Artificial Intelligence as a Driver of Change in Customer Experience: A Study of the European Banking Sector

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Abstract EN

This study explores the role of Artificial Intelligence (AI) as a catalyst for transforming customer experience (CX) in the European banking sector. It analyzes how AI technologies, including Machine Learning, Natural Language Processing, and large language models, are reshaping internal banking processes and customer-facing services. By integrating data from expert interviews and survey responses, the research examines the current AI landscape, its applications, and the impact on customer satisfaction and personalization. Additionally, the study addresses regulatory challenges, ethical considerations, and data privacy issues influencing AI adoption in banking.

Through a mixed-methods approach combining abductive, deductive, and inductive methodologies, the findings reveal that AI is a strategic tool for banks seeking to enhance operational efficiency and deliver more personalized customer experiences. However, AI implementation varies, with some banks cautiously experimenting and others fully integrating AI into customer interactions. The research also highlights challenges of aligning AI innovations with regulatory frameworks, maintaining transparency to ensure customer trust, and managing organizational change.

The conclusion emphasizes that while AI will not replace human interaction, its role in augmenting human expertise is crucial. A hybrid approach, where AI supports but doesn't fully automate customer-facing services, is seen as the future direction for banks. By adopting this model, banks can improve personalization, efficiency, and customer engagement while addressing concerns about data security, transparency, and bias. This analysis offers valuable insights for stakeholders in the European banking sector, guiding AI-driven transformation.

Keywords: artificial intelligence, customer experience, banking, AI adoption, digital transformation, machine learning, financial services, AI governance, AI ethics, data privacy, personalization, fintech, European banking sector, customer engagement

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Sumário PT

Este estudo explora o papel da Inteligência Artificial (IA) como catalisador na transformação da experiência do cliente (CX) no setor bancário europeu. Analisa como tecnologias como Machine Learning, Processamento de Linguagem Natural e grandes modelos de linguagem estão reformulando processos internos e serviços ao cliente. A pesquisa, que integra dados de entrevistas com especialistas e questionários, examina o panorama atual da IA, suas aplicações e o impacto na satisfação e personalização dos serviços bancários. Além disso, aborda desafios regulatórios, éticos e de privacidade de dados que influenciam a adoção da IA no setor.

Com uma abordagem de métodos mistos (abdutiva, dedutiva e indutiva), os resultados mostram que a IA é essencial para aumentar a eficiência operacional e oferecer experiências mais personalizadas. No entanto, a implementação da IA varia: alguns bancos adotam a tecnologia com cautela, enquanto outros já a integraram amplamente nas interações com clientes. A pesquisa também destaca os desafios de alinhar as inovações da IA com os marcos regulatórios.

A conclusão ressalta que a IA não substitui totalmente a interação humana, mas complementa a experiência do cliente. Um modelo híbrido, no qual a IA apoia sem automatizar totalmente os serviços, é visto como o futuro para os bancos. Esse modelo pode melhorar a personalização, eficiência e engajamento, abordando preocupações com segurança de dados, transparência e viés. A análise oferece insights valiosos para o setor bancário europeu sobre como lidar com a transformação impulsionada pela IA.

Palavras-chave: inteligência artificial, experiência do cliente, setor bancário, adoção de IA, transformação digital, serviços financeiros, governança de IA, ética de IA, privacidade de dados, personalização, fintech, setor bancário europeu

Título: Inteligência Artificial como Motor de Mudança na Experiência do Cliente: Um Estudo do Setor Bancário Europeu

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Contents

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Table of Abbreviations

AGI	Artificial General Intelligence
AI	Artificial Intelligence
AIoT	Artificial Intelligence of Things
ASI	Artificial Super Intelligence
ASR	Automatic Speech Recognition
ATM	Automated Teller Machine
B2B	Business-to-Business
B2C	Business-to-Consumer
BDA	Big Data Analytics
CX	Customer Experience
DL	Deep Learning
EPI	European Payment Initiative
EXQ	Experience Quality
GDPR	General Data Protection Regulation
GRU	Gated Recurrent Unit
HMM	Hidden Markov Models
IoT	Internet of Things
LSTM	Long Short-Term Memory
NLG	Natural Language Generation
NI	Natural Intelligence
NFC	Near Field Communication
NLP	Natural Language Processing
NPS	Net Promoter Score
OCX	Omnichannel Customer Experience
PII	Personally Identifiable Information
RNN	Recurrent Neural Network
SDL	Service-Dominant Logic
SEPA	Single Euro Payments Area
SSTs	Self-Service Technologies
TCQ	Touchpoints, Context, and Qualities
XAI	Explainable Artificial Intelligence

1 Introduction

The history of banking has been marked by milestones that reflect the economic and technological realities of different historical times. The beginning of banking dates back to ancient civilization needing to manage and facilitate trade. When societies shifted from nomadic lifestyles to a more sedentary culture, a standardized medium of exchange became necessary. In its early stages this was met by commodity money like grain or cattle, which, especically in Mesopotamia around 2000 BCE, was even used for loans in grain. This marks the beginning of deposit and loan banking as we know it (Battilossi et al., 2020; Bhatia, 2022; Wirth, 1896). Eventually metal coinage was introduced in kingdoms and city-states as a more convenient and standardized medium of exchange. By the Renaissance, banking in medieval Italy had taken on a more formal structure. The Medici Bank, was established in 1397 pioneered many features of modern banking services like deposits and the transfer of funds. This eventually underwrote trade and commerce across Europe.

The founding of the Bank of England in 1694 that acted as a banker to the government, played a crucial role in setting the groundwork for modern central banking as well as the issuance of banknotes (Bhatia, 2022; Colvin, 2015). The Industrial Revolution in the 18th and 19th centuries came with the rise of commercial banks, the establishment of central banking systems due to the need for large scale industry financing and economic stability (Bhatia, 2022; Colvin, 2015; Neal, 1991; Pollard, 1967). During this time, banking practices were characterized by personal relationships and manual record-keeping. The expansion of financial services with the introduction of new banking products, as well as many upcoming innovations like the telegraph, enabled faster communication and transactions (Bhatia, 2022)

Figure 1 The different phases of the banking evolution (Bhatia, 2022)

In the 20th century many transformative changes were introduced, beginning with banking becoming more accessible to the broader population, as retail banking grew. This introduced the Expansion phase of banking, which including the next two phases is visualized in **Figure 1** (Schuster et al., 2019; Mehdiabadi et al., 2020; Bhatia, 2022). In the second half of the 20th century computers revolutionized data processing. The first ATM was installed 1967 by Barclays Bank in London, which quickly changed how banking customers interacted with

their banks, as it allowed a 24/7 access to cash (Bhatia, 2022; Reid et al., 2011; Consoli, 2005).

In the 1990s, the so-called capital market exploration phase began, and the digital era took off with online banking (Schuster et al., 2019). A pioneer in online banking was Wells Fargo which launched the first online banking platform in 1995 in tandem with rising use of personal computers in households. Before this they had provided online account access through Prodigy in 1989. In the mid-1990s, Wells Fargo established a website, which was initially used mainly for marketing purposes and to collect customer feedback. By May 1995, customers could not only review accounts but also perform transactions online, positioning Wells Fargo as a leader in digital banking services (Bentz, 2023; Bhatia, 2022).

At the beginning of the 21st century the focus shifted even further from transactional convenience to personalized customer experience, enabled by the data revolution that made it possible for banks to leverage customer data to tailor services (Bhatia, 2022; McWaters, 2018). Schuster calls the period after 2007 the rearrangement ("Neuordnung") phase (Schuster et al., 2019).

In the EU banking landscape, the rearrangement phase has been shaped by regulatory and technological advancements (Schuster et al., 2019; Bhatia, 2022). One of the milestones was implementation of the Single Euro Payments Area (SEPA) across the European Union starting with credit transfers in 2008, followed by direct debits in 2009, and finally full implementation in 2014 across the euro area. This marked the beginning of streamlined cross-border payments, which made transactions across the European Union much easier. Alongside SEPA implementation, adoption of near field communication (NFC) technology enhanced the convenience of contactless payments (European Central Bank, 2024; Lastra, 2017; Bhatia, 2022).

By 2018 the Revised Payment Services Directive was introduced which fostered competition and innovation through open banking (Bhatia, 2022). This directive was followed by the rise of digital first financial platforms, like the fintechs N26 and Revolut that catered to an increasingly tech-savvy European clientele. The European Union developed the European Payment Inititative (EPI) that aimed to create a unified payment solution for consumers and payments across Europe, which will be launched under the name "Wero" in France, Germany and Belgium in mid-2024 (EPI Company, 2023; Bouilhet, 2020).

The latest frontier in the evolution of banking is Artificial Intelligence and companies are increasingly turning towards AI solutions for intelligent, customer-centered and data driven banking ecosystems (Schuster et al., 2019).

Despite significant advancements in artificial intelligence (AI), European banks face challenges integrating these technologies into the customer experience. While AI-driven solutions like intelligent user interface designs have the potential to bring efficiencies to customer interactions, how AI can be used in customer facing online interaction and its impact on customer satisfaction and engagement are still being studied. AI technologies raise questions about alignment with customer expectations and overall acceptance of AI as part of the banking experience.

This thesis examines the transformation of customer experience through AI solutions in European banks. It seeks to contribute to the strategic discourse on AI in banking by identifying factors influencing the success of AI integration from both customer and industry expert standpoints.

The following **Research Question** will be addressed:

How is AI a driver of change for customer experiences in the European banking sector?

The scope of this study is the European banking sector, focusing on retail banking services that directly interact with customers. We examine integration of AI technologies such as machine learning and natural language processing. The research focuses on customer perspectives gathered through expert insights and a survey, excluding technical and financial performance data of the banking institutions. Further, the study is limited to AI applications in customer-facing roles and does not consider back-office operations.

2 Literature review

The funnel approach was utilized to investigate the existing literature, beginning with a broad perspective, and narrowing down to specific details. Initially, concepts of artificial intelligence (AI), Customer Experience (CX) and its applications in the banking industry are discussed. Next, we examine the impact of AI on banking as well as challenges and consideration.

2.1 Introduction to AI

2.1.1 Definition of Artificial Intelligence (AI)

Defining AI has been a persistent challenge within both academic and practical domains. AI is frequently mentioned in media and advertisements, yet clear and concise definitions remain elusive, complicating communication and understanding among entities that collaborate on AI applications (Kaplan, 2016). Over time, various attempts have been made to define AI, with definitions often evolving alongside technological advancements.

The most commonly accepted definition frames AI as a branch of computer science focused on developing intelligent machines capable of performing tasks that typically require human intelligence, such as learning, reasoning, and self-correction (David B. Leake, 2001; Franenfield, 2020).

Other scholars have proposed more specific definitions. Kaplan and Haenlein. define AI broadly as a system's ability to interpret external data correctly, learn from such data, and use those learnings to achieve specific goals and tasks through flexible adaptation (Kaplan & Haenlein, 2019).

While researchers and government officials are still in disagreements in the definition of AI systems. The current work in progress definition of the EU AI Act is the following: *"AI system' means a machine-based system that is designed to operate with varying levels of autonomy and that may exhibit adaptiveness after deployment, and that, for explicit or implicit objectives, infers, from the input it receives, how to generate outputs such as predictions, content, recommendations, or decisions that can influence physical or virtual environments."* (Office of the European Union, 2024, p. 46) This is the definition used for the remainder of this thesis.

The subsequent section will explore the historical milestones and key developments that have shaped the trajectory of AI technologies.

2.1.2 Evolution and History of AI

The concept of AI has a rich history, with its origins tracing back to ancient philosophical inquiries by figures like Aristotle (Chang, 2020). However, the field truly began to take shape alongside the development of modern computers. Charles Babbage's design of the first working computer in 1822 marks a significant milestone (Grzybowski et al., 2024). Alan Turing, often regarded as the father of AI, introduced the general-purpose computer in 1936 and later proposed the Turing test in 1950 to assess machine intelligence, which will be discussed in detail in chapter 2.1.4 Foundations of AI (Zerilli et al., 2021; Chang, 2020).

AI's early focus was on game-playing programs, which led to significant milestones such as the development of chess and Go-playing AI systems (Murphy, 1985; Hutson, 2018). Despite these advancements, the field experienced periods of stagnation, known as "AI winters," where progress slowed due to limited funding and interest. The term "Artificial Intelligence" was officially coined by John McCarthy in 1956 at the Dartmouth conference, marking the beginning of the field's modern era (Bleakley, 2020).

Recent advancements in AI, particularly in machine learning and deep learning with Generative AI, have expanded its applications beyond simple tasks to complex areas like natural language processing and autonomous systems (Yashchenko, 2024). The evolution of AI and its increase in popularity over time as well as major breakthroughs can be seen in **Figure 2**. Despite significant progress, challenges remain in achieving "strong AI," and researchers continue to explore new approaches, including the potential development of artificial consciousness (Yashchenko, 2024). As AI technologies continue to evolve, they are increasingly being integrated into banking Customer Experience strategies (Silva et al., 2021).

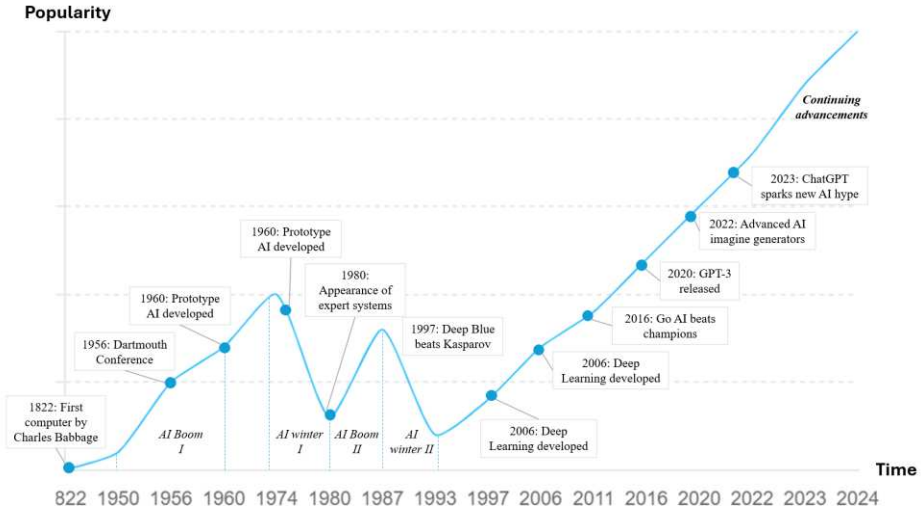

Figure 2 Artificial Intelligence Popularity over time (Chang, 2020; Yashchenko, 2024)

As the historical context of AI demonstrates its progression from theoretical constructs to advanced technologies, the next section will examine the fundamental components that underlie AI systems and their diverse applications across various domains.

2.1.3 Key Components and Applications of AI

AI is built upon several fundamental components that drive its capabilities across various domains. These components include knowledge representation, reasoning, natural language processing, machine learning, computer vision, and robotics These foundational elements enable AI systems to perform a wide array of tasks, including decision-making, language understanding, image recognition, and autonomous operation (Sennott et al., 2019; Westera et al., 2019).

At its core, AI functions primarily as a predictive technology, leveraging large datasets to forecast outcomes and make informed decisions. Unlike human intelligence, AI's predictive nature is central to its ability to automate processes and enhance decision-making across multiple fields (Heath, 2019).

AI’s applications are wide-ranging, spanning industries such as healthcare, finance, automotive, and beyond. AI's key components, such as machine learning, natural language processing, and robotics, support a variety of tasks like decision-making and automation (Sennott et al., 2019). In banking, AI enhances credit scoring, fraud detection, and customer relationship management, providing more personalized experiences and improving operational efficiency (Ragazzo et al., 2023). The detailed exploration of AI's role in banking, including AI-driven personalization and its implications for customer experience, will be addressed in subsequent chapters.

The integration of AI across various domains underscores the technology's transformative potential. However, challenges remain in fully automating and optimizing these applications. (Sobecki et al., 2019). Moreover, as AI systems become more autonomous, the interaction between the AI observer and its environment, as well as the decision-making processes, becomes pivotal to understanding their development. Heiden and Tonino-Heiden argue that an AI system does not merely observe its environment in a passive manner. Instead, the act of observation by the AI actively influences and shapes the reality it perceives, a notion akin to quantum entanglement in quantum physics. This concept suggests that the AI's perception of reality is not just a straightforward recording of data but a dynamic interaction where the AI’s observations help to construct the reality it encounters. Additionally, the decision-making

process in AI is deeply connected to the principle of time irreversibility. Once an AI system makes a decision, that decision is final and cannot be reversed, establishing a clear, one-way direction or "arrow" of time. This irreversibility underscores the importance of each decision in the AI's operation, as every choice permanently alters the course of the AI's actions and its subsequent interactions with the environment. Intelligence in AI, therefore, involves a continuous, dynamic exchange of information, where the system perpetually engages in asking and answering questions to guide its actions and improve its decision-making over time (Heiden & Tonino-Heiden, 2020).

Having outlined the core components of AI and provided a preliminary overview of its applications, the focus will now shift to a general understanding of specific AI technologies.

2.1.4 Foundations of AI

AI draws on various disciplines like computer science, neuroscience, and economics, which contribute to its ability to simulate human intelligence. These interdisciplinary approaches support key functions like decision-making, language processing, and visual recognition (Lavanya & Garg., 2021). In banking, AI's predictive capability helps in customer experience management and personalization (Russel & Norvig, 2010).

Control theory and cybernetics contribute to AI by providing principles for designing systems capable of autonomously regulating their behavior, a concept initially developed by Norbert Wiener and others. This foundation has been key to enabling adaptive and self-regulating machines. Linguistics, particularly through computational linguistics, intersects with AI in the realm of understanding and processing human language. Noam Chomsky's critique of behaviorist approaches spurred significant advances in natural language processing, thereby enhancing AI's ability to handle complex language tasks. Together, these disciplines form the bedrock of AI technologies, facilitating tasks such as decision-making, language processing, visual recognition, and autonomous operation. Central to AI's functionality is its predictive capability, which allows it to analyze large datasets, forecast outcomes, and improve decision-making across various fields (Russel & Norvig, 2010).

Another pivotal concept in AI is the Turing Test, proposed by Alan Turing in his 1950 paper "Computing Machinery and Intelligence." The Turing Test serves as a benchmark for evaluating a machine's ability to exhibit intelligent behavior indistinguishable from that of a human. In the test, a human interrogator interacts with both a human and a machine through a text-based interface, without knowing which is which. If the interrogator cannot reliably

distinguish between the human and the machine, the machine is said to have passed the test (Grzybowski et al., 2024; Kaplan, 2016; Yashchenko, 2024). While there have been many attempts to create AI systems that can pass the Turing Test, no machine has definitively passed it to the satisfaction of the AI community. The Turing Test has sparked extensive debate, raising questions about the nature of intelligence and the potential for machines to possess consciousness. Despite its criticisms, particularly for its anthropocentric focus, the Turing Test remains a significant motivator for advancements in AI, particularly in natural language processing and machine learning (Kaplan, 2016; Russel & Norvig, 2010).

The types of AI can be categorized into seven distinct classes based on their capabilities and complexity, as shown in **Figure 3**. Reactive machines represent the most basic form of AI, capable only of responding to specific inputs without memory or learning capabilities. Limited memory AI systems, such as those used in self-driving cars, can learn from historical data to make informed decisions. The theory of mind AI, still largely conceptual, aims to understand human emotions and predict behavior by incorporating emotional intelligence. Self-aware AI, which represents a future development, would possess consciousness and self-awareness, enabling it to understand its own state and that of others. Artificial Narrow Intelligence (ANI), also known as Weak AI, is specialized for specific tasks and currently constitutes the majority of AI applications. Artificial General Intelligence (AGI), or Strong AI, aspires to emulate human cognitive abilities across a wide range of tasks, although it remains largely theoretical. Finally, Artificial Super Intelligence (ASI) surpasses human intelligence in all aspects, representing the pinnacle of AI development, where machines would not only replicate but exceed human cognitive functions (Lavanya & Garg., 2021).

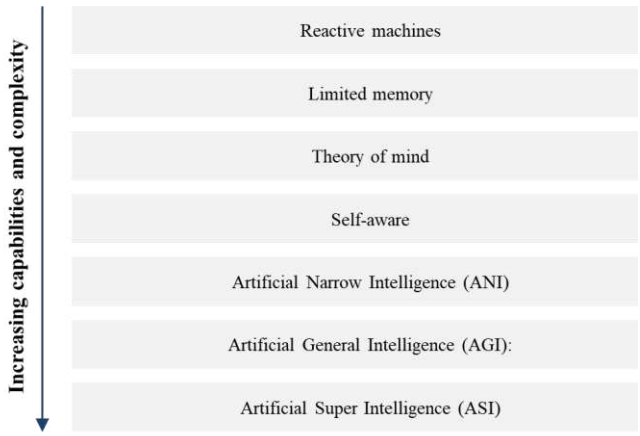

Figure 3 Types of AI (Jokanovic et al., 2022)

As illustrated in **Figure 4**, the field of AI is extensive, comprising various subfields that collectively contribute to the creation of intelligent systems, and many are interconnected. While it can be difficult to strictly separate certain AI technologies and use cases, in an attempt AI was organized into several fundamental domains, each playing a crucial role in the overall architecture of these systems. At the highest level, AI branches into distinct areas such as Machine Learning (ML), Natural Language Processing (NLP), Robotics, Computer Vision, and Expert Systems. These broad categories are further divided into specialized techniques and approaches, reflecting the multidisciplinary nature and complexity inherent in AI research and development (Mukhamediev et al., 2022). These technologies collectively contribute to the broader AI framework, allowing systems to perform tasks ranging from image recognition to decision-making with high accuracy (Lavanya & Garg., 2021). The technologies relevant for the banking sector are described in more detail in chapter 2.3 AI Technologies with Banking Applications.

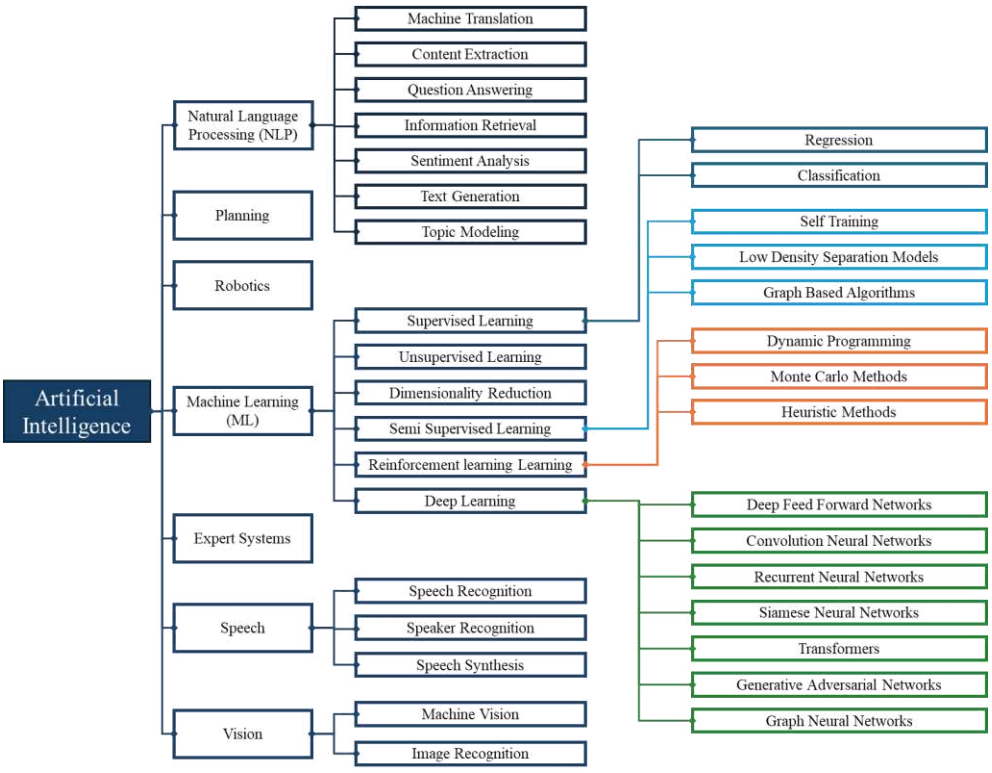

Figure 4 Subsections of AI (Mukhamediev et al., 2022).

In the context of AI systems, the process of transforming data into actionable outputs can be understood through the framework of building blocks, as illustrated in **Figure 5**. These building blocks consist of inputs, processes, outputs, and a knowledge base that collectively drive the functionality of AI systems. The input stage involves the collection of structured and unstructured data, which are the raw materials that AI systems use to generate insights.

Structured data, such as inventory figures and sales data, is organized in a way that makes it readily analyzable, while unstructured data, including social media posts and multimedia content, requires more sophisticated techniques for analysis (Paschen, 2019).

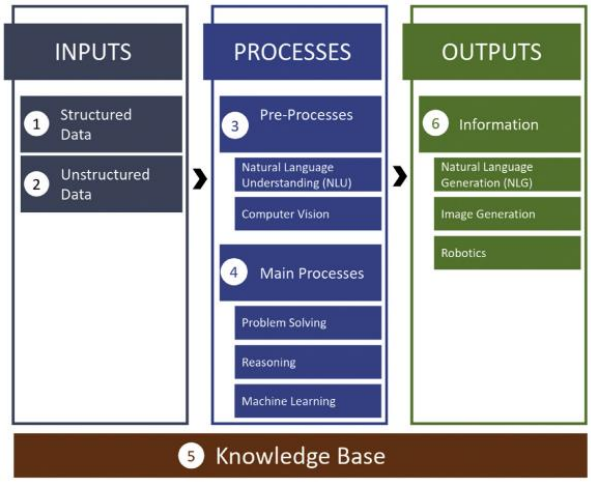

Figure 5 Building blocks of AI systems (Paschen, 2019

Once data is collected, it undergoes a series of processes, beginning with pre-processing steps like Natural Language Understanding (NLU) and Computer Vision. These pre-processes are critical for transforming raw data into a format that AI systems can effectively work with. Following this, the main processes, including problem-solving, reasoning, and machine learning, come into play. These processes enable AI systems to interpret data, draw inferences, and make predictions, ultimately leading to the generation of valuable outputs (Paschen, 2019).

The outputs of AI systems typically include information, such as insights derived from data, which can be used to inform decision-making processes. Additionally, AI systems are capable of generating outputs like natural language text (through Natural Language Generation, or NLG), images, and even physical actions through robotics. The knowledge base, a central repository of data, information, and learned experiences, supports these processes by storing and providing the contextual understanding necessary for the AI system to operate effectively (Paschen, 2019).

2.2 Introduction Customer Experience (CX)

2.2.1 Definition and Importance of CX

CX has emerged as a cornerstone in marketing, representing the full spectrum of cognitive, emotional, sensorial, and behavioral responses that customers exhibit throughout their

interactions with a company's products, services, or brand. These responses are influenced by a combination of direct managerial stimuli, such as marketing strategies and service quality, and broader consumption processes that unfold over time (Becker & Jaakkola, 2020). The importance of CX is underscored by its significant impact on business outcomes, including customer satisfaction, loyalty, and word-of-mouth behavior. CX's role as a driver of customer-perceived value, and its subsequent effect on consumer behavior, highlights the strategic importance of managing these experiences effectively (Kuppelwieser et al., 2021).

Advancements in Big Data Analytics (BDA) allow businesses to gain insights into customer behavior, helping to personalize CX strategies (Holmlund et al., 2020).

Several models conceptualize CX. Zha et al. propose a modular approach combining service marketing, experiential marketing, and branding to create a holistic view of CX. He suggests that CX is too complex to be understood through just one perspective. Service marketing focuses on delivering quality service and ensuring customer satisfaction, while experiential marketing aims to create memorable experiences that emotionally engage customers. Branding, on the other hand, involves how a company presents its image and values to the public. **Figure 6** illustrates these three logics as overlapping circles, where their intersections highlight the synergy between service quality, sensory experiences, and brand messaging. This framework ensures that all aspects of CX—from acquisition to engagement and loyalty—are addressed (Zha et al., 2023).

