situation. Although AI offers significant advantages in forecasting, it's crucial to recognize the associated limitations and obstacles. Tackling issues such as data accuracy, integrating human knowledge, and controlling implementation expenses is vital. Nevertheless, as we anticipate the future, AI in business purchasing forecasting is positioned to progress further, utilizing predictive analysis and independent decision-making abilities. Collaborative AI systems are expected to enhance supply chain synchronization, thereby improving forecasting precision and flexibility in response to changing market dynamics. By understanding both the benefits and obstacles and foreseeing future developments, businesses can maximize the benefits of AI in supply chain forecasting.

Multiple studies have identified various advantages, disadvantages, cases that suit more accuracy, and positive and negative effects associated with artificial intelligence (AI) and

traditional methods of forecasting. Reflecting on several studies, results have shown that using AI for forecasting can have both good and bad effects, not all perfect, but it's not all bad either. Regarding the comparison of these two approaches (traditional and AI models) for forecasting accuracy, the majority of studies in the literature have found that AI contributes to more precise predictions with the help of algorithms such as machine learning and deep learning.

6.1 Limitations of the study

While looking into how AI can make purchasing forecasts better, I recognized some limitations in the study. I mainly looked at data from open-access online sources, so the findings might not apply everywhere. One limitation of the study was the difficulty in finding academic articles specifically focused on AI used in the forecasting process. Many authors tend to discuss AI broadly and its general benefits, rather than focusing on its applications in forecasting. Also, the data used might have had some missing or biased parts, which could have affected the results. Additionally, there are emerging technologies and applications that have been recently established for predicting future business demand. Since the field of AI is constantly evolving, this study could become outdated after a certain period. Furthermore, the study relied on available secondary sources, and information from online sources alone was insufficient to fully address the research objectives.

6.2 Suggestions for future studies

Artificial Intelligence (AI) has been talked about for a long time, especially in movies and debates. Some worry that intelligent machines could end up ruling the world, making humans just serve them. Research on AI and related technologies is ongoing and endless. Every day, new discoveries and advancements are made in this field, constantly generating fresh insights and knowledge. It is unrealistic to declare that research on AI is ever "done" or "complete" because there's always more to learn and explore. The quest for understanding should continue indefinitely. Since the study only covered a small part of AI uses, future research could involve both supply chain experts and IT professionals. They can work together to understand the topic better.

To conduct such research, it is advisable to interview respondents who possess substantial experience with AI. The future researcher could identify suitable respondents relevant to

the topic and gather data by interviewing them. This approach ensures that the research questions are answered with greater depth and insight.

References

- Aamer, A., Eka Yani, L. P., & Alan Priyatna, I. M. (2021). Data Analytics in the Supply Chain Management: Review of Machine Learning Applications in demand forecasting. *Operations and Supply Chain Management: An International Journal*, 1–13. <https://doi.org/10.31387/oscm0440281>
- Abouzeid, E. (2021a, February 8). *The Five Rights of Procurement*. LinkedIn. <https://www.linkedin.com/pulse/five-rights-procurement-eman-abouzeid-cscp-cips/>
- AI planning and forecasting for business*. Domo. (n.d.). <https://www.domo.com/glossary/what-is-ai-planning-and-forecasting>
- Andreu-Perez, J., Deligianni, F., Ravi, D., & Yang, G.-Z. (2017b). *Artificial Intelligence and robotics*. UK-RAS Network.
- Artificial Intelligence Forecasting: How to forecast using Artificial Intelligence and deep learning*. FasterCapital. (n.d.-a). <https://fastercapital.com/content/Artificial-intelligence-forecasting--How-to-Forecast-Using-Artificial-Intelligence-and-Deep-Learning.html#The-challenges-of-traditional-forecasting-methods-and-how-AI-can-overcome-them.html>
- Atwani, M., Hlyal, M., & Elalami, J. (2022b). A review of artificial intelligence applications in Supply Chain. *ITM Web of Conferences*, 46. <https://doi.org/10.1051/itmconf/20224603001>
- Badenhorst, J. A., Cilliers, J. O., Dlamini, W., & Ambe, I. M. (2018). *Purchasing and supply management*. Van Schaik Publishers.
- Bahameish, B., Yaqot, M., Franzoi, R., & Menezes, B. (2022). Artificial Intelligence in Procurement: An overview and case study of Qatar foundation. *Proceedings of the International Conference on Industrial Engineering and Operations Management*. https://www.researchgate.net/publication/370105196_Artificial_Intelligence_in_Procurement_An_Overview_and_Case_Study_of_Qatar_Foundation
- Bharadiya, J. P. (2023). Machine learning and AI in business intelligence: Trends and opportunities. *International Journal of Computer (IJC)*, 48(1), 123-134.
- Birim, S., Kazancoglu, I., Mangla, S. K., Kahraman, A., & Kazancoglu, Y. (2022). The derived demand for advertising expenses and implications on sustainability: A comparative study using Deep Learning and traditional machine learning methods. *Annals of Operations Research*. <https://doi.org/10.1007/s10479-021-04429-x>
- Biswas, K., & Patra b, Dr. G. (2023). Role of artificial intelligence (AI) in changing consumer buying behaviour. *International Journal of Research Publication and Reviews*, 04(02), 943–951. <https://doi.org/10.55248/gengpi.2023.4227>

- Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, 9(2), 27–40. <https://doi.org/10.3316/qrj0902027>
- Brink, H. I. (1993). Validity and reliability in qualitative research. *Curationis*, 16(2). <https://doi.org/10.4102/curationis.v16i2.1396>
- Bryman, A., & Bell, E. (2011). *Business research methods 3e* (3rd ed.). Oxford University Press.
- Chase, C. (2009). *Demand-driven forecasting: A Structured Approach to forecasting*. J. Wiley & Sons.
- Demand planning solutions market size & share report, 2030*. Demand Planning Solutions Market Size & Share Report, 2030. (n.d.). <https://www.grandviewresearch.com/industry-analysis/demand-planning-solutions-market-report/toc>
- Esposito, A. (2024, January 2). *IKEA improves forecast accuracy with ai-powered demand sensing*. Retail TouchPoints. <https://www.retailtouchpoints.com/topics/data-analytics/ai-machine-learning/ikea-improves-forecast-accuracy-with-ai-powered-demand-sensing>
- Forecasting: Forecasting accuracy: Against actual results*. FasterCapital. (n.d.). <https://fastercapital.com/content/Forecasting--Forecasting-Accuracy--Against-Actual-Results.html>
- Guida, M., Caniato, F., Moretto, A., & Ronchi, S. (2023). The role of Artificial Intelligence in the procurement process: State of the art and research agenda. *Journal of Purchasing and Supply Management*, 29(2). <https://doi.org/10.1016/j.pursup.2023.100823>
- Hansun, S., Charles, V., Gherman, T., & Varadarajan, V. (2022). Hull-Wema: A novel zero-LAG approach in the moving average family, with an application to COVID-19. *International Journal of Management and Decision Making*, 21(1), 92–112. <https://doi.org/10.1504/ijmdm.2022.119582>
- Hennink, M. M., Hutter, I., & Bailey, A. (2020). *Qualitative research methods*. Sage.
- Johnsen, T. E., Howard, M., & Miemczyk, J. (2019). *Purchasing and Supply Chain Management: A sustainability perspective*. Routledge.
- Kiefer, D., Ulmer, A., & Clemens van Dinther. (2019). Application of Artificial Intelligence to optimize forecasting capability in procurement (Vol. 5). Reutlingen; Research Gate. https://www.researchgate.net/publication/336879934_Application_of_Artificial_Intelligence_to_optimize_forecasting_capability_in_procurement
- King, N. (2004). Using templates in the thematic analysis of text. *Essential Guide to Qualitative Methods in Organizational Research*, 202–222. <https://doi.org/10.4135/9781446280119.n21>

- Mesfin, T. (2007). Evaluation of purchasing practice at Addis University of Commerce(thesis). Addis Ababa.<https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=32c4a8674168cb50e4cb1a3af26a911d4dc07e0c>
- Morgan, H. (2022). Conducting a qualitative document analysis. *The Qualitative Report*, 27(1/4). <https://doi.org/10.46743/2160-3715/2022.5044>
- Niss, Janne Principal Solution Architect Connect via LinkedIn Johanna Småros Co-founder, Janne Nissi Principal Solution Architect Connect via LinkedIn, Nissi, J., Architect, P. S., Småros Co-founder, J., Småros, J., Co-founder, Tommi Ylinen Chief Product Officer Connect via LinkedIn, Ylinen, T., Officer, C. P., Ala-Risku Director, T., Ala-Risku, T., & Director. (2024, January 25). *Measuring forecast accuracy: The Complete Guide*. RELEX Solutions. <https://www.relexsolutions.com/resources/measuring-forecast-accuracy/>
- Pasonen, P. (2020). *The Use of Artificial Intelligence in the Supply Chain Management in Finnish Large Enterprises* (thesis). University of Vaasa, Vaasa. https://osuva.uwasa.fi/bitstream/handle/10024/11406/UniVaasa_2020_Pekka_Pasonen.pdf?sequence=2&isAllowed=y
- Pham, C. C. (2019). *Developing a Demand-driven Forecasting in Purchasing*. (thesis).<https://www.theseus.fi/bitstream/handle/10024/172090/Bachelor%20Thesis-Cuong%20Pham-converted%20%281%29.pdf?sequence=2&isAllowed=y>
- Roberts, P., Priest, H., & Traynor, M. (2006). Reliability and validity in Research. *Nursing Standard*, 20(44), 41–45. <https://doi.org/10.7748/ns2006.07.20.44.41.c6560>
- Sanders, N. R. (2017). *Forecasting fundamentals*. Business Expert Press.
- Traditional procurement versus AI-driven procurement: What's the difference?* (2016, March 18).<https://www.gep.com/blog/technology/traditional-versus-ai-driven-procurement-processes-whats-the-difference>
- Vanclay, F., Baines, J. T., & Taylor, C. N. (2013). Principles for ethical research involving humans: Ethical Professional Practice in Impact Assessment Part I. *Impact Assessment and Project Appraisal*, 31(4), 243–253. <https://doi.org/10.1080/14615517.2013.850307>
- Whitefield-Madrano, A. (2023, May 5). *Retailers forecast demand with AI and Data Analytics*. Technology Solutions That Drive Business. <https://biztechmagazine.com/article/2024/02/retailers-forecast-demand-ai-and-data-analytics>