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AI Integration in the Banking Industry: A Case Study of J.P. Morgan.

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Abstract:

As the financial industry undergoes a profound technological transformation, the role of artificial intelligence (AI) in shaping the banking industry services has become progressively more vital. This research aims to expose, through a relevant case study in the banking industry, the integration of artificial intelligence (AI) in bank's services, with a particular focus on J.P. Morgan, a global banking giant. Understanding the pragmatic functions, challenges, and implications of AI in banks emerges as a pivotal requirement in a landscape where technological breakthroughs redefine the contours of financial services. Through in-depth analysis of J.P. Morgan's AI initiatives, the study's objective is to illustrate the multifaceted role of AI in enhancing the services provided by banks such as customer interactions, risk management, fraud detection, and operational efficiency. The examination goes beyond mere technological considerations, diving into the regulatory frameworks governing AI in banking, its implications, and the developing landscape of customer expectations in a financial ecosystem powered by AI.

Key words: Artificial intelligence (AI), technology, J.P. Morgan, banking, financial industry, services.

Resumen:

A medida que la industria financiera experimenta una profunda transformación tecnológica, el papel de la inteligencia artificial (IA) en la configuración de los servicios bancarios se vuelve cada vez más importante. Esta investigación tiene como objetivo exponer, a través de un caso de estudio relevante en la industria bancaria, la integración de la inteligencia artificial (IA) en los servicios bancarios, con un enfoque particular en J.P. Morgan, un gigante bancario mundial. Comprender las funciones pragmáticas, desafíos e implicaciones de la IA en la banca emerge como un requisito fundamental en un panorama donde los avances tecnológicos redefinen los contornos de los servicios financieros. A través del análisis en profundidad de las iniciativas de IA de J.P. Morgan, el propósito del estudio es ilustrar el papel multifacético de la IA en la mejora de los servicios proporcionados por los bancos, como las interacciones con los clientes, la gestión de riesgos, la detección de fraude y la eficiencia operativa. El estudio va más allá de consideraciones tecnológicas simples, adentrándose en los marcos regulatorios que rigen la IA en la banca, sus implicaciones y el panorama en evolución de las expectativas de los clientes en un ecosistema financiero impulsado por la IA.

Palabras clave: Inteligencia artificial (IA), tecnología, J.P. Morgan, banca, industria financiera, servicios.

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1. Introduction

1.1. Context of the issue

We find ourselves in an era of change where the world is continually being shaped and transformed by technological advances. This makes it practically impossible to find or talk about companies that do not apply technology in any of their activities or operations. Over the last few decades, emerging technologies have been integrated into all areas due to the process of globalization, which has completely changed the rules of the game. Businesses of all sizes and in practically all industries have adopted a variety of technological approaches. Today we find technological advances in fields we would never have thought of, such as healthcare with telemedicine, agriculture with precision farming, education through e-learning platforms, or transportation with autonomous vehicles. However, although we see these advances most of the time as advantages full of business opportunities, they are still under development and impose certain limitations and demands on traditional sectors.

The banking industry is not spared from the changes occurring as a result of digitalization. The international financial crisis in 2008 had a significant impact on this sector, which led to a profound reflection on banking. Apart from the fact that banks suffered a serious deterioration in their margins, they were faced with a loss of confidence in traditional banking by customers and the emergence of digital alternatives to all products in the sector. For that reason, the digital transformation has led to a high level of consolidation in the sector necessary to maintain its competitiveness and profitability.

All banks must be at the forefront of technological innovation if they want to avoid the risk of losing customers by not implementing in time the profound and swift changes that are taking place in terms of technological innovation. The pace at which technology is developing and adapting is accelerating, posing major obstacles for banks and placing pressure on them to stay ahead. Not only does new technology affect the core operations of the banking industry, but it also has an impact on interactions with customers. Financial institutions need to be aware of new customer expectations and the need to cut expenses to increase their margins, as well as to comply with the new requirements of the regulatory framework.

The role artificial intelligence (AI) plays in the banking and financial sector will be the main focus of this study, with a particular emphasis on J.P. Morgan, a global investment bank. The integration of artificial intelligence is today, an indispensable strategy for a bank to not only survive but also thrive in the current landscape marked by fierce competition and rapid change. This strategy is thought to be essential to banks' and most businesses' future success in the years that lie ahead. The case of J.P. Morgan is of special interest as it stands out as one of the world's biggest technology-driven companies and has secured its spot as one of the best banks performing services using AI. It is one of the oldest financial institutions, tracing its roots in 1799 in New York City, and has made significant investments in technology to enhance its operations, improve client relations as well as their experience, and remain in line in the constantly evolving financial market (J.P. Morgan Chase & Co., 2024). Using the efficient application of sophisticated technology, J.P. Morgan has managed to optimize procedures, introduce innovative financial services, and adjust to the evolving demands of its customer base, therefore consolidating its standing as a frontrunner in the global banking industry.

1.2. Purpose and motives

The primary motivation for this research is my personal interest in J.P. Morgan's application of artificial intelligence in worldwide banking practices. This curiosity is a result of the desire to comprehend how technology advancements—more especially, artificial intelligence—are changing the way the modern world operates. Due to its propensity to adopt the newest technologies to obtain a distinct competitive advantage over its rivals, this industry has been the explicit focus of the research. This technology might lower industrial costs and provide a fair playing field for all parties involved. The primary goals are to comprehend the dynamics that result from this technological convergence and investigate how AI affects and enhances banks' strategies. However, it should be remembered that this transformation is still in the early stages of development, so it may also place restrictions and requirements on conventional banking.

The dynamic evolution of company strategies and the rising impact of new technologies in a market that is becoming more and more digitized make this analysis essential in today's environment. After all, banking is a necessary part of everyone's life; it is

present everywhere and sometimes goes undetected, leaving us unaware of its existence. Depending on their target market and corporate objectives, each business will create a unique strategy to comprehend the changing possibilities and threats concerning the firm's strengths and limitations.

Comprehending the effects of artificial intelligence (AI) on banks is becoming essential in a highly competitive economic landscape. With the ability to analyze massive data sets, comprehend our preferences, and provide personalized experiences, artificial intelligence (AI) has completely changed how companies interact with consumers. Because of this, how AI is affecting the banking industry offers crucial insight into the new interaction and personalization dynamics of the digital era. In addition to spotting new trends and best practices, banks are attempting to predict and adjust to shifting customer behavior. Moreover, investigating how AI affects financial institutions may help businesses become more competitive by strengthening their client connections, improving processes, and enhancing their position in a particular market. This is especially important in a world where relevance and personalization are critical.

Moreover, the choice to focus on J.P. Morgan is supported by its leadership position in the technology industry and recognition for leading the digital transformation as one of the leading and most significant financial organizations globally. J.P. Morgan has demonstrated a resolute commitment to innovation, namely in the fields of artificial intelligence and technology, placing it at the forefront of integrating AI into its operations. Examining the company's past allows one to understand how AI technologies have developed, particularly digital transformation, automation, and artificial intelligence—all of which are essential elements of modern banking operations. J.P. Morgan was chosen for examination in part because of its progressive stance on technology. We'll examine many initiatives that demonstrate the breadth of artificial intelligence's global and technical possibilities, including the employment of chatbots, COiN (Contract Intelligence), and other efforts.

2. State of the Issue

2.1. What is Artificial Intelligence?

Everything started through the Industrial Revolution during the 1760s, considered an episode of great technological and social change (PK, 1984, p. 65). Due to this development, a lot of manual jobs have been substituted by new technological advances, which most of the time implies a tremendous help to humankind. Artificial intelligence is one of the most significant and influential instances of this technological advancement. It is a branch of science and technology that constructs intelligent machines and computer systems capable of performing a variety of duties that require human intelligence. AI used to only be a concept seen in science fiction stories and discussions about how technology is affecting the present world. However, it has since become a part of who we are in our daily lives (PK, 1984, p. 65).

Humanity has spent ages trying to comprehend how human intelligence functions to anticipate and influence human behavior. When people hear what is known as artificial intelligence (AI), they frequently visualize robots capable of thinking and acting like human beings. The scope of AI goes beyond that, as it not only focuses on understanding but also on "creating intelligent entities". AI currently encompasses a wide range of subfields, spanning from the general (learning and perception) to the specific, such as playing chess, proving mathematical theorems, writing poetry, driving a car on a crowded street, and diagnosing diseases. AI is relevant to any intellectual task, truly representing a universal field (Russel & Norvig, 2010). As a result, it now serves as the key foundation of many technical and various other sectors, bringing a significant impact on sectors like manufacturing, healthcare, supply chains, etc. AI's ability to execute tasks beyond human capability results in numerous applications, which enhances performance and productivity (PK, 1984, p. 65).

First, it is important to establish a definition to enhance the comprehension of the artificial intelligence concept. Numerous studies propose definitions that emphasize different aspects while also overlapping. This generates diverse interpretations of the concept, further complicating the task of determining the precise definition. Currently, there is observable variation among different companies and scholars, each contributing distinct ideas without

reaching a consensus on the definition of AI. Hence, for this study, we will meticulously review some definitions, highlighting similarities and key components.

In the book "Artificial Intelligence: A Modern Approach," Russel and Norvig (2010) collect eight different definitions of the term, grouping them into 4 categories along two dimensions. They clarify that *"the definitions on top are concerned with thought processes and reasoning, whereas the ones on the bottom address behavior. The definitions on the left measure success in terms of fidelity to human performance, whereas "rationality" the ones on the right measure against an ideal performance measure, called rationality"* (p 1-2).

Table 1: Some definitions of artificial intelligence, organized into four categories.

Thinking Humanly	**Thinking Rationally**
"The exciting new effort to make computers think ... *machines with minds*, in the full and literal sense." (Haugeland, 1985) "[The automation of] activities that we associate with human thinking, activities such as decision-making, problem-solving, learning ..." (Bellman, 1978)	"The study of mental faculties through the use of computational models." (Charniak and McDermott, 1985) "The study of the computations that make it possible to perceive, reason, and act." (Winston, 1992)
Acting Humanly	**Acting Rationally**
"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzweil, 1990) "The study of how to make computers do things at which, at the moment, people are better." (Rich and Knight, 1991)	"Computational Intelligence is the study of the design of intelligent agents." (Poole *et al.*, 1998) "AI . . . is concerned with intelligent behavior in artifacts." (Nilsson, 1998)

Fuente: Russel & Norvig, 2010

Following the organization of these definitions, we can continue to examine the main approaches to AI, such as machine learning and deep learning.

Starting with machine learning (ML) is a factor that is increasingly developing and is closely linked to artificial intelligence technology as it is a subfield within AI. According to Microsoft Azure, machine learning is considered a *"process by which mathematical models of data are used to help a computer learn without direct instructions...uses algorithms to identify patterns in the data...then used to create a data model that can make predictions"* (Microsoft Azure, n.d.).

The definitions in Table 1 lead us to the conclusion that the ultimate purpose of AI is to develop human-like intelligence in machines. Learning algorithms aim to achieve this goal by simulating how the human brain learns. In order to accomplish this, machine learning—a field that sprang from artificial intelligence—is essential (Das, Dey, Pal, & Roy, 2015). Unlike traditional programming approaches that rely on explicit instructions, machine learning empowers machines to acquire intelligence reminiscent of humans by learning from data and experiences autonomously (Das, Dey, Pal, & Roy, 2015). That is why Strene (2017) concludes in his book "Artificial Intelligence for Marketing: Practical Applications" that "*artificial intelligence is a machine pretending to be a human, while machine learning is a machine pretending to be a statistical programmer"* (p.4).