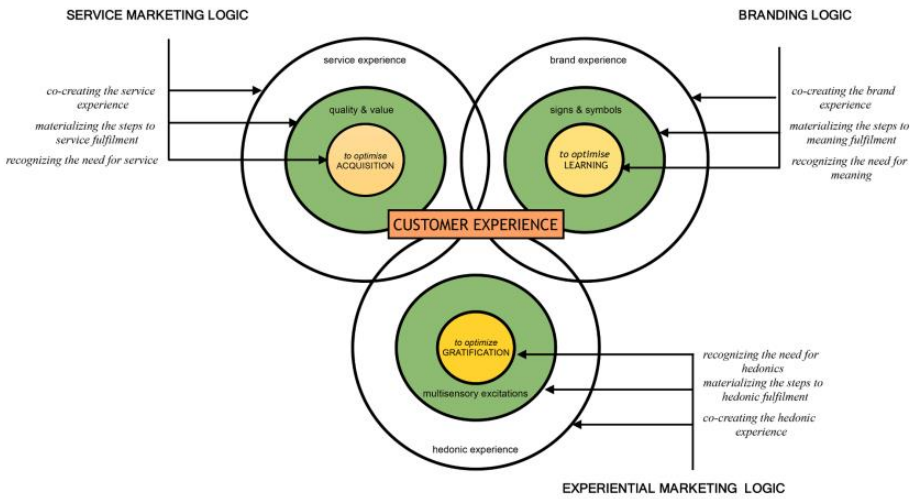

Figure 6 CX Modularity Framework (Zha et al., 2023)

Meanwhile, De Keyser et al. offer another comprehensive way to understand CX the TCQ framework, shown in **Figure 7**. This framework highlights three key elements: touchpoints, context, and qualities (TCQ). Touchpoints are all the different interactions a customer has

with a brand, such as visiting a website or talking to customer service. Context refers to the environment in which these interactions happen, which could include physical settings, social conditions, or even economic factors. Qualities are the characteristics of these interactions, such as how easy or enjoyable they are. The TCQ Framework suggests that to effectively manage CX, companies need to understand how these three elements—touchpoints, context, and qualities—work together to shape a customer's overall experience. (Keyser et al., 2020).

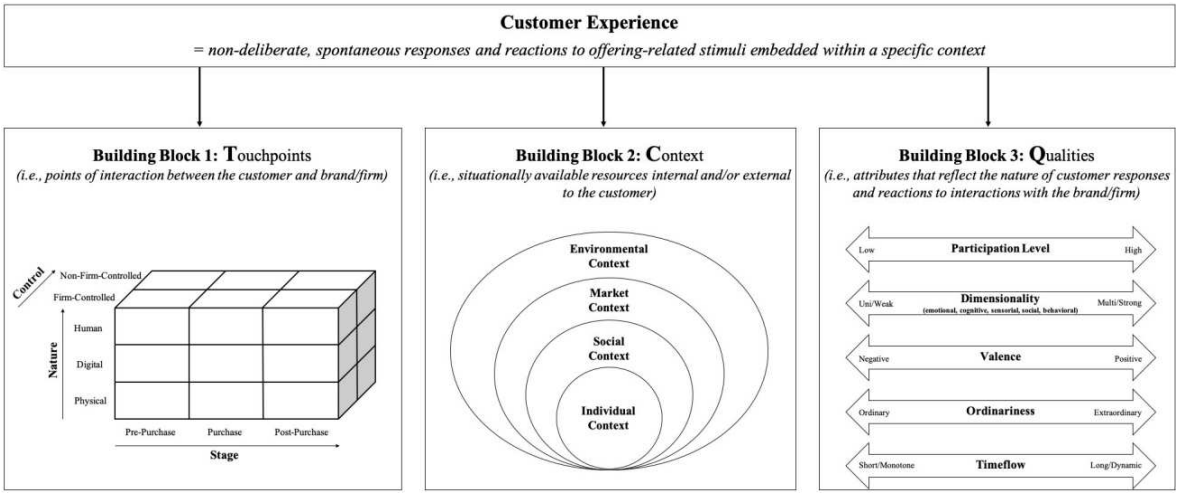

Figure 7 TCQ Nomenclature (Keyser et al., 2020)

One crucial aspect of CX that has gained attention is the differentiation between internal and external touchpoints. Internal touchpoints are those that the organization can directly control, such as service quality and brand messaging. In contrast, external touchpoints are those influenced by factors outside the organization's direct control. These touchpoints can be further classified into four categories: brand-owned, partner-owned, customer-owned, and social/external/independent. The acknowledgment and understanding of these touchpoints present significant opportunities for firms to manage customer experiences more effectively, even in areas where direct control is limited (Siqueira et al., 2020).

In exploring the long-term nature of CX, Siebert et al. introduced the concepts of the "loyalty loop" and the "involvement spiral" to describe two distinct types of customer journeys. These models, illustrated in **Figure 8**, offer a comprehensive view of how customers interact with brands over time, highlighting the importance of tailoring CX strategies to meet different customer needs and expectations (Siebert et al., 2020).

The **loyalty loop** describes a predictable, cyclical pattern of experiences that reinforce customer loyalty, especially in industries like banking and insurance, where stability and reliability are key. Companies streamline journeys by removing unnecessary steps and

providing consistent, high-quality service at each touchpoint. This encourages repurchasing and long-term loyalty, creating a strong customer-brand relationship. **Figure 8** illustrates this process as a series of loops that customers repeatedly cycle through, each reinforcing their loyalty to the brand (Siebert et al., 2020).

The **involvement spiral**, by contrast, features a dynamic, unpredictable customer journey, driving engagement through novelty and excitement. Often seen in industries like gaming and entertainment, it keeps customers engaged with varied experiences, encouraging deeper interaction with the brand. Instead of consistency, this model focuses on adventure and discovery, represented by an upward spiral of growing engagement and complexity. **Figure 8** visualizes this as an upward, widening spiral, symbolizing the growing intensity and complexity of the customer's engagement with the brand (Siebert et al., 2020).

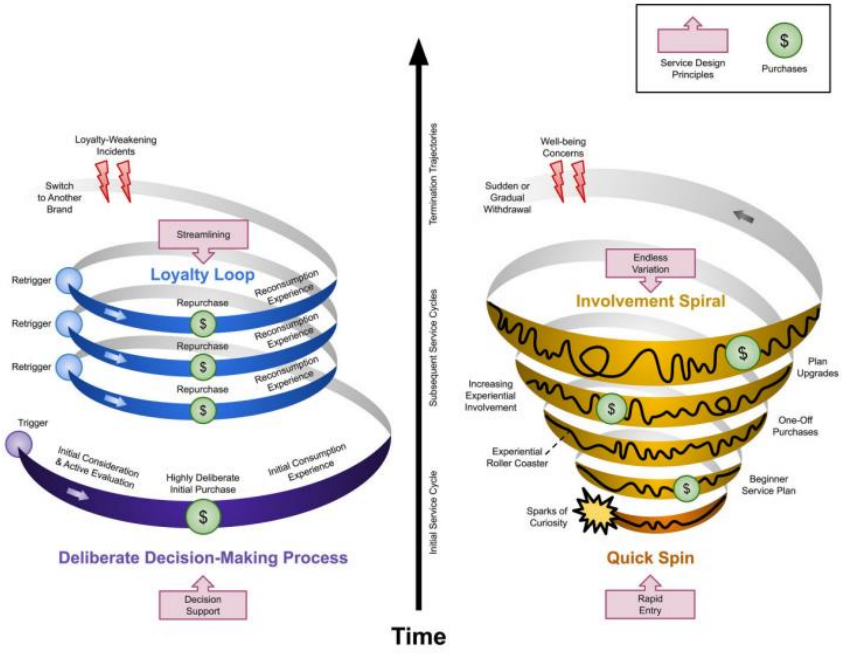

Figure 8 A Visualization of the Loyalty Loop and the Involvement Spiral (Siebert et al., 2020)

As technology continues to evolve, there are new opportunities to integrate innovations such as artificial intelligence and machine learning into CX strategies, potentially transforming how companies engage with their customers (Silva et al., 2021; Vergallo et al., 2022).

2.2.2 CX in Banking: Past and Present

In the banking sector, CX has evolved significantly, particularly with the rise of digital technologies and AI. Traditionally, banks relied on in-person interactions within branches, where the quality of customer service and personalized attention were key determinants of CX. However, the shift towards digital banking has fundamentally changed the landscape,

with online and mobile platforms now playing a crucial role in how customers interact with financial institutions.

Research shows that CX in banking is influenced by a variety of factors, including virtual, physical, and service interactions (Makudza, 2020). These interactions are further categorized by functional, mechanic, and humanic clues, which are essential in shaping the customer's overall experience (Chauhan et al., 2022). The customer experience management (CXM) model for banking encompasses expecting, conceptual, and caretaking factors, which collectively aim to enhance the overall CX (Heshmati et al., 2019). As technology continues to play a significant role, innovations such as digital banking platforms have improved access to financial services, thereby enhancing CX (Vergallo et al., 2022).

Current practices in the banking sector emphasize the importance of co-creating value with customers and providing highly personalized services. This involves adopting customer-centric approaches that integrate banking services into the broader value creation processes of customers' lives (Peña-García et al., 2021; Komulainen et al., 2019). The adoption of innovative technologies in banking has revolutionized service delivery, improving speed, security, and convenience (Vergallo et al., 2022). Research has shown that factors such as brand equity, customer satisfaction, and demographic characteristics significantly influence the relationship between CX and customer loyalty, underscoring the importance of these elements in banking (Kamath et al., 2019). Additionally, studies highlight the importance of brand touchpoints in increasing switching costs, which play a crucial role in retaining customers within the competitive banking industry (Sultan, 2019).

Interactivity and social presence in digital channels additionally contribute to brand engagement, leading to positive experiences, satisfaction, and loyalty (Garzaro et al., 2020). Mobile banking services, in particular, have emerged as significant factors in shaping customer value and experience, with customer engagement acting as a mediator between experience outcomes and non-transactional behaviors such as loyalty and advocacy (Komulainen et al., 2019; Moliner-Tena et al., 2019). The integration of AI into customer service has allowed banks to offer more responsive and tailored interactions, essential in a highly competitive financial services sector. However, the rise of digital channels has also introduced new complexities, requiring banks to develop comprehensive CXM models that consider the intricacies of the digital landscape. Such models should encompass the entire customer journey, ensuring that each touchpoint, whether internal or external, contributes positively to the customer's overall experience (Heshmati et al., 2019).

Challenges remain in understanding and measuring customer experience across different cultural contexts, which is particularly relevant in global financial services (Al-Wugayan, 2019). As the banking industry continues to evolve, there is an increasing focus on customer-centric approaches that integrate services into customers' value creation processes, a strategy that is becoming essential for maintaining competitiveness (Komulainen et al., 2019; Mishra et al., 2020).

2.2.3 General Concepts of CX

Measuring CX is essential for understanding and improving how customers perceive their interactions with a brand. Traditional metrics such as customer satisfaction and Net Promoter Score (NPS) have been widely used; however, recent research suggests that these measures may not fully capture the complexity of CX. For instance, while NPS is useful for assessing customer loyalty, it does not account for the many different factors that can influence how customers experience a brand across various touchpoints (Imhof et al.,2020).

Recent studies have developed more comprehensive scales for measuring CX in omnichannel environments—those that include both physical and digital interactions. For example, Gahler et al. proposed a multi-dimensional scale that addresses the challenges of measuring CX across various touchpoints, emphasizing the need to consider the entire customer journey rather than isolated interactions. This scale captures the complexity of modern CX by integrating dimensions such as emotional and cognitive responses, which are critical in both digital and physical environments (Gahler et al. 2022).

Rahman et al. introduced the **Omnichannel Customer Experience (OCX) scale**, which measures how customers perceive their experiences across multiple channels. It evaluates key aspects like channel integration, consistency, seamlessness, personalization, and the continuity of the customer journey. The scale assesses how well channels work together to create a unified experience, ensuring smooth transitions and effective personalization at each stage. This approach helps businesses identify strengths and weaknesses in their omnichannel strategies, ensuring a cohesive and satisfying customer experience across all channel (Rahman et al., 2022).

The **EXQ (Experience Quality) scale**, revisited by Kuppelwieser and Klaus, expands the understanding of CX in both B2C and B2B environments. It includes three key dimensions: brand experience, service provider experience, and post-purchase experience. These dimensions cover the entire customer journey, from pre-purchase interactions to post-purchase

evaluations, influencing long-term loyalty. This holistic approach helps businesses understand CX quality across various touchpoints and contexts, highlighting the complexity of measuring customer experiences and the need for comprehensive tools. (Kuppelwieser & Klaus. 2021).

The influence of **external touchpoints**—factors beyond organizational control, like peer-to-peer interactions and customer reviews—on CX is increasingly recognized. These factors significantly impact customer perceptions and behaviors (Siqueira et al., 2020). CX measurement frameworks must account for these, moving beyond traditional satisfaction scores to capture more nuanced insights (Hodgkinson et al., 2021).

The rise of **online and omnichannel systems**, integrating physical and digital channels, has been a key focus, offering seamless and cohesive customer journeys (Silva et al., 2021). **Self-Service Technologies (SSTs)**, including ATMs, chatbots, and service robots, are also transforming CX management, allowing customers to personalize experiences and boosting operational efficiency. However, the success of SSTs depends on customer acceptance and the value they provide (Silva et al., 2021).

As CX management grows more complex, traditional metrics are increasingly being supplemented or transformed by **AI-driven tools**. The next chapter will explore AI's role in enhancing CX in the banking sector, from customer-facing technologies to back-office operations, contributing to a more efficient, personalized experience.

2.3 AI Technologies with Banking Applications

This chapter examines AI technologies currently applied in banking, with sections covering Machine Learning (ML), Natural Language Processing (NLP), Large Language Models (LLMs), and others. Each technology's underlying principles and specific banking applications are explored.

While technologies like NLP, LLMs, Generative AI, and Speech Recognition are rooted in ML, they involve specialized applications that go beyond traditional ML. To highlight their unique roles and broader contexts, these technologies are discussed in separate chapters.

2.3.1 Machine Learning (ML)

2.3.1.1 The Technology

ML is a rapidly evolving field that encompasses various approaches to automated analytical model building and problem-solving using data (Jung, 2022; Zhi-Hua Zhou, 2021). ML is

fundamentally driven by three critical components: data, model, and loss function, which collectively shape the learning process and determine the effectiveness of the algorithms in extracting patterns and making predictions (see **Figure 9**). The interconnection between these components is central to the overall performance and accuracy of ML models (Jung, 2022).

Data forms the foundation of ML, representing collections of individual data points characterized by features and labels. Features are measurable properties of the data, while labels are the outcomes the model aims to predict. The diversity, quantity, and quality of data are crucial factors that significantly influence the model's ability to generalize and perform accurately across various contexts (Jung, 2022). Consequently, sophisticated data engineering and preprocessing techniques are often required to address challenges such as data imbalance, missing values, and the necessity for large datasets. The model, or hypothesis space, consists of computationally feasible hypothesis maps that translate from feature space to label space. The loss function measures the discrepancy between the model's predictions and the actual outcomes, guiding the learning process by quantifying the "cost" of incorrect predictions (Jung, 2022). This process is critical in refining the model's predictive capabilities, with various optimization techniques, such as gradient descent, employed to minimize the loss function (Zhi-Hua Zhou, 2021).

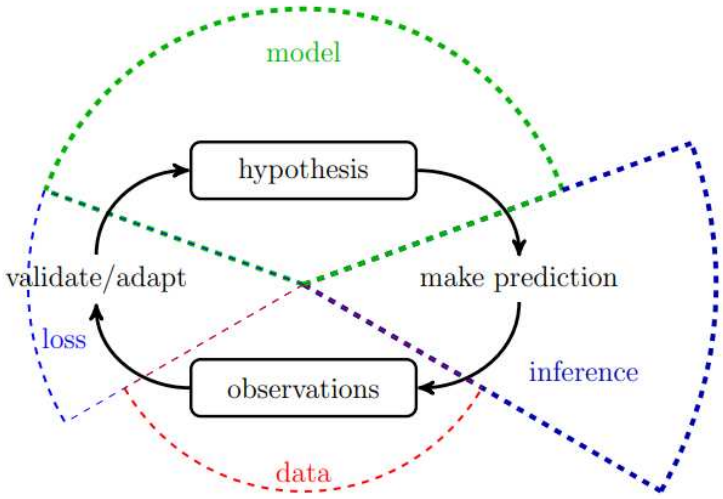

Figure 9 Machine Learning three main components: model, data and loss (Jung, 2022)

ML methodologies are typically classified into several paradigms: supervised learning, unsupervised learning, reinforcement learning (RL), and deep learning (DL). Supervised learning entails training a model on a labeled dataset, where each data point is associated with a known output. The objective here is to learn a mapping from inputs to outputs, enabling the

model to make accurate predictions on new, unseen data. This paradigm is particularly well-suited for tasks like classification and regression (Jung, 2022). In contrast, unsupervised learning does not require labeled data; instead, it focuses on discovering hidden patterns or intrinsic structures within the data, such as clustering or dimensionality reduction (Maleki et al., 2020). RL represents a distinct approach where an agent learns to make decisions by interacting with its environment, optimizing its behavior to maximize cumulative rewards over time. RL is particularly useful in dynamic environments, such as autonomous driving and game playing, where the agent must adapt to changing conditions (Zhi-Hua Zhou, 2021).

Deep learning, a specialized subset of ML, leverages neural networks with multiple layers to model complex relationships within large datasets. Unlike traditional ML algorithms that might employ shallow architectures, deep learning models incorporate multiple layers of neurons, allowing them to capture more intricate and abstract patterns in the data. This process is visualized in **Figure 10**. This ability has made deep learning particularly significant in applications requiring the processing of vast amounts of data, such as image and speech recognition. Deep learning models often outperform shallow ML models due to their hierarchical feature representation, which is crucial for tasks that involve high-dimensional data (Janiesch et al., 2021). However, they are computationally intensive and necessitate large datasets to prevent overfitting, which can undermine model generalizability.

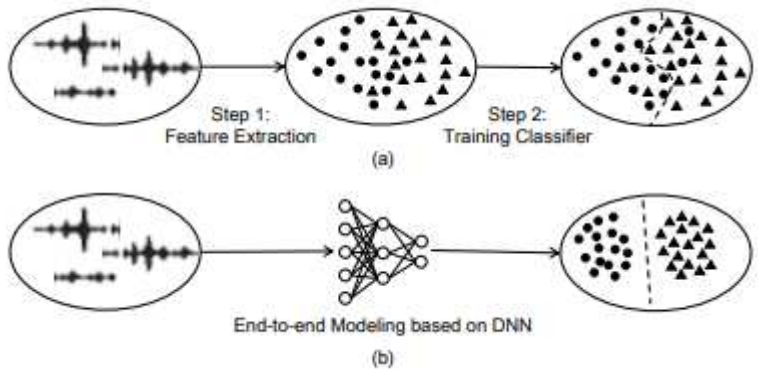

Figure 10 Schematic visualization of (a) classical machine learning methods and (b) deep learning (Chang et al., 2021).

The rise of deep learning, coupled with the increasing availability of data and computational power, has propelled ML into new domains, leading to breakthroughs in areas such as autonomous vehicles and personalized medicine. As ML continues to evolve, emerging areas such as quantum ML are being explored, which promise to bring unprecedented advancements in computational efficiency and problem-solving capabilities (Khan et al., 2020).

2.3.1.2 Applications in Banking

One of the most impactful applications of ML in banking is in credit scoring. Traditionally, credit scoring was a manual and somewhat subjective process, often relying on a limited set of data points. However, ML algorithms have transformed this process by analyzing a vast array of data, including credit history, income, employment status, and spending behavior, to assess the creditworthiness of individuals. These algorithms can predict the likelihood of repayment more accurately than traditional methods, allowing banks to make better-informed lending decisions. For example, Capital One has adopted ML to automate its credit scoring process, significantly reducing the time required for loan approvals and providing customers with quicker credit decisions (Pattnaik et al., 2024; Goodell et al., 2021; Gigante & Zago, 2022; Hentzen, 2021).

Fraud detection is another critical area where ML is making significant contributions. Banks handle millions of transactions daily, making it imperative to detect and prevent fraudulent activities in real-time. ML models excel at this by continuously monitoring transaction patterns and identifying anomalies that may indicate fraudulent behavior. These models can adapt to new types of fraud as they learn from the data, thereby offering a dynamic and proactive approach to fraud prevention. For instance, JPMorgan Chase utilizes ML algorithms to detect and mitigate fraudulent credit card transactions, ensuring both customer safety and the integrity of the bank's operations (Pattnaik et al., 2024; Noreen et al., 2023; Herrmann & Masawi, 2022).

Moreover, customer segmentation is another area where ML is proving to be invaluable. By analyzing customer data, including behaviors, demographics, and financial needs, ML enables banks to segment their customer base more effectively. This segmentation allows for targeted marketing campaigns, customized product offerings, and more personalized customer service. For example, HSBC uses ML to categorize customers into distinct groups based on their spending habits, investment preferences, and risk tolerance, allowing the bank to tailor its services and communication strategies to each segment, thereby enhancing customer engagement and satisfaction (Gigante & Zago, 2022).

Risk management in banking is also greatly enhanced by ML. Banks are exposed to various types of risks, including credit risk, market risk, and operational risk. ML models help in assessing these risks more accurately by analyzing historical data and identifying potential risk factors that may not be evident through traditional methods. These models can forecast potential losses, optimize investment strategies, and refine decision-making processes, thereby

contributing to more robust and informed risk management practices (Pattnaik et al., 2024; Cao et al., 2021; Herrmann & Masawi, 2022).

Finally, ML significantly contributes to personalization in banking services. By analyzing customer interactions, preferences, and financial histories, ML enables banks to tailor their product offerings and services to individual customer needs. This could involve generating customized product recommendations, personalizing marketing messages, or offering bespoke financial advice. For instance, banks can use ML to understand a customer's spending habits and financial goals, allowing them to provide personalized investment advice or savings plans, thus enhancing the customer experience and fostering deeper relationships with clients (Gigante & Zago, 2022; Noreen et al., 2023).

2.3.2 Natural Language Processing (NLP):

2.3.2.1 The Technology

NLP is at the intersection of artificial intelligence, linguistics, and computer science, and it plays a critical role in enabling machines to understand and generate human language. Recent advancements, particularly in deep learning, have significantly enhanced the performance of NLP systems across a wide array of tasks, from sentiment analysis to machine translation and beyond (Lauriola et al., 2021). The integration of deep learning techniques, such as transformers and recurrent neural networks, has allowed for more nuanced understanding and generation of text, propelling NLP applications into new domains, including healthcare, legal analysis, and customer service automation (Otter et al., 2020).

The scope of NLP is vast, covering both foundational linguistic processing and a wide range of computational linguistics applications. Foundational tasks include tokenization, part-of-speech tagging, syntactic parsing, and named entity recognition, which are essential for building complex systems that understand human language. These tasks require sophisticated models that capture the intricacies of syntax, semantics, and pragmatics (Bender et al., 2019). Syntactic parsing helps determine grammatical structure, influencing meaning interpretation, while semantic analysis focuses on understanding word and sentence meanings, crucial for information retrieval and question answering (Bender et al., 2019).

In addition to these core linguistic tasks, NLP applications have been increasingly employed in various fields, demonstrating their versatility and impact. In the medical domain, NLP is used to analyze clinical texts, aiding in patient care and clinical research by extracting relevant

information from electronic health records (Arivazhagan et al., 2023). In management research, NLP techniques are utilized to analyze large volumes of textual data, such as annual reports and social media posts, enabling researchers to uncover patterns and insights that inform business strategy (Kang et al., 2020).

NLP faces challenges in understanding higher-level language aspects, like pragmatics and discourse, which are crucial for tasks such as sentiment analysis and conversational agents. Current models struggle with these tasks as they require deep understanding of context, speaker intentions, and sentence relationships (Bender et al., 2019). Additionally, data bias and ethical concerns remain key issues, which will be touched upon in later chapters (Arivazhagan et al., 2023).

NLP's integration with other AI technologies, like computer vision and robotics, is creating new research opportunities. Multimodal systems combining NLP with image processing are advancing areas like virtual assistants and autonomous vehicles, requiring real-time language processing (Otter et al., 2020).

Despite significant progress, NLP systems still struggle with tasks that require deep contextual understanding, long-term reasoning, and the ability to generalize from limited data (Edwards, 2021).

2.3.2.2 Applications in Banking

NLP's prominent application in banking is through chatbots. These AI-powered assistants, like Bank of America's "Erica," help with tasks such as account inquiries, bill payments, and transaction management. By processing natural language, these chatbots reduce the need for human intervention and improve customer satisfaction (Pattnaik et al., 2024; Fazal et al., 2023; Cao et al., 2021; Hentzen, 2021; Noreen et al., 2023; Rahman et al., 2021; Mogaji, 2021).

NLP is also crucial for sentiment analysis, where it helps banks analyze feedback and social media to understand customer perceptions and adjust products or strategies, enhancing satisfaction and loyalty (Kang et al., 2020).

In regulatory compliance, NLP automates document analysis and ensures banks stay compliant with evolving regulations. For example, the Financial Conduct Authority (FCA) in the UK is exploring the use of NLP in its Digital Regulatory Reporting project, which aims to

simplify the regulatory compliance process by automating the interpretation and implementation of regulations (R. Al-Shabandar et al., 2019).

2.3.3 Large Language Models (LLMs) and Generative AI (GenAI)

2.3.3.1 The Technology

The significant impact and expansive capabilities of LLMs and GenAI go beyond the traditional scope of Natural Language Processing, justifying a dedicated chapter to explore their unique contributions and implications.

While LLMs form the backbone of many generative AI systems, GenAI extends these capabilities further, encompassing a broader range of applications. GenAI's potential to autonomously create diverse forms of content—such as images, music, and code—demonstrates its versatility in both creative and functional domains, making them incredibly powerful tools for understanding and generating natural language (Douglas, 2023; Bandi et al., 2023). These models are built on transformer architectures and are trained on vast corpora of text, enabling them to generate human-like responses and perform a wide range of language-related functions (Min et al., 2021).

Central to the mechanics of LLMs is the transformer architecture, which utilizes self-attention mechanisms to process input sequences in parallel. This approach contrasts with earlier models like recurrent neural networks (RNNs) and long short-term memory (LSTM) networks, which processed input sequentially and struggled with long-range dependencies. The self-attention mechanism in transformers allows LLMs to capture relationships between words regardless of their distance in the text, leading to a more nuanced understanding of language (Min et al., 2021).

LLMs are fundamentally built upon pre-trained language models, which are trained on extensive text corpora to capture linguistic patterns, context, and semantics. These models can be categorized into three primary types, each with distinct architectures and training objectives: autoregressive models, masked language models, and encoder-decoder models (Min et al., 2021). Those three models are shown in **Figure 11**.

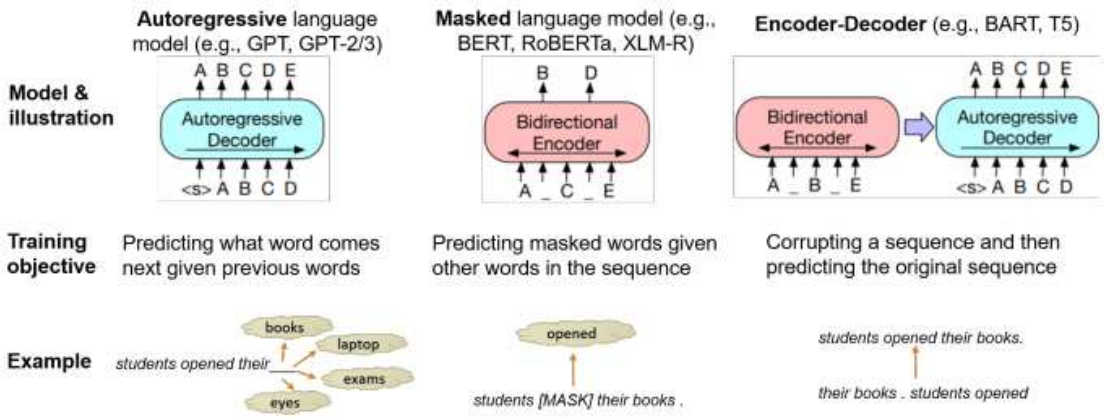

Figure 11 Three types of pre-trained language models (Min et al., 2021)

LLMs are typically trained using unsupervised learning methods, where the model learns to predict the next word in a sequence based on the context provided by the preceding words (Douglas, 2023).

A key factor in the success of LLMs is their scale. Models like GPT-3 contain hundreds of billions of parameters, which are essentially the weights that the model adjusts during training to optimize its performance. Research has shown that increasing the number of parameters and the size of the training data leads to better performance across a variety of NLP tasks (Zhao et al., 2023). This phenomenon, known as scaling laws, suggests that larger models trained on more data can achieve more accurate and versatile language processing capabilities. However, the trend towards larger models also raises significant challenges related to computational resources and energy consumption, as training these models requires vast amounts of computing power and electricity (Min et al., 2021).

Understanding the differences between Discriminative AI and Generative AI is crucial, as they represent distinct approaches to data processing—classification versus content creation— and should not be mixed up. Each offers unique strengths and applications. The difference between those two is visualized in **Figure 12**. Discriminative AI focuses on decision-making by analyzing input data to classify or predict outcomes, such as identifying objects within an image. In contrast, Generative AI excels in creating new content by learning patterns and distributions within the training data, thereby generating text, images, or other media based on specific prompts (Banh et al., 2023).

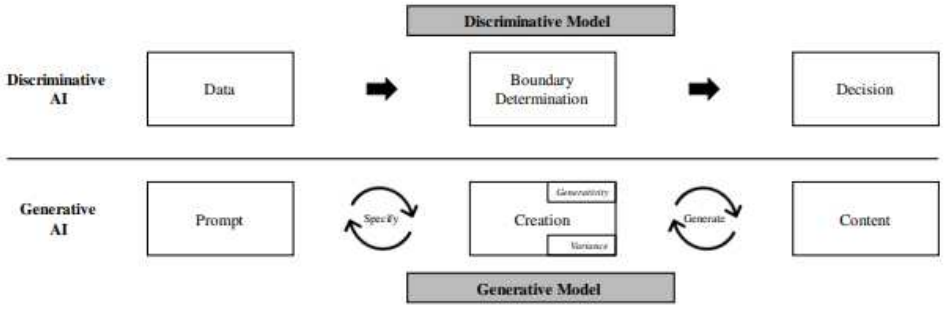

Figure 12 Procedural differences of generative AI and dicriminative AI (Banh et al., 2023)

The use of LLMs in creative fields also raises important questions about originality, authorship, and the role of AI in artistic expression. As these models become more sophisticated, the line between human and machine-generated content is likely to blur, leading to new ethical and philosophical challenges (Agüera y Arcas, 2022).

The application of GenAI extends beyond creative domains. The impact of LLMs extends beyond traditional AI domains, finding applications in fields such as healthcare, education, and law. In healthcare, LLMs are being used to summarize medical records, assist in patient communication, and even aid in diagnosing diseases (Khan Raiaan et al., 2024). Additionally it can assist in generating synthetic data for research, or in education, where it can personalize learning experiences (Ooi et al., 2023). In management, Generative AI is reshaping decision-making processes and organizational structures by providing advanced tools for content creation and strategic planning (Korzyński et al., 2023). However, the widespread use of Generative AI also raises critical ethical concerns, particularly related to issues of trust, control, and the potential for misuse in generating misleading or harmful content (Kalota, 2024).

LLMs have demonstrated exceptional capabilities in understanding and generating natural language, making them highly effective for tasks such as translation, summarization, and sentiment analysis. These models can generate text that is not only coherent and contextually relevant but also stylistically consistent with human language (Buttrick, 2024).

Furthermore, GenAI's integration into decision-making and management is transforming strategic planning, recruitment processes, and HR management by automating routine tasks and supporting higher-level decision-making (Korzyński et al., 2023).

Despite their many advantages, LLMs are often criticized for their lack of explainability. The models operate as "black boxes," meaning that their internal decision-making processes are

not transparent, even to the researchers who develop them (Zhao et al., 2023). This lack of interpretability raises concerns about trust and accountability, especially in high-stakes applications like healthcare and criminal justice, where the consequences of an incorrect or biased decision can be severe. Researchers are working on developing explainable AI techniques that can provide insights into how LLMs arrive at their decisions, but achieving a balance between explainability and performance remains a significant challenge (Zhao et al., 2023).

2.3.3.2 Applications in Banking

LLMs and GenAI are driving transformative changes within the banking sector, particularly in how banks manage operations and engage with customers. These advanced AI systems are capable of processing and generating human-like text, allowing for sophisticated applications that extend beyond traditional AI uses. One of the significant advancements brought about by LLMs and GenAI is in the realm of personalized financial advice. These models analyze vast amounts of data, including individual customer profiles, financial histories, and current market trends, to provide customized financial recommendations. This level of personalization surpasses what was previously possible, enabling banks to offer tailored investment portfolios or savings plans that align closely with each customer's unique financial goals (Ooi et al., 2023; Sheth et al., 2022).

In addition to providing personalized financial advice, GenAI is revolutionizing the way banks approach content generation. These models can automate the creation of detailed and personalized financial reports, marketing materials, and other essential documents, allowing human resources to focus on more strategic tasks. For instance, GenAI can produce client-specific financial summaries, complete with tailored visualizations and commentary, significantly enhancing the client experience while reducing the time and effort required for manual document preparation (Ooi et al., 2023).

LLMs and GenAI also play a crucial role in navigating the complex regulatory environment in banking. By analyzing large volumes of regulatory texts, these models can extract key information, identify compliance risks, and suggest necessary actions. This capability not only ensures that banks remain compliant with current regulations but also significantly reduces the time and resources required for manual reviews. For example, some banks are utilizing GenAI to automate the interpretation and implementation of new legal requirements, thereby streamlining their compliance processes (Königstorfer & Thalmann, 2020).

Moreover, LLMs and GenAI enhance risk management practices in banking by providing advanced tools for assessing and mitigating various risks. These models analyze historical data, market conditions, and economic indicators to predict potential losses and optimize investment strategies. By modeling different market scenarios, banks can make more informed decisions, even in uncertain economic environments (Ooi et al., 2023; Herrmann & Masawi, 2022). Additionally, LLMs enable more refined customer segmentation and targeted marketing efforts by analyzing customer data to identify distinct groups based on behaviors, preferences, and financial needs. This allows for the development of highly personalized marketing campaigns and product offerings, enhancing customer engagement and satisfaction (Kumar et al., 2019; Ooi et al., 2023).

2.3.4 Automatic Speech Recognition (ASR)

2.3.4.1 The Technology

ASR has become an integral part of modern technology, allowing for seamless voice interaction with devices in a manner that feels natural and intuitive. These systems are capable of transcribing speech into text even under challenging environmental conditions, such as background noise or varied speaker accents, by processing free-form speech (Georgescu et al., 2021). Speech signals offer a wealth of information beyond just the spoken content; they can be used for a variety of recognition tasks, including identifying the speaker's identity, emotional state, health status, spoken language, accent, age, and gender (Nassif et al., 2019).

ASR systems have evolved significantly from traditional pipeline architectures to more advanced end-to-end models. This evolution has been significantly driven by deep learning techniques, particularly through the adoption of end-to-end models that utilize deep neural networks (DNNs) (Georgescu et al., 2021). In traditional pipeline ASR, the process is multi-component, involving separate modules for feature extraction, acoustic modeling, and language modeling. This approach often uses a weighted finite state transducer for decoding, where each module contributes to the final output by transforming the input speech signal into phonetic units and then into words. On the other hand, end-to-end ASR systems integrate these processes into a single neural network that simultaneously learns to model acoustic and language information. This unified approach simplifies the ASR system by removing the need for handcrafted features and phonetic dictionaries, allowing the system to directly map raw audio inputs to text outputs. The most common end-to-end architecture employs Connectionist Temporal Classification or sequence-to-sequence models, which are trained to

predict the entire sequence of characters or word-parts in one step. This shift from pipeline to end-to-end models has led to improvements in accuracy and efficiency, as the models are better equipped to handle the variability in speech, such as different accents and spontaneous speech patterns. An example of how end-to-end ASR works in comparison to pipeline ASR is shown in **Figure 13**.

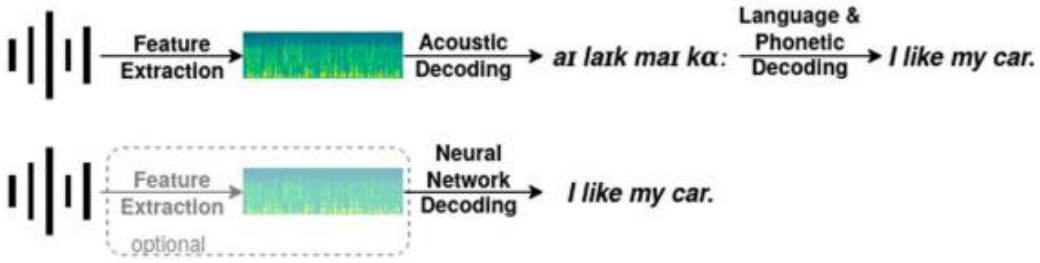

Figure 13 Pipeline (top) vs. end-to-end (bottom)ASR (Georgescu et al., 2021).

Speaker recognition is a critical component of automated speech recognition systems, focused on identifying and verifying individuals based on their unique vocal characteristics, with applications ranging from security authentication to personalized user experiences (Nassif et al., 2019; Kabir et al., 2021). These tasks are essential for enhancing the personalization and accuracy of voice-based systems (Kabir et al., 2021).

The ongoing research in deep learning for speech applications indicates a trend towards more sophisticated and personalized voice-based technologies. This includes the development of novel neural network architectures that can better handle the complexities of speech data while being computationally efficient enough for deployment in a wide range of devices. Moreover, the integration of multi-modal inputs, such as combining audio with visual cues from lip movements, is expected to further enhance the robustness and accuracy of ASR systems in challenging environments (Nassif et al., 2019).

2.3.4.2 Applications in Banking

ASR is playing a significant role in modernizing the banking sector, particularly in enhancing customer experience and streamlining operations. While other technologies such as ML, NLP, and LLMs focus on data analysis, text understanding, and content generation, ASR specifically leverages the power of voice as an input method, enabling hands-free, intuitive interactions for customers.

For instance, banks are employing ASR for voice-based authentication, where the customer's spoken voice is compared with a previously recorded voice pattern to verify their identity. This method of authentication not only simplifies the login process but also adds an extra

layer of security by using unique voice patterns, which are difficult to replicate (Fares, 2023; Klaus and Zaichkowsky, 2020; Lazo & Ebardo, 2023; Srinadi, 2023; Vergallo et al., 2022). In the realm of fraud detection, ASR complements the efforts of ML by analyzing voice patterns in real-time. For example, during phone calls or interactions with automated systems, ASR can detect anomalies such as stress or an unusual pace of speech, which could indicate fraudulent behavior. This voice-based analysis adds another dimension to the fraud detection strategies already discussed in the context of ML and GenAI (Königstorfer & Thalmann, 2020).

Additionally, ASR extends the capabilities of LLMs and NLP by converting spoken words into text, making it particularly useful for digitizing audio recordings of meetings, phone calls, or customer interactions. This process creates searchable records that improve both efficiency and compliance. ASR can also analyze customer feedback captured through voice, identifying recurring themes, issues, or preferences that can be used to enhance products, services, and customer experience (Königstorfer & Thalmann, 2020).

Building on the use of chatbots and virtual assistants discussed in the NLP and LLM chapters, ASR powers voice-controlled banking applications and services. Customers can use voice commands to perform a variety of tasks such as checking balances, transferring funds, and paying bills, making banking more accessible, especially for those who prefer a hands-free experience. This integration of ASR with AI-driven systems like Bank of America's "Erica" ensures that voice commands are understood and processed effectively, further enhancing customer convenience (Aw et al., 2022; Klaus and Zaichkowsky, 2020; Srinadi, 2023; Mogaji, 2021; Vergallo et al., 2022).

ASR also plays a role in personalizing financial services, a theme shared with both ML and GenAI. By capturing and analyzing spoken interactions, ASR helps gather valuable information about a customer's financial goals and preferences. This data can then be used by robo-advisors to generate personalized financial recommendations. The use of voice as a data source offers a unique advantage in understanding the nuances of customer intent and emotion, which might not be as easily captured through text alone (Piotrowski, 2023). Furthermore, ASR enhances customer support by enabling AI-powered systems to understand and respond to spoken inquiries. While NLP and LLMs provide the foundation for understanding and generating responses, ASR allows these interactions to take place in a natural, conversational manner. This not only improves the efficiency of customer service operations but also frees up human agents to focus on more complex issues, ultimately

leading to higher customer satisfaction (Hentzen, 2021; Rahman et al., 2021; Alnaser et al., 2023).

Moreover, ASR contributes to the automation of call center tasks, aligning with the operational efficiencies discussed in the ML and LLM chapters. It powers Interactive Voice Response systems, allowing customers to navigate menus and complete tasks using voice commands (Vergallo et al., 2022).

2.3.5 Internet of Things (IoT) and Artificial Intelligence of Things (AIoT)

2.3.5.1 The Technology

The IoT refers to a system of interconnected devices equipped with short-range transceivers, enabling communication among a diverse array of objects and devices, and between people and things. This technology allows for a novel dimension of information exchange, improving various aspects of daily life by integrating devices such as sensors, embedded systems, and smart devices into a cohesive network. These devices communicate via technologies like RFID, Wi-Fi, GSM, and Bluetooth, facilitating advanced control and monitoring services across various applications (Chander et al., 2022).

The AIoT represents the convergence of AI and the IoT, a synergy that has brought forth revolutionary advancements across various sectors (Chang et al., 2021). When integrated, AI enhances the data processing capabilities of IoT devices, leading to more intelligent, autonomous, and efficient systems (Zhang et al., 2020).

AIoT systems are architecturally complex, typically involving multiple layers of computing—cloud, fog, and edge computing—that together support the rapid processing and analysis of vast amounts of data Chang et al., 2021).

A key component of AIoT is AI-based sensors, which are integral to IoT applications. These sensors, characterized by onboard intelligence, are capable of processing data locally and making real-time decisions based on the detected patterns. They offer improved efficiency, intelligence, and context-awareness, enabling more sophisticated applications across industries. These AI-enhanced sensors are not only more sensitive and accurate but also contribute to the overall robustness and safety of the systems in which they are embedded, such as industrial Cyber-Physical Systems (CPSs) (Mukhopadhyay et al., 2021).

However, the integration of AI with IoT also introduces several challenges, particularly related to processing power, energy efficiency, and security. AIoT devices are often deployed

in resource-constrained environments, where energy consumption and computational power are limited. This has led to the adoption of edge computing strategies, where data processing is distributed closer to the data source, significantly reducing the demand on centralized cloud resources and enabling faster decision-making (Zhang et al., 2020).

In addition to technical challenges, AIoT systems must address issues of scalability, interoperability, and security. The seamless operation of AIoT systems across different devices and platforms requires careful consideration of interoperability standards to ensure compatibility and efficient communication between heterogeneous systems (Narasimha Swamy et al., 2020). Security is another critical concern, given the vast amount of sensitive data that AIoT systems handle. The development of robust encryption techniques and secure communication protocols is essential to protect against cyber threats and ensure data privacy Chang et al., 2021).

AIoT's potential extends beyond industrial applications into areas such as smart cities, healthcare, and environmental monitoring. In smart cities, AIoT can optimize traffic management, enhance public safety through surveillance systems, and improve energy efficiency in buildings (Mohindru et al., 2019). In healthcare, AIoT enables real-time monitoring of patient conditions through wearable devices, supporting timely interventions and personalized healthcare services (Mukhopadhyay et al., 2021).

The future of AIoT is closely tied to the evolution of Industry 5.0, where human-machine collaboration is expected to reach new heights. In this context, AIoT will play a crucial role in enhancing manufacturing automation, improving decision-making processes, and fostering a more adaptive and resilient industrial environment (Chander et al., 2022).

2.3.6 Automation vs Augmentation

This subchapter on the difference between automation and augmentation, while not focused on a specific technology, is critical for understanding the evolving role of AI across various sectors in a company. Automation refers to the replacement of human tasks by machines, effectively reducing or eliminating human involvement in specific processes (Agrawal et al., 2023). This replacement can significantly enhance productivity and efficiency, particularly in repetitive or data-intensive tasks. However, automation is often associated with concerns regarding job displacement, as it can lead to the substitution of human labor with machines, potentially impacting employment and social structures (Y. Lei et al., 2024).

In contrast, augmentation focuses on enhancing human capabilities rather than replacing them. Augmented intelligence integrates AI into human workflows, providing additional support and enabling individuals to perform their tasks more effectively (Dégallier-Rochat et al., 2022). This approach is not solely about improving efficiency; it also complements human skills with AI's capabilities, such as processing vast amounts of data or performing complex computations rapidly (Yau et al., 2021).

The automation-augmentation paradox underscores the tension between these two approaches. Organizations often face strategic decisions about whether to fully automate a task or use AI to augment human efforts. This paradox suggests that while automation may lead to efficiency and cost savings, it can also create challenges by reducing the need for human involvement. Conversely, augmentation necessitates continuous human-machine interaction, which, while potentially more resource-intensive, maintains human oversight and decision-making capabilities (Raisch et al., 2021).

Moreover, the augmented intelligence approach, which aligns with the concept of empowerment, emphasizes AI systems that do not replace human decision-making but rather enhance it. This approach is particularly relevant in complex scenarios where human judgment and contextual understanding are essential, such as in managerial decision-making or customer service (Dégallier-Rochat et al., 2022).

Finally, the paradoxical tension between automation and augmentation reflects a broader strategic challenge for organizations: balancing the immediate efficiency gains from automation with the long-term benefits of human-centered augmentation. As AI technologies continue to evolve, this balance will become increasingly important in determining the role of humans in the workforce and the future of work itself (Raisch et al., 2021).

2.4 Impact of AI on Banking CX

Building on the foundational AI technologies discussed in previous chapters, this section explores how AI serves as a transformative force in the banking industry, reshaping customer interactions, enhancing service personalization, and driving operational efficiencies. As customer expectations continue to evolve, the ability to deliver exceptional, AI-powered experiences has become a critical competitive advantage for banks. This chapter will examine the multifaceted impact of AI on banking CX, focusing on key areas such as personalization, process optimization, and customer engagement.

2.4.1 AI-Driven Personalization in Banking

AI-driven personalization, often referred to as hyper-personalization, represents a significant shift in the way banks interact with their customers. This approach utilizes advanced AI technologies to tailor content, products, and services to the unique preferences and behaviors of individual customers, thereby enhancing the overall customer experience (Gigante & Zago, 2022; Sheth et al., 2022; Chen & Prentice, 2024). By analyzing vast amounts of customer data, AI-driven personalization allows banks to offer services that are not only relevant but also timely and contextually appropriate, thereby creating a win-win scenario for both the banks and their customers (Gigante & Zago, 2022; Payne et al., 2021; Sheth et al., 2022).

At the core of AI-driven personalization is the ability of AI technologies to process and analyze customer data in real-time. This includes transaction history, spending patterns, and even lifestyle choices, which are used to build comprehensive customer profiles (Sheth et al., 2022). These profiles then inform personalized recommendations and services, such as tailored financial advice, customized marketing offers, and adaptive user interfaces. The use of AI in this manner not only enhances the relevance of services but also increases the efficiency of their delivery, which is crucial for maintaining high levels of customer satisfaction and loyalty (Gigante & Zago, 2022; Königstorfer & Thalmann, 2020).

One of the key AI technologies employed in this context is the use of chatbots. These AI-powered virtual assistants provide personalized customer service by handling routine inquiries, offering product recommendations, and even performing basic financial advisory roles. The ability of chatbots to operate 24/7 and deliver consistent, personalized experiences across various channels significantly enhances customer satisfaction and engagement. (Libai et al., 2020; Aw et al., 2022; Hoyer et al., 2020).

AI-driven personalization also extends to the creation of personalized banking gateways, which are tailored interfaces that adapt to the specific needs and preferences of individual users. By integrating AI with banking enterprise resource planning systems, banks can offer a seamless, customized experience that aligns closely with the customer's financial behaviors and preferences (Sheth et al., 2022; Fares et al., 2022; Trawnih et al., 2022).

Customers generally perceive AI-driven personalization as superior to traditional methods due to its increased accuracy, relevance, and efficiency (Kumar et al., 2019). AI's ability to analyze large datasets enables it to offer more precise and relevant recommendations, which contrasts with the broader and often less accurate personalization achieved through traditional

means (Xu et al., 2020). Moreover, the automation of these processes through AI enhances convenience for customers, who can receive tailored services without needing to initiate complex interactions (Sheth et al., 2022; Tulcanaza-Prieto et al., 2023).

However, the shift towards AI-driven personalization is not without its challenges. While customers appreciate the convenience and relevance of AI-powered services, there are concerns regarding transparency, control over personal data, and the potential for ethical issues. Ensuring that AI systems are transparent and that customers retain control over their data is crucial for maintaining trust and satisfaction in these digital interactions (Ameen et al., 2020; Vives, 2019).

Sheth provides a comprehensive framework for understanding AI-driven personalization in banking, particularly in the context of integrating AI with human elements to enhance customer experiences. This framework, as illustrated in the accompanying graph, positions AI at the center of a dynamic interplay between personalization, customer experience, and banking services. It emphasizes the strategic use of AI in banking, advocating for a balanced integration where AI complements human roles rather than replaces them entirely. The framework highlights key aspects such as trust, quality, and customer engagement, which are crucial for the successful implementation of AI-driven services (Sheth et al., 2022). Moreover, the framework stresses the need for trust and privacy management, which are essential in building and maintaining customer confidence in AI-driven services. By ensuring transparent data practices and robust security measures, banks can foster a sense of trust that is vital for the widespread adoption of personalized AI services (Sheth et al., 2022).

Service-Dominant Logic (SDL) framework provides an insightful lens through which the value-in-use perceptions of AI-based mobile banking applications can be examined. According to Payne et al., SDL emphasizes the co-creation of value between firms and customers, particularly in service ecosystems where technology, like AI, plays a central role. In the context of mobile banking, SDL suggests that the interaction between AI technologies and customers forms the crux of value creation. This framework highlights the importance of customers' comfort with AI technologies, which significantly influences their perceived value of AI-driven services (Payne et al., 2021). It is proposed that value-in-use is derived not only from the technological capabilities of AI but also from how well these technologies align with customer expectations and needs. As AI continues to transform mobile banking, the SDL framework underscores the necessity of understanding and enhancing the interactive processes between AI systems and users to maximize value co-creation. This approach is

particularly critical in the dynamic environment of digital banking, where the success of AI-driven services hinges on the continuous and collaborative engagement between banks and their customers (Payne et al., 2021; Fares et al., 2022).

The literature provides several examples of successful AI-driven personalization initiatives in banking. For instance, Bank of Ireland has implemented a data collection system that enables personalized financial recommendations, significantly enhancing customer engagement. Similarly, Bank of America's AI-powered chatbot "Erica" has been instrumental in providing personalized advice and automating routine tasks, thereby improving customer service and operational efficiency (Gigante & Zago, 2022).

2.4.2 AI and Internal Process Optimization in Banking

AI is changing internal processes within the banking sector, offering substantial improvements in efficiency, cost reduction, and decision-making accuracy. By automating repetitive tasks, enhancing risk management, and improving data analysis capabilities, AI has become an integral tool for banks looking to optimize their operations and maintain a competitive edge in an increasingly digital marketplace (Fares et al., 2022; Northey et al., 2022; Königstorfer & Thalmann, 2020) Moreover, AI's integration into banking operations is not merely a tool for efficiency but also a transformative force that redefines how banks approach customer service and operational management, thus reshaping the traditional banking model into a more dynamic and responsive framework, thereby enhancing the overall customer experience (Noreen et al., 2023).

One of the primary benefits of AI in banking is its ability to automate routine tasks such as data entry, transaction processing, and regulatory reporting. This automation not only reduces the workload on human employees but also allows them to focus on more complex and strategic activities, thereby increasing overall productivity. For instance, AI can streamline the process of verifying customer identities, significantly reducing manual effort and improving accuracy (Fares et al., 2022; Noreen et al., 2023; Rahman et al., 2021; Königstorfer & Thalmann, 2020). This shift towards automation is critical in an environment where banks are pressured to enhance service delivery while simultaneously managing operational costs, a balance that AI facilitates effectively (Sheth et al., 2022 ;Lazo & Ebardo, 2023).

AI algorithms excel at analyzing vast amounts of transaction data to identify patterns and anomalies that may indicate fraudulent activity. By leveraging AI, banks can enhance their fraud detection capabilities, resulting in a significant reduction in fraudulent transactions and

associated losses. For example, AI-powered systems can continuously monitor customer behavior and transaction patterns to detect suspicious activities, enabling banks to take preventive measures promptly (Cao, 2022; Cao,2020; Fares et al., 2022; Königstorfer & Thalmann, 2020; Noreen et al., 2023; Srinadi, 2023; Rahman et al., 2021). The role of AI in fraud detection underscores its importance in maintaining trust and security in digital banking environments, where the volume and complexity of transactions pose significant challenges (Cao, 2022).

AI significantly enhances the accuracy of credit risk assessments by analyzing a wide range of data points, including borrowers' financial histories, income levels, and spending patterns. This data-driven approach allows banks to make more informed lending decisions, which in turn improves portfolio performance and minimizes potential losses. For instance, a bank might use AI to evaluate the creditworthiness of loan applicants more accurately, leading to better loan approval decisions and reduced default rates (Cao, 2022; Cao,2020; Fares et al., 2022; Noreen et al., 2023; Srinadi, 2023; Rahman et al., 2021). This precision in credit risk assessment is especially valuable in ensuring that banks can manage risk effectively, particularly in volatile market conditions where traditional methods may fall short (Gigante & Zago, 2022).

AI's ability to analyze customer data at scale enables banks to tailor their marketing efforts and customer service strategies more effectively. By identifying trends and insights within customer data, AI helps banks develop personalized product offerings and marketing campaigns, thereby improving customer engagement and satisfaction. For example, a bank might use AI to identify customers who are most likely to be interested in a new investment product, thereby focusing its marketing resources more effectively (Königstorfer & Thalmann, 2020; Sheth et al., 2022 ;Lazo & Ebardo, 2023). This capability not only enhances customer loyalty but also drives profitability by aligning product offerings more closely with customer needs and preferences (Noreen et al., 2023; Rahman et al., 2021).

In the domain of asset management, AI provides banks with advanced tools to analyze market data, economic indicators, and customer preferences. These insights enable the development of sophisticated, data-driven investment strategies that optimize asset allocation and generate higher returns. For instance, AI can help a bank identify investment opportunities based on real-time market trends, leading to improved portfolio performance (Königstorfer & Thalmann, 2020; Sheth et al., 2022; Gigante & Zago, 2022). AI’s role in asset management is indicative of its broader impact on financial services, where predictive analytics and real-time

data processing are becoming increasingly vital for maintaining competitive advantage (Fares et al., 2022).

Compliance with regulatory requirements is a critical aspect of banking operations, and AI plays a key role in automating compliance monitoring and regulatory reporting. By doing so, AI helps banks ensure that they meet all applicable regulations, thereby minimizing the risk of penalties. For example, AI can automate the monitoring of compliance with anti-money laundering regulations by detecting suspicious transactions and reporting them to authorities in real-time (Cao, 2022; Cao,2020; Fares et al., 2022; Königstorfer & Thalmann, 2020; Northey et al., 2022; Srinadi, 2023; Rahman et al., 2021). The ability of AI to handle complex compliance tasks not only reduces the risk of human error but also allows banks to respond more swiftly to regulatory changes, thus maintaining operational integrity and minimizing legal risks (Lazo & Ebardo, 2023).

Benefits of AI in Internal Process Optimization

The implementation of AI in banking's internal processes yields several significant benefits. By automating routine tasks, AI reduces the manual effort required for operations, allowing banks to operate more efficiently. Automation of processes through AI leads to lower labor costs and minimizes the errors associated with manual operations, resulting in substantial cost savings. AI algorithms excel at data analysis, reducing the likelihood of errors and enhancing the accuracy of decision-making processes (Northey et al., 2022; Fares et al., 2022; Königstorfer & Thalmann, 2020; Rahman et al., 2021). In addition, AI’s capacity to deliver real-time insights into operational performance provides banks with the agility needed to adapt to market changes swiftly and efficiently (Sheth et al., 2022). Through advanced fraud detection, accurate credit risk assessments, and effective compliance monitoring, AI contributes to more robust risk management practices within banks (Fares et al., 2022; Königstorfer & Thalmann, 2020; Lazo & Ebardo, 2023). Moreover, AI's ability to provide personalized customer interactions and tailored product offerings significantly enhances customer satisfaction and loyalty (Königstorfer & Thalmann, 2020; Rahman et al., 2021; Sheth et al., 2022 ;Lazo & Ebardo, 2023; Gigante & Zago, 2022). As AI continues to evolve, its role in internal process optimization is likely to expand, offering even greater potential for innovation, efficiency, and growth in the banking sector (Noreen et al., 2023).

2.4.3 Enhancing Customer Satisfaction and Engagement with AI

AI enhances customer satisfaction in banking by improving various aspects of the customer experience. Several studies underscore these benefits, emphasizing the pivotal role of AI in delivering personalized, efficient, and user-friendly banking services.

AI-driven personalization plays a significant role in enhancing customer satisfaction. Gigante and Zago highlight that personalized recommendations based on deep analytics can help customers achieve their saving goals, improve money management skills, and boost overall satisfaction. Additionally, the automation of recurring payments and the delivery of tailored alert messages can enhance convenience and reduce anxiety related to potential overspending or insufficient funds. This level of personalization is further supported by AI's ability to tailor services and communications to individual customer preferences, ensuring that interactions are relevant and valuable (Gigante & Zago, 2022).

Another critical aspect of AI's impact on customer satisfaction is efficiency and responsiveness. According to Northey et al., AI can significantly improve customer satisfaction by automating tasks and providing quicker responses, especially for low-complexity inquiries. This efficiency is crucial in today's fast-paced banking environment, where customers expect immediate solutions to their problems (Northey et al., 2022). Similarly, Rahman et al. emphasize the role of AI-powered chatbots in providing 24/7 customer support, handling a high volume of inquiries, and guiding customers through complex financial tasks. These capabilities not only enhance customer understanding and financial well-being but also contribute to a more satisfying banking experience (Rahman et al., 2021).

Proactive engagement is another way AI drives customer satisfaction. AI can proactively reach out to customers with relevant information and offers based on their individual needs and behaviors. This approach fosters a sense of connection with the bank and encourages customers to engage more deeply with the services offered. By anticipating customer needs and addressing them before they become issues, AI can significantly enhance customer satisfaction and loyalty (Ooi et al., 2023).