Machine Learning is divided into four principal categories:

- Supervised Learning: According to Zohuri y Rahmani (2023), in this instance, the user gives the algorithm pairs of inputs and desired outputs, and the algorithm works out how to give an input the desired result. Specifically, without assistance from a human, the algorithm can produce an output for an input it has never seen before. Machine learning algorithms that automate decision-making by extrapolating from well-known examples are the most effective (Das, Dey, Pal, & Roy, 2015).
- Semi-supervised Learning: Zohuri and Rahmani (2023) suggest that this type of learning is a hybrid approach that combines elements of supervised and unsupervised learning therefore incorporating both labeled and unlabeled instances.

- Unsupervised Learning: the learning algorithm is not guided by instructors or predetermined outputs in this scenario. Rather, the algorithm's job is to use its processing methods to extract information from the supplied data (Zohuri and Rahmani, 2023). For instance, Google News groups news articles from many sources based on common subjects using clustering algorithms, making it easier for users to find pertinent content (Das, Dey, Pal, & Roy, 2015).
- Reinforced Learning: It involves guiding an agent on how to behave in a way that maximizes rewards over the long run and it runs on a system that rewards right behavior and penalizes wrong behavior (Das, Dey, Pal, & Roy, 2015).

In the realm of machine learning, we currently face issues that were unimaginable a few years ago. The present models are more sophisticated and less interpreted than previous ones. They have been able to be utilized in a greater variety of jobs and become more integrated into daily life than they were in the past because they are granted greater flexibility to make decisions and take action in a variety of domains (Biran & Cotton, 2017). AI algorithms in autonomous cars like Teslas and virtual assistants like Apple's Siri are two examples of how technology has changed our daily lives by increasing efficiency and decreasing human error. These algorithms have transformed the way we interact with technology and made many everyday chores easier since they provide quick responses and simple access to information and services (Simplilearn, 2024). There is little doubt that in the future, this discipline will continue to gain popularity and provide fascinating and critically important work (Biran & Cotton, 2017).

Deep learning is a topic that must be discussed to comprehend AI and machine learning. IBM (n.d.) describes this subset of machine learning as using multi-layered neural networks in an attempt to replicate how the human brain functions. It lets them learn from a lot of data, even when it is far from matching their capability. Networks of processing units within the overall system can specialize in the detection of specific undetectable characteristics in the data by imitating the architectural features of the nervous system (Arrabales, 2016). This enables the system’s components to resemble human tasks like voice and tone recognition, image and face identification, and prediction, among others (Arrabales, 2016).

Amazon Web Services (AWS) (2023) states that deep learning is widely used across a range of businesses. For instance, deep learning models are used by autonomous cars in the automobile industry to recognize people and traffic signs automatically. Defense systems in aerospace utilize deep learning to locate and annotate regions of interest in satellite images. Deep learning technologies are used in industrial facilities to automatically identify individuals or things that are too close to machinery for safety. Similar to this, deep learning is employed in medical studies to evaluate medical pictures and identify cancer cells, enabling precise diagnosis. These are just a few instances given by AWS of how deep learning has been used in many fields to increase the precision and efficiency of several operations.

However, as previously said, machine learning is the subset of deep learning, meaning that machine learning was created before the advent of deep learning. An intriguing example is used in a BBVA (2023) article to easily convey this point: think of AI, machine learning, and deep learning as being similar to Russian matryoshka dolls. The biggest doll stands for artificial intelligence, a vast discipline that aims to build robots that can mimic human functions including perception, thinking, and learning. The following doll is contained inside this: machine learning, a field of study devoted to creating methods by which machines may be taught to carry out certain jobs using data. The tiny doll at the center of it all is deep learning, a particular kind of machine learning that aims to imitate human thought and learning.

Figure 1. Russian matryoshka dolls representing AI, ML, and DL

Source: BBVA (2023)

Then, the primary distinction between machine learning and deep learning, according to IBM's data and AI team's blog post, is how the algorithms learn and how much data they require. Deep learning automates most of the process and can deal with vast unstructured data sets, whereas machine learning can work with labeled data sets and requires human intervention to find patterns. Deep learning, which is renowned for its scalability and capacity to handle challenging problems, is centered around neural networks (IBM, 2023). To have a better grasp of how AI and its sublets function, it is crucial to comprehend this hierarchy and its distinctions, even though the latter two are occasionally discussed combined.

2.2. Origins and historical evolution of Artificial Intelligence (AI)

To understand more fully how we have reached this point of technological advancement it is essential, besides analyzing and exploring the different types of definitions and subfields of AI, to examine it from its beginnings to contextualize its development. Since ancient times, mankind has sought to understand the processes that trigger human thought, to later recreate it in intelligent machines. Philosophical contributions have been among the disciplines that have shaped the foundations of AI, as the concept of "intelligent machines" was introduced by philosophers to help us appreciate and understand the value of being human.

Philosophical contributions have been among the disciplines that have shaped the foundations of AI. The first example we can look at is Aristotle (384. B.C.), recognized as the first person to articulate a detailed and precise system of principles and rules governing the rational functioning of the mind (Russel & Norvig, 2010). Moreover, Thomas Hobbes (1588-1679) remarked *"for REASON ... is nothing but reckoning ..."*, implying that the elements involved were formal components connected through purely syntactic operations, so that reasoning could be simplified to calculation (Dreyfus & Dreyfus, 1991). The philosopher Ramon Llull (1232–1315) proposed developing a logical machine capable of either validating or invalidating arguments (Velasco, 2014). The "Rechenuhr", also known as a calculating clock, was the first device capable of performing arithmetic operations in a completely mechanical way. This groundbreaking invention is associated with the German scientist Wilhelm Schickard (1592-1635) in 1623 (Guijarro, 2019). Nevertheless, a more successful calculating machine known as the "pascaline" was designed in 1642 by the mathematician and physicist Blaise Pascal (1623-1662) (Swaine & Freiberger, 2022). As a result, the

emergence of AI can be traced back to ancient times and was aided by the efforts of mathematicians, engineers, and psychologists. Although they might not have been directly involved in specific research and development, they have made a significant contribution by providing creative concepts that have paved the way for AI's subsequent advancement.

Subsequently, the 1950s are regarded as a pivotal period for the history of AI given that it was during this period that the field of AI began to take shape and establish the foundation for many years of subsequent research and innovation. The significance of one of the most outstanding mathematicians of the twentieth century, Alan Turing, is important to note. In 1950, he published his article "Computing Machinery and Intelligence" in the philosophical journal “Mind”, where he provided a summary of his thoughts and ideas on intelligent machinery and artificial intelligence at the time (Turing, 1950). In addition, the article also outlines his arguments and reflections, such as Turing's prediction that an *“average interrogator will not have more than 70 percent chance*” of distinguishing the computer from a person “after five minutes of questioning” (Turning, 1950).

In the same article, Turing proposes what is known as the "Turing Test" or "the imitation game", a mechanism based on the principle of imitation with which he intends to address the question of whether machines are intelligent or not, able to reason and imitate human thought. Turing (1950) describes the game as follows:

> *“There is a person, a machine, and an interrogator. Separated from both the subject and the machine, the interrogator seeks to determine which is which. Each is given the designation "X" or "Y," but the interrogator is first unsure of who is ‘X.’ They may inquire, ‘Will X please tell me whether X plays chess?,’ and 'X' and 'Y' need to react appropriately as well. The human's objective is to help the interrogator accurately identify the machine, while the machine's is to fool the interrogator into thinking it is the person. The aim of the machine is to trick the interrogator into mistakenly conclude that the machine is the other person; the object of the other person is to try to help the interrogator to correctly identify the machine” (Oppy & Dowe, 2003)*

The test requires the computer to be able to understand language and express it coherently, to store the information received, to use the information to respond and be able to formulate conclusions, to learn from behavior and the environment, and to be able to

manipulate objects to answer. Therefore, the computer passes the test if the human who is interrogating, after asking the questions and receiving the answers, cannot differentiate whether the answers come from a person or a computer.

This test, in a way, reveals the connection between the possible functions of computers and our conventional notions of thinking. Turing's ideas and experiments are recognized as fundamental contributions to the early stages of artificial intelligence. They posed important questions about intelligence and machine capabilities and introduced foundational concepts like the Turing Test. Even if subsequent developments in AI have expanded upon and at times challenged Turing's beliefs, his work is still regarded as a seminal landmark in the history of AI.

However, the term “artificial intelligence” first appeared in the summer of 1956, during the historic "Dartmouth Summer Research Project on Artificial Intelligence (DSRPAI)", led by one of the pioneers of AI, John McCarthy. This roughly eight-week conference, which was hosted at Dartmouth College in Hanover, New Hampshire, drew a wide range of scientific experts in the field. Claude Shannon, the father of information theory, Nathaniel Rochester, the designer of the first scientific computer, IBM 701, and John McCarthy, a mathematics professor at Dartmouth at the time, were among the notable individuals (PK, F. A., 1984, p. 65). The convention’s primary purpose was to bring together experts in various fields to explore the creation of machines capable of simulating human intelligence. The DSRPAI stood out to be a successful event, becoming a significant turning point in the development of AI research (PK, F. A., 1984, p. 65).

Russell and Norvig (2010) address two interesting questions in their book "Artificial Intelligence: A Modern Approach": "*Given that decision theory, control theory, and operations research share several of the same goals as artificial intelligence, why couldn't all of the work done in AI have been done under these titles? Alternatively, why is artificial intelligence not a subfield of mathematics?*." They concluded that the Dartmouth workshop proposal (McCarthy *et al.*, 2006) provides the answer to these questions by highlighting the necessity for AI to become a separate field. While control theory, operations research, and decision theory all have similar ends in mind, AI stands out for its singular emphasis on replicating human capabilities like creativity, self-improvement, and language use. Although these fields focused on specific domains, none explored the intricacies of human potential.

Furthermore, computer science and AI methodology are intimately related, making AI the sole field focused on building machines that can operate autonomously in dynamic environments. This unique approach underlines AI's multifaceted nature and its vital role in shaping future technological developments as well as our comprehension of intelligent systems.

The contribution of Allen Newell and Herbert Simon of Carnegie Mellon University (CMU) at that conference in Dartmouth is worth mentioning. By introducing the first automatic theorem-proving program, called "Logic Theorist," they proved that computers, which are essentially limited to working with numbers, could also interpret symbols (Ertel, 2018). According to many, this program is the first instance of artificial intelligence (AI) that has ever existed (Ertel, 2018). Its capacity to use automated reasoning to solve complex problems set the stage for future developments in artificial intelligence and made it possible for humanity to develop increasingly sophisticated systems in the decades that followed.

A few years later, in 1961, the General Problem Solver (GPS) invented by Newell and Simon again made history. While the Logic Theorist focused on proving theorems, GPS was designed to mimic human approaches to problem-solving. It demonstrated the ability to address issues similar to human methods, particularly about subgoals and possible courses of action (Russel & Norvig, 2010). The physical symbol system theory was first proposed by Newell and Simon in 1976 in response to the effectiveness of GPS as a model of human cognition. According to this hypothesis, every computer or human system that exhibits intelligence must have the ability to work with symbol-based data structures (Russel & Norvig, 2010). In essence, it implies that the manipulation of symbols within a physical symbol system is the source of intelligence (Russel & Norvig, 2010).

3. Challenges confronting the banking sector and the need for a digital transformation

Digital transformation is becoming increasingly necessary for traditional banking. The need for a more flexible, interactive, and diverse financial business model that can satisfy all client needs across a wider variety of services and assets is growing as a result of regulatory pressure and changes.

A 2016 report by Minsait titled "The New Banking Value Creation Model Based on Disruptive Technologies" lists several difficulties that the banking system is now facing in the wake of the economic downturn. These challenges are significant because they affect the banking sector and must be resolved to keep its operations and services profitable and efficient.