Personalized communication facilitated by AI also contributes to higher customer satisfaction levels. AI enables banks to tailor communication to individual customers' preferences, including sending targeted messages, offering relevant notifications, and using language and tone that resonate with each customer. This tailored communication strategy ensures that

customers feel valued and understood, which is crucial for maintaining high levels of satisfaction (Noreen et al., 2023).

Enhanced financial literacy through AI-driven tools is another factor that contributes to customer satisfaction. AI-powered tools, such as financial management apps, help customers better understand their finances by offering insights into spending habits, providing budgeting assistance, and suggesting ways to improve financial well-being. This educational aspect of AI not only empowers customers but also strengthens their engagement with the bank (Sheth et al., 2022).

Measuring customer engagement and satisfaction in AI-driven banking services requires a multifaceted approach, considering the unique characteristics of these technologies. Various studies highlight key metrics and considerations to effectively gauge these aspects.

Usage Metrics are crucial in understanding how frequently and actively customers use AI-enabled features within banking services. Metrics such as app usage frequency, feature utilization rates, time spent on AI-driven platforms, transaction volume through AI channels, and engagement with chatbots or virtual assistants are essential indicators of how well these technologies are being adopted (Alnaser et al., 2023; Payne et al., 2021; Fares et al., 2022; Northey et al., 2022).

Feedback and Sentiment Analysis involve capturing customer feedback and analyzing sentiment towards AI-driven features. Methods such as customer surveys, Net Promoter Score (NPS), social media monitoring, review analysis, and text analysis of chat logs provide valuable insights into how customers perceive AI-driven services and their overall satisfaction with these innovations (Payne et al., 2021; Tulcanaza-Prieto et al., 2023; Chauhan et al., 2022; Prentice & Nguyen, 2020).

Behavioral Metrics offer insights into customer actions and behaviors related to AI-driven services. Metrics such as click-through rates, conversion rates, retention rates, and customer churn rates help banks understand the effectiveness of AI in engaging customers and maintaining their loyalty (Chauhan et al., 2022; Prentice & Nguyen, 2020).

Satisfaction and Experience Metrics measure how satisfied customers are with the AI-driven features and their overall experience. Customer satisfaction scores, user experience surveys, perceived usefulness, and perceived ease of use are crucial indicators of how well AI-driven

services meet customer expectations and contribute to a positive banking experience (Alnaser et al., 2023; Chauhan et al., 2022; Tulcanaza-Prieto et al., 2023).

Trust and Security Metrics address customer concerns around data security and privacy, which are paramount for AI-driven banking. Trust in AI-driven systems, perceived risk, and data security measures are critical factors in ensuring that customers feel confident in using AI-powered banking services (Northey et al., 2022; Tulcanaza-Prieto et al., 2023; Bharti, 2023).

By employing a combination of these metrics, banks can gain a comprehensive understanding of how customers perceive and engage with AI-driven banking services, ultimately improving customer experience and driving satisfaction.

2.5 Challenges and Consideration in AI Integration

As AI technologies continue to transform the customer experience in the banking sector, it is crucial to address the various challenges and considerations that come with their integration. In this chapter, the most pressing challenges and considerations in AI integration within the European banking sector, focusing on regulatory compliance, data privacy and security, ethical concerns, and customer and employee trust and acceptance will be explored. Understanding and addressing these issues are essential for banks to navigate the complexities of AI adoption and fully leverage its potential in enhancing customer experiences.

2.5.1 Data Privacy, Regulatory Concerns and Sustainability Concerns

The integration of AI in the European banking sector brings significant challenges related to data privacy and regulatory compliance. As AI systems increasingly handle vast amounts of sensitive customer data, ensuring compliance with existing regulations like the General Data Protection Regulation (GDPR) becomes critical. The GDPR mandates strict guidelines on data collection, processing, and storage, emphasizing the need for explicit consent from individuals, the right to be forgotten, and the implementation of robust data security measures. For AI systems, which often rely on large datasets and continuous data flow, navigating these requirements can be particularly challenging (Quezada-Tavárez et al., 2022).

One of the primary concerns is the difficulty in ensuring transparency and accountability in AI systems. AI's inherent complexity, particularly in machine learning models that operate as "black boxes," makes it challenging to provide clear explanations for how decisions are made. This opacity can conflict with GDPR's requirement for transparency and the ability of

individuals to understand and challenge decisions made by automated systems (Königstorfer & Thalmann, 2020).

To address these issues, the European Union is developing the AI Act, a landmark regulatory initiative that introduces a risk-based approach to AI regulation. The AI Act categorizes AI systems into different risk levels: minimal risk, high risk, and unacceptable risk. High-risk AI systems, which include applications in the banking sector such as credit scoring and anti-money laundering, will be subject to stringent requirements, including robust documentation, risk mitigation strategies, and human oversight (Mazzini & Bagni, 2023; Enqvist, 2023 Pavlidis, 2024; Regulation - EU - 2024/1689 - EN - EUR-LEX, 2024). The AI Act emphasizes explainability, ensuring that AI decisions can be understood and audited by human operators, which is crucial for maintaining trust in AI-driven banking services (Pavlidis, 2024).

The AI Act's deadlines for compliance are pivotal for the banking industry. Member States must designate national authorities to enforce AI regulations by 2 August 2025, and companies must comply with the Act by 2 August 2026. Non-compliance could result in significant fines, up to 7% of global annual turnover for violations of banned AI applications and up to 3% for other obligations (European Commission, 2024).

In addition to the AI Act, the upcoming Cyber Resilience Act will also impact AI integration in banking by mandating that all products connected directly or indirectly to another device or network comply with specific cybersecurity requirements by 2027 (Digital Strategy, 2024). This regulation underscores the importance of secure-by-design systems and continuous alignment between legal requirements and technological capabilities (Hamon et al., 2024).

The ongoing evolution of these regulatory frameworks highlights the complexity of AI integration in the banking sector. Banks must not only adapt to these stringent legal requirements but also proactively develop systems that prioritize data privacy, transparency, and security to maintain customer trust and comply with European regulations. Failure to address these concerns could lead to significant legal and reputational risks, undermining the potential benefits of AI in enhancing customer experiences (Hoxhaj et al., 2023 Rességuier & Ufert, 2023).

While AI presents vast opportunities for enhancing customer experience and operational efficiency in banking, it is crucial to address sustainability challenges to ensure long-term viability. AI holds significant potential to contribute to sustainability across various sectors, including renewable energy, environmental health, and the achievement of sustainable

development goals (SDGs). However, the rapid development and deployment of AI technologies present substantial environmental challenges. AI systems, particularly those involving large-scale machine learning models, require significant computational resources, which, in turn, result in high energy consumption and increased carbon emissions. This environmental impact raises concerns about the sustainability of AI and underscores the need for the adoption of practices that reduce the ecological footprint of AI technologies (Halsband, 2022; Rohde et al., 2024).

The environmental implications of AI include the substantial energy requirements for training and running complex algorithms, which can contribute significantly to carbon emissions. This aspect is particularly critical as the banking sector increasingly adopts AI-driven technologies. Sustainable AI development must, therefore, incorporate energy-efficient practices, leveraging advancements in green computing and optimizing algorithms to reduce energy consumption without compromising performance. Additionally, the lifecycle of AI hardware, from production to disposal, raises concerns about electronic waste and resource depletion, necessitating strategies for responsible sourcing and recycling (Kumar Kar et al., 2022).

Moreover, the concept of intergenerational justice, which emphasizes the ethical responsibility to preserve the environment and resources for future generations, should be a guiding principle in AI development and deployment within the banking sector. This approach ensures that the benefits of AI do not come at the expense of long-term environmental sustainability. It also highlights the need for transparent and revisable AI systems that account for their environmental impact, promoting a balance between technological innovation and the preservation of ecological integrity (Halsband, 2022; Rohde et al., 2024).

To mitigate these environmental impacts, researchers and policymakers advocate developing sustainability frameworks that promote energy-efficient AI models and integration of renewable energy sources into AI infrastructure. These efforts aim to ensure that AI technologies contribute positively to environmental sustainability without compromising their effectiveness. Moreover, the convergence of AI with other technologies, such as blockchain and IoT in smart city architectures, offers promising solutions for urban sustainability challenges, provided these systems are designed with environmental considerations at their core (Singh et al., 2020; Vinuesa et al., 2019). As AI continues to evolve, its role in advancing sustainability will depend heavily on how these environmental challenges are addressed through both technological innovation and regulatory measures.

2.5.2 Ethical Concerns and Bias in AI

The integration of AI in banking, while offering substantial benefits, also raises significant ethical concerns, particularly regarding bias and fairness. As AI systems become more embedded in customer-facing applications, the potential for these technologies to perpetuate existing biases or create new forms of discrimination has become a critical issue. Ethical concerns in AI primarily revolve around issues such as algorithmic bias, transparency, accountability, and the potential for AI systems to reinforce social inequalities.

Algorithmic bias refers to the systematic and repeatable errors in AI systems that lead to unfair outcomes, such as privileging one group over another based on race, gender, or other characteristics. This bias often originates from the data on which these systems are trained. For instance, if historical data used to train an AI system reflects existing societal biases, these biases can be inadvertently embedded into the AI's decision-making processes (Saeidnia, 2023; Aquino, 2023). In the banking sector, this can manifest in various ways, such as discriminatory lending practices, biased credit scoring, and unequal access to financial services. The use of AI in these areas can perpetuate existing disparities, making it harder for marginalized communities to achieve financial equity (Khan & Umer, 2024).

Recent studies have highlighted significant concerns regarding gender and racial biases in AI-generated content, particularly from large language models like ChatGPT and LLaMA. These biases not only affect the outputs of AI systems but can also influence human users who interact with these systems, potentially reinforcing and spreading biased views in society (Xiao Fang et al., 2023; Vicente & Matute, 2023). For example, in medical diagnostics, studies have shown that even after AI assistance is removed, participants continued to exhibit biases inherited from the AI system, demonstrating the deep impact these technologies can have on decision-making processes (Vicente & Matute, 2023).

Another significant ethical concern is the lack of transparency and explainability in AI systems. Many AI models, particularly those based on deep learning, operate as "black boxes," where the decision-making process is not easily interpretable by humans. This opacity poses a challenge in the financial sector, where regulatory compliance and consumer trust are paramount (Nishant et al., 2023). Without a clear understanding of how AI systems arrive at their decisions, it becomes difficult to identify and mitigate potential biases, leading to a lack of accountability.

Explainable AI (XAI) is emerging as a potential solution to these issues. XAI aims to make AI systems more transparent by providing insights into the decision-making processes of these systems, thereby improving their interpretability and trustworthiness. In the context of financial services, XAI can help ensure that AI-driven decisions are fair, accountable, and compliant with ethical standards (Chen et al., 2023). However, the implementation of XAI is still in its early stages, and significant challenges remain in balancing the trade-off between transparency and the performance of AI models.

To address these ethical concerns, researchers and practitioners are advocating for the development of robust bias mitigation strategies. These strategies include pre-training, training, and post-training interventions designed to reduce bias in AI models. For example, using causal models to create fair datasets during the training phase can help minimize the introduction of biases (González-Sendino et al., 2024). Additionally, inclusive design principles, which involve diverse stakeholders in the development and evaluation of AI systems, are crucial for ensuring that these technologies do not disproportionately disadvantage any particular group (Varsha, 2023).

Furthermore, the financial sector must prioritize algorithmic transparency and accountability by implementing regular audits and evaluations of AI systems to detect and correct biases. This approach will not only help in maintaining regulatory compliance but also in building consumer trust in AI-driven services (Akter et al., 2023). The proactive management of algorithmic bias, coupled with the adoption of ethical AI practices, is essential for ensuring that the integration of AI in banking enhances customer experience without compromising fairness or equity.

2.5.3 Integration with Legacy Systems and Operational Scalability

Integrating AI into the existing IT infrastructures of banks, particularly those reliant on legacy systems, presents a multifaceted challenge. Legacy systems, characterized by outdated technology and limited flexibility, often hinder the seamless adoption of AI. These systems were not designed to handle the advanced computational requirements of AI technologies, leading to compatibility issues and significant technical complexity in implementation (Lazo & Ebardo, 2023; Payne et al., 2021). According to Haefner et al., managing data effectively and ensuring that the technical infrastructure can support AI systems are crucial aspects of enabling successful AI integration and scaling in organizations (Haefner et al., 2023). Research highlights that banks must invest in robust infrastructure upgrades and specialized

expertise to bridge this compatibility gap and ensure smooth AI integration (Lazo & Ebardo, 2023; Payne et al., 2021).

One of the primary hurdles in integrating AI with legacy systems is the inherent lack of scalability. Legacy systems, by design, lack the flexibility needed to scale AI solutions effectively as a bank's operations grow (Payne et al., 2021). This limitation not only affects the ability of AI systems to handle increasing data volumes and transaction complexities but also restricts the potential for AI to deliver enhanced customer experiences at scale (Fares et al., 2022). Firms need to consider both technical and social components, such as developing a data pipeline and establishing the right organizational structure, to successfully implement and scale AI systems (Haefner et al., 2023). Effective change leadership is essential for overcoming these challenges, as it ensures that both the technical and human aspects of scaling AI are addressed in tandem, thereby enabling the organization to adapt more fluidly to the demands of AI technologies (Wijayati et al., 2021). To overcome these challenges, banks are urged to consider comprehensive infrastructure overhauls, including upgrading older systems and investing in scalable, flexible platforms that can support AI applications in the long term (Payne et al., 2021; Fares et al., 2022).

Moreover, the regulatory and compliance landscape poses additional challenges when integrating AI into legacy systems (R. Al-Shabandar et al., 2019). While regulatory challenges have been discussed in the previous chapters, legacy systems may not be equipped to provide the necessary documentation and model transparency, further complicating compliance efforts (R. Al-Shabandar et al., 2019). In the production phase, companies must ensure that their data infrastructure is well-organized to support compliance and scalability, enabling AI systems to handle a wide variety of business processes efficiently (Haefner et al., 2023). The leadership is incredibly important in ensuring that compliance measures are not only met but also integrated into the broader strategic vision for AI, thereby reducing resistance and aligning AI initiatives with regulatory expectations (Wijayati et al., 2021). As a result, banks must implement robust model management practices and vendor management strategies to mitigate these risks and align with evolving regulatory standards (R. Al-Shabandar et al., 2019).

Data integration is another critical aspect of AI scalability (Ooi et al., 2023). Effective AI implementation requires seamless integration with existing data warehouses and databases, which can be a time-consuming and complex process when dealing with legacy systems (R. Al-Shabandar et al., 2019). Strategic data management practices, along with investments in data integration tools, are essential to facilitate the smooth operation of AI systems as a bank's

operations expand (Ooi et al., 2023). A strong technical foundation, including data pipeline development and infrastructure optimization, is key to scaling AI systems effectively (Haefner et al., 2023). Aligning these technical efforts with a clear leadership vision and employee engagement strategies is crucial for ensuring that the technological advancements are supported by a workforce that is prepared and motivated to work with AI (Wijayati et al., 2021). This integration ensures that AI solutions can scale efficiently, allowing banks to maintain a competitive advantage in a rapidly evolving market (Ooi et al., 2023; R. Al-Shabandar et al., 2019).

The successful scaling of AI operations also hinges on effective change management, particularly in relation to employee training and preparedness (Wijayati et al., 2021). The introduction of AI into banking requires a cultural shift within organizations, where employees are not only equipped with the necessary skills but are also prepared to adapt to new technologies (Bhargava et al., 2020). Haefner et al. stress the importance of creating the right organizational context, which includes setting a clear AI growth vision and building technical and domain capabilities among employees (Haefner et al., 2023). Change leadership is instrumental in driving this cultural shift, particularly by promoting work engagement and aligning employee goals with the broader objectives of AI integration (Wijayati et al., 2021). This shift involves fostering a culture of continuous learning, where employees are trained and reskilled to work effectively alongside AI systems (Bhargava et al., 2020). Managers play a crucial role in this process, providing the leadership necessary to guide teams through the transition and ensure that the workforce is ready to leverage AI capabilities (Wijayati et al., 2021; Bhargava et al., 2020).

Moreover, managing employee perceptions of AI is critical for successful adoption (Rahman et al., 2021). Concerns about job security, the need for continuous learning, and varying levels of digital readiness among staff can create resistance to AI integration (Gfrerer et al., 2020). Haefner et al. identify the development of a suitable organizational structure and the promotion of AI champions within the organization as key strategies to foster acceptance and drive the adoption of AI technologies (Haefner et al., 2023). Wijayati notes that Change Leadership can significantly mitigate these concerns by fostering a supportive environment that encourages open communication and addresses employee anxieties directly, thereby enhancing overall engagement and facilitating smoother AI integration (Wijayati et al., 2021). Targeted training programs, clear communication, and efforts to align employee and

management perspectives on digital readiness are essential strategies to address these concerns and foster a positive attitude towards AI (Gfrerer et al., 2020; Rahman et al., 2021).

2.5.4 Customer Trust and Acceptance

Customer trust and acceptance are foundational to the successful integration of AI-driven services in the banking sector. As AI technologies increasingly permeate customer service environments, the factors influencing trust, such as transparency, reliability, and data privacy, become critical to ensuring positive customer experiences and sustained engagement with these advanced systems (Ameen et al., 2020; Trawnih et al., 2022; Prentice & Nguyen, 2020).

Transparency emerges as a key determinant of customer trust in AI-driven services. When customers are provided with clear and comprehensible information about how AI systems function, including the purpose behind data collection and analysis, their trust in these technologies increases significantly. For example, research highlights that customers are more likely to trust AI systems if they are aware of the systems' capabilities in terms of convenience, security, interface design, and customer support (Ameen et al., 2020). Similarly, the importance of making the algorithmic processes and goals of deploying AI transparent to maintain and build trust has been emphasized. These insights suggest that transparency is not just a technical requirement but a critical strategy for fostering trust and ensuring the successful adoption of AI services in banking (Trawnih et al., 2022).

Reliability is another factor influencing customer trust. Customers often compare the reliability of AI tools with human assurance, particularly in contexts where safety and comfort are paramount. While AI can minimize errors, it must consistently deliver accurate and dependable results to gain and maintain customer trust (Prentice & Nguyen, 2020). The successful implementation of AI in customer service, as seen in the case of Uniqlo where AI-driven systems led to a high rate of customer purchases, demonstrates the impact of reliability on customer engagement and satisfaction. This example illustrates that when AI systems perform reliably, they not only enhance customer trust but also drive higher levels of customer interaction and transaction completion (Xu et al., 2020).

Data privacy concerns further complicate the landscape of customer trust in AI. As AI technologies often require extensive data collection, customers may perceive these practices as intrusive, leading to apprehension about their personal information being mishandled. Research notes that customers are particularly wary of new technologies that collect their data, emphasizing the need for transparent privacy policies to alleviate these concerns (Chen

& Prentice, 2024). Moreover, it is argued that trust must be built around the responsible handling of sensitive customer data, particularly in the context of banking, where data security is of utmost importance. These findings suggest that demonstrating a strong commitment to data privacy is essential for fostering trust and acceptance of AI-driven services (Königstorfer & Thalmann, 2020).

Building customer trust, therefore, requires a multifaceted approach that includes clear communication, reliable service delivery, and robust data privacy practices (Trawnih et al., 2022; Chen & Prentice, 2024; Königstorfer & Thalmann, 2020). Effective communication about the benefits of AI and its role in enhancing the banking experience is crucial. Customers should be informed about how AI systems support their transactions securely and how their data is used to develop tailored financial products (Mogaji, 2021). Furthermore, strategies that emphasize the value of AI to customers, such as the use of AI-powered chatbots to provide 24-hour customer service, can significantly improve customer satisfaction and engagement (El-Gohary, 2021)

Trust and acceptance are also closely linked to the perceived quality of the AI-powered customer experience. Research highlights that trust mediates the relationship between AI-powered service quality, personalization, and perceived sacrifice (Trawnih et al., 2022). When customers perceive AI-driven services as convenient, personalized, and of high quality, they are more likely to develop a strong sense of trust in the brand and its technology (Ameen et al., 2020). This trust, in turn, enhances the overall customer experience, leading to increased satisfaction and loyalty (Trawnih et al., 2022).

The research suggests that customer trust and acceptance are essential drivers of positive customer experiences with AI-powered services (Trawnih et al., 2022; Ameen et al., 2020; Xu et al., 2020). Achieving these outcomes requires a strategic focus on transparency, reliability, data privacy, and effective communication (Chen & Prentice, 2024; Königstorfer & Thalmann, 2020). By addressing these factors, banks can not only build trust in their AI-driven services but also leverage these technologies to create more engaging, satisfying, and secure customer experiences in an increasingly digital banking landscape (Mogaji, 2021; El-Gohary, 2021).

2.6 AI in Banking: Dynamic Capabilities, Disruptive Innovation, Both, or Neither?

AI in the banking sector exemplifies how advanced technologies can function simultaneously as dynamic capabilities and drivers of disruptive innovation (Barreto, 2010). The specific impact of AI on these two strategic concepts is contingent on its implementation and the contextual environment within which it operates. This chapter explores AI's dual role in banking, examining how it enhances dynamic capabilities while also serving as a catalyst for disruptive innovation, thereby reshaping the industry (Abou-Foul et al., 2023; Pereira, 2024; Gallego-Gomez & Pablos-Heredero, 2020).

Dynamic capabilities are defined as a firm's ability to efficiently manage resources to adapt to evolving market conditions and seize emerging opportunities. Within the banking sector, AI significantly strengthens these capabilities, enabling institutions to remain agile and responsive in an increasingly dynamic digital landscape. AI applications enhance a bank's capacity to sense market trends and identify new opportunities. By analyzing vast datasets, AI allows banks to detect subtle shifts in consumer behavior, market demands, and emerging risks, thereby facilitating more informed and timely strategic decisions (Abou-Foul et al., 2023; Chen et al., 2023; Gallego-Gomez & Pablos-Heredero, 2020).

In addition to sensing opportunities, AI enhances a bank’s capacity to effectively seize them. By automating processes and optimizing resource allocation, AI enables banks to mobilize assets swiftly and efficiently in response to market changes. This capability is crucial in the banking sector, where the ability to act quickly on emerging opportunities can provide a significant competitive advantage. AI's role in resource mobilization is particularly pivotal, as it enhances operational efficiency and supports the development of innovative products and services that are closely aligned with evolving customer needs (Abou-Foul et al., 2023; Gallego-Gomez & Pablos-Heredero, 2020).

Moreover, AI facilitates the reconfiguration of banking operations, allowing institutions to adapt their business models and internal processes to align with new market realities. This continuous renewal is essential for maintaining competitiveness in a dynamic environment. AI drives business model innovation and enables the absorption of new knowledge, both of which are crucial for long-term strategic success (Herrmann & Masawi, 2022; Abou-Foul et al., 2023; Gallego-Gomez & Pablos-Heredero, 2020). Gallego-Gomez & Pablos-Heredero (2020) highlight that AI aids banks in reconfiguring their processes and strategies to enhance

efficiency and competitiveness, including automating repetitive tasks and optimizing resource allocation. Their analysis of real-world examples, such as Mastercard's AI-driven conversational applications, Royal Bank of Scotland's AI-enhanced customer service through Luvo, and CaixaBank's integration of IBM Watson, demonstrates AI's crucial role in enhancing dynamic capabilities (Gallego-Gomez & Pablos-Heredero, 2020).

Disruptive innovation is characterized by the process through which new technologies and business models challenge established market players, often beginning within niche markets before expanding into the mainstream. AI has played a transformative role in driving such innovation within the banking sector. Traditional banks are increasingly facing competition from fintech companies that leverage AI to offer specialized financial services. These fintechs typically target underserved segments, such as small and medium-sized enterprises or specific industries, offering more efficient, affordable, and accessible solutions compared to traditional banking services (Herrmann & Masawi, 2022; Pereira, 2024; Gallego-Gomez & Pablos-Heredero, 2020).

The rise of fintech companies exemplifies how AI can act as a disruptive force within the banking industry. By providing innovative financial services tailored to niche markets, these new entrants challenge the established norms of traditional banking. This disruption is not limited to market entry; it extends to altering customer expectations and redefining service delivery models. AI-powered solutions enable fintechs to offer personalized, convenient, and cost-effective services, which, in turn, pressures traditional banks to innovate or risk losing market share to these agile competitors (Herrmann & Masawi, 2022; Pereira, 2024; Gallego-Gomez & Pablos-Heredero, 2020).

AI’s influence in the banking sector cannot be confined to either dynamic capability or disruptive innovation alone; rather, it often encompasses both roles simultaneously. On one hand, AI enhances the dynamic capabilities of banks by enabling them to adapt to shifting market conditions, optimize their operations, and create new value propositions. This adaptability is critical for banks seeking to maintain a competitive edge in an increasingly digital economy. AI drives continuous innovation within traditional banking institutions, helping them to evolve and meet the demands of modern consumers (Abou-Foul et al., 2023; Herrmann & Masawi, 2022; Gallego-Gomez & Pablos-Heredero, 2020).

On the other hand, AI serves as a powerful catalyst for disruptive innovation. It empowers fintech companies to challenge the traditional banking sector by offering more innovative,

accessible, and efficient financial services. The disruptive potential of AI lies in its capacity to enable new business models that can outpace the slower, more established processes of traditional banks. As a result, AI not only enhances the operational capabilities of existing banks but also fosters the rise of new competitors that redefine the financial services landscape (Herrmann & Masawi, 2022; Pereira, 2024; Gallego-Gomez & Pablos-Heredero, 2020).

AI in banking is thus a complex and multifaceted phenomenon, embodying both dynamic capability and disruptive innovation. Its impact on the banking sector is contingent upon how it is leveraged by both traditional banks and fintech companies. As illustrated by Gomez & Pablos-Heredero (2020), AI enables banks to adapt to the ever-changing market, innovate, and maintain a competitive edge. This dual role of AI, as both a dynamic capability and a driver of disruptive innovation, underscores its strategic importance in shaping the future of the banking industry (Gallego-Gomez & Pablos-Heredero, 2020).

3 Methodology (Analysis)

This chapter outlines the research methodology employed in this study, encompassing the research design, data collection methods, and data analysis procedures.

3.1 Research Design

The research design was developed to explore the impact of AI on CX and to analyze the strategic implications this may have for the European banking sector. Both primary and secondary data were gathered for this purpose, as illustrated in **Figure 14.**

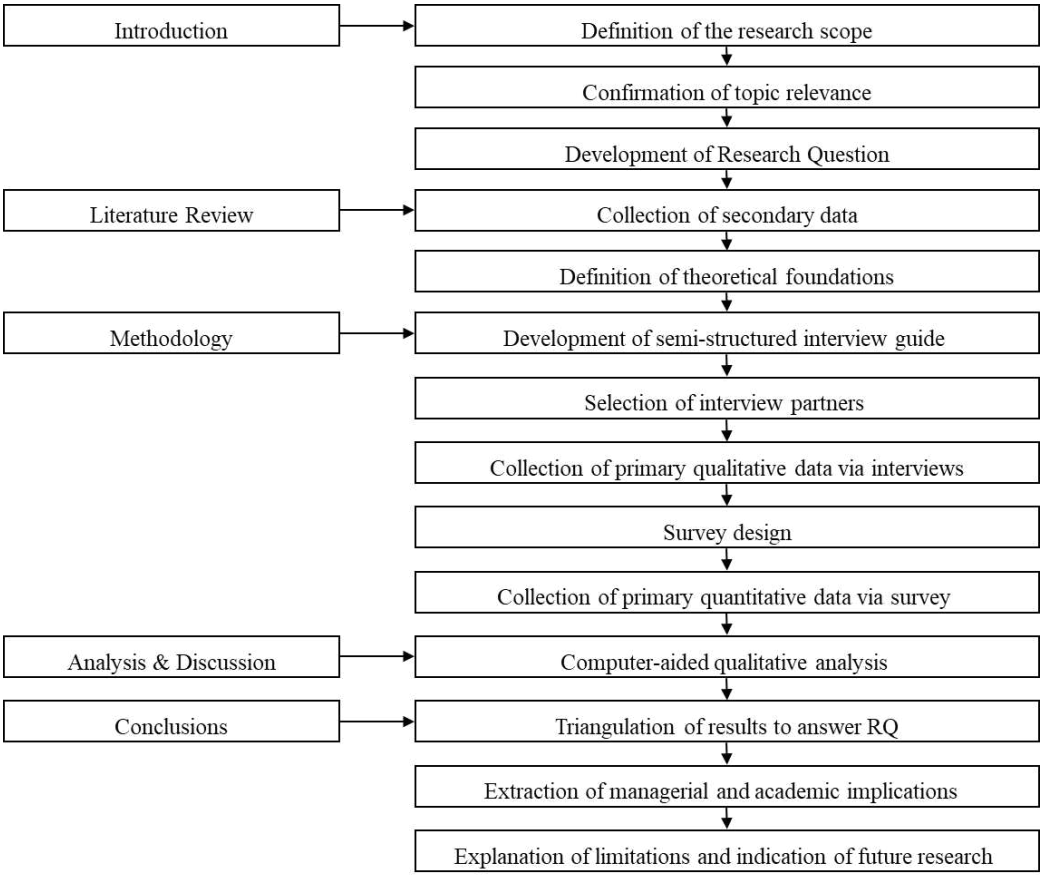

Figure 14 Research Design

The following sections describe the data collection and analysis processes for both secondary and primary data. An overview of these processes is provided in **Figure 15**. The thesis was entirely written by the author, with all ideas being original, while ChatGPT was used solely to improve sentence and paragraph structure as well as grammar.