- The challenge to traditional business models is established in two primary aspects. First, bank intermediation margins have been reduced by weak economic development. Second, the financial crisis has made consumers less confident in banks, which has encouraged "Shadow Banking" to grow. In addition to creating regulatory issues, this scenario fosters innovation and gives tech companies a chance to compete in the conventional banking market (Minsait, 2016).
- Weaknesses that were exposed during the last financial crisis have led to increased regulatory pressure. Social pressure has led to stricter regulations that place greater demands on banks. Consequently, banks encounter noteworthy obstacles concerning their profitability. Their potential for expansion is limited since they have to lessen their leverage to abide by these laws. They also have to grapple with rising operating expenses, especially in areas like technology and human resources (Minsait, 2016).
- Society's loss of trust is manifested in the perception that traditional banking disregarded its social responsibility in the years before the crisis. This perception undermined public trust in traditional banking and made it more difficult to mend client relationships, which in turn led to an increase in debt and economic stagnation (Minsait, 2016). According to research done by the consulting firm Accenture (2020), the percentage of Spanish clients who trust banks has decreased from 29% four years ago to 20%, and globally, trust in banks has dropped from 43% to 29% in the past two years.
- Emerging at an unprecedented rate are new technical challenges that potentially transform and revolutionize financial services. These challenges are driven by advancements like blockchain technology, artificial intelligence, and augmented reality (Minsait, 2016).
- A new customer relationship model has been created as a result of developments in technology, and as consumer behavior is always changing, there is a present need to

create a "peer-to-peer" discourse that is tailored to the new lifestyle of society (Minsait, 2016).

- The emergence of new competitors, including Fintech firms and technology giants, is posing a challenge to the obvious shift in the banking market's structure. This dynamic, which is becoming more prevalent across all facets of traditional banking, is changing the industry to one with more open competition (Minsait, 2016).

Enrique García Sánchez, Head of Enterprise Architecture Strategy at CaixaBank, notes that "innovation cannot be left for later" in an IBM report from 2019. It is typical for financial institutions and organizations to go through multiple crises at once, one after the other, or even more than one at a time. Organizations need to be infused with innovation and digital transformation, since keeping an innovative pulse will ensure that they are prepared for the next big change.

In this report, Jim Marous, an internationally renowned financial industry strategist, declared that "*the biggest challenge for banking in this age of disruption will be to break free from the patterns and comfort level of the past and accept the realities of the new digital marketplace – it is the non-banks that are setting the expectations for the new generation of banking consumers*" (Minsait, 2016). This phrase essentially emphasizes how important it is for banks to adapt to change, integrate new technology, and satisfy changing customer needs to be competitive in today's banking market.

4. Digitalization of the banking industry

In the same way that new formats are emerging in every industry and demonstrating more successful outcomes than those attained through old formats, all organizations, including the big banks, now recognize the necessity of a digital transformation of their operations and products.

Clara Navio (2020) refers to two key definitions in her article, sourced from the OECD and cited by Roland Berger Siemens in a paper on the impact of digital transformation on the economy. The first one defines digitization as "*the application of a general-purpose technology that benefits all sectors of the economy*." The second defines digital transformation as "*the comprehensive interconnection of various sectors of the economy and*

how actors in each sector will adapt to the new conditions prevailing in the digital economy" (Navio, 2020).

There are many reasons why these changes are being brought about and this type of transformation is seen as one of the main needs. Some examples can be the economic crisis of 2008, the pandemic in 2020, and especially the increasing technological development of the last few years. These circumstances not only erode trust in banking institutions but also deteriorate their traditional image and complicate the retention of existing customers and the attraction of new ones. In addition, it is inevitable not to take into account the response and reaction of customers to these new technological trends. In the banking industry, banks are a great example of companies with very strong customer bases. To ensure that these are not threatened by the digitalization of banking, banks are developing more efficient, cost-effective, and technologically advanced products on the market to allow customers to take control.

According to Trillo (2016), "*the sector is undergoing a radical transformation that is based on a combination of factors: new customer relationship channels (apps versus traditional branch), changes in the decision criteria of consumers who are not only looking for the best financial conditions but also the best possible experience in their relationship with their entities that allow them to have personalized options, and total control from their mobile interface*" (Trillo, 2026). As a result, clients nowadays are considerably more demanding and better informed about the latest banking services available and perceive alternatives such as digital and personalized experiences to be more convenient and affordable, something traditional banks did not provide until now (Trillo, 2026). This transition to a digital environment is no longer an option for companies, as the global economy's development implies digital growth and underlines the vital importance of new technological challenges for banking and its survival.

Eva Díaz also discusses banking clients in her article and mentions that "*new technologies have changed the profile of the banking customer. The financial sector is facing a digitized, more demanding user who is also more self-sufficient. Customers navigate through the ocean of oversupply and the possibility of having it all at the click of a button*" (Díaz, 2018). As we've previously mentioned, this change gives customers total authority over the industry and makes meeting their requirements more difficult. The "self-sufficiency"

of the banking client—the ability to handle their financial demands and transactions without the direct involvement of a bank employee—is a crucial point to emphasize. They no longer need individualized assistance to manage their finances since they have access to new technologically produced tools that allow them to do tasks like checking balances, making transfers, and making payments all digitally and autonomously.

Additionally, Fintonic's founder Lupina Arriaga notes in the same article that "*banks handled everything up until now, but that has already changed—they are now product providers.*" The important thing is that a customer trusts you and does not see that you are going to push a product onto them (Díaz, 2018). It is crucial that a consumer has trust in you and does not perceive you as someone trying to force a product upon them (Díaz, 2018). In a market rife with options and opportunities, the introduction of new products and offerings enables consumers to explore several options and ultimately identify the most favorable one that fulfills their demands.

The manner in which institutions and their clients engage is changing significantly in the contemporary financial climate. The trend is for digital banking to give precedence to customer needs above product innovation, putting the demands of the consumer at the core of the offering. Demand is moving toward financial services that are as simple to use and available anytime, anywhere, as the social networks and email that customers use on a daily basis (BBVA, 2015). This is because more consumers are embracing digital interactions in many facets of their lives. These modifications may mark the beginning of a new industrial revolution that will affect not just the financial sector but potentially other industries as well. In the medium and long run, there is potential for these changes to become the norm for conducting business (BBVA, 2015).

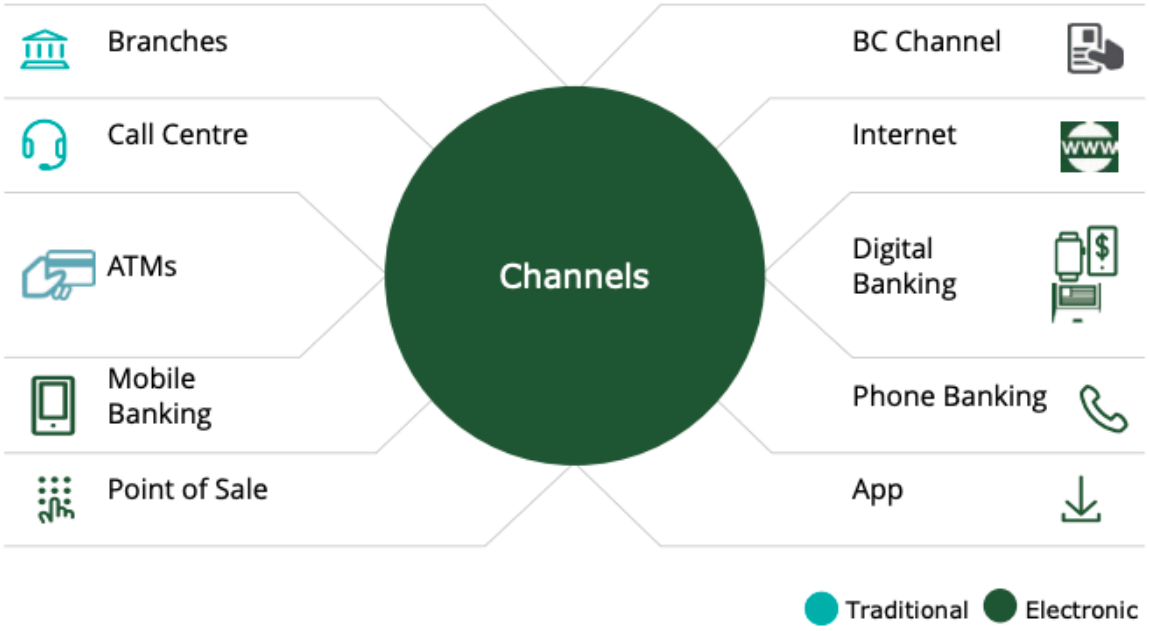
A discussion of the drastic upheaval of banking models is covered in a Deloitte (2020) report centered on the future of banking. Even though the report specifically focused on key developments leading up to the year 2020, the changes and transformations have not stopped in real-life scenarios. The study underscores major changes in banking operations while highlighting innovation and technology to improve their services.

Deloitte (2020) provides four instances. The first is the use of innovative technologies like artificial intelligence (AI) and digital platforms to enhance client experiences and

expedite banking procedures. Second, an evolution in the direction of inclusive banking, which strives to assist a larger spectrum of clients and communities (Deloitte, 2020). Third, banks are forging non-traditional alliances with fintech firms and other industries to expand their reach and open up opportunities (Deloitte, 2020). This has led to the development of advanced services and products that are customized to meet the changing demands of their clientele. Last but not least, fintech capabilities—such as online payment platforms, and mobile banking apps—are emphasized as being crucial to transforming banking into a more customer-centric industry. These capabilities allow banks to offer individualized services and improve client engagement (Deloitte, 2020).

They also provide Figure 2, separated into two categories and displaying traditional banking channels on one side and digital banking channels on the other.

Figure 2. Traditional channels vs. Digital Channels



Source: Deloitte (2020). Banking on the Future: Vision 2020.

In the left column, several traditional channels have been present since the beginning of banking history. Branches, for example, can be considered the main channel of traditional banking, where customers go to carry out various banking operations such as money deposits or transfers. In addition, there are automated teller machines (ATMs) and call centers, which allow customers to check their balance and communicate with customer service for inquiries,

among other functions. On the other hand, in the right-hand column, there are several digital channels, some of which are considered relatively recent. Online or mobile banking allows customers to perform the same banking operations mentioned above through a computer or mobile device with just a click of a button. There are also chatbots, programs with which people can interact with customer service without the need to call on the phone to consult and resolve any questions they may have.

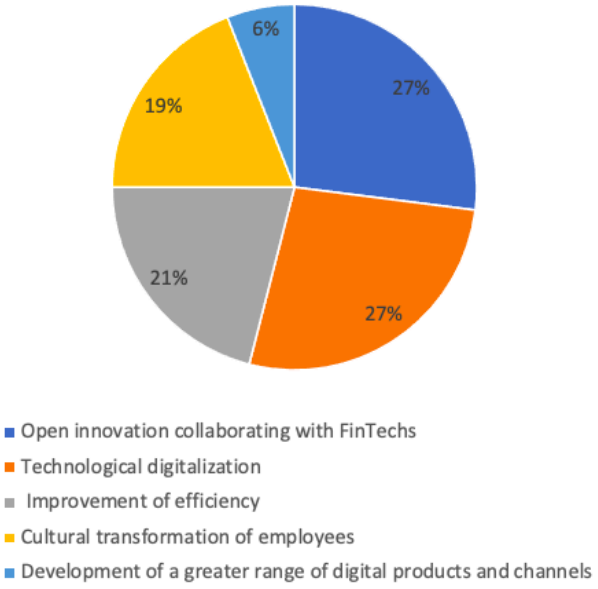
Some of the channels mentioned are likely to be more relevant than others for both customers and banks. Additionally, it is conceivable that the different channels interact with one another— some complementing each other while others compete with each other. Although Figure 2 does not reflect this dynamic of importance or complementarity, it does illustrate how banking digitalization has generated a several new channels that offer customers the option of carrying out banking operations with advantages such as flexibility, speed, convenience (avoiding the need for people to travel) and efficiency (allowing banks to cut costs).