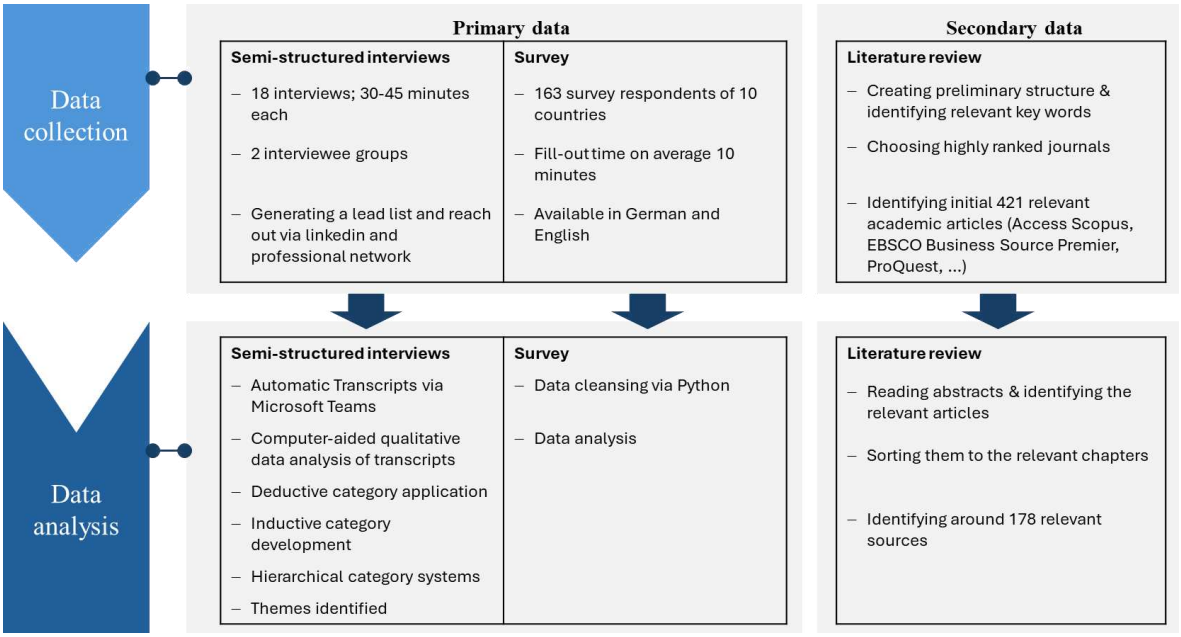

Figure 15 Overview Methodology

3.2 Data collection

3.2.1 Secondary Data – Literature Review

The secondary data collection involved systematic review of various databases, including Scopus, EBSCO Business Source Premier, and ProQuest, along with an examination of official government regulations. As depicted in **Figure 16**, a multi-step process was followed, which resulted in the identification of 75 relevant sources. Additional sources were selected through cross-referencing and direct searches for specific topics, such as AI technologies and their impact on banking and customer experience. Furthermore, the AI tool Elicit was used to identify additional sources for each chapter, both in total leading to the inclusion of 100 additional references. Finally 178 references were used for the literature review.

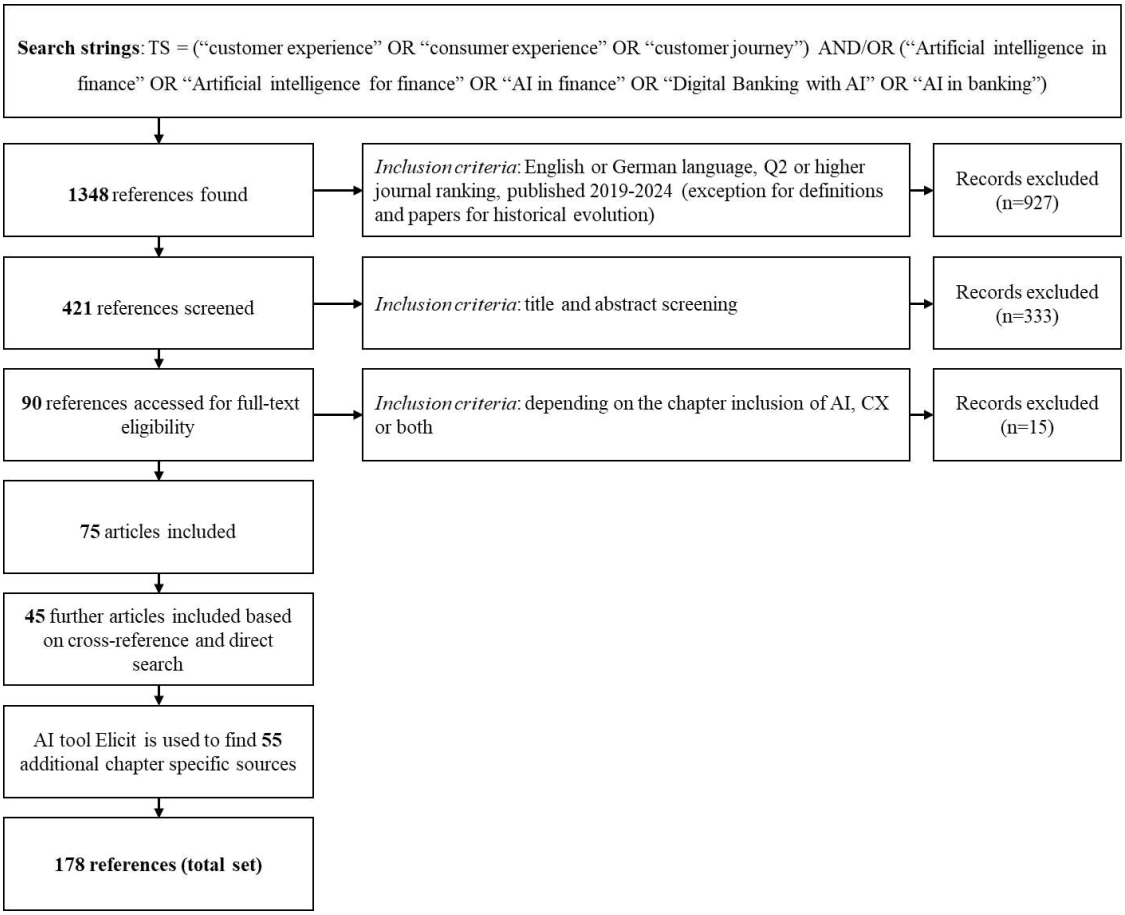

Figure 16 Secondary Data Collection Process

3.2.2 Primary Data – Expert Interviews

The expert interviews in this research were designed to serve two primary purposes. Firstly, to engage AI experts in discussions to understand the current state of AI technology, future outlooks, and common challenges faced when implementing AI in banks, particularly in the context of CX. Secondly, to assess the current status of AI adoption in banks, focusing on its application in enhancing CX. Based on these objectives, the interview partners were categorized into two groups. The first group included AI experts with a focus on finance or customer experience, such as AI engineers, consultants with AI or banking expertise, and experts from related industries like telecommunications or IT. The second group consisted of senior banking professionals from Austria and Germany, occupying leadership positions (e.g., head of department or higher) and responsible for AI strategy and its practical application in customer or operational contexts.

The goal was to recruit 12-18 participants, with empirical evidence suggesting that this number of interviews typically achieves satisfactory data saturation (Guest et al., 2006). A total of 35 individuals were approached via LinkedIn, identified using keywords such as "AI,"

"banking," and "finance." Six individuals agreed to participate in interviews, while the remaining interviewees were recruited through personal networks in the finance sector, resulting in an additional 12 interviews.

The interviews provided insights into various aspects of AI in the banking sector. The semi-structured format allowed for detailed responses, which informed the survey design and enabled cross-referencing among interviews to gather further information. The interview structure was organized around multiple topics with guiding questions tailored to each participant's level of knowledge and familiarity with the subject matter (see Appendice).

Seventeen of the Eighteen interviews were conducted via Microsoft Teams, while one was an in-person interview, and with the participants' consent, they were recorded and automatically transcribed.

An overview of the 18 interviewees can be found in **Table 1**.

#	**Stakeholder Type**	**Current Position**	**Expertise**	**Years of Experience in Banking/AI**
1	Corporate Finance Advisors (mid-level)	Senior Manager Consulting: Finance and Service Industry, Finland	Advisory finance, cards development, payment and retail banking, customer experience, AI and advanced analytics,	> 20 years banking and financial services/ AI and Advanced Analytics: 3 years
2	Corporate Finance Advisors (senior-level) & Professional Associations	Customer Strategy Advisor/Director for Behavioral Science Design & Advisory in the Finance industry; CBO at a South African Impact Investor, UK	Advisory, Retail Banking, AI Strategy, Internal Capacity Building	>20 years Extensive experience in banking, with a focus on AI and retail banking across sub-Saharan Africa, Western Europe, and Eastern Europe
3	Corporate Finance Advisors (senior-level)	Head of Enterprise Payment Solutions, at a Provider for financial technology	Advisory, Payments, AI, AI Engineering Major,	>25 years in banking and AI

	& Professional Associations	solutions retail and institutional banking, Singapore	Product Development	
4	Operational Management (Banking)	Project Manager, Digital Area, Big regional bank, Digital Services PGK, Austria	Sales, Customer Experience, AI Implementation, Project Management	>10 years
5	Technology Provider for Financial Services	Head of AI for Banking (AI & Data Product Implementation) at a leading global provider of advanced cloud computing services and AI-driven solutions for enterprise customers across various industries, USA	AI and data product implementation, customer problem-solving in large global banks	3 years banking / 25+ years in IT/AI
6	Executive Leadership (C-level)	CIO Group Functions, Group Data & AI Lead at a major European bank, Europe	Strategic Risk Management, Enterprise Architecture, IT Strategy, Data, AI, Finance, Banking	> 18 years in banking/AI, extensive leadership experience in risk, data, and IT strategy
7	Operational Management (Banking)	Head of Department Digital Customer Service at regional bank, Austria	Operational banking, digital customer service, omni-channel management, AI in customer processes, and	> 20 years in banking, including roles in digital transformation and AI implementation

			regulatory compliance	
8	Digital Banking Product Management	Head of Payment Channels at a South Tyrolian bank (IT), Italy	Specializes in digital payment systems, including cards, POS devices, internet banking for both private and corporate customers, and digital payment options	>20+ years, Extensive experience in banking and payment systems management
9	Executive Leadership (C-level)	CFO and Chief AI Officer of one of the biggest telecom and media company in the country, Portugal	Financial Leadership, Corporate Finance, AI Strategy, Digital Strategy, Big Data, IT Strategy	> 15 years of experience, extensive background in AI, digital strategy, and finance leadership
10	Corporate Banking Executive	Group Corporate Steering and Customer Experience B2B at a Major European Bank, Austria	Corporate Steering, Customer Experience, Sales Management, B2B	> 15 years in banking, extensive experience in corporate steering and customer experience management
11	Corporate Banking Executive	Head of Group Business Performance Management at a Major European Bank, Austria	Business Performance Management, Efficiency Management, Organizational Development, Leadership	> 7 years in banking, broad experience in organizational development, business management

12	Corporate Banking Executive	Head of Marketing and Communications at a regional bank in Vienna, Austria	Marketing & Communications, Retail Marketing, Brand Coordination, AI in Marketing	> 15 years in marketing, communications, and project/event management
13	Product Owner	Product Owner - AI, Senior Requirements Engineer / Chief Product Owner at a Major European Bank (Digital Transformation), Austria	AI Product Development, Requirements Engineering, Process Automation, Data Analysis, Digital Transformation, Product Ownership,	>4 years in banking, AI experience in product management and process automation / > 9 years in product management, experience in digital business transformation
14	Strategic Management (Banking)	Strategic Project Lead at a Major European Bank (strategic AI Solutions), Austria	AI Solutions, Business Development, Consulting, Mergers & Acquisitions, Carve-outs, Integrations	> 6 years in banking and consulting, experience in AI-driven customer solutions
15	IT Strategy Executive	IT Office at a Major Swiss Bank/Product Owner, Switzerland	Digital Transformation, Agile Leadership, Business & IT Strategy, AI, Multichannel Management	> 25 years in IT and banking, extensive experience in digital transformation and leadership

16	Digital Transformation Executive	Head of Digital Transformation & Automation at a Private Bank, Germany	Digital Transformation, Automation, AI, Asset Management, Business Development, Strategic Analysis	> 4 years in banking, extensive experience in digital transformation and AI, with a background in quantitative finance
17	Executive Leadership (C-level)	CFO Group Functions at a major European bank, Europe	Finance, Capital Markets, Trading & Sales, Equity Markets, Derivatives	> 25 years in banking, extensive leadership in capital markets and treasury
18	Executive Assistant	Executive Assistant to CFO & COO at a Major European Bank	Business Architecture, Digital Transformation, Strategic Consulting, Data Analysis	> 6 years in banking and data analysis, extensive experience in business architecture and digital transformation

Table 1 Overview Interview Partners

3.2.3 Primary Data – Survey

Building on the insights from the literature review and expert interviews, a survey was designed to assess how banking customers perceive AI within their customer journey. The survey was administered in both German and English and distributed through personal networks as well as within a consultancy. The survey comprised mostly mandatory multiple-choice questions, along with voluntary open-ended questions. On average, participants took eight minutes to complete the survey, and a total of 163 responses were collected between July 28, 2024, and August 19, 2024.

The survey was structured as follows (for details, see Appendice): After providing an explanation of artificial intelligence and customer experience, the survey first gathered basic demographic information. It then explored participants' specific banking experiences with their primary and secondary banks, including their awareness of AI solutions, previous use of such technologies, and how these impacted their customer experience. The final section asked

more general questions regarding the aspects of AI in banking that are most important to them, their primary concerns, whether they would recommend AI solutions to friends, and their willingness to pay for such services. The open-ended questions sought participants' main concerns and wishes regarding AI in banking.

3.3 Data analysis

3.3.1 Primary Data – Expert Interviews

As some of the interviews were held in German, those were translated to English. As a next step a thematic analysis was conducted to explore how AI is driving changes in customer experiences across European banks. The process began with a thorough review of the interview transcripts and the interview guide to identify common themes and patterns. This initial reading helped pinpoint recurring concepts related to AI implementations and their impact on customer experiences.

Using MAXQDA24 software, the qualitative data from the interviews was systematically coded and categorized. This facilitated the identification of key themes directly related to the research question. The software's tools enabled the exploration of relationships between codes, revealing how AI influences banks operations, strategy and various aspects of customer experience in banking.

Several key findings emerged. These findings are being discussed in chapter 4. Individual interviews and the MAXQDA24 code can be found in the Appendic3.

3.3.2 Primary Data – Survey

This section details the methodology used to analyze survey data, exploring customer perceptions of AI in banking. Key stages include data preparation, demographic overview, exploratory data analysis, and regression analysis, all crucial for understanding AI's impact on the European banking sector.

3.3.2.1 Data Preparation

The process began by consolidating responses from both the English and German surveys into a single dataset. Data cleaning addressed missing values and ensured consistency across variables, particularly for translated responses.

3.3.2.2 Demographic Overview

The demographic analysis covered gender, age, geographical distribution, living area classification, education, and employment. The **gender distribution** was balanced (47% women, 53% men), with most respondents aged 26-35, and fewer aged 55+ (see **Figure 17 & 18**)

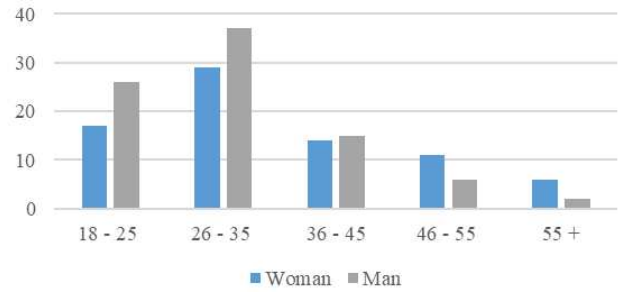

Figure 17 Age distribution based on gender

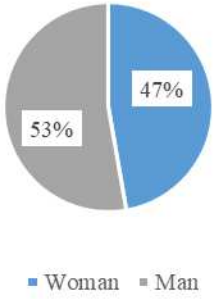

Figure 18 Gender distribution of survey respondents

Geographical data showed that 139 of 163 respondents were from Austria, with smaller representations from other European countries (**Figure 19**).

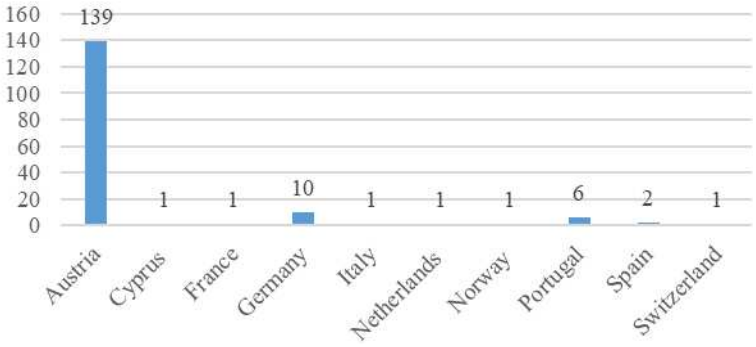

Figure 19 Geographical Distribution of Respondents by Country

Most respondents lived in large cities (111 out of 163), which likely influenced their experiences with AI in banking (see **Figure 20**). The sample was highly educated, with many holding a master's degree (**Figure 21**), and most respondents were employed full-time (64%) across various sectors, especially advisory (59%) (see Figures 21 and 22). The Austrian

majority provided context for the deeper analysis to follow.

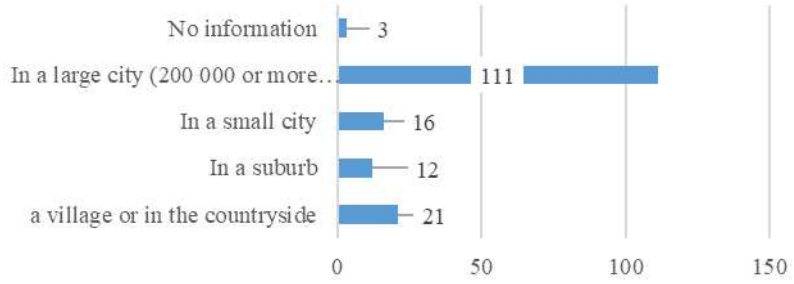

Figure 20 Living Area Classifications of Respondents

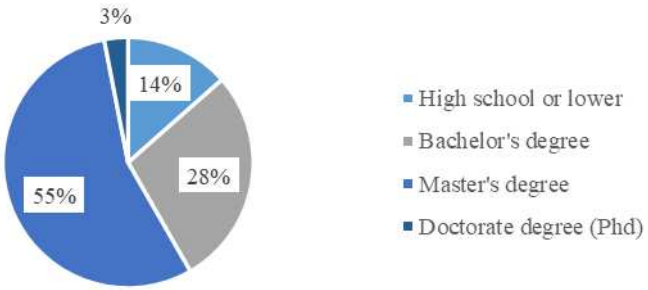

Figure 21 Educational Attainment of Respondents

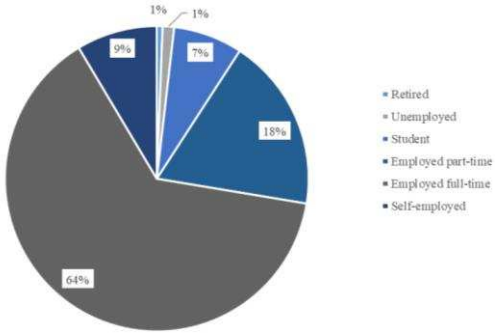

Figure 22 Current Employment Status of Respondents

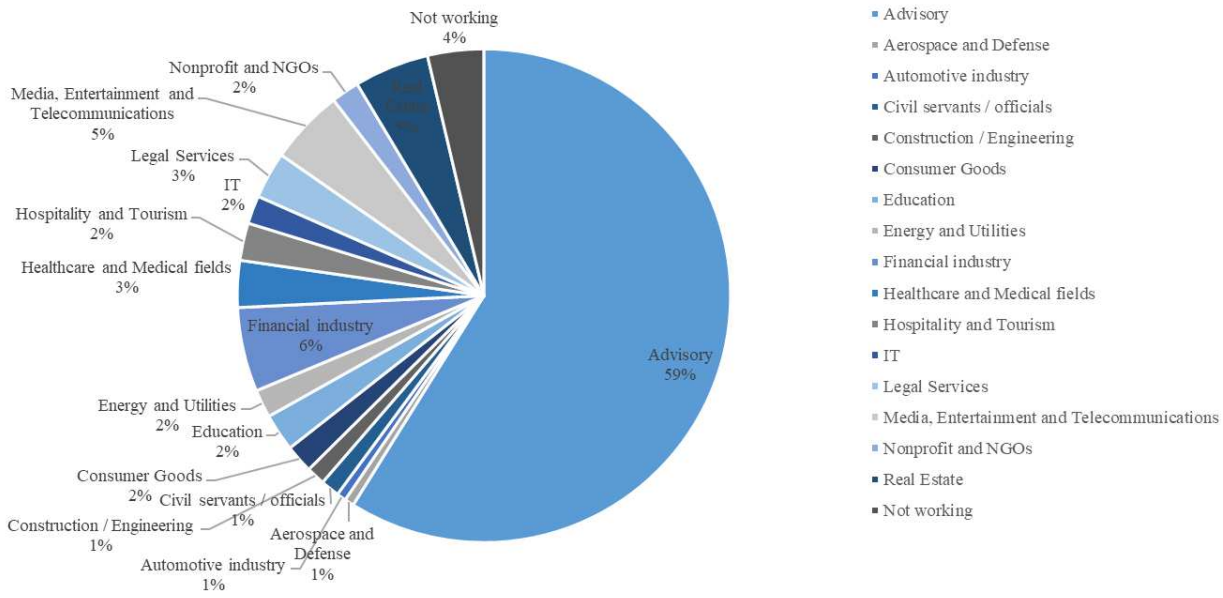

Figure 23 Industry Representation Among Survey Respondents

This demographic overview highlights the characteristics of the survey sample and sets the stage for a deeper analysis. The Austrian majority provided context for the deeper analysis to follow.

3.3.2.3 Exploratory Data Analysis

An exploratory data analysis was conducted to identify patterns, using cross-tabulations to examine relationships between demographic variables and AI awareness. Frequency analysis highlighted how many respondents had used AI-based services in banking. These insights set the stage for the more detailed regression analysis.

3.3.2.4 Regression Analysis

To gain deeper insights into the factors influencing customer perceptions of AI in banking, regression analysis was employed. The objective was to identify key relationships between demographic factors, AI awareness, and the likelihood of engaging with AI-based banking services.

Ordered Logistic Regression was used for ordinal outcomes, like the importance of ease of use or security in banking services. Python was used to fit the regression models, exploring how factors like age, education, and AI awareness impacted customer priorities. The results were analyzed in the context of broader research goals.

3.3.2.5 Interpretation of Results

The results of both the exploratory and regression analyses were interpreted to understand how demographics and AI awareness affect customer satisfaction and engagement with AI in banking. These findings helped draw broader conclusions about AI's transformative role in the sector and are further discussed in Chapter 4.1.

4 Analysis & Discussion

4.1 Expert Interviews

4.1.1 Introduction to AI in Banking: The Current Landscape

AI's transformative impact on various industries is well-documented, and banking is no exception. In the European banking sector, AI has become a key strategic tool, allowing institutions to enhance customer experiences, streamline operations, and deliver personalized services. Approximately 75% of the interviewees (experts as well as banking employees) emphasized that AI is integral to their strategies.

4.1.1.1 AI as a Necessity in Banking

Interviewee 1 emphasized the necessity of AI in modern banking, stating, "*In one way or another, [banks] need to apply AI in their business operations*." He reflected the sentiment that AI has become indispensable for future banking strategies, explaining that AI isn't just an optional technology but a "*must*" for banks that want to remain competitive in the rapidly evolving digital landscape. While some banks remain cautious, he pointed out that the potential benefits of AI far outweigh the risks, urging institutions to explore AI capabilities sooner rather than later.

Interviewee 2 emphasized that AI is not just about enhancing efficiency but also about ensuring customer trust in a rapidly evolving digital environment. He explained,

"*AI plays a significant role in fraud detection, and without it, maintaining security and customer confidence would be much harder. This is why AI is not just a strategic tool, but a necessity in modern banking*." (Interviewee 2)

Interviewee 3 echoed this view, comparing the need to adopt AI with the early days of the internet:

"*Yes, I think they do [have to use AI within banking]. Just as banks needed to experiment with the Internet when it first became widely available in the early '90s, they need to start engaging with AI now. It's not something you*

can just switch on overnight. There needs to be an understanding of the technology at all levels of the bank, from the IT department to the C-suite. Banks definitely need to start today to understand how AI works in their organization." (Interviewee 3)

4.1.1.2 Strategic Importance of AI

Interviewee 17 noted that AI has rapidly become a critical component in banking strategies, largely driven by developments such as ChatGPT. He explained, "*AI has come into the top five or ten strategic considerations... this really changed the thinking*." At his bank, AI is seen as essential to digitalization, customer interaction, and democratizing access to banking services.

This sentiment reflects the urgency with which European banks are adopting AI to maintain competitiveness in an increasingly digital landscape.

Interviewee 16, who works at a private bank without a credit business, highlighted that their approach to AI is different compared to more commercial banks. "*We're not a typical bank; we're a private bank without a credit business, so it's a bit different for us compared to other banks*," he explained. His experience with AI has been shaped by his background in quantitative finance, but the bank is still in the process of defining what constitutes AI, particularly in light of the forthcoming EU AI Act.

4.1.1.3 Early AI Applications in Banking

Interviewee 8 pointed out that AI is present in the marketing area of his bank, but its use is still relatively limited across other areas, mainly focusing on automation. "*There are certain automations implemented, which in a certain way also count as AI*," he said. One of the main AI applications is in the automation of back-office activities, particularly to handle the increasing volume of inquiries. "*The volume of inquiries we're receiving would no longer be manageable otherwise*."

Similarly, Interviewee 7 discussed how their bank has shifted focus from a purely bank-centric view to a customer-centric one, integrating AI through omnichannel management to harmonize digital processes across regions. "*We established a Customer Experience Team… to integrate a customer-centric view into all processes*."

Despite the progress, Interviewee 1 remarked that many banks are still cautious in their approach: "*So currently, banks are still in the learning phase and in the early stages of that*

journey, maybe due to several reasons," pointing to regulatory challenges and concerns over data privacy.

4.1.2 Banking Approaches and Status Quo Regarding AI Adoption

4.1.2.1 Cautious AI Adoption

European banks have adopted different strategies to incorporate AI into their operations, ranging from cautious experimentation to full-scale implementation. Approximately 60% of banking interviewees indicated that their banks are still in the early stages of AI deployment, with many focusing on limited pilot programs or using AI for back-office operations. Interviewee 1 noted, "*AI is a must, but many banks are implementing it gradually, starting with internal operations like fraud detection and compliance*."

Interviewee 12, who works at a bank just beginning its AI journey, highlighted the cautious approach of his institution: "*We are really at the beginning at [bank name], but we are looking into it a lot right now.*" The bank is involved in several pilot projects, including AI-supported minute-taking and an internal chatbot, though results have been mixed, particularly with the minute-taking project due to issues like dialect and speech clarity.

4.1.2.2 AI in Fraud Detection and Trading

Interviewee 3 explained that AI has been used in banking for over two decades, primarily in fraud detection and trading. "*Fraud detection systems use a rules-based approach*," he said, noting how these systems flag suspicious transactions, such as rapid usage across different countries. In investment banking, AI plays a significant role, but much of it remains proprietary: "*The decisions and machine learning used in trading operations are massively deployed but kept secret.".*

4.1.2.3 Internal Efficiency vs. Customer-Facing AI

Interviewee 2 explained that banks are currently using AI primarily to enhance internal efficiency. "*AI in our bank is still focused on enhancing operational efficiency through automation, but we are cautious about extending its applications to customer-facing services*," he said. Many banks are adopting this approach, using AI to optimize internal processes like compliance and fraud detection, while customer-facing AI solutions are still in their infancy. Interviewee 5 highlighted a similar approach, he explained that their institution uses AI primarily to optimize internal operations. He stated, "*Our customer-facing AI solutions are still limited because we need to ensure the technology's reliability first."*

Interviewee 16's bank is still in the test phase of AI implementation, focusing on "*low-hanging fruits*" that offer significant optimization with minimal effort. He noted that the bank had identified 23 AI use cases, six of which were in the pipeline, though full governance of AI is still in the process of being established.

4.1.3 AI Use Cases in Current Practice

4.1.3.1 AI in Customer Service and Fraud Detection

One of the most prominent uses of AI in the European banking sector is improving customer service. Over 70% of the banking interviewees indicated that their institutions have implemented AI tools, such as chatbots and virtual assistants, to handle routine customer inquiries. Interviewee 1 emphasized that AI's primary focus in many banks has been on back-office efficiency and cost reduction: "*AI brings down costs and improves efficiency*."

Interviewee 15 explained that they were already using AI in multiple areas like cybersecurity and electronic fraud detection, which are two of the most commonly used AI applications based on the interviews. Additionally, they use AI for in-voice biometrics and digital onboarding. In voice biometrics, it helps to identify a customer within a few seconds via the phone. While digital onboarding compares a customer's ID or passport with the person. The latter is also being used. The latter technology has also been used by interviewee 4's bank, who further explained that AI and Big Data is then used to verify the picture. However, AI tools like ChatGPT are limited, and there are strict guidelines: "*There are rules to ensure no personal data or banking secrets are used in such tools.'*

Interviewee 3 reiterated the role of AI in fraud detection, where rule-based systems flag unusual activity. This aligns with current literature on AI's ability to process vast datasets in real-time to improve risk management.

4.1.3.2 AI in Compliance and Operational Efficiency

AI's role in compliance and operational efficiency is expanding, as Interviewee 17 explained. His bank uses AI for legal analysis and monitoring regulatory updates, which are becoming priorities for the next 12 to 18 months. However, challenges like data privacy and data quality limit AI's full potential in compliance.

In its current phase, the bank is primarily using AI in back-office operations and compliance, interviewee 16 explained. For instance, the bank employs AI for legal analysis and to monitor regulatory updates, which the head of group legal has identified as a priority for the next 12-

18 months. Additionally, ML has already been applied in areas like operational accounting and process automation. Interviewee 18 of the same bank notes,

"*We have a lot of processes that are currently straight-through or automated, and we have tools and solutions that have this AI component*." (Interviewee 18)

However, AI's full potential is not yet realized across all areas, with data privacy and data quality issues being key limitations.

4.1.3.3 Advanced AI Applications in Reports and Chatbots

The bank of interviewee 16 has already deployed some AI use cases. For instance, they developed a chatbot for the Chief Economist that summarizes daily meetings and makes them available to currently only internal employees but will soon be available for external clients. This use case is currently in testing, with plans to go live soon. Another important application of AI has been in automating the analysis of long reports—often hundreds of pages—by using an AI tool to extract and summarize key information. "*This has significantly reduced the time needed for such tasks. 'The process time has been reduced from many hours to just a few minutes*," Interviewee 16 explained. They also use AI for tasks such as programming, economics, and PowerPoint preparation, using chatbots for quick and efficient outputs."

Interviewee 6 added that AI plays a significant role in back-office automation and decision-making, although governance challenges remain. He also highlighted the importance of reliability when using AI prototypes, especially in customer-facing applications. Similarly, Interviewee 14 stressed the need for AI tools to perform well from the start to avoid disengagement, particularly in customer-facing roles.

4.1.4 Impact of AI on Customer Experience

4.1.4.1 AI's Role in Personalization and Responsiveness

AI has significantly improved personalization and responsiveness in customer service. Around 90% of interviewees reported that AI will enhance a bank's ability to deliver more tailored services. Interviewee 9, from a telecom company, highlighted how AI accelerates customer experience improvements: "*AI will turbocharge everything around customer experience*.". He highlighted the use of AI for personalized product recommendations and alerts: 'AI allows you to be much more granular in the way you provide that experience.'"

Interviewee 14 stressed that AI can significantly enhance the customer experience by simplifying complex interactions.

"Even with the most used features, people still can't find them. But if I give you an LLM that allows you to type whatever question you have into a single input field, many more people will adopt it because they develop the habit of checking [banks app] first," (Interviewee 10)

,he explained. This approach not only makes the app more intuitive but also improves overall customer satisfaction by providing faster, more direct responses. Interviewee 11 shared insights on how AI will be revolutionizing customer service.

"*AI is allowing us to personalize our services much more effectively. We are able to analyze large amounts of customer data in real-time, which means we can offer tailored solutions almost instantaneously. This significantly improves the customer experience*." (Interviewee 11)

4.1.4.2 Cautious Deployment in Customer-Facing Applications

Despite these advances, banks remain cautious about deploying AI in direct customer-facing roles. Interviewee 17 explained that while his bank experimented with a custom chatbot similar to ChatGPT, they are reluctant to roll it out fully: "*AI tools used with customers need to be safe and protective toward both sides—customers and the bank*."

Interviewee 16's bank is similarly cautious, particularly because of its focus on maintaining personal contact as a competitive advantage: "*If we rely too much on AI and chatbots, we risk losing the strength or unique selling point we have."*

4.1.4.3 Customer Adoption AI

While AI offers significant potential to enhance customer interactions, banks are mindful of over-relying on it and keeping customers adoption willingness in mind. Interviewee 9 pointed out that customer willingness to adopt AI varies, depending on age and ability, and customers often resist subpar solutions. He explained that high-quality voice interactions through generative AI have proven more acceptable than poor chatbot experiences. "*The hardest part is ensuring adoption—if people don't see the benefit, they won't use it*."

4.1.5 AI Use Case Identification Process

4.1.5.1 Structured Processes vs. Ad-Hoc Approaches

Only a few of the interviewees indicated that their banks have structured processes for identifying relevant AI use cases. According to Interviewee 1, use cases are typically identified based on operational bottlenecks and customer pain points, with fraud detection, compliance, and operational efficiencies being the main priorities.

On the other hand, Interviewee 7 described how his bank's approach to AI use case identification is more experimental: "*We are still in the experimentation phase, so our AI use cases are identified based on the available technology rather than a formal process*."

4.1.5.2 Challenges in AI Use Case Identification

Identifying the right AI use cases presents several challenges. Interviewee 15 emphasized the importance of finding use cases with unstructured data where AI can provide the most value, while Interviewee 17 discussed the difficulty in calculating AI's return on investment upfront. "*It's hard to predict upfront... You really have to bring the product to the market and analyze the results*."

Interviewee 13 discussed the challenges of identifying the right AI use cases.

"*One of the key challenges we face is knowing where AI will add the most value. Often, we identify use cases based on existing pain points, but predicting the ROI is always difficult. It's a constant process of testing and learning*." (Interviewee 13)

Interviewee 16 shared that their bank developed a decision tree tool to help employees determine whether AI or more traditional digitalization methods should be used for a given task: "*Sometimes, standard IT solutions are the better choice*."

4.1.6 Future AI Use Cases Under Development

4.1.6.1 AI in Personalized Financial Advisory

Looking forward, many banks are developing AI-powered financial advisory services to provide personalized advice based on real-time data analysis. Interviewee 1 highlighted the potential of these services, explaining, "*A similar kind of customer experience can be created, which is more personalized, really related to the customer's current life situation*."

Interviewee 12 emphasized the future importance of hyper-personalization: "*We're moving toward hyper-personalization, regardless of the product or industry.*"

4.1.6.2 Expansion of AI in Customer Processes

AI's role in automating customer financial services is also expanding. Interviewee 14 explained, "*We are working on things like summarizing a contract into five paragraphs, for instance*." While these applications are still in development, the goal is to anticipate and act on customer needs proactively.

Interviewee 16 noted that AI will soon be integrated into his bank's CRM system to enhance customer engagement through personalized email and request generation. However, his bank remains cautious about over-relying on black-box models, as transparency is crucial for maintaining client trust.

4.1.7 Challenges in AI Implementation

4.1.7.1 Regulatory and Data Management Challenges

Despite the promise of AI, its implementation in banking is not without challenges. One of the most commonly cited issues by 75% of the interviewees was the regulatory environment. Interviewee 1 pointed out that banks are slow to adopt new technologies like AI because they are so heavily regulated. He emphasized that "*AI-generated responses still need to be checked by humans*" to ensure compliance with regulatory frameworks. This concern aligns with recent literature discussing the balance between AI innovation and regulation (Königstorfer & Thalmann, 2020).

Interviewee 17 noted that AI governance and data management pose ongoing challenges. "*Not only are we not finished with it—you can't be finished with it*," he explained, stressing that building robust AI governance is a task that will take years. He also highlighted data quality issues, stating, "*Data quality is a huge challenge, not only in our industry but in others as well.*" Interviewee 17 shared an example where an AI system flagged an employee's monthly savings transfer as a spending problem, illustrating the occasional inaccuracies AI systems can generate.

4.1.7.2 Integrating AI with Legacy Systems

About 50% of the interviewees cited difficulties in integrating AI with legacy systems as a significant challenge. Interviewee 1 explained that many banks operate outdated infrastructure that was never designed with AI in mind, making upgrades to accommodate AI both costly and time-consuming. He remarked, "*Banks need to harness their data*" and ensure that it's structured properly before they can realize AI's full potential.

Interviewee 4 said "*In terms of AI implementation, many banks are still facing significant issues and problems related to their existing infrastructure, which wasn't designed to handle AI-driven systems*".

Interviewee 16 noted similar concerns, explaining that differentiating between true AI and older machine learning models marketed as AI can be difficult. This requires banks to

carefully scrutinize vendors to ensure they are offering valuable, up-to-date models. Additionally, data protection remains a significant issue for many banks, especially when it comes to where and how data is processed. "*We prefer on-premise or European-based solutions due to strict data protection laws*," Interviewee 16 explained.

4.1.7.3 Governance and Ethical Challenges

Governance issues were another commonly mentioned challenge. Interviewee 17 explained, "*We are currently building AI governance around it*," stressing that governance should be clear and understandable for all employees, not just AI experts. He emphasized the need to balance regulation with innovation, cautioning that too many restrictions could stifle AI progress, while too few could lead to inefficiencies.

Interviewee 17 highlighted the challenges related to AI governance and data management, with governance structures for AI still in development. As they explained, "*Not only are we not finished with it—you can't be finished with it*," emphasizing that establishing robust AI governance will be an ongoing challenge over the next several years. Interviewee 16 emphasized, "*I would add data quality as a huge challenge, not only in our industry but probably in others as well*." He explained that AI systems sometimes make errors, like misinterpreting customer behavior. For example, one system flagged an employee's monthly savings transfer as a spending problem. Additionally, data privacy issues prevent the bank from fully using AI in customer interactions, as they must ensure watertight protection of sensitive information. Furthermore, they mentioned the importance of balancing data protection and data ethics, especially in avoiding biased data that could lead to inaccurate AI outputs.

Ethical concerns were raised by several interviewees. Interviewee 8 pointed out the importance of ensuring that AI models are fair and transparent. "*We need to avoid reinforcing biases, especially in areas like credit scoring*." Interviewee 15 also noted that Switzerland is monitoring AI developments with a particular focus on fairness and bias and expects the regulatory landscape to change in the coming years.

4.1.8 Change Management and Organizational Culture

4.1.8.1 Cultural Shifts and Employee Concerns

Successfully integrating AI into banking operations requires more than just technological upgrades; it demands significant organizational change. Around 80% of the interviewees

highlighted cultural shifts and employee concerns as major challenges. Interviewee 4 shared that while there is excitement around omnichannel management projects, some advisors are worried about job security: "*Advisors might worry about how their jobs will change or if they'll even be needed in the future*."

Interviewee 8 noted that while AI is generally viewed as an aid rather than a threat to job security, automation will likely reduce the number of physical employees. However, he stressed that the key cultural shift is seeing AI as a tool to enhance, not replace, human work.

4.1.8.2 Employee Training and AI Governance

Several banks are addressing these concerns through extensive employee training programs. Interviewee 16 stressed the importance of training staff to view AI as complementary to their work rather than as a replacement: "*We've rolled out extensive AI training programs for our staff, focusing on how AI can complement their work rather than replace them*." He emphasized that these programs have been crucial in alleviating employee fears and encouraging staff to embrace AI.

Similarly, Interviewee 17 noted that AI governance frameworks are being built to manage AI usage effectively. He explained, "*It's very important that there is a basic understanding of what's going on at all levels*," highlighting the need for training at every level, from entry-level employees to senior leadership. Banks like Interviewee 16's have also created AI Centers of Excellence and appointed AI Champions from different business units, ensuring that all departments are aligned in their AI strategies.

Interviewee 14 emphasized the importance of involving employees in the AI adoption process. His bank runs workshops and brainstorming sessions with teams to ensure they understand how AI will improve their work. "*We want employees to feel that AI is there to support them, not compete with them*," he explained.

4.1.9 Long-Term Future Scenarios for AI in Banking

4.1.9.1 Automation and AI's Role in Banking's Future

Many interviewees expressed optimism about the long-term role of AI in banking. Interviewee 14 envisioned a future where banking is largely automated:

"*Banking needs to be automated to the point where you don't have to do anything actively. The bank should act in your interest, anticipate your needs, and even carry out actions automatically*." (Interviewee 14)

He believes that traditional banks have an advantage over tech companies like Google due to their control over financial data, which will play a key role in creating personalized services for customers.

Similarly, Interviewee 1 predicted that AI will become a fundamental part of banking operations, though he expects the transition to be gradual. "*Banks will start from the back-office internal processes first, apply AI, create learnings that way*," he said, noting that once banks feel comfortable with AI internally, they will gradually introduce AI-driven services for customers.

4.1.9.2 AI and Human Judgment

Despite AI's growing capabilities, several interviewees believe that human judgment will remain crucial, especially in complex financial matters. Interviewee 6 remarked, "*AI will certainly automate a lot of processes, but customers will still value human interaction*, particularly in sensitive financial matters like wealth management and financial planning."

Interviewee 10 reinforced this view, explaining that while AI will handle transactional tasks, specialized advisory services will still require human expertise.

"*There won't be the bank employee who can answer all questions, but rather specialists for insurance, credit cards, financing, securities, payments, for example*." (Interviewee 10)

Interviewees also emphasized that physical branches will still play an important role in the future. Interviewee 6 explained that while banks have been advised to reduce their branch presence, branches remain a critical differentiating factor, particularly for handling complex customer problems. Interviewee 11 added that digital offerings still have a long way to go before they can replace in-person services, particularly for older generations or those who prefer personal interaction.

4.1.9.3 AI's Potential to Transform Customer Engagement

Several interviewees highlighted the potential of AI to transform customer engagement. Interviewee 9 described how AI is helping banks predict customer needs and offer proactive solutions.

"*In the future, AI could enable a shift towards a more advisory-centric model, where banks serve not just as transactional institutions but as life partners helping customers achieve financial goals*." (Interviewee 9)

Interviewee 15 predicted that AI could automate around 75% (based on a study he read) of banking jobs over the next 15 years, significantly transforming processes like transaction

processing. However, he warned that this could lead to challenges in retaining operational knowledge, as fewer employees will have hands-on experience with these tasks.

Interviewee 16, meanwhile, envisioned that AI would enhance speed and customer-centricity, particularly in payments and transactions. Looking further ahead, Interviewee 9 believed that AI would continue to optimize processes like mortgage credit evaluation, providing more efficient, personalized products for customers.

4.2 Survey

4.2.1 Insights from Qualitative Survey Responses

This chapter presents an analysis of the qualitative feedback provided by survey respondents on the use of AI in banking. The responses were categorized under four main questions to draw out the key themes and insights.

4.2.1.1 Key Benefits of AI in Banking

Respondents highlighted several benefits of AI in banking, with speed and efficiency being the most frequently mentioned. The ability of AI to provide quick responses, particularly in handling standard inquiries, was seen as a significant advantage. AI's 24/7 availability was also frequently cited, giving customers access to banking support at any time.

Another benefit mentioned was the role of AI in data management and analysis. Respondents appreciated automated processes like payment transactions and expense visualization, which helped them manage finances more effectively..

4.2.1.2 Desired Improvements in AI-Based Banking Services

While AI offers many benefits, respondents identified areas for improvement. Personalization was a recurring theme, with a desire for AI systems to deliver more tailored services. Many respondents also called for greater transparency in AI decision-making processes, wanting to understand how AI arrives at certain recommendations.

The limitations of current AI systems, especially chatbots, were frequently criticized. Respondents emphasized the need for AI to recognize when a human agent should take over more complex cases, suggesting that a balance between AI and human service would improve customer satisfaction.

4.2.1.3 Concerns About AI in Banking

Data privacy and security were the top concerns. Respondents expressed worries about how their data would be used and whether it would remain secure. Many also feared that replacing human interactions with AI could reduce service quality since machines lack empathy.

Concerns about AI's accuracy and systemic biases, especially in areas like credit allocation, were also highlighted. Some respondents believed AI could serve banks' interests more than customers', leading to less favorable outcomes for the latter.

4.2.1.4 Suggestions for New AI-Based Features and Services

Respondents proposed several new AI features they'd like to see implemented. Personalized investment advice was a popular suggestion, with respondents seeking AI to offer tailored recommendations and support.

Another idea was an AI-powered personal assistant for financial tasks, portfolio performance insights, and credit advice. Respondents also wanted enhanced transaction analysis tools, including more detailed categorization and better search functionalities.

4.2.2 Comparative Analysis Across Demographics and Education Levels

Understanding how AI shapes customer experiences requires exploring customer needs, concerns, and expectations. The survey gathered insights from a diverse range of respondents, uncovering how AI impacts their banking experiences. This section builds on the demographic overview and exploratory data analysis in Chapter 3.3.2.2, examining cross-tabulations and key variable relationships to provide a nuanced understanding of how different demographic groups perceive the importance of various banking factors.

The following analysis examines how specific demographic groups align with or diverge from these overall trends (for details see Appendice)

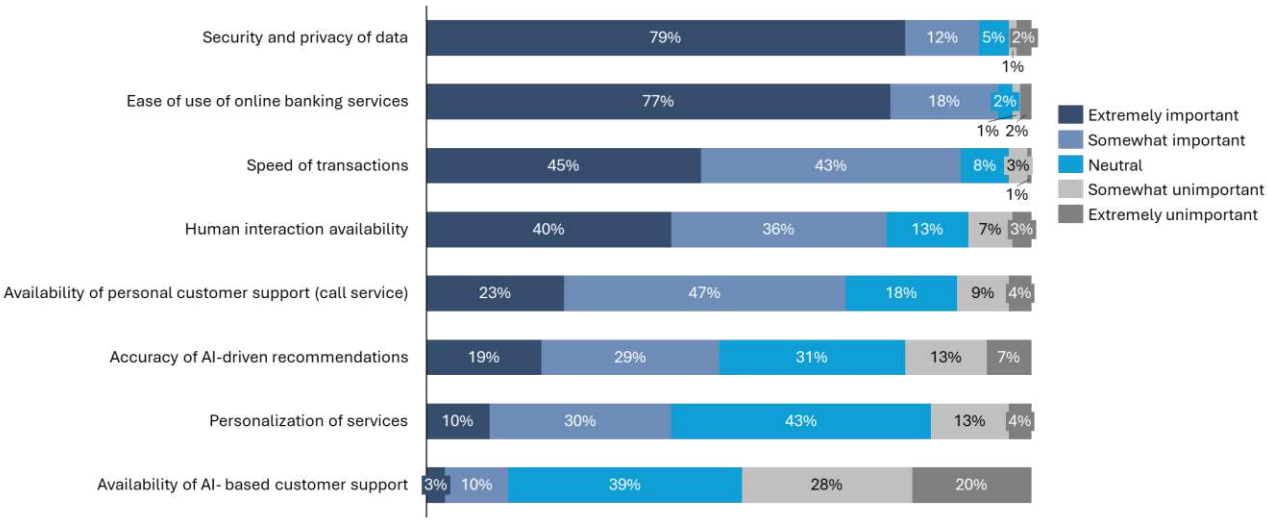

Figure 24 Survey Responses: How important are the following factors to you when considering your banking experience?

4.2.2.1 Security and Privacy of Data

In the general survey (**Figure 24**), 79% of respondents rated data security as extremely important, making it the top priority. Security concerns were even more pronounced among certain demographics. For instance, 91% of high school graduates and 88% of respondents from small towns considered it extremely important, showing that the level of concern about data security slightly varies depending on education and living area.

4.2.2.2 Ease of Use of Online Banking Services

Ease of use was ranked as extremely important by 77% of respondents overall. This percentage was higher among village residents (90%) and high school graduates (91%), suggesting that ease of use may be a priority for groups that may face more challenges in accessing complex banking services.

4.2.2.3 Human Interaction Availability

Human interaction availability was rated as extremely important by 40% of respondents. However, this number increased significantly for older and less urbanized populations, such as village residents (52%) and those with a master's degree (46%). This highlights that certain groups continue to value personal touch in banking services.

4.2.2.4 Personal Customer Support (Call Service)

In the general overview, 23% of respondents rated personal customer support as extremely important. However, the importance of this service was higher among small-town residents (38%) and high school graduates (32%), reflecting a greater reliance on traditional customer support in these segments.

4.2.2.5 Accuracy of AI-Driven Recommendations and Personalization of Services

A significant portion of respondents remained neutral about the accuracy of AI recommendations (31%) and the personalization of services (43%). This neutrality was particularly prevalent among higher-educated respondents, such as those holding a bachelor's or master's degree, suggesting that AI-based personalization and recommendations may not yet meet expectations for these groups.

4.2.2.6 Availability of AI-Based Customer Support

AI-based customer support was one of the least important factors, with only 3% of respondents considering it extremely important. Neutrality and indifference were especially common among respondents living in larger cities and those with higher education levels. This suggests that AI support has not been fully embraced in customer service expectations.

4.2.2.7 Conclusions

While security and privacy were universally important, their perceived importance varied slightly depending on education and location. Similarly, ease of use was crucial, particularly for village residents and those with lower education levels. Human interaction remained essential for older, less urbanized populations, indicating the need for banks to balance digital and human touchpoints.

The neutral stance toward AI-driven recommendations and personalization among educated respondents indicated that these services have room for improvement. The mixed reception toward AI-based customer support also suggests that AI's role in customer service requires clearer communication and a better-defined value proposition.

4.2.3 AI Awareness and Engagement in Primary and Secondary Banking Relationships

This section explores customer interactions with AI in their primary and secondary banking relationships, focusing on AI awareness and usage. The length of these relationships influenced awareness and engagement, with customers more likely to interact with AI in their primary bank accounts.

4.2.3.1 Primary Bank Accounts

Respondents most commonly identified **Erste Bank Austria, Raiffeisenbank, Easybank**, and **Bank Austria** as their primary financial institutions, with varying levels of AI awareness and engagement across these banks. Erste Bank Austria had the highest awareness, with 52% of respondents familiar with its AI usage, and 64% of those had actively used its AI services,

indicating strong integration of AI in customer services. Raiffeisenbank showed lower engagement, with 34% aware of AI and only 25% of them using it, suggesting AI might be less accessible or appealing. Easybank and Bank Austria showed similar patterns, with 56% and 57% AI awareness, and about half of those respondents using AI services, indicating moderate engagement. A key factor was the duration of the customer's relationship with the bank, as 74% of respondents had been with their bank for over five years, likely increasing familiarity with AI-driven services and boosting usage.

4.2.3.2 Secondary Bank Accounts

Secondary bank accounts, often used for specific or limited needs, showed different patterns in AI awareness and usage. N26 and Revolut were the most frequently mentioned, but AI awareness was lower, with 50% of respondents aware of AI usage in N26 and 38% in Revolut. Engagement was even lower, with only 38% of those aware in N26 and 33% in Revolut using AI services. Other secondary banks, like Erste Bank Austria and Raiffeisenbank, showed similar trends, with even lower awareness and usage, indicating that AI services were less integrated into the secondary banking experience. The relationship with secondary banks was notably shorter than with primary accounts: only 44% had been with their secondary bank for more than five years, while 37% had been customers for three years or less. This shorter duration likely contributed to lower AI engagement, as customers interacted less frequently with their secondary accounts and seemed more willing to switch banks.

4.2.3.3 Comparative Analysis and Implications

The comparison between primary and secondary accounts revealed key insights into how AI was integrated into customer experiences. Respondents demonstrated higher AI awareness in primary bank accounts than in secondary ones, likely due to more frequent interactions and longer relationships. However, awareness didn't always lead to usage, indicating that banks must focus not only on implementing AI but also on ensuring its accessibility and relevance to customers.

Certain banks, like Erste Bank Austria and Raiffeisenbank, led in both AI awareness and usage, suggesting they were more effective in integrating AI into essential services. This indicated that these banks might play a larger role in driving changes in customer experience through AI.

Lower AI awareness in secondary accounts suggested these accounts were used less frequently or for more specific purposes, where AI services were not as prominent. Thus,

while AI had the potential to transform customer experiences, its impact was more noticeable in primary banking relationships, where interactions were more regular and in-depth.

The variation in AI awareness across banks likely reflected their different strategies for deploying AI. Erste Bank Austria's high AI awareness suggested a deliberate effort to inform customers about AI usage, whereas some secondary banks may have chosen a more subtle approach, leading to lower awareness despite AI being in use.

4.2.4 Main Concerns about AI

Understanding customer concerns about AI in banking is crucial for developing solutions that are both effective and widely accepted. Survey data reveals significant variations in AI-related concerns across demographics such as education, age, gender, and living location. This section explores these differences, highlighting key concerns for each group and comparing them to the overall population (see **Figure 25**).

Across all respondents, data privacy was the top concern, with 46% identifying it as their primary issue, reflecting the growing focus on protecting sensitive financial information. Additionally, 23% were concerned about the lack of human interaction in AI-driven services, while 14% highlighted security issues, emphasizing the need for strong security measures.

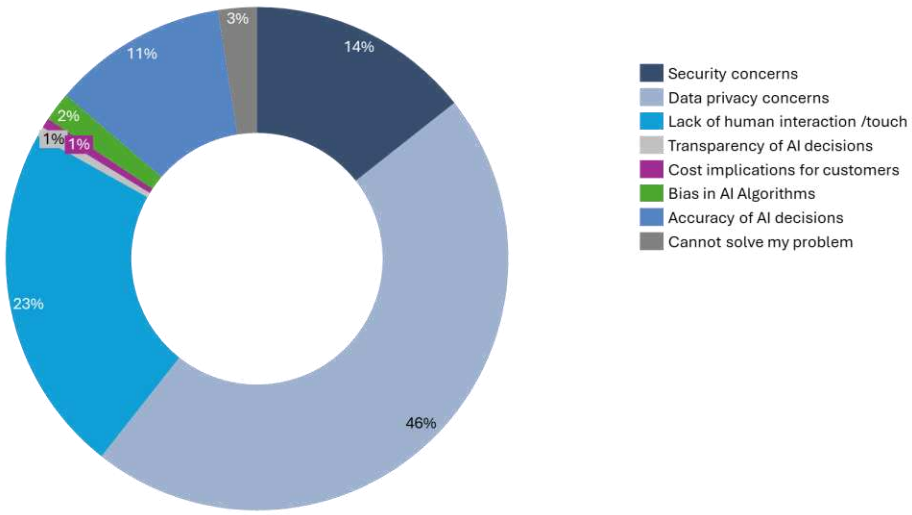

Figure 25 Distribution of primary concerns about AI in the banking sector across all respondents

AI concerns varied notably by education level. Respondents with a Master's degree were less worried about data privacy (45%) but more concerned about human interaction (26%) and security (10%), indicating a heightened awareness of AI's potential depersonalization and risks. Conversely, those with a high school education or less had the highest concern for data

privacy (50%) and also significant concerns about human interaction (27%), suggesting greater vulnerability or distrust of AI technologies among this group.

Age also played a key role. Younger respondents (18-25) were most concerned with data privacy (51%) and security (19%), showing a preference for digital interactions over traditional human services. In contrast, older respondents (55 and above) were more focused on security (38%) and less concerned with data privacy (25%), likely reflecting their cautious approach toward AI due to a stronger attachment to traditional banking.

Gender differences revealed distinct perceptions of AI risks. Both men and women shared strong concerns about data privacy (46% each), but men were more concerned with AI decision accuracy (15% vs. 7% for women), while women were slightly more concerned about the lack of human interaction (24% vs. 21% for men), indicating a possible greater appreciation for personal service among women.

Location further influenced AI concerns. Urban respondents were focused on data privacy (43%) and AI accuracy (14%), reflecting their greater exposure to digital services. Rural respondents were most concerned with data privacy (52%) and human interaction (29%), suggesting a preference for more traditional, personal banking. Suburban respondents showed an equal focus on data privacy and security (42%), indicating a balanced awareness of both issues in AI applications.

4.2.5 Regression Analysis and Insights

This section presents the results of several regression models applied to the survey data, aiming to identify the relationships between demographic characteristics, AI awareness, and customer engagement with AI-based services. The analyses explore how these factors influence various aspects of the banking experience, offering a deeper understanding of AI's role in shaping customer experiences. Before presenting the results, it is essential to understand the key statistical metrics used in these models (see **Table 2**)

Coefficient (Coef.)	Represents the expected change in the dependent variable for a one-unit change in the independent variable
Z-Value	Indicates how many standard deviations an observed value is from the mean. A higher absolute z-value suggests stronger evidence against the null hypothesis

P-Value	A p-value less than 0.05 is considered statistically significant, indicating that the independent variable likely has a significant effect on the dependent variable
AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion)	Lower values indicate better model fit, balancing goodness-of-fit and model complexity
Log-Likelihood	Reflects how well the model explains the observed data, with higher values indicating a better fit
Variance Inflation Factors (VIFs)	calculated to check for multicollinearity, with all values being below the standard threshold of 10, indicating no severe multicollinearity across the models.
Breusch-Pagan test for homoscedasticity	performed for each model, with all p-values greater than 0.05, confirming that homoscedasticity was maintained, ensuring consistent residual variances.

Table 2 Key Statistical Metrics

This chapter explores the regression analysis results of several models aimed at understanding the factors influencing customer perceptions of various aspects of the banking experience, including ease of use, customer support, AI-based services, transaction speed, personalization, security, and the accuracy of AI-driven recommendations. The analysis addresses the research question by examining the statistical significance of predictors, multicollinearity, and homoscedasticity in each model.

Ease of Use of Online Banking Services

The first model explored factors influencing the perceived ease of use of online banking services using ordered logistic regression, given the ordinal nature of the dependent variable. The log-likelihood was -105.71, with an AIC of 263.4 and a BIC of 343.9, indicating a reasonable fit. However, none of the predictors—such as age, gender, education level, or AI awareness—were statistically significant, with all p-values above 0.05. For instance, the highest z-value was 1.541 ($p = 0.123$) for education level, showing no notable impact on ease of use.

This lack of significant predictors suggests that ease of use is a universal expectation, unaffected by demographic factors or AI awareness. This aligns with the idea that ease of use

in online banking has become a baseline expectation due to widespread adoption of online interfaces. The model's multicollinearity diagnostics showed VIFs below 2, indicating no serious multicollinearity, and the Breusch-Pagan test ($p = 0.731$) confirmed homoscedasticity, meaning residual variance was consistent. In terms of AI as a driver of change, the model suggests AI improvements may not directly affect customers' baseline expectations for ease of use.

Availability of Personal Customer Support (Call Service)

The second model focused on customer perceptions of personal customer support, particularly call services. The log-likelihood was -197.40, with an AIC of 446.8 and a BIC of 527.2. A significant predictor in this model was education level ($p = 0.040$), indicating that customers with higher education levels place a higher value on personal customer support compared to those with lower education levels.

This finding could suggest that more educated customers are more discerning in their preferences for personalized, human-centered services, possibly due to a heightened awareness of service quality or expectations of more personalized attention. No multicollinearity issues were detected, as all VIFs remained under 1.8, and homoscedasticity was confirmed (Breusch-Pagan test $p = 0.980$), validating the consistency of residual variance.

These results suggest that banks need to consider educational background when implementing AI-driven services. While AI can enhance efficiency, customers with higher education may still expect personalized support, reflecting a more nuanced preference for human interaction alongside technological solutions.

Availability of AI-Based Customer Support

The third model examined customer perceptions of AI-based customer support. The log-likelihood was -208.87, with an AIC of 469.7 and a BIC of 550.2. Two significant predictors emerged: willingness to pay extra for enhanced AI services ($p = 0.013$) and awareness of AI usage in the primary bank ($p < 0.001$). These results indicate that customers who are aware of AI in their bank and willing to invest in enhanced services place greater importance on AI-based customer support.

No multicollinearity issues were detected (VIFs below 1.8), and homoscedasticity was confirmed (Breusch-Pagan test $p = 0.848$). These findings suggest that customer awareness of

AI plays a key role in shaping their expectations and valuation of AI-driven support services, highlighting the importance of educating customers about AI's capabilities and offering premium AI services.

Speed of Transactions

The fourth model focused on factors influencing customer perceptions of the importance of transaction speed. The log-likelihood was -162.42, with an AIC of 376.8 and a BIC of 457.3. Awareness of AI in the primary bank was the only significant predictor ($p = 0.043$), indicating that customers aware of AI's role are more likely to value transaction speed. No multicollinearity issues were present (VIFs below 1.8), and homoscedasticity was confirmed (Breusch-Pagan test $p = 0.697$). These results suggest that AI's perceived value may be linked to its ability to enhance transaction efficiency, particularly for customers familiar with its capabilities.

Personalization of Services

The fifth model examined the factors influencing the perceived importance of service personalization. The log-likelihood was -206.18, with an AIC of 464.4 and a BIC of 544.8. Awareness of AI in the primary bank was the only significant predictor ($p = 0.033$), suggesting that customers who are aware of AI in their banking services are more likely to value personalized experiences. No multicollinearity issues were detected (VIFs below 1.8), and homoscedasticity was confirmed (Breusch-Pagan test $p = 0.280$). These results indicate that AI awareness could be linked to higher expectations for personalized banking services among customers.

Security and Privacy of Data

The model assessing the importance of data security and privacy showed a log-likelihood of -108.29, with an AIC of 268.6 and a BIC of 349.0. A significant predictor in this model was the willingness to pay for enhanced AI services ($p = 0.047$), suggesting that customers who are open to investing in AI services may also place greater importance on data security and privacy. The findings point to a potential link between perceived value in AI and concerns about data protection. No multicollinearity issues were present, with all VIFs below 2.0, and the model met the assumption of homoscedasticity (Breusch-Pagan test $p = 0.995$). This could indicate that as AI is integrated into banking, data security remains a consistent concern across respondents willing to adopt such technologies.

Accuracy of AI-Driven Recommendations

The final model examined customer perceptions of the accuracy of AI-driven recommendations. With a log-likelihood of -217.71, an AIC of 487.4, and a BIC of 567.9, the model encountered Hessian inversion issues, making it impossible to generate reliable coefficient estimates or draw statistical conclusions. Due to these convergence problems, the model cannot be fully interpreted. However, the lack of significant results in earlier models suggests that AI-driven recommendations still need refinement to meet customer expectations, indicating that while AI holds promise in personalized banking, further development is necessary to improve recommendation accuracy.

4.2.5.1 Summary of Non-Significant Models

Several regression models were tested to evaluate the influence of various factors on aspects of the banking experience, such as AI-based customer support, service personalization, and data security and privacy. These models did not produce statistically significant results, suggesting weaker relationships between the independent variables and these aspects or that other unmeasured factors may be at play. Although findings were not significant, they underscore the complexity of customer experiences in banking. The results imply that perceptions of certain services might be shaped by factors beyond those included in the models, pointing to the need for further research to identify other relevant variables.

The following summary **Table 3** presents the key findings from the regression analyses, highlighting which customer experience aspects are positively or negatively influenced by various demographic and behavioral variables.

Aspect of Customer Experience	Significant Predictor	Effect Direction	Coefficient	p-value
Ease of Use of Online Banking Services	None	N/A	N/A	N/A
Availability of Personal Customer Support	Education Level	Positive	0.3611	0.040
Availability of AI-Based Customer Support	Willingness to Pay Extra for Enhanced AI	Positive	0.3992	0.0013
	AI Awareness in Primary Bank	Positive	0.6390	<0.001
Speed of Transactions	AI Awareness in Primary Bank	Positive	-0.5649	0.043
Personalization of Services	AI Awareness in Primary Bank	Positive	0.3508	0.033

Security and Privacy of Data	Willingness to Pay for Enhanced AI Services	Positive	0.4515	0.047
Accuracy of AI-Driven Recommendations	None	N/A	N/A	N/A
Human Interaction Availability	None	N/A	N/A	N/A

Table 3 Overview of Regression Results Highlighting Influential Factors on Customer Experience Aspects

5 Conclusion

This thesis set out to explore how AI serves as a driver of change in customer experiences within the European banking sector. By analyzing both expert interviews and customer survey responses, this research has provided insights into how AI is shaping the current landscape of banking, as well as the challenges and opportunities associated with its implementation. In particular, this study has examined AI's role in enhancing operational efficiency, personalizing services, and transforming the way customers interact with their financial institutions. This concluding chapter summarizes through triangulation of the literature research, expert interview results and the survey results the key findings, provides reflections on the broader implications for the industry, and offers recommendations for future research and practice.

5.1 Summary of Key Findings

AI has emerged as a crucial technology in the European banking sector, with a significant portion of banks adopting it as a strategic tool. The findings from the expert interviews suggest that AI is seen as a necessity for banks to remain competitive in an increasingly digital world (Interviewee 1). Whether through the automation of back-office processes or customer-facing applications like chatbots and virtual assistants, AI is being implemented in ways that optimize both operational efficiency and customer experience. Approximately 75% of the experts interviewed confirmed that AI plays a central role in their banks' strategies, highlighting its transformative potential.

However, despite the enthusiasm surrounding AI, the degree of its adoption varies significantly across the industry. Many banks remain in the early stages of implementation, focusing on internal applications such as fraud detection, compliance, and process automation (Interviewee 1; Interviewee 17). For instance, Interviewee 16’s institution, a private bank, has developed 23 AI use cases but remains cautious about full-scale implementation, particularly in customer-facing roles. This cautious approach is reflected across the industry, with banks striving to balance AI's benefits with the regulatory, ethical, and operational challenges posed by its use.

Survey results similarly underscore the potential benefits of AI while also revealing customer concerns. Many respondents expressed appreciation for AI's ability to deliver quick responses, particularly in routine inquiries, as well as its role in automating transaction processing. However, concerns about data privacy and the perceived lack of human interaction were prominent, particularly among older respondents and those with less experience in digital banking environments. This highlights a key tension within AI implementation: while AI enhances efficiency, it risks alienating customers who still value personal, human interactions in banking (Interviewee 9; Interviewee 16).

AI's ability to personalize services is one of its most widely recognized strengths. Over 90% of the experts interviewed confirmed that AI allows for more tailored customer experiences, offering services and recommendations that align with individual needs and preferences. Interviewee 9 stressed that AI is already "turbocharging" personalization, allowing banks to provide more granular and relevant customer experiences. However, the survey data revealed that customers still perceive a gap between what AI promises in terms of personalization and what is currently delivered. This suggests that while AI has significant potential to enhance personalization, further development is required to meet customer expectations fully.

5.2 Implications for the European Banking Sector

The findings of this thesis have several key implications for the European banking sector. First, the gradual adoption of AI, particularly in internal operations, reflects the current priority of improving dynamic capabilities rather than embracing disruptive innovation. As discussed in the literature review, dynamic capabilities allow banks to reconfigure their resources to meet evolving market demands, and AI is serving as a vital tool in this ongoing adaptation. Most banks are leveraging AI to optimize internal processes, enhance compliance, and manage risks, which aligns with the dynamic capabilities framework (Barreto, 2010).

However, AI also presents opportunities for disruptive innovation, particularly in customer-facing applications. While banks are cautious about over-relying on AI for direct customer interactions, AI tools such as personalized financial advisory services and automated onboarding are already showing promise in transforming the customer experience. As Interviewee 13 noted, AI could ultimately shift the banking model towards one where customer needs are anticipated and proactively addressed through automated solutions. This suggests that while dynamic capabilities are currently the primary focus, disruptive innovation may emerge as AI technologies become more sophisticated and customer adoption increases.

Nevertheless, the findings also highlight significant challenges to AI implementation. Regulatory constraints, particularly concerning data privacy and protection, pose major hurdles to widespread AI adoption in banking. Interviewee 1 emphasized that banks remain cautious due to the heavily regulated environment, and AI-generated responses still need to be verified by humans to ensure compliance. The forthcoming EU AI Act, which aims to establish comprehensive governance around AI use, further underscores the need for banks to balance innovation with regulatory compliance (European Commission, 2021).

Additionally, the integration of AI into legacy systems remains a challenge for many banks. As Interviewee 1 pointed out, outdated infrastructure hinders the full potential of AI, necessitating costly and time-consuming upgrades to accommodate new technologies. Furthermore, governance and ethical issues continue to be areas of concern, with several interviewees stressing the importance of ensuring fairness, transparency, and accountability in AI systems. Addressing these challenges will be critical for banks to realize the full potential of AI while maintaining customer trust and meeting regulatory obligations.

5.3 Recommendations for the Banking Sector

Based on the findings of this research, several key recommendations can be made to guide the continued adoption and strategic deployment of AI in the banking sector. These recommendations are aimed at addressing both current limitations in AI integration and opportunities for future innovation. The recommendations draw from both the insights provided by interviewees and the survey data, as well as the broader discussions in the literature on AI's role in transforming the banking sector.

Foster a Balanced Approach Between Dynamic Capabilities and Disruptive Innovation

The ongoing debate in the literature on whether banks should prioritize dynamic capabilities or disruptive innovation is particularly relevant in the context of AI. As demonstrated in this thesis, banks must strike a balance between leveraging AI for enhancing internal efficiency and exploring more disruptive applications that can fundamentally reshape customer-facing services. Dynamic capabilities refer to the bank's ability to continuously improve processes and adapt to changes, while disruptive innovation focuses on radically changing how services are delivered to customers.

Survey respondents and interviewees indicated that while AI is currently enhancing operational efficiencies, its true potential in transforming customer interactions is still

emerging. Therefore, banks should adopt a dual strategy. On one hand, they should continue using AI to optimize existing operations and reduce costs. On the other hand, they should invest in innovative AI solutions that have the potential to disrupt traditional banking models, such as personalized financial advisory services powered by AI or fully automated customer service platforms. This balanced approach will allow banks to remain competitive in an increasingly AI-driven market while also meeting the evolving needs of their customers (Königstorfer & Thalmann, 2020).

Expand AI-Driven Personalized Services

One of the key findings from the survey and expert interviews is the growing customer demand for more personalized banking services. While AI has proven effective in automating routine tasks, some customers expressed a desire for AI systems to offer more tailored services that cater to their individual financial goals. AI-driven personalization could include real-time financial advice, customized product recommendations, and alerts tailored to the customer's financial behavior and preferences.

Banks should expand their AI offerings beyond basic automation and begin exploring hyper-personalized financial services. This could include integrating AI into CRM systems to offer tailored product recommendations, as well as using machine learning algorithms to analyze customer behavior and provide individualized financial advice. As the survey results indicated, customers are increasingly willing to embrace AI if it delivers tangible, personalized benefits. Banks that invest in developing these capabilities will be better positioned to meet customer expectations and foster greater loyalty.

Enhance AI Transparency and Governance Frameworks

A major concern raised by both interviewees and survey respondents was the transparency of AI systems, particularly in areas such as fraud detection, credit scoring, and customer service. Customers want to understand how AI systems are making decisions that affect their financial well-being. Additionally, regulatory concerns surrounding AI, including the upcoming EU AI Act, require banks to develop robust governance frameworks to ensure AI systems are transparent, fair, and accountable.

Banks should prioritize the development of governance frameworks that ensure the ethical and transparent use of AI. This includes implementing explainable AI models that allow customers and regulators to understand how decisions are being made. Governance should

also focus on mitigating biases in AI algorithms, ensuring that AI-driven services do not unintentionally discriminate against certain demographic groups. By aligning their AI strategies with upcoming regulations, banks can not only maintain compliance but also build trust with their customers.

Develop Hybrid Models that Combine AI with Human Expertise

While AI has significant potential to enhance efficiency and reduce costs, the research shows that customers still value human interaction, particularly in complex financial matters such as wealth management and financial planning. A recurring theme in the interviews was the fear that over-reliance on AI could erode the personal touch that many customers expect from their banks.

To address this concern, banks should aim to develop hybrid service models that combine AI efficiency with human expertise. AI can handle routine, transactional tasks, such as basic inquiries or standard financial advice, while human advisors focus on more complex or personalized customer needs. This approach will not only maintain the human touch in banking but also allow AI to free up human advisors' time, enabling them to focus on high-value customer interactions.

Modernize Legacy Systems to Enable Full AI Integration

As highlighted by the interviewees, one of the main barriers to fully realizing the potential of AI in banking is the outdated nature of many banks' IT systems. Legacy systems, which were not designed to accommodate AI technologies, limit the scalability of AI-driven innovations. Without upgrading these systems, banks risk falling behind in an increasingly AI-driven market.

Banks need to prioritize modernizing their infrastructure and data management systems to support the full integration of AI. This will involve significant investment in both hardware and software upgrades, as well as ensuring that data is structured in a way that can be easily accessed and analyzed by AI systems. By investing in these upgrades, banks can ensure that they are well-positioned to adopt new AI technologies as they emerge, without being constrained by outdated systems.

Address Cultural and Organizational Challenges

Successfully integrating AI into banking operations requires not only technological upgrades but also significant cultural and organizational changes. Many interviewees emphasized that

AI adoption has raised concerns among employees, particularly regarding job security. There is also a need to foster a culture of innovation within banks to ensure that AI is seen as a complementary tool rather than a threat.

Banks should focus on extensive employee training programs to build an AI-ready workforce. These programs should emphasize how AI can enhance employees' roles by automating routine tasks and enabling them to focus on more complex, value-added activities. Additionally, banks should consider establishing AI Centers of Excellence, where employees can experiment with new AI tools and technologies and share best practices across the organization. By fostering a culture of innovation and collaboration, banks can ease employee concerns and accelerate the adoption of AI across all departments.

Encourage Cross-Industry Collaboration for AI Innovation

Given the shared challenges surrounding AI adoption in the banking sector, there is a strong case for greater cross-industry collaboration. Many of the challenges identified in this research, such as regulatory compliance, ethical concerns, and legacy system integration, are not unique to individual banks. Collaboration across the financial industry could help accelerate the development of best practices and solutions to these challenges.

Banks should actively seek opportunities to collaborate with other financial institutions, technology providers, and regulatory bodies to develop industry-wide standards for AI governance, data privacy, and ethical AI use. Joint initiatives, such as industry consortiums or public-private partnerships, could help pool resources and expertise to address common challenges and drive innovation in AI technologies.

5.4 Limitations and Future Research

While this research provides valuable insights into AI's role as a driver of change in the European banking sector, several limitations must be acknowledged. Firstly, the relatively small survey sample limits the generalizability of the findings, particularly given that a significant portion of respondents were from the advisory sector and lived in urban areas. This focus on city-dwelling professionals may not fully capture the experiences of more rural or less professionally engaged customers, where AI adoption and perceptions may differ.

Additionally, the expert interviews were primarily conducted with professionals from German-speaking countries, specifically Germany, Austria, and Switzerland. As such, the findings largely reflect trends in these regions, which may not be representative of the broader

European banking sector. Regulatory and cultural differences across Europe, particularly in Southern or Eastern European markets, may result in varied AI adoption practices, limiting the ability to generalize the results across all European banks.

Given these limitations, future research should expand both the geographic and demographic scope of participants to better understand AI's impact across diverse regions and customer segments. Future studies could examine how banks are investing in AI, how AI-driven UX design will evolve, and explore comparisons with AI implementation in the insurance sector. Additionally, research should investigate AI acceptance among bank employees, effective change management strategies, and the impact of AI on employee experience. It would also be valuable to analyze specific age groups more thoroughly and explore differences in AI adoption between rural and urban areas. By broadening the focus, future studies can provide a more comprehensive understanding of AI's role in reshaping the banking industry.

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7 Appendices

Expert Interviews

Interview Guide

Target Group 1: AI experts (global)/ **Target Group 2:** Bank executives, AI strategists, senior employees bank, Customer Experience Manager, AI Implementation Lead, Marketing Manager

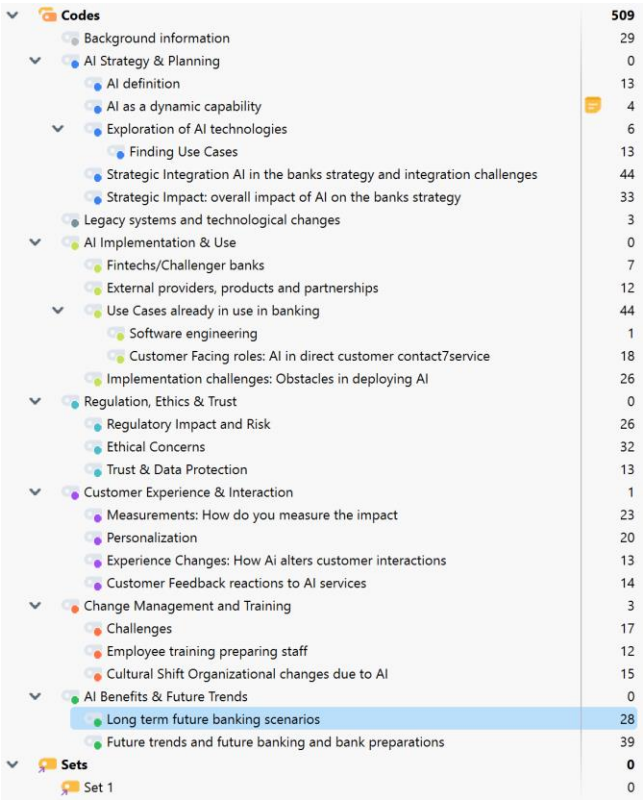
Example: Target Group 1 *(Target Group 1 is a slight variation of these questions)*

1. **Current AI Integration**
    - Does your bank have a specific AI strategy?
    - Can you describe your bank's current approach to AI integration in customer-facing solutions and in non-customer facing solutions?
    - If AI is not yet implemented, what are the primary reasons or barriers?
    - Based on your experience, how is AI transforming customer experience in the financial sector?
    - What challenges do financial institutions face when implementing AI in customer-facing roles?
2. **Strategic Objectives**
    - What are the strategic objectives behind considering or implementing AI in your bank?
    - How do you anticipate AI will impact your bank's strategic goals?
    - How do you view AI in terms of providing a competitive advantage in the banking sector?
3. **Potential and Perceived Benefits**
    - What potential benefits do you see AI bringing to customer experience and overall bank operations?
    - How do you perceive AI will influence customer experience in the long term?
    - How does AI enable personalized customer experiences in banking?
4. **Exploration and Planning**
    - Is your bank currently exploring or planning to explore AI technologies? If so, what steps are being taken?
    - How do you plan to align AI initiatives with your bank's overall strategy?
    - What best practices do you recommend for the seamless integration of AI technologies in banks?
5. **Competitive Position**
    - How do you view AI in terms of providing a competitive advantage in the banking sector?
    - If AI is not yet implemented, how do you perceive its potential impact on competitive positioning?
    - What lessons can banks learn from other sectors' experiences with AI?
6. **Challenges and Considerations**

- What challenges or considerations are influencing your bank's decision to implement or not implement AI?
- How do you plan to address these challenges if AI integration is pursued?
- How should banks address regulatory and ethical challenges to ensure compliance and customer trust?

7. **Regulatory and Ethical Considerations**
   - How do regulatory and ethical considerations impact your views or plans regarding AI?
   - What measures would be necessary to ensure compliance and ethical use of AI?
   - What are the major regulatory and ethical challenges associated with AI in banking?
8. **Future Trends and Innovations**
   - What future trends in AI technology do you think will impact the banking sector?
   - How is your bank preparing for potential AI advancements, even if not currently implementing them?
   - What future trends do you foresee in AI technology that will impact the banking sector?

MAXQDA Coding System



Interview Participants

PARTICIPANT 1

Background Information:

He is a consultant, focusing on the retail banking sector. His expertise spans various areas of

banking, but his current role emphasizes digital transformation, particularly in customer-facing operations. He has observed the evolution of AI in the banking industry and believes it's on the cusp of significant transformation, especially with regards to customer experience (CX).

AI Implementation & Customer Experience (CX):

He highlighted that AI is making banking more personalized, allowing institutions to offer services that are tailored to individual customer needs. A significant use case is AI's ability to enhance customer journeys by analyzing large volumes of data to predict what products or services a customer might be interested in. This could range from personalized loan offers to targeted savings plans based on a customer's spending habits. For example, Jani mentioned that AI can track a customer's financial behavior over time and offer specific advice, such as suggesting investment options when their savings balance reaches a certain threshold.

Banks are also using AI to identify key moments in a customer's life when certain financial products might be relevant. For instance, if a customer frequently searches for mortgage information or visits housing websites, the AI system could preemptively offer mortgage advice or loan options, which provides a seamless, personalized interaction. He emphasized that AI in this context is about creating a relationship where the bank anticipates the customer's needs and offers solutions proactively.

AI's Challenges in Legacy System Integration:

One of the biggest barriers to AI adoption that he discussed is the difficulty of integrating modern AI systems with legacy IT infrastructures, which are common in older banks. Many financial institutions still rely on outdated, fragmented systems that cannot easily support advanced AI technologies. This is particularly problematic in institutions with siloed data systems where information about customers is not centralized. Jani explained that in such scenarios, AI's potential is limited because it cannot access all the necessary data to provide accurate predictions or recommendations.

For example, some banks are using AI in customer support, but the AI systems struggle because they are not fully integrated into the bank's broader ecosystem. This means that the AI cannot pull real-time customer data from across different departments, reducing its effectiveness.

AI in Back-Office Operations:

Beyond customer-facing roles, he also discussed AI's use in back-office operations, particularly in areas like fraud detection, risk management, and regulatory compliance. AI can scan thousands of transactions in real-time, flagging unusual patterns that might suggest fraud. He provided an example of a bank using machine learning to monitor transaction behavior,

where the system can detect deviations from a customer's usual patterns and raise alerts if something seems off—such as sudden large withdrawals or transfers to foreign accounts.
AI is also helping banks with regulatory compliance by automating many of the manual tasks that human employees used to handle, such as reviewing documents and ensuring transactions comply with anti-money laundering (AML) regulations. This not only saves time but reduces the likelihood of human error.

Regulatory and Ethical Considerations:

He raised concerns about the ethical implications of AI, particularly when it comes to data privacy. As AI systems analyze more customer data to offer personalized services, there's a growing risk of privacy infringements if proper safeguards aren't in place. He stressed that regulators are still figuring out how to address these issues, meaning banks must be cautious in their AI deployments to avoid violating customer privacy or facing regulatory backlash.

Future of AI in Banking:

He is optimistic about the future of AI but noted that its success will depend heavily on how well banks can integrate these technologies with their existing systems and processes. He predicted that regulatory bodies would play a significant role in shaping how AI is used in the future, particularly around data privacy and transparency.

PARTICIPANT 2

Background Information:

Participant 2 is deeply involved in the strategic integration of AI at a major financial institution. His role focuses on aligning AI deployments with the organization's long-term goals, ensuring that new technologies are scalable and adaptable to the company's future needs. He sees AI not as a quick fix, but as a long-term investment that requires careful planning and collaboration across business units.

AI Strategy & Planning:

Participant 2 emphasized that a successful AI strategy requires clear alignment with business objectives. Many banks are looking to AI for operational efficiency, especially in automating routine tasks like fraud detection, risk management, and credit scoring. He described AI as a tool for "strategic integration," meaning that it must be tested thoroughly in real-world scenarios before being scaled up across the organization.

For example, he mentioned a use case where his institution used AI to improve its credit risk models. The bank deployed machine learning algorithms to analyze customer credit histories and predict the likelihood of default. This not only sped up the approval process but also improved accuracy by removing some of the human biases that traditionally affected loan decisions. However, he pointed out that while the AI models are excellent for processing large amounts of data quickly, human experts are still needed to make the final decisions,

particularly in borderline cases where AI might not account for nuanced factors like sudden changes in a customer's financial situation.

Exploration of AI Technologies:

Participant 2 discussed the wide range of AI technologies being explored by his institution, from natural language processing (NLP) for automating customer inquiries to more sophisticated machine learning models for decision-making in risk management. One of the more advanced use cases involved AI's ability to detect patterns in fraud detection. The system looks at millions of transactions in real-time and flags suspicious activities based on established patterns. For instance, if a customer's card is suddenly used in multiple high-risk locations within a short period, the AI system can block the card and notify the customer, potentially preventing significant fraud losses.

He also talked about how AI is improving the bank's ability to perform compliance checks. AI systems can scan contracts, financial reports, and other documents to ensure they meet regulatory requirements, reducing the need for manual reviews.

AI's Role in Decision-Making:

Participant 2 emphasized that while AI can provide data-driven insights, it cannot replace human decision-making entirely. AI models are particularly good at identifying trends and patterns in large datasets, which can inform decisions in areas like credit risk and investment strategies. However, AI-generated insights should always be interpreted by human experts who understand the broader business context. In his institution, for example, AI is used to rank loan applicants based on their risk profiles, but human underwriters still review the highest and lowest rankings to ensure fairness and accuracy.

Regulatory and Ethical Considerations:

He underscored the growing importance of data governance and the ethical use of AI, particularly as regulators become more focused on issues like data privacy and algorithmic transparency. He pointed out that AI systems must be transparent, especially in financial services, where decisions can have significant consequences for customers. His institution has started working on "explainable AI" systems that can provide clear reasoning for their decisions, particularly in high-stakes areas like loan approvals and fraud detection.

Future of AI in Banking:

Participant 2 sees AI as a critical tool for future growth in the banking sector. He predicted that AI would become increasingly important in automating routine tasks, freeing up employees to focus on more strategic work. However, he cautioned that large-scale AI adoption would require a strong regulatory framework to ensure that AI is used ethically and effectively.

PARTICIPANT 3

AI Definition and Evolution:

Participant 3 defines AI as tasks that, if performed by humans, would require intelligence. While AI has existed for decades, it has only recently gained traction in banking due to the conservative nature of financial institutions and regulatory concerns.

AI Use Cases in Banking:

He identifies chatbots and virtual assistants as key AI use cases in banking. These tools manage simple customer inquiries like balance checks and transaction histories but struggle with more complex issues requiring human intervention. Another prominent use case is fraud detection, where AI monitors transactions in real-time and flags suspicious activity, helping reduce fraud losses.

Challenges with AI Adoption:

Organizational resistance is a major challenge, with many customer service employees fearing job loss due to AI. Banks need to implement change management programs to help employees view AI as a tool that assists rather than replaces them. Another challenge is the gap between AI's perceived and actual capabilities, especially in complex tasks like loan approvals.

AI in Operational Efficiency:

AI also improves operational efficiency by automating back-office tasks. For example, AI systems can review regulatory compliance documents for anomalies, significantly reducing time and human error. In risk management, AI helps analyze market data and predict potential risks, enabling quicker, more informed decisions.

Challenges with Scaling AI:

Scaling AI across large organizations is difficult, as successful pilot projects often struggle to expand due to integration issues with legacy systems and the need for substantial investment.

Future of AI in Banking:

AI will become a standard tool in banking, especially in areas like personalized financial advice and automated lending decisions. Successful adoption will depend on managing human aspects of change and building customer trust in AI systems.

PARTICIPANT 4

AI Use Cases in Banking:

Participant 4 shares examples of AI's use in fraud detection and customer authentication. His bank uses AI to monitor transactions for suspicious activity and to verify customer identities, cross-referencing documents with global databases to ensure compliance with KYC regulations. This process, once manual and time-consuming, is now almost instantaneous.

AI in Customer Service:

AI is also deployed in customer service, where virtual assistants handle routine queries like balance checks and recent transactions. This reduces the workload on human agents, allowing them to focus on more complex issues.

Regulation, Ethics & Trust:

He expresses concern about the lack of clear regulatory frameworks for AI, making it difficult for banks to innovate while staying compliant. He emphasizes the importance of building customer trust in AI, especially in high-stakes areas like loan approvals, by making AI systems more transparent and explainable.

Challenges in AI Adoption:

Trust and transparency are significant hurdles, especially in decisions like loan approvals where customers are wary of machines making judgments about their creditworthiness. Integration with legacy systems is another challenge, as many banks still operate with outdated technology.

Future of AI in Banking:

Participant 4 is optimistic about AI's future in predictive analytics and personalized financial advice. However, banks need to address regulatory, ethical, and technological challenges for AI to reach its full potential.

PARTICIPANT 5

AI and Customer Experience (CX):

Participant 5 highlights how AI is transforming customer interactions by offering personalized services. AI can analyze customer spending patterns and provide tailored financial product recommendations, such as personalized loan offers or savings plans. AI also helps identify key moments in a customer's life—like buying a home—prompting the bank to offer relevant financial products at the right time.

AI Use Cases in Customer Service and Beyond:

He shares that AI-powered virtual assistants handle routine inquiries, such as balance checks and card management. These systems are available 24/7, providing quick responses and freeing human agents for more complex issues. AI is also used in fraud detection, monitoring transactions for unusual patterns and flagging suspicious activities in real time.

AI Benefits & Future Trends:

Looking ahead, Participant 5 predicts that AI will play a greater role in predictive analytics, helping banks anticipate customer needs before they arise. AI is also expected to take on more complex decision-making, such as loan approvals, with human oversight focusing on exceptions.

Challenges in AI Adoption:

He notes that AI adoption is hindered by the difficulty of integrating AI with legacy systems. The cultural shift required for AI adoption is also a challenge, as employees may feel threatened by AI replacing their roles. Proper training and change management programs are essential to ensure employees see AI as a benefit rather than a threat.

Ethical and Regulatory Concerns:

Participant 5 raises concerns about data privacy and algorithmic transparency, emphasizing the need for banks to ensure that AI systems are transparent and free from bias, especially in areas like credit scoring and loan approvals.

Future Vision for AI in Banking:

He believes AI will play a transformative role in both customer-facing services and back-office operations. The next phase of AI development will focus on building customer trust and improving the transparency and fairness of AI-driven decisions.

PARTICIPANT 6

AI Strategy & Planning:

Participant 6 explains that AI is central to their bank's strategic operations, aligning AI projects with broader business goals rather than viewing AI as a mere tool. AI is used to analyze customer behavior, enabling more accurate market segmentation and product tailoring.

AI in Customer Experience (CX):

AI chatbots improve customer experience by handling initial inquiries, reducing response times, and improving satisfaction. Predictive models identify customer needs, such as when they might require a new mortgage, allowing the bank to offer relevant services in advance.

Implementation Challenges:

He notes the difficulty of integrating new AI systems with the bank's legacy infrastructure, which caused delays in AI-driven projects. AI literacy among employees is also crucial, as the bank invests in training to help staff work effectively with AI.

AI Benefits & Future Trends:

AI has been instrumental in fraud detection and risk management, with algorithms analyzing transaction data in real-time to identify potential risks. In the future, AI will play a larger role in decision-making and providing personalized financial advice.

Regulation, Ethics & Trust:

The participant raises concerns about ethical issues, particularly around data privacy and bias in decision-making algorithms. Engaging with regulators and ensuring transparent AI processes will be essential to maintain customer trust.

PARTICIPANT 7

AI in Customer Experience:

The participant highlights AI's role in managing routine customer inquiries, noting that their AI systems autonomously handle over 70% of queries, such as balance checks and loan statuses. For complex cases like loan disputes, human agents take over, maintaining a balance between AI and human involvement to ensure a high-quality customer experience.

AI in Risk Management and Fraud Detection:

AI is integral to the bank's risk management, particularly in fraud detection. The participant shares how AI monitors millions of transactions daily, detecting anomalies like multiple large withdrawals across different locations. This real-time monitoring has drastically reduced response times in addressing potential fraud.

AI Strategy & Implementation:

The bank's AI strategy enhances both customer-facing services and internal operations. One AI-driven tool helps assess credit risk by analyzing financial data and market conditions, cutting credit assessment time by 30%. The participant emphasizes that AI complements human decision-making, allowing analysts to focus on nuanced aspects like market trends.

Challenges of AI Integration:

Regulatory compliance is a significant challenge, particularly in ensuring transparency in AI-driven decisions like loan approvals. While frameworks have been implemented to meet these requirements, they often slow down AI integration.

Future of AI:

The participant foresees AI handling more predictive analytics, especially in financial advisory services, where AI could provide real-time investment advice based on market trends and customer profiles. However, human advisors will still play a key role in high-net-worth client interactions.

PARTICIPANT 8

Valuation of AI in Operations:

AI has transformed the bank's operations, automating tasks like document processing and compliance checks. Loan applications can now be processed in under two minutes, allowing staff to focus on more strategic tasks like customer relationship management.

AI in Financial Planning & Customer Interaction:

AI enhances the customer experience through financial planning tools. For example, an AI-powered platform provides personalized investment recommendations based on customer goals and risk tolerance, increasing engagement with the bank's wealth management services. However, human advisors still review high-stakes decisions.

AI in Risk and Compliance:

AI has improved compliance efforts, especially in automating Anti-Money Laundering (AML)

checks. AI scans large transaction volumes for suspicious activity, flagging potential issues for further review, thus reducing regulatory risk.

Challenges in AI Integration:

Integrating AI with existing systems remains a challenge. A recent AI project in credit risk assessment faced delays due to compatibility issues with the core banking software. Convincing senior management of AI's long-term value is another ongoing hurdle.

Future of AI:

The participant envisions AI taking on more decision-making in areas like financial advice and portfolio management but stresses the importance of human judgment for high-value, risk-related decisions.

PARTICIPANT 9

AI Strategy & Planning:

AI is central to the bank's strategy, especially for managing large datasets and automating customer service. AI-driven analytics assess customer interactions, improving response times by 40% through sentiment analysis of emails and complaints. This helps the bank understand customer pain points and deliver better service.

AI in Customer Service:

The bank uses AI for personalized product recommendations, identifying customers likely to benefit from certain products based on their transaction histories. This proactive approach has increased product uptake and strengthened customer loyalty.

AI in Fraud Detection and Risk Management:

AI enhances fraud detection by analyzing real-time transaction data. One use case involved the AI system flagging suspicious international transfers, enabling the bank to prevent fraud before significant losses occurred.

Challenges in AI Adoption:

Ethical concerns, particularly bias in AI models, have emerged, especially in credit scoring. The bank has implemented oversight processes to audit AI decisions and ensure fairness.

Future of AI:

AI will predict customer needs and offer tailored services proactively. The participant sees generative AI as a future tool for crafting personalized financial strategies, but stresses that human oversight will remain essential to maintain ethical and regulatory standards.

AI in Regulatory Compliance:

AI helps the bank monitor transactions for regulatory compliance, automatically flagging suspicious activities. This proactive approach reduces both financial risk and manual efforts, making compliance more efficient.

PARTICIPANT 10

AI Strategy & Planning:

AI is integral to both customer-facing and internal processes. AI-driven automation has streamlined back-office tasks, reducing manual effort and allowing the bank to allocate resources to areas requiring human judgment, improving overall efficiency.

AI in Customer Service:

AI-powered virtual assistants manage routine inquiries like loan statuses and account balances, reducing customer wait times and improving satisfaction. AI also analyzes customer data to identify challenges and refine services.

AI in Fraud Detection & Risk Management:

AI analyzes real-time transaction data to detect fraud. It flags abnormal patterns, such as high-value transactions across distant locations, enabling timely intervention. AI has also reduced false positives, minimizing disruptions for legitimate customers.

Challenges in AI Adoption:

Integrating AI with legacy systems has been time-consuming. Customer trust in AI is another hurdle; the bank is working to build transparency and assure customers that human agents are available for complex inquiries.

Regulation, Ethics & Trust:

Transparency is vital in AI-driven decision-making, particularly in areas like loan approvals. The participant calls for more comprehensive regulations to keep up with AI advancements.

Future of AI:

AI will increasingly take on predictive roles, such as forecasting trends and suggesting investment strategies. However, human oversight will remain essential for decisions involving ethical considerations and complexity.

PARTICIPANT 11

AI Strategy & Implementation:

AI tools are used to enhance operational efficiency, particularly in the loan application process, where AI has reduced approval times from days to hours. While AI speeds up routine tasks, human employees review complex cases to ensure accuracy and fairness.

AI in Customer Acceptance:

Some customers are uncomfortable with automated systems. To build trust, the bank explains AI's role in decision-making, especially in loan approvals. The participant is working on tools that make AI decisions more transparent for customers.

AI in Personalization and CX:

AI analyzes spending patterns to offer relevant financial products, such as credit cards or

savings accounts. This personalization has increased product uptake. The bank also uses AI to anticipate customer needs, allowing for proactive service offerings.

AI Benefits & Future Trends:

The participant is optimistic about AI's future in automating internal processes and improving customer experience. However, human involvement will still be necessary for complex financial decisions, particularly for high-net-worth clients.

PARTICIPANT 12

Legacy Systems and Technological Integration:

The organization's outdated systems have been a barrier to AI adoption. These legacy systems lack the scalability and agility needed for AI, requiring continuous updates to remain competitive in the evolving digital landscape.

AI Strategy & Planning:

The AI strategy focuses on marketing automation and customer interactions, using AI to gather data and improve campaign efficiency. The goal is to automate lower-level tasks while allowing employees to focus on high-value work, complementing human expertise.

AI Implementation & Use:

AI tools are being tested in marketing automation, particularly for customer targeting and personalized offers. However, outcomes are still in early stages, and a lack of skilled personnel remains a barrier to broader AI adoption.

Customer Experience (CX) & Interaction:

AI's role in customer interactions is limited, though the organization is piloting AI-driven personalization projects. Chatbots and automated tools are being explored to handle routine inquiries, freeing human agents for complex issues.

AI Benefits & Future Trends:

AI will streamline operations and improve customer service, taking over routine tasks while employees focus on higher-value interactions. However, transparency and ethical AI use remain priorities as the organization navigates technological and resource-related challenges.

PARTICIPANT 13

Legacy Systems and Technological Challenges:

Participant 13 emphasizes that legacy systems pose significant challenges to AI integration in financial institutions. Many banks are burdened by years of technological debt, which hinders their ability to adopt modern AI platforms. These older systems often can't handle the large amounts of data needed for AI models, forcing the need for substantial infrastructure investments.

AI Strategy & Planning:

The participant's organization focuses on automating processes and improving customer

service through AI. High-impact use cases like credit risk management, customer onboarding, and fraud detection are prioritized based on their potential to generate value, either by reducing costs or enhancing customer satisfaction. He notes that measuring AI's ROI is complex, as benefits like improved customer satisfaction or risk mitigation are often qualitative.

AI Implementation & Use:

AI is already in use in several areas, such as AI-driven chatbots for customer service and fraud detection algorithms that monitor transaction patterns. The organization is also exploring AI in credit scoring, where machine learning models assess risk more accurately. However, regulatory compliance remains a challenge, often slowing AI implementation.

Customer Experience (CX) & Interaction:

AI enhances customer interactions by providing personalized product recommendations based on customer behavior. However, the participant stresses the importance of balancing AI with human interaction, especially for complex financial decisions, as many customers still prefer speaking to a human.

Regulation, Ethics & Trust:

The participant is concerned about the increasing regulatory scrutiny, particularly with the upcoming AI Act. The organization is preparing compliance strategies and has set up internal ethics boards to ensure AI projects meet regulatory standards. Transparency and accountability are central to their AI ethics strategy, especially in how customer data is handled.

AI Benefits & Future Trends:

He sees AI becoming central to automating routine processes and providing personalized services. AI will enable faster decision-making and more accurate risk assessments, but full adoption will require ongoing investments in infrastructure and talent development.

PARTICIPANT 14

Legacy Systems and Technological Integration:

The participant discusses how legacy systems hinder AI integration in his organization. Many processes are highly deterministic, limiting the flexibility AI requires. This rigidity leads to slow change, often affecting customer experiences through delayed services or subpar digital interactions.

AI Strategy & Planning:

The organization is cautiously advancing AI projects, focusing on operational efficiency and customer satisfaction. AI chatbots, currently being tested for customer service roles, face high expectations from customers, who demand flawless performance from the start. This poses a challenge for delivering scalable and adaptable AI solutions.

AI Implementation & Use:

AI is being used to enhance customer communications through personalized notifications, reminding customers of actions like bill payments or savings opportunities. Internally, AI automates workflows like document processing and compliance checks, and the organization is exploring AI for fraud detection, where it outperforms traditional methods in identifying suspicious transaction patterns.

Customer Experience (CX) & Interaction:

AI is viewed as a way to improve customer experiences through more personalized and seamless interactions. However, the participant notes that current implementations still feel rigid, lacking the human empathy needed for more nuanced interactions. The goal is to integrate AI in a way that complements human service without losing the personal touch.

Ethical Considerations:

Bias and data privacy are top priorities for the organization. They have implemented internal oversight to ensure AI tools are transparent and decisions are explainable. The participant highlights the importance of building customer trust, especially around how their data is used.

AI Benefits & Future Trends:

The participant envisions AI automating much of the routine work currently done by employees, allowing them to focus on complex, strategic tasks. However, AI's introduction must be managed carefully to avoid alienating customers who still prefer human interactions.

PARTICIPANT 15

Legacy Systems and Technological Integration:

The participant highlights that legacy systems present major obstacles to AI adoption in his organization. These systems aren't designed for the flexibility AI requires, delaying AI initiatives. Replacing or upgrading these systems is costly and time-consuming, further complicating efforts to implement AI, especially in critical areas where agility is key.

AI Strategy & Planning:

The organization's AI strategy aims to enhance customer-facing services and back-office operations. AI is expected to assist with customer onboarding, loan processing, and personalized product recommendations. By analyzing customer data, AI algorithms can offer tailored financial products like savings accounts or loan options. Each AI project is carefully evaluated to ensure measurable value.

AI Implementation & Use:

The organization has deployed AI in customer service through chatbots that handle routine inquiries, allowing human agents to focus on more complex issues. AI is also used in fraud detection, where machine learning models monitor transactions for suspicious activities. In

credit risk management, AI helps assess loan applicants' risk profiles by analyzing historical data, leading to faster and more accurate decisions.

Customer Experience (CX) & Interaction:

AI enhances customer experiences by providing personalized product recommendations based on individual spending habits. Predictive models help customers manage accounts more efficiently by analyzing spending patterns and suggesting ways to optimize savings. However, customer acceptance of AI remains a challenge, as many prefer human interaction for complex financial decisions.

Regulation, Ethics & Trust:

The upcoming AI Act is expected to significantly impact how AI is used in the financial sector. The participant's organization is preparing for these changes by ensuring its AI systems comply with regulatory requirements. They have established an internal ethics board to oversee AI projects, ensuring transparency and ethical use. Building customer trust in AI systems, particularly around data use, is a top priority.

AI Benefits & Future Trends:

The participant believes AI will transform the financial sector by automating routine processes, freeing up employees for more strategic tasks. AI could eventually handle the entire loan application process with minimal human intervention. However, the transition must be managed carefully to ensure customers remain comfortable using AI-driven services.

PARTICIPANT 16

Background Information:

Participant 16 works at a private financial institution that emphasizes personalized services. With a background in both academia and semi-professional sports, he brings a unique perspective on performance management and strategic thinking. His institution's smaller size allows it to remain agile and deliver highly customized services to its clientele.

AI Strategy & Planning:

The institution's AI strategy focuses on improving operational efficiency without compromising the personal service that distinguishes it from larger competitors. AI is integrated at different levels, from back-office functions to customer-facing roles. AI tools are used to automate routine tasks like data entry and report generation, freeing professionals to focus on personalized client interactions and strategic decision-making.

AI Implementation & Use:

AI is used in risk management and investment analytics, where it detects market anomalies and assesses risk factors in real-time. A key use case involves client risk profiling, where AI analyzes behavioral data to tailor products and services to individual client risk appetites. This allows the institution to provide bespoke financial advice while minimizing risk.

Future of AI in Banking:

Looking ahead, the participant sees AI becoming even more integrated into operations, from client onboarding to portfolio management. However, he cautions against over-reliance on AI, noting that high-end financial services will continue to require a personal touch for building client trust. The institution plans to explore advanced AI technologies in predictive analytics to further enhance its customized services.

PARTICIPANT 17

AI Definition and Strategic Impact:

Participant 17 defined AI as a system designed to perform tasks that would otherwise require human intelligence, such as data analysis, decision-making, and prediction. At his financial institution, AI is primarily seen as a tool to streamline processes and improve decision-making accuracy. Participant described the AI strategy as not only operational but also strategic, emphasizing that AI can optimize both back-office processes (e.g., automating routine tasks) and front-office activities (e.g., customer interaction and service personalization).

AI's ability to analyze vast datasets quickly and accurately has allowed the institution to react faster to market changes. For example, AI tools are used to analyze credit risk and generate real-time forecasts, which help manage risk more effectively.

AI Implementation Challenges:

One of the biggest challenges, according to Participant, is integrating AI into the institution's legacy systems. Older systems are often incompatible with modern AI technologies, making it difficult to leverage AI's full capabilities without significant upgrades. Cultural resistance within the organization also poses a challenge, as staff accustomed to traditional methods may be reluctant to adopt new technologies.

Regulatory concerns are another major issue. Financial regulators require transparency in AI models, particularly in sensitive areas like credit scoring. Participant's institution ensures that AI models are interpretable and that human oversight remains a critical component of decision-making.

Use Cases:

Participant highlighted several use cases where AI has delivered value, particularly in credit scoring. AI models analyze not just financial data but also behavioral data to predict creditworthiness, resulting in faster and more reliable decisions. Another key application is in customer segmentation, where AI analyzes customer behavior to create targeted marketing campaigns. By identifying patterns in transaction data, the institution can offer personalized products that better meet individual needs.

Future of AI:

Participant envisions AI playing a key role in decision-making across the institution. He believes that AI will continue to augment human decision-making, enabling faster, more informed choices. Participant expects AI's predictive analytics capabilities to expand, providing real-time insights into market trends and helping the institution proactively adjust its strategies.

PARTICIPANT 18

AI Exploration and Strategic Planning:

Participant 18 focuses on exploring AI's potential in the financial sector, identifying where AI can streamline operations and add value to client services. Participant emphasized that AI is not a one-size-fits-all solution and should be applied strategically. AI has been particularly successful in fraud detection, where it identifies suspicious transactions more quickly than human analysts. In other areas, like customer relationships, AI complements rather than replaces human interaction.

Challenges in AI Adoption:

The biggest challenge, according to Participant, is managing stakeholder expectations, especially among employees concerned about job displacement. Participant stressed that AI is designed to enhance staff roles rather than replace them. Another challenge is ensuring transparency in AI models, which can be complex and difficult to explain to both clients and regulators.

AI in Practice:

Participant's institution has successfully implemented AI in fraud detection and risk management. AI analyzes transaction data in real-time, identifying patterns that indicate potential fraud. This has significantly improved response times and reduced the institution's exposure to risk.

AI chatbots have also been deployed to handle routine customer inquiries, freeing up human staff to focus on more complex issues. These chatbots, powered by natural language processing, understand and respond to customer queries in real-time, improving efficiency and customer satisfaction.

Future of AI in Banking:

Participant sees AI playing an increasingly important role in predictive analytics and personalized services. AI will help the institution anticipate customer needs, offering more tailored products and services. However, Participant believes that AI must work alongside human expertise, particularly in areas where personal relationships and nuanced decision-making are critical.

Survey Questionnaire

Question	Answer Options
1. What is your gender?*	- Woman / Man/ Non-Binary/ Other

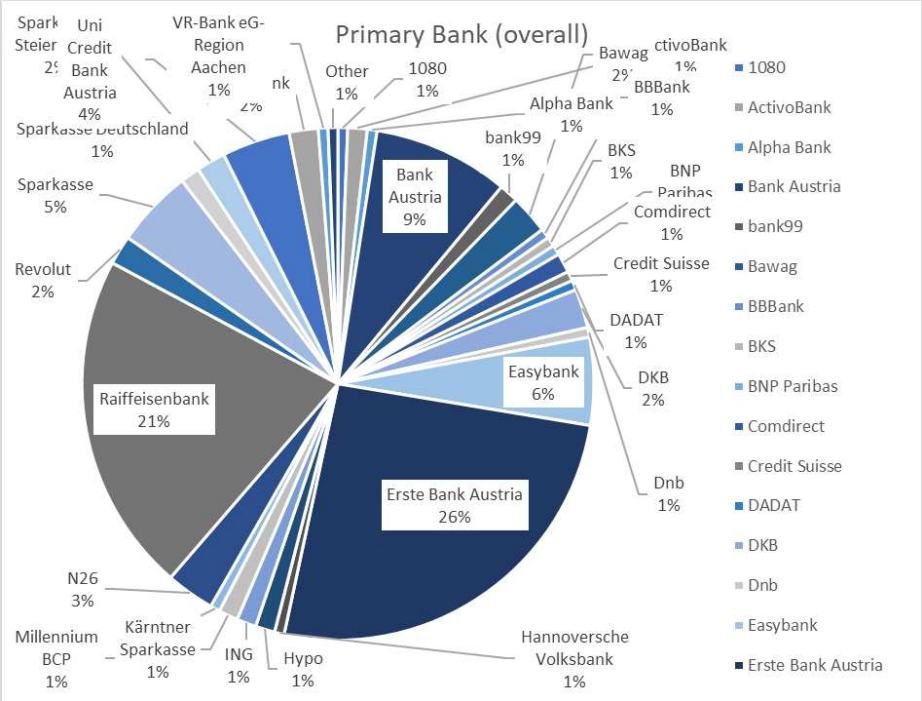
2. How old are you?*	< 18; 18-25; 26-35; 36-45; 46-55; 55+
3. What is the highest level of education you've completed?*	- High school or lower - Bachelor's degree - Master's degree - Doctorate degree (PhD)
4. Where do you live?*	- Austria - Other and specify
5. What type of area do you currently live in?*	- In a large city (200,000 or more residents) - In a small city - In a suburb - In a village or in the countryside
6. Which industry are you working for?*	-Automotive industry - Aerospace and Defense - Advisory - Agriculture - Construction/Engineering *and so on*
7. What is your current main occupation?*	- Student; employed full time; employed part-time, self-employed, unemployed; retired
8. Which bank do you primarily use?*	- [Open-ended text field]
9. How long have you been with your current bank?*	- Less than 1 year; 1-3 years; 3-5 years; more than 5 years
10. Are you aware of your primary bank using AI technologies (e.g., chatbots, automated financial advice)?*	- Yes or No
11. Have you interacted with any AI-based services provided by your bank?*	- Yes or No
12. If yes, which AI services have you used? (Check all that apply)	- Chatbots for customer service - Automated financial advice - Fraud detection alerts - Personalized financial recommendations - Other
14. How satisfied are you with the following aspects of AI in your banking experience (main bank)?*	- Ease of use of AI-based services - Responsiveness of AI customer support - Accuracy of AI-driven recommendations - Security of AI-managed data - Speed of AI-related transactions - Personalization of services through AI - AI services as a substitute for personal service
15. Do you have a secondary bank?*	- Yes or No
16. If yes, which one?*	- [Open-ended text field]
17. How long have you been with your current secondary bank?*	- Less than 1 year; 1-3 years; 3-5 years; more than 5 years
18. Are you aware of your secondary bank using AI technologies (e.g., chatbots, automated financial advice)?*	- Yes or No
19. Have you interacted with any AI-based services provided by your secondary bank?*	- Yes or No

20. If yes, which AI services have you used? (Check all that apply)	- Chatbots for customer service - Automated financial advice - Fraud detection alerts - Personalized financial recommendations - Other
21. If other, please specify	- [Open-ended text field]
22. How satisfied are you with the following aspects of AI in your banking experience (secondary bank)?*	- Ease of use of AI-based services - Responsiveness of AI customer support - Accuracy of AI-driven recommendations - Security of AI-managed data - Speed of AI-related transactions - Personalization of services through AI - AI services as a substitute for personal service
23. How important are the following factors to you when considering your banking experience?*	- Ease of use of online banking services - Availability of personal customer support (call service) - Availability of AI-based customer support - Speed of transactions - Personalization of services - Security and privacy of data - Accuracy of AI-driven recommendations - Human interaction availability
24. Would you be willing to pay extra for enhanced AI-based banking services?*	- Yes or No
25. If yes, how much extra would you be willing to pay per month?*	- Less than 5 EUR to more than 20 EUR
26. What are your main concerns about using AI in banking? (Check all that apply)*	- Data privacy concerns - Security concerns - Lack of human interaction/touch - Accuracy of AI decisions - Bias in AI algorithms - Transparency of AI decisions - Cost implications for customers - Cannot solve my problem - Other
27. If other, please specify	- [Open-ended text field]
28. How likely are you to recommend AI-based banking services to others?*	- Very likely to very unlikely
29. What do you find most beneficial about AI-based services in your banking experience (if any)?	- [Open-ended text field]
30. What improvements would you like to see in AI-based banking services?	- [Open-ended text field]
31. Do you have any concerns about the use of AI in banking? If yes, please specify.	- [Open-ended text field]
32. What features or services would you like to see your bank offer through AI that are currently not available?	- [Open-ended text field]

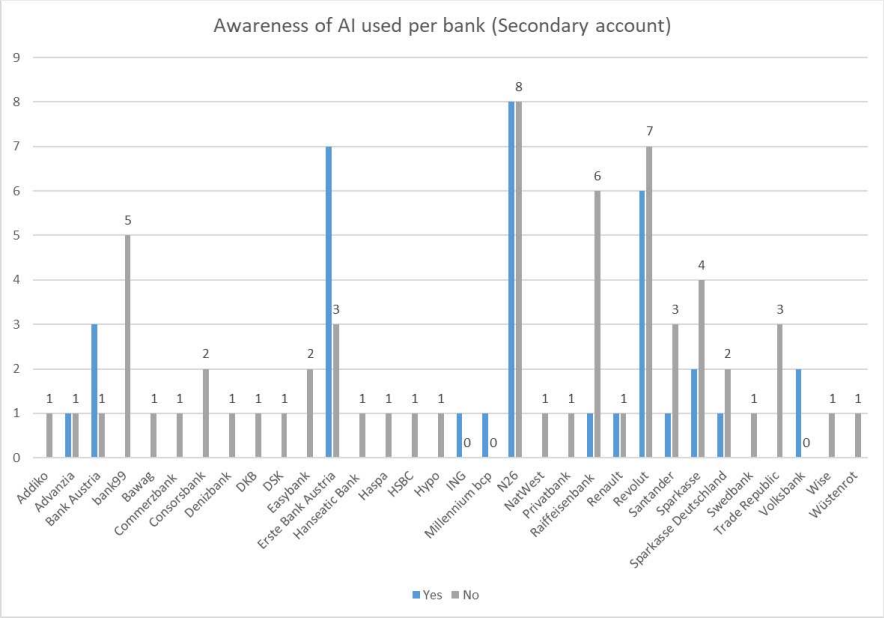
Additional Data and Graphs

Survey Analysis

Survey Question: Which bank do you primarily use?



Survey Question: Are you aware of your primary bank using AI technologies(e.g., chatbots, automated financial advice)?



Survey Question: Have you interacted with any AI-based services provided by your bank? (Primary Bank)