Since 2008, the number of branches in Spain has been progressively declining, as they have closed over 50% of branches by 2020. In 2008, there were 45,662 branches, the highest number in the financial industry's history, and by 2020, there were 22,271 branches. Big banks like Santander, CaixaBank, and BBVA have been impacted by this as well because they are attempting to improve efficiency and adjust to the increased digitization brought about by the epidemic and the 2008 financial crisis by eliminating thousands of branches (Alconada, 2021).

The digital transformation encompasses more than just adopting computer-based IT infrastructures as well as developing an online presence for oneself on social media platforms. The scope of digitization is exceptionally deep and wide; it involves a major and comprehensive evolution of the business—in this case, the banking industry—that includes both the evolution of the end product that is offered and the reconfiguration of the internal operations of the company. Adopting technology merely for modernization is not sufficient; businesses also need to take advantage of its digital capabilities to boost customer satisfaction, cut expenses, simplify procedures, and increase operational effectiveness. Therefore, digital transformation entails a significant shift in the organizational attitude that

promotes ongoing innovation and flexibility in the face of a business environment that is continuously changing.

Figure 3: Key competitive levers



Fuente: Finnovating, 2019

The Financial Innovation Barometer (BIF), prepared by the Financial Digitalization Observatory of Funcas (ODF-Funcas) and Finnovating, have elaborated in 2019 Figure 3. This figure outlines the primary competitive levers that financial institution managers believe are essential to overcoming industry challenges and enhancing their competitive edge. These tactics, often known as competitive levers, encompass a range of elements. Here, open innovation collaborating with FinTech and technological digitalization are shown with the same outcome of 27%. The former speaks about collaboration in order to develop new goods, services, or technology with third-party companies, including fintechs or startups. This emphasizes how crucial it is to fund external digital growth, which might involve banks working with FinTech companies and purchasing innovative startups. This investment is necessary to maintain competitiveness in the new market and, in certain situations, is also crucial for survival. It also demonstrates how digital transformation extends beyond an organization's internal operations. In the latter case, new technologies like blockchain, big data, and artificial intelligence are adopted in order to enhance customer experience, efficiency, and product offerings. The bank is undergoing a thorough overhaul of all of its

offerings in order to meet industry expectations and stay up to date with emerging technologies (Finnovating, 2019).

If all of these levers are successfully attained, we eventually reach the third competitive lever in the figure: efficiency improvement, which has a 21% weight (Finnovating, 2019). This improvement covers both external and internal factors, such as the customer experience when utilizing the numerous products and services that banks offer, as well as internal factors like the cost system and the effectiveness of the bank's processes. But without the final two levers—employee cultural transformation, which accounts for 19% and refers to "back office" changes, and the development of more digital products and channels, which accounts for 6% and "front office" changes—this entire achievement will not be achievable (Finnovating, 2019).

Keeping with the previous point, the digitalization of the banking sector has had a major impact on internal company operations as well as customer service. On the one hand, there has been a significant emphasis on enhancing client services, which has resulted in a noteworthy rise in the global user base of online banking (Campos-García, 2022). It is also important to consider how the COVID-19 epidemic in 2020 contributed to this trend by pushing more consumers—especially the older generations, who ought to be included as well—toward digital platforms. However, digital technology has also helped to streamline internal procedures, increasing the effectiveness of operations and services and making remote work easier during the pandemic (Campos-García, 2022).

As for the front office, it refers to the relationship our Clients have with their customers (notice the play on "C" vs. "c"), according to Ángel Martínez, an IBM Engineer. Customers of our clients go to what is essentially "the counter" to purchase goods and services (Martinez, 2014). Thus, digital transformation has reduced or eliminated a lot of tasks that are typically performed by humans, particularly front office work, while at the same time serving to streamline the convoluted and time-consuming bank administration process.

Employees who work in front office operations typically interact with clients directly; in a business, this would be the sales and reception area. According to an Indeed article on understanding the difference between front and back office (2023), the front office in a bank

includes customer-facing interactions and services, for example, those employees dedicated to generating revenue for the company by providing direct customer services, such as wealth management, capital markets, investment banking, research, sales, teller services, customer service, and loan processing.

The consumer profile has drastically altered as a result of digitization, and banks now need to modify their offerings accordingly. Almost all commercial banks have created digital solutions for their products and services, allowing customers to interact with them more easily and seamlessly. They have also provided self-service options and personalized services, which have completely revolutionized the customer journey and experience, bringing convenience and satisfaction to a previously unheard-of level (ebankIT, n.d.).

Customer-facing interactions, for instance, may be related to problem-solving. However, chatbots and virtual assistants have assumed this role, decreasing the need for human support teams and guaranteeing effective, round-the-clock customer support (ebankIT, n. d.). They are also capable of providing 24/7 support, customized recommendations, and quicker response times (ebankIT, n. d.). Additionally, teller services can include money transfers. For this, mobile banking apps with features like mobile check deposits as well as self-service kiosks and ATMs with transfer capabilities have been introduced. As we previously stated, this also applies to branch closures; as an illustration, consider Spain, where over 50% of branches have closed in the previous 15 years (Alconada, 2021). Furthermore, loan processing typically entails an enormous amount of paperwork at every stage. However, with the process becoming more digital, online loan application portals have been put in place to allow customers to electronically submit loan applications and monitor the status of those applications in real time (Parthasarathy, 2023). This has reduced operating costs and customer acquisition costs, improved customer experience, and—most importantly—saved a lot of time (Parthasarathy, 2023).

By digitizing, the banks hope to increase their productivity and profitability while also streamlining their customer services, saving time and money, and reallocating resources to areas that need more care, like marketing campaigns, technology advancements, and better customer service. Enabling customers to make transactions more efficient and straightforward—for example, free instantaneous electronic transfers through apps, mobile or watch payments using artificial intelligence, or fingerprint or facial recognition access to a

wealth of information—improves the customer experience and draws in new and returning customers. Athavale (2023) estimates that by the end of last year, the total potential cost reductions for banks via AI were expected to be $447 billion.

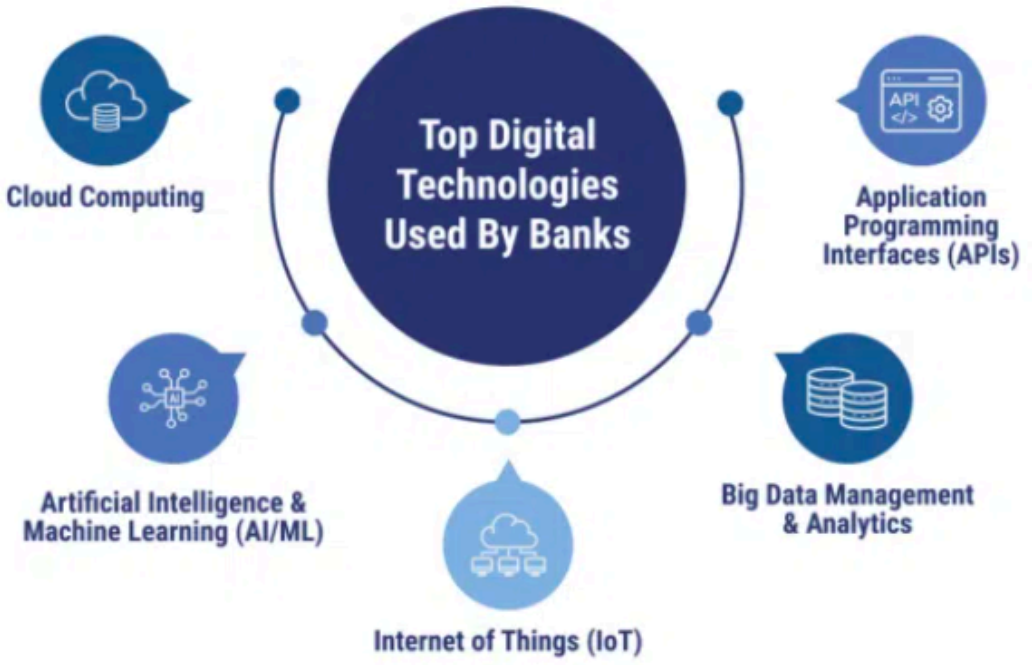
On the other hand, the term "back office" describes the interior workings of the bank, including any sections where staff members do not have direct contact with customers (Pavez, 2022). It is important to emphasize that these adjustments are essential for the bank's operating efficiency to be competitive and to guarantee client happiness, even when they are not apparent to consumers or the outside world. Joan Carbonell (2020), partner at Axis Corporate Consulting advises that to maximize operational efficiency across the board for the financial institution, modernization, and digitization should also address back office shortcomings. According to Carbonell (2020), *"Financial institutions must be aware of new customer needs and the need to reduce costs in order to increase their margins.*" He does, however, also note that businesses, banks included, have made significant investments in the development and enhancement of non-face-to-face channels in recent years, particularly concerning front office and customer service operations. Consequently, a major obstacle for banks in their quest for the highest possible levels of operational efficiency is that the majority of back office sections continue to rely on intricate and traditional methods, such as the usage of paper documents and manual procedures (Carbonell, 2020).

Thus, to truly achieve a positive outcome, measures like digitizing internal systems, implementing cutting-edge tools to make customers' jobs easier and help them obtain pertinent information more quickly, and automating all bank operations and processes are essential. A 2018 analysis from Bain & Company for the World Economic Forum estimates that banks have invested $1.2 trillion in digital transformation, but only 1% of that amount will truly reach its objectives. According to the Finextra newspaper, the primary reason is that most banks are unaware that internal culture, or the back office, is where it all begins (Novikova, 2018). Therefore, internal processes may be antiquated and underdeveloped if banks continue to invest in changes that are solely focused on improving the customer experience. This will later negatively impact them as they may not be able to meet all front office demands, which could result in congestion and negatively affect the customer.

As for the activities carried out in the back office, a few examples could be IT equipment, communication within the organization, administrative duties, record-keeping and

documentation management, treasury operations including cash management, liquidity management, funding strategies, marketing, and advertising... (Pavez, 2022). In the current digital age, both the front office and all of these processes have gone digital, such as the administration of administrative duties. To store, organize, and retrieve information electronically rather than relying on paper files and documents, banks are digitizing their document management systems (Lovett, 2023). They are also gradually introducing artificial intelligence to analyze vast amounts of data and identify potentially fraudulent or suspicious activity, which aids in the banks' more effective compliance with regulatory requirements. Consequently, automation in banking boosts efficiency, security, and flexibility (Lovett, 2023).

Figure 4: Digital techniques used by banks



Source: Lovett, 2023

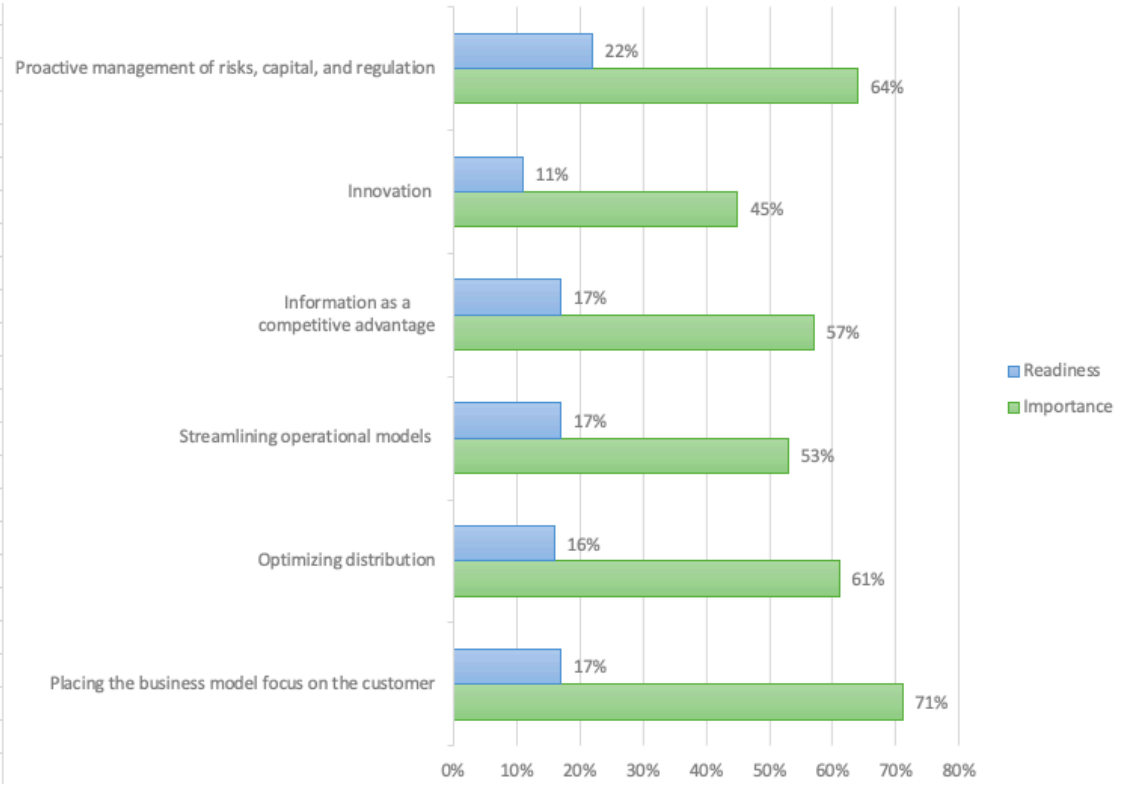
Six digital technologies are included in this graphic, which depicts the primary tools utilized by banks: cloud computing, Internet of Things (IoT), big data management and analytics, artificial intelligence (AI) and machine learning (ML), and APIs. Using this cutting-edge technology transforms the back-office activities outlined before. Lovett (2023) claims that cloud computing has allowed banks to update their infrastructures, allowing for more scalability and flexibility in the management of backend systems and, as a result,

increased adaptability to the constantly shifting needs of the market. As previously indicated, AI and ML have optimized back-office operations and improved productivity by automating monotonous chores and personalizing client interactions. IoT has also introduced novel solutions like smart safes (Lovett, 2023). Additionally, banks are integrating business intelligence (BI) software and cloud monitoring tools, for example, in big data management and analytics. This promotes risk management and continuous improvement in back-office operations. Finally, but just as importantly, by connecting to other platforms and services, APIs improve user experience and provide additional capabilities (Lovett, 2023).

While both front and back office modifications must be considered, none would be feasible without an adjustment in the business model due to shifting client preferences and profiles as well as the introduction of creative technological-financial models. Research authored by PWC (2020), which drew on interviews with executives from top financial institutions across many nations, explores the issues facing the banking industry now, the developments that will shape its future, and the adjustments that ought to be implemented.

As for the changes that banks should undertake, PWC (2020) lists 6 different ones: the need to focus the business model on the customer, optimize distribution, streamline operating models, use information as a competitive advantage, innovate, and proactively manage risk, capital, and regulation. If we examine carefully, the back office is where the majority of the aforementioned changes are taking place.

Figure 5: Necessary changes to be made in banks



Source: PWC, 2020

The percentages obtained from PWC's (2020) interviews, based on the significance and preparedness of the aforementioned changes in banks, are displayed in Figure 5. It is clear that obtaining valuable customer data and putting the customer at the center of the business model is highly valued (71%), as is proactive risk, capital, and regulatory management (64%), which relates to automating internal or back office processes at the bank. Banks acknowledge the significance of these reforms, but there is a clear disconnect between their perceived relevance and their desire to put them into practice. Consequently, even while most bank managers agree that these steps are important, very few think they are ready to do them.

The term "deconstruction" is first used in the context of banking by Evans and Wurster (1999). They explain it as reorganizing organizational behavior and altering conventional procedures that are still in place in banks to fully utilize modern resources like information and communication technologies (ICT) and preserve competitiveness in a market that is continuously changing. This method, together with the "five elements" that Lopez *et*

al. (2013) established, is typical for analyzing a novel banking business model that has been modified for the modern digital era. Among these components are:

- Development of an innovative value proposition that benefits both the client and the company.
- Design of the innovative value chain of the banking company.
- Combination of information and communication technologies (ICT) and technological innovation.
- Establishment of a strategic direction built on intangible resources and innovative capabilities.
- Strengthening of an open innovation culture within the financial institution.

When combined, these strategies provide a focused route to modernization and excellence in a banking setting that is becoming more digital and client-focused. It would assist banks in creating adaptive and competitive advantages to handle the demands of digital banking in a complicated and dynamic socioeconomic environment. In addition, this approach would integrate disruptive technology, embrace open innovation, and strike a balance between offline and online operations while working with other industry participants.

5. Integration of AI in the banking sector

The role of AI in the banking sector has become fundamental to an organization's efficiency and competitiveness, and its use is now imperative for the industry to expand. AI is dramatically changing the way companies develop, implement, and optimize their operations, products, and services, as it can evaluate massive amounts of data, detect trends, and make automatic judgments.

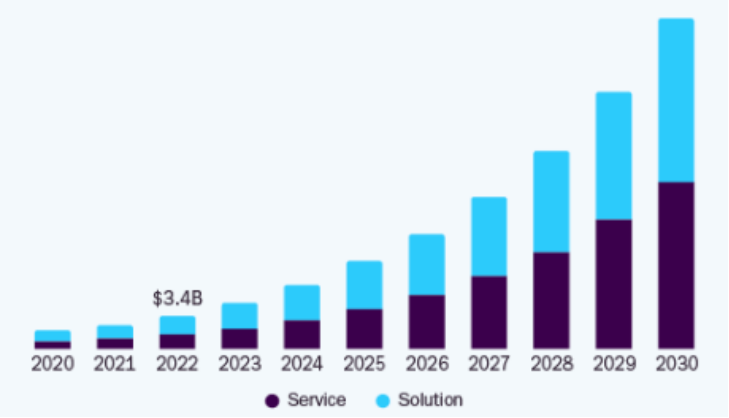
As discussed by Sardana and Singhania (2018) digital technology has had a tremendous influence on the banking industry, resulting in the emergence of digital banking, which encompasses terms such as electronic, online, and mobile banking. They also point out the main differences between digital and traditional banks: the latter place more emphasis on customization and flexibility for customers who are comfortable with technology, while the former provide standardized services and depend on pre-engineered software to reach a wider audience and satisfy customer needs (Sardana & Singhania, 2018). To generate tailored offers, digital banks additionally use their IT know-how to comprehend the preferences and

actions of their clients (Sardana and Singhania, 2018). Thus, in the current digital world, sectors that depend on consumer pleasure and competitiveness, like banking, must embrace technological improvements.

The financial industry has witnessed a notable surge in the utilization of artificial intelligence in the last decade. This growth can be partly ascribed to the massive volume of data produced daily that has grown by over 25% between 2021 and 2022, as well as the development of more affordable and powerful algorithms (Ibañez, 2023). According to a poll by the National Business Research Institute with more than 100 respondents, 32% of them acknowledged utilizing AI technology. The research additionally indicated that the industry is expected to generate an estimated $47 billion in sales by 2020 (Kochhar *et al.*, 2019). Furthermore, in a Forbes article, Maskey (2018), the founder of Fusemachines, a business that specializes in providing artificial intelligence solutions and services, emphasizes how AI is positively influencing the expansion of financial institutions and has the potential to save the banking industry more than $1 trillion by 2030.

The following graph, provided by Grand View Research, displays the market size for artificial intelligence (AI) in the US banking industry by component from 2020 to 2030, shown in USD billion. It also emphasizes how the artificial intelligence market in banking was estimated to be worth USD 19.87 billion globally in 2023 and is expected to grow at a compound annual growth rate (CAGR) of 31.8% between 2024 and 2030, resulting in a projected market size of approximately USD 170 billion by 2030 (Grand View Research, 2024).

Figure 6. U.S. Artificial Intelligence in Banking Market



Source: Grand View Research (2024)

In the figure depicted, we can observe that services and solutions are included, which is indicative of ongoing innovation fueled by quick technical advancement. New AI applications have resulted from this, upending traditional banking practices and encouraging the creation of creative financial services and solutions. Grand View Research (2024), for instance, noted that Temenos, a software business with its headquarters in Switzerland, unveiled a cutting-edge safe solution for banks in September 2023. This technological solution uses Generative Artificial Intelligence (AI) to automatically classify customers' banking activities, enabling banks to offer personalized information to enhance digital banking experiences.

As previously stated, the massive volume of data created daily—primarily due to the growth of the Internet—is one of the factors contributing to the rise in the use of IA across all industries. Data volume increases as a result of expanding Internet connections and coverage (Ibáñez, 2023). These statistics come from a variety of sources, including internet search engines and social media platforms like Facebook, Twitter, and YouTube, which saw a 21% increase in consumption of these platforms between 2021 and 2022 as a result of the pandemic (Juste, 2021).

Since they manage credit, money, and other financial activities, financial institutions are sometimes referred to as the "lifeblood" of the modern economy (Umamaheswari & Valarmathi, 2023). They promote newly established firms financially and urge people to save money and earn interest for a more secure future. All transactions carried out by financial institutions must be meticulously documented, and computers are mainly employed for this purpose. In addition, banks carry out their operations through the use of a variety of channels for their operations, including ATMs, emails, mobile banking, Internet banking, and smartphone banking. The smooth functioning of financial operations across computers and networks is made possible by the incorporation of AI (Umamaheswari & Valarmathi, 2023).

We will examine in-depth several instances that show the most innovative applications of AI in the modern world and how banks are affected by it in the next section. These applications are widely used in the financial and economic sectors, as well as constantly evolving.

5.1. Applications of AI in banks

Big data

When we talk about the term Big Data we refer to data sets or combinations of data sets that are challenging to gather, manage, process, or analyze using traditional technologies and tools because of their size (volume), complexity (variability), and rate of expansion (velocity) (PowerData, 2024).

Sherry Tiao (2024), a senior manager at Oracle specializing in AI and analytics, lists the three "Vs" of big data:

- Volume: The quantity of data is significant. Managing massive amounts of unorganized, low-density data is what big data is all about. This might include sensor data, user clicks on websites or applications, social media feeds, and data of questionable value (Tiao, 2024).
- Velocity: Velocity is the speed at which information is received and perhaps processed. Instead of being saved on disk, data usually flows into memory at fast speeds. Some internet-connected gadgets require quick assessment and action because they function in real-time or almost real-time (Tiao, 2024).
- Variety: Variety includes a wide range of possible data kinds. Conventional data was easily stored in relational databases since it was organized. Nonetheless, new types of unstructured data were brought about by the emergence of big data. Text, audio, and video are examples of unstructured and semi-structured data that need preprocessing to extract meaning and enable metadata (Tiao, 2024).

Therefore, it is crucial to bear in mind three things: the enormous amount of data that is present in many contexts; the diverse range of data types that are often stored in big data systems; and the accelerated rate at which data are created, gathered, and processed (Hashemi-Pour *et al.*, n.d.). Veracity and value are two more Vs that have lately been added to the many definitions of big data. The real value may be found in the data reviewed since it is essential and offers information that businesses can utilize. Nevertheless, some of the data may be erroneous or lacking due to the volume of information we collect. Because of this,

evaluating the data's authenticity and level of reliability—the final two Vs, veracity and value—is crucial (Gómez, 2020).

Big data is impressive to executives and senior employees of major businesses for reasons other than its sheer size and "bigness"—its lack of structure, its opportunities, and the affordable nature of the technologies it uses are its three main selling points (Davenport & Dyché, 2013). According to a 2012 NewVantage Partners research that polled over fifty top businesses, revealed that "*it's about variety, not volume. Successful companies engaged in Big Data initiatives are focused on data variety, not volume, both today and three years from now. The most significant goal and potential benefit of Big Data initiatives lies in the ability to analyze diverse data sources and new types of data, rather than managing very large data sets"* (Davenport & Dyché, 2013, p.2).

Furthermore, big data is essential to the banking industry because it produces enormous volumes of data every second and supplies the vast amounts of data required to train AI algorithms for a variety of operations. Valentyn Zubenko (2023) claims that big data has transformed the banking industry by allowing banks to analyze a wide range of data points, such as their financial histories, investment trends, and spending patterns, to get a deeper knowledge of their clientele. Because of this, banks are able to provide customized banking solutions, which raises the satisfaction of customers and makes it simpler to anticipate and stop customer attrition (Zubenko, 2023). Big data-driven customer segmentation in banking greatly influences how clients are categorized, for instance, according to their financial characteristics, such as the use of credit cards or their financial status (Shalimov, 2023). This is a must for examining consumer behavior, introducing more successful marketing campaigns, and determining the best course of action to fulfill the unique requirements of every client. Furthermore, big data solutions let banks rapidly address the queries and concerns of their customers by analyzing their profiles and views promptly, which in turn fosters a sense of trust and improves customer loyalty (Zubenko, 2023). Real-time performance measurements are provided by these technologies, enhancing operational visibility and facilitating proactive issue resolution. Zubenko uses BNP Paribas as an example, which tracks important indicators including staff productivity and client acquisition and retention using data analytics tools.

Fraud detection and prevention are two significant changes that big data has brought about in financial organizations. Banks can stop illegal transactions and spot instances of identity fraud by monitoring consumer spending patterns and spotting odd behavior (Zubenko, 2023). Likewise, these technologies allow for a high degree of automation in banking processes, which lowers the chance of mistakes, saves money, and helps identify and mitigate cybersecurity risks (Zubenko, 2023). This enhances banking industry security generally.

Blockchain:

Blockchain is a distributed database of transaction records that is controlled by a decentralized community and is validated and updated by a global network of computers, which prevents transaction history unaltered by any individual (Sarmah, 2018). Data security and integrity are guaranteed by this distributed structure since the data cannot be altered or erased. Blockchain technology guarantees transparency and eliminates the need for middlemen by functioning in a decentralized peer-to-peer network (Sarmah, 2018). As a result, it makes it possible for more transparent, safe, and inclusive corporate networks; common operational models; more effective procedures; lower expenses; and new banking and financial goods and services.

Although blockchain is not as prevalent in banking as other technologies, it still has numerous advantages and works successfully with AI projects. Improved security is one of the main advantages of blockchain technology, as it uses cryptography to protect data and develop records that are difficult to alter or forge. Additionally, identity verification systems offer a safe and nearly impenetrable means of verifying the identities of clients, reducing the risk of fraud and identity theft (DBS, 2023). Additionally, by automating or simplifying procedures, blockchain enables transactions that are quicker and more effective. This efficiency is demonstrated, for instance, by the use of smart contracts, which are self-executing algorithms made possible by blockchain technology (DBS, 2023).

Chatbots:

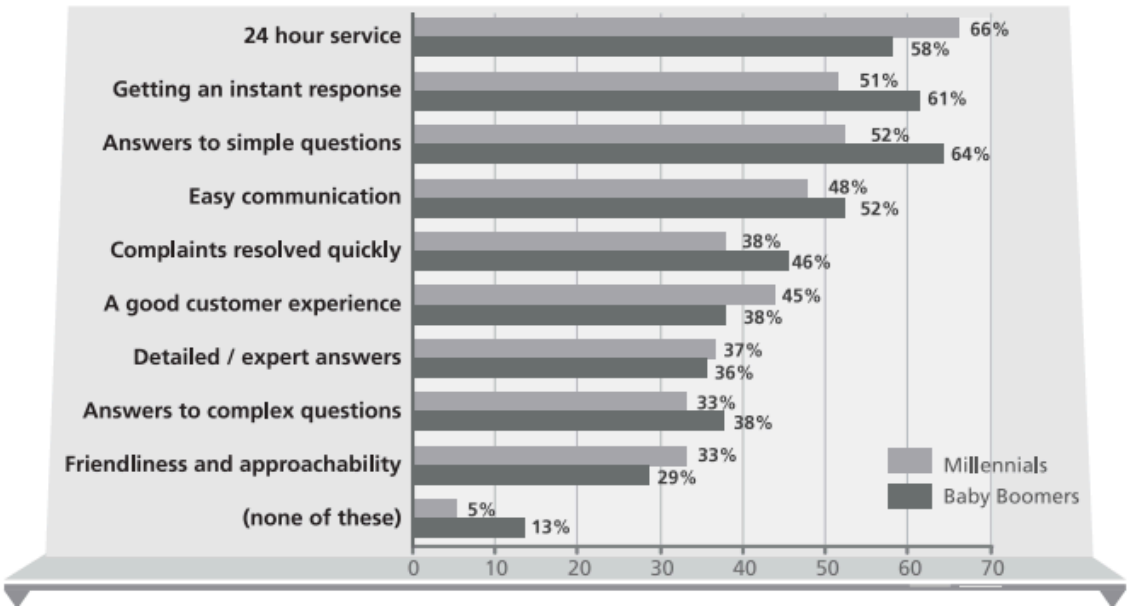
The abundance of media outlets and communication channels accessible today necessitates the continuous processing of messages. As a result, developments in digital

technology are critical to banking since they enable smooth coordination between different market participants. In this setting, artificial intelligence-powered chatbots become invaluable tools for enterprises. These tools are certain kinds of computer programs made to have natural language conversations with users. According to Zemčík (2019), in response to messages from users, they choose the most suitable response from preprogrammed schemas or, for more recent bots, employ adaptive machine learning algorithms.

Chatbots can now comprehend more deeply and react to user input more naturally thanks to techniques like machine learning (ML) and natural language processing (NLP) that make interactions more smooth and fluid (Lin *et al.*, 2023). The primary objective of chatbots or virtual assistants is to offer assistance and precise answers to frequently asked questions or targeted activities, such as bookings, product or service information, and problem-solving (Telefónica, 2023). Some are more generic and cover a wide range of subjects, while others concentrate on a particular area, like customer service.

Figure 7 below, which uses data from Kaczorowska-Spychalska, 2019, shows some of the possible benefits of chatbots: they may be available 24/7, provide quick answers, handle basic questions, and handle complaints, among other things.

Figure 7. Potential benefits of Chatbots (Millennials vs. Baby Boomers)



Source: Kaczorowska-Spychalska (2019)

The graphic illustrates the potential benefits of virtual assistants and contrasts the opinions and degrees of satisfaction of two different generations about chatbots. While 64% of millennials (those born between 1981 and 1996) commend chatbots for their ability to enable easy communication and provide clear answers to inquiries, 61% of millennials also say they want immediate responses. On the other hand, 66% of baby boomers—those born between 1946 and 1964—frequently use chatbots to learn about goods and services at any time of day, and 51% of them likewise prefer prompt responses. The figure implies that it is true that chatbots may assist both generations and that they will also partly satisfy current generations like Generation Z, who were born between 1994 and 2010. This is because chatbots are now considered a new commercial banking tool. When developing and putting into practice these communication systems, it is crucial to consider the different requirements and expectations of everyone.

Additionally, Bella Church (2023), an IBM web strategist, describes five types of chatbots that combine natural language processing (NLP) and artificial intelligence (AI) to have sophisticated discussions with consumers.

- Menu-based chatbots present pre-programmed alternatives for responses, resembling a decision tree. Simply "clicking" on the button or menu that best suits their requirements at the moment allows users to interact with them. They struggle with more complicated questions, but they are excellent at responding quickly to simple ones (Church, 2023).
- Rules-based chatbots employ keyword recognition to answer preset inquiries, but if they don't grasp the user's purpose, they might overlook important details and start repeating themselves (Church, 2023).
- AI-powered chatbots, equipped with natural language understanding (NLU) and AI technologies, enable chatbots to process user questions in any format and provide precise and comprehensive replies over time by remembering prior exchanges. Virtual assistants using AI, such as Google Assistant and Apple's Siri, can understand and respond to voice commands for a range of tasks (Church, 2023).
- Voice chatbots facilitate voice conversations, improving customer happiness and engagement by providing relevant replies in a conversational tone and expeditiously addressing problems (Church, 2023). For example, this includes Alexa from Amazon.

- Generative AI chatbots, such as ChatGPT and DALL-E, incorporate empathy and produce high-quality text, graphics, and audio responses, resembling human-like conversations (Church, 2023).

Modern banking solutions, such as chatbots, are now regular offerings and give clients a simple and quick method to interact with their banks. For example, in 2018, Bank of America unveiled Erica, an AI-driven chatbot with more than 16 million users. In addition to tracking expenditure and savings targets and providing individualized insights and recommendations, Erica helps clients manage their money (Goodstein, 2023). Because they offer easy, round-the-clock service and can handle many requests at once, lowering client wait times, it makes sense that the popularity of chatbots and AI assistants among bank customers continues to grow.

Sarthak Gupta (2023) lists a plethora of advantages and benefits that come with intelligent chatbots and virtual assistants, especially for the banking industry. Among these, a few significant advantages stand out:

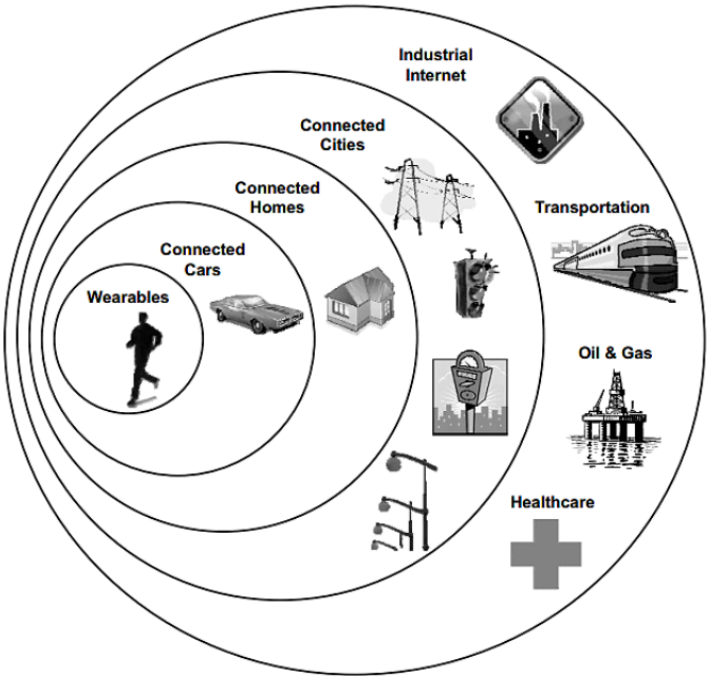
- Chatbot for 24/7 availability: guarantees that clients can get assistance and information at any time, boosting their satisfaction and the bank's reputation.
- Cost savings with chatbot implementation by eliminating the need for sizable customer support personnel.
- Instantaneous response via AI chatbot to customer inquiries reduces wait times and increases satisfaction.
- Handling high-volume requests with a chatbot ensures constant service quality.
- Improved customer experience and accessibility through chatbots since they provide individualized interactions based on past encounters and preferences
- Automation of repetitive tasks with chatbots frees up human resources for more complicated clients' demands, resulting in increasing productivity.
- Enhanced security of clients' data and financial transactions with AI chatbots

<u>IoT (Internet of Things):</u>

The Internet is without a doubt one of the most important and powerful innovations in human history. Abashidze and Dąbrowski (2016) define the Internet of Things, or IoT, as a

network of things that are linked. Since there are practically endless applications for IoT technology, the term "devices" has a very broad definition. The Internet Protocol (IP), which is often connected to the Internet, is commonly used to connect wired and wireless networks that connect sensors and actuators built into physical objects, such as pacemakers and roads (Chui, 2010). It may therefore be used for a wide range of objects, including industrial machinery, medical implants, and even whole structures, as well as everyday objects like computers, mobile phones, cars, and appliances. For example, it facilitates the use of smart refrigerators that, among other things, track product shortages and suggest purchases, as well as the remote monitoring of blood pressure and pulse rate (Abashidze and Dąbrowski, 2016). This represents a change in the way we interact with the physical and digital worlds, offering opportunities to improve the sustainability, productivity, and quality of living of contemporary civilization.

Figure 8. Internet of Things in various areas of activities



Source: Abashidze and Dąbrowski (2016)

Taking account of the fact that IoT is the next evolution of the Internet, it is very probable that it will demonstrate a significant leap in terms of gathering, analyzing, and disseminating data that may be transformed into knowledge and information (Evans, 2011). The networking of common things through integrated systems that can gather data, distribute

it, and then communicate and interact with one another is the primary goal of this technological advancement (Xia *et al.*, 2012). The result is a widely distributed network of devices that can communicate with people and other gadgets as well as with humans (Xia *et al.*, 2012). It's crucial to understand the distinction between the Internet of Things and the Web, though. While the latter seeks to create an interface that makes the information flowing via the Internet useful, the former's primary purpose is to move information from one location to another swiftly, consistently, and securely (Evans, 2011).

Because of the changing ways that customers behave and use the data that is available, there is no way that the bank's stakeholders can avoid making digital adjustments (Khanboubi, 2019). As a result, IoT integration is showing up more and more in the operations of financial institutions. Given that clients in today's linked lifestyle want banks to provide creative solutions to fulfill their changing demands, these networked gadgets provide a big potential for banks to remain competitive (Bakar, 2021).

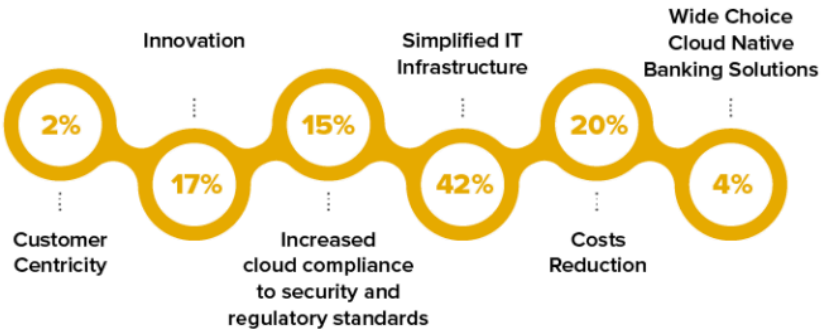
For example, mobile banking has completely changed how users maintain their accounts, providing easy access to banking services from any digital interface and substituting physical signatures for digital ones, meaning users no longer need to be present in person to complete transactions (Khanboubi, 2019). Moreover, biometric technology guarantees safe access to mobile banking services on a variety of digital devices, including e-wallets, by recognizing people based on their unique behavioral and physical characteristics (Bakar, 2021). Furthermore, IoT devices have the capacity to gather real-time data from the banking industry, which subsequently enables financial institutions to meet the demands of their consumers wherever and whenever they arise (Dilmegani, 2024). As an example, one possibility involves anticipating how long consumers would have to wait at bank locations or notifying clients when their account balances are about to run out (Dilmegani, 2024). The crux of the matter is that banks are enabled to provide accurate and prompt services by using real-time data collecting. IoT is used in a variety of financial services, such as Know Your Customer (KYC), which is used by financial institutions to confirm the identity of their clients and analyze their behavior. To prevent fraud and money laundering, banks use KYC processes (Bakar, 2021). As a result, among other uses, IoT is used to improve customer service, expand service offerings, improve analytics, handle cyber risks, and ease personal financial management.

Cloud computing:

According to Lewis (2010), cloud computing is a method of employing computers that focuses on providing virtualized, adaptable hardware and software to a large number of users via the Internet. Unlike network computing, which can only be accessed over a company's network, this is much larger because it involves multiple companies, servers, and networks (Lewis, 2010). Additionally, the services and storage it offers are accessible from anywhere at any time via an Internet connection (Mirashe, 2010). Because it enables them to store their information in the cloud, eliminating the need to buy and store memory devices, this kind of computing is therefore especially beneficial for small businesses that cannot afford the same amount of hardware and storage as other larger firms (Huth & Cebula, 2011).

Over 90% of firms use cloud technology, up from 88% the year before, according to an O'Reilly survey that shows how more and more sectors are adopting it (Srivastava, 2023). But before fully adopting cloud services, the banking industry is taking its time and closely examining them for security and privacy issues.

Figure 9. Factors Driving Banks to Adopt Cloud Technology



Source: Srivastava (2023)

The figure highlights the main forces encouraging banks to use cloud computing. One of these is client-centricity, in which banks give priority to the wants and needs of their customers to match their changing expectations. Innovation plays a part in keeping banks competitive by allowing them to launch new goods and services. Data protection and regulatory compliance are ensured by adhering to security and regulatory requirements. Operations are streamlined by a simplified IT architecture, which lowers complexity and

boosts productivity. Optimizing IT expenditures is one way to save expenses, and over time, this may result in large savings. Finally, a variety of cloud-native banking options offer freedom in terms of picking appropriate platforms and services to fulfill certain needs (Srivastava, 2023).

For banks, cloud computing has many advantages: better data security; usage-based payment; reduced infrastructure costs; and access to software programs like CRM and ERP for better customer interactions (Srivastava, 2023). Moreover, it offers increased operational efficiency, guarantees quality control, risk, and investment management without requiring a sizable upfront hardware investment, and supports business continuity through disaster recovery and adaptable operating models (Vinoth *et al.*, 2022). Furthermore, it encourages Green IT by moving services into a virtual environment, cutting down on energy use and carbon emissions, and maximizing the use of computing power (Vinoth *et al.*, 2022).

6. Theoretical Framework

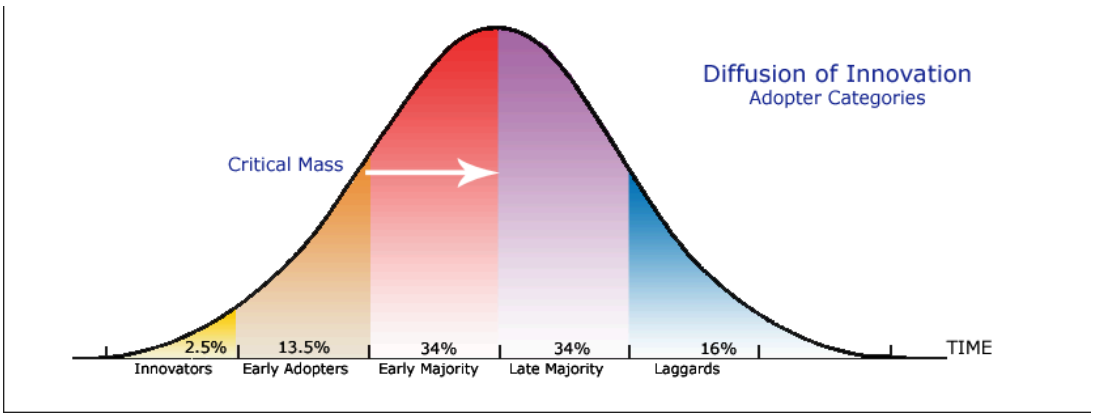
The principal goal of the Manhattan Company, the first predecessor of J.P. Morgan Chase, was to furnish drinking water to New York City when it was founded in 1799. But it quickly began to branch out into banking (J.P. Morgan Chase & Co., 2024). With the goal of expediting the settlement of interbank transactions in New York State, the New York Clearing House Association was established in 1853 and included numerous JPMC predecessors as founding members (Liberto, 2022). This demonstrated how J.P. Morgan has used banking methods that did not rely exclusively on artificial intelligence. Banks relied on manual procedures to clear checks prior to the creation of contemporary clearinghouses like the New York Clearing House when messengers physically went from bank to bank to exchange checks for cash. This approach was risky in addition to being time-consuming (J.P. Morgan Chase & Co., 2024). The New York Clearing House Association's funding-provided structure did away with antiquated and readily exploited trades and gave the financial markets much-needed stability (Liberto, 2022).

Home banking innovations began to emerge in the 1980s, for instance, the Channel 2000, which is connected to J.P. Morgan Chase through its predecessor companies. When Channel 2000 was established, users could use their television displays to carry out standard banking functions like paying bills, checking account balances, and transferring money between accounts (J.P. Morgan Chase & Co., 2024). The fact that this service used standard

phone lines to function is notable since it shows how dependent it was on the current communication infrastructure (J.P. Morgan Chase & Co., 2024). In 1985, the New York Currency Exchange (NYCE) offered convenient cash access with more than 800 ATMs spread across 650 locations throughout the tri-state region. J.P. Morgan's funds had a hand in founding NYCE, demonstrating their early contributions to the company's growth. In the same era, in 1985, NYCE provided easy cash access through 800+ ATMs in 650 locations across the tri-state area. J.P. Morgan's predecessors helped found NYCE, indicating early involvement in its development. By working with other networks, NYCE increased the number of ATMs to over 18,000 around the country, improving banking accessibility (J.P. Morgan Chase & Co., 2024). The wide branch network of traditional banks results in high operational costs because of the expenditures associated with maintaining a large number of branches and a well-established network of ATMs. Furthermore, they had to incur greater costs to bring on new clients (Temelkov, 2020).

This is an illustration of the Diffusion of Innovation Theory, which offers a framework and a collection of ideas to help explain the adoption and dispersion of innovative banking practices and technology across time (Dearing & Cox, 2018). This theory dates back to Gabriel Tarde in 1903 and emphasizes the importance of peer networking and communication in the process of people adopting new concepts, goods, or behaviors (Kaminski, 2011). The hypothesis was made popular by Everett Rogers, who divided adopters into five categories: innovators, early adopters, early majority, late majority, and laggards (Kaminski, 2011). When J.P. Morgan's historical trajectory is analyzed under the lens of the Diffusion of Innovation Theory; there are striking similarities between how the company has evolved and how the theory operates.

Figure 10. Diffusion of Innovation Theory Categories



Source: (Kaminski, 2011)

A diffusion of innovation adopter categories framework, which groups people according to their inclination to accept new concepts or technologies, is depicted in the figure above. According to Kaminski (2011), the categories involve innovators (compromising the initial 2.5% of users who are "venturesome" and "risk takers") and early adopters (compromising 13% of adopters who are opinion leaders affecting mainstream acceptance). 34% of adopters, or the early majority, tentatively accept innovations after seeing the advantages that early adopters have shown. After them, the late majority, or an additional 34% of adopters, demonstrate prudence, fear of technology, and are largely motivated by the need to maintain competitiveness, and laggards, or the last 16%, oppose change until it becomes the standard or imperative (Kaminski, 2011). The typical diffusion pattern is depicted by the S-shaped curve, which starts slowly with innovators and early adopters, picks up speed as the majority adopts, and then slows down as laggards join. These categories could, however, overlap, and the rate of dissemination is influenced by things like social context and perceived danger.

In the first category, innovators, The Manhattan Company can be cited as an example of an early user of innovative methods in the banking sector. It showed a pioneering spirit akin to that of inventors in the Diffusion of Innovation Theory by initially concentrating on providing drinking water and then shifting its focus to banking operations (J.P. Morgan Chase & Co., 2024). Comparably, the introduction of Channel 2000 and NYCE in the 1980s serves as an example of how progressive banks embraced technical advancements as early adopters (J.P. Morgan Chase & Co., 2024) Furthermore, in the context of the Diffusion of Innovation

Theory, innovators are those who pioneer the adoption of new techniques to streamline interbank transactions, as evidenced by the founding of the New York Clearing House Association in 1853 (Liberto, 2022).

In first category, innovators, within the banking industry we find examples mentioned such as The Manhattan Company, which epitomize the early adopters of innovative practices and initially focused on supplying drinking water and later pivoted to banking operations, showcasing a pioneering spirit akin to that of innovators in the Diffusion of Innovation Theory (J.P. Morgan Chase & Co., 2024). Similarly, the advent of Channel 2000 and NYCE in the 1980s exemplifies technological innovations embraced by forward-thinking banks as early adopters (J.P. Morgan Chase & Co., 2024). Moreover, the establishment of the New York Clearing House Association in 1853 underscores the role of innovators within the banking sector, since they were pioneering the adoption of new methods to streamline interbank transactions, making them innovators in the context of the Diffusion of Innovation Theory (Liberto, 2022). The early and late majority as well as laggards were interested in these innovations as they gained traction and spread throughout the banking industry (Kaminski, 2011). Because they are prepared to take chances and explore novel concepts in the face of uncertainty, innovators are frequently the first to adopt innovations, frequently before they are generally acknowledged or shown to be successful. As such, needing adequate funding to support their innovative initiatives (Singer, n.d.). However, because they were based on pre-existing technology and ideas and provided only slight modifications rather than completely new paradigms, Channel 2000 and NYCE were not ground-breaking or revolutionary developments in the banking industry (Singer, n.d.).

It is also important to highlight some of the theory's most important features, like a relative advantage, which gauges how much innovation is thought to be an advance over earlier approaches (Kaminski, 2011). Adoption of technology such as NYCE and Channel 2000, for example, provided relative benefits over manual banking operations, such as increased convenience and efficiency (J.P. Morgan Chase & Co., 2024) According to Kaminski (2011), compatibility is the degree to which an invention aligns with people's values, experiences, and needs. J.P. Morgan's predecessors provided innovations that addressed common banking difficulties while also being compatible with changing socio-cultural values and client needs (Singer, n.d.). Time is important as dispersion happens gradually, even though it is not a primary trait; J.P. Morgan’s innovations demonstrate the

crucial role that time plays in the process as they move through several stages among various adopter categories, from early awareness to complete implementation (Singer, n.d.). Finally, Rogers emphasizes ideas like weak ties, opinion leaders, social learning, and critical mass, which all have an impact on the acceptance rate of these innovations within the social system in which they are disseminated (Singer, n.d.). Within the banking sector, which exemplified a similar social structure, new ideas were presented, taken up, and incorporated into standard operating procedures, incorporating banks, clients, authorities, and additional parties in the dissemination process. Thus, in light of J.P. Morgan's historical evolution, this hypothesis provides an example that sheds light on how banking innovations were embraced and disseminated.

Conventional banks have traditionally followed a rigid business plan that puts products ahead of the needs of their clients (Ananiev, 2022). In their quest for economies of scale and the optimization of their costly infrastructure and capacities, they frequently fail to effectively utilize their data and continue to be product-driven (Omura, 2023). When visiting a bank in person, access to traditional banking services, like these branches, was usually restricted to specific hours, and the knowledge and experience of bank staff determined how quickly a customer could be served (Temelkov, 2020). Moreover, conventional banks had greater labor and maintenance expenses due to their physical location and organizational design (Temelkov, 2020). Furthermore, the bank's reach was limited to areas where branches were present, which created issues with availability and accessibility (Temelkov, 2020).

One salient feature of the conventional business model pertains to banks' provision of in-person client interactions through the establishment of a network of physical branches (Chiorazzo, V. *et al.*, 2016). Customers get the opportunity to interact with bank employees face-to-face in this way, and this familiarity may come in helpful when you need more assistance (Chase, 2024). Additionally, because the traditional method was not based on patterns like its modern online counterparts may be, it provided every customer support option at that precise moment to any question a human could have because you were speaking face-to-face with an employee, who is supposed to have expertise (Goodshore, 2023).In the past, this provided direct customer service, where customers would go to a physical location to get financial advice or purchase new products from real people, thereby, being present in these local branches gave customers more confidence in situations like opening a bank account (Šarkauskaitė, 2023).

Moreover, withdrawal slips, which are bank documents that list the date, account number, and amount to be withdrawn, are among the numerous paper-based transactions that were involved. These slips function as written requests to the bank for payment to the account holder, with the specified quantity deducted from the stated account number (Unacademy, 2024). Since people just needed to visit their neighborhood bank to deposit their money, using these branches made it comparatively simple to deposit cash from your business, store, etc (Goodshore, 2023). Similarly, checks have been around for a while in a variety of formats. Before, people had to travel in person to issue checks, which are drafts that are written, dated, and signed, and instruct banks to pay a particular amount of money to the bearer (Kagan, 2024). Financial institutions are directed by checks to move money from the payor's account to the payee's or that individual's account (Kagan, 2024).

Prior to the widespread usage of dataphones and electronic transfers, cash and cheques were the most often used payment methods. In the past, people utilized cash or checks to make in-person purchases at businesses (Rodriguez, 2024). People used checks and money orders, which are paper papers that may be acquired at banks or post offices and delivered to the addressee for collection, to settle bills, make purchases, or make remote payments (Grant, 2024). These tangible, paper-based payment options offered a straightforward and practical means of managing payments without depending solely on banks. Since debit cards weren't introduced until the 1980s and pin or chip cards weren't introduced until the 2000s, these were widely used before the widespread adoption of digital technologies in financial transactions (Bátiz, 2022).

Furthermore, much like a commercial bank, traditional mail-based operations like local post offices would provide basic banking services including cashing checks, processing bill payments, and even making modest loans (Tretina, 2023). Offering banking services through the post office network has proven to be an inventive way to expand access to banking, as evidenced by the rise in this type of service during the 2000s as a means of diversifying banking offerings. In Europe, for example, postal banking accounted for thirty percent of post office revenue (Inter-American Development Bank, 2003). As an illustration, J.P. Morgan launched the Post Office card account (POca) in 2003 as a conventional banking service in the UK. This service does not rely on sophisticated technology and instead

processes transactions mostly by hand (J.P. Morgan, 2018). Users may withdraw money from Post Office branches or ATMs with the Post Office brand using the Post Office card account, which offers a straightforward banking choice for handling pension, benefit, or tax credit payments (J.P. Morgan, 2018). Customers were frequently updated on their accounts and received critical information in this approach.

Historically, written correspondence—such as letters or statements sent by mail—was how banks kept in touch with their clients. The Erie Canal made mail transportation for post offices easier, and The Bank of The Manhattan Company, a forerunner of J.P. Morgan, was instrumental in supporting construction in 1825 (Smithsonian National Postal Museum, n.d.). The Post Office Department heavily relied on the Northern Pacific Railroad, along with other lines supported by Morgan and his firm, to deliver mail across the nation. Additionally, by financing the completion of the railroad by the turn of the 20th century, J. Pierpont Morgan cemented his reputation as America's most influential railroad financier of the time (Smithsonian National Postal Museum, n.d.). Post offices were able to reach clients more effectively thanks to these transportation networks, which made it easier to deliver mail over large distances.

As we've been seeing, a large portion of banking procedures were done by hand in the past. Likewise, human review, manual transaction monitoring, simple data-matching technologies, and cross-sector data-matching solutions were among the most widely used methods for fraud detection and prevention in traditional banks (LinkedIn, 2023). To spot possible suspicious and unusual activity that would point to fraudulent operations and take preventive action, this required manually reviewing transactions and organizational data (Choong, 2023). Banks also used conventional rule-based systems to identify fraudulent activity. According to predetermined guidelines, including certain transaction thresholds or patterns, these systems were made to detect fraud (Writer, 2023).

Using manual accounting systems, such as accounting books or paper spreadsheets, was another manual method that banks employed. They would record transactions into a paper ledger or spreadsheet and use a calculator to do any necessary computations ("Accounting Methods," 2023). Accounting books are manually updated with transactions through the use of physical records, books, pads of paper, written ledgers, and physical records. A manual accounting system will typically include multiple ledgers, each with its

own book, to record various account kinds, such as payroll and sales. The business's financial statements will be prepared using the data entered into these ledgers. ("Accounting Methods," 2023). In this manner, they would compute balances, interest, and other financial figures to prepare financial statements and tax returns ("Accounting Methods," 2023). For this reason, banks mostly relied on labor-intensive manual record-keeping systems that required a lot of paperwork for account management, transaction tracking, and financial reporting.

Furthermore, manual loan processing was also utilized in conjunction with manual accounting and computation methods. In addition, there was a ton of paperwork, manual document verification, and approval procedures that could take several days or weeks to finish (Faster Capital, 2024a). They also have to manually assess their creditworthiness because they would be doing it by hand (Faster Capital, 2024a).

As was previously said, conventional banking worked under a variety of business models and offered a wide range of financial products and services. Some banks even made it their goal to serve as their clients' complete one-stop shops (Temelkov, 2020). However, when J.P. Morgan's activities are examined via the prism of Customer Relationship Management (CRM) theory, several important patterns become apparent. CRM is the term for a collection of business plans, procedures, and technology advancements centered on a company's interactions with its clients (Fernández, 2023). CRM is known for being client-centric, which helps to gather important customer data including needs and preferences ("12 preferences," 2024). Here, J.P. Morgan forerunners, in this case, like The Manhattan Company, which started as a provider of drinking water, eventually moved into banking. By diversifying their offerings early on, they showed that they were willing to adapt to the changing needs and preferences of their clientele (J.P. Morgan Chase & Co., 2024).

Effectively managing customer connections across a variety of channels, utilizing data to improve the customer experience, and guaranteeing smooth integration across touchpoints for consistent and cohesive interactions are all essential components of a successful CRM (Payne & Frow, 2004). The 1980s saw the launch of NYCE ATMs and Channel 2000, two proactive initiatives that epitomize the essence of successful CRM. These initiatives sought to improve customer satisfaction by providing convenient banking services that allowed customers to conduct simple transactions remotely or easily access cash through ATMs (J.P. Morgan Chase & Co., 2024). They also understood the value of in-person

interactions in establishing and preserving client relationships. For example, brick-and-mortar branches offered a physical setting where clients could interact with bank employees in person, establishing a feeling of familiarity and trust (Chiorazzo, V. *et al*., 2016). The whole client experience was improved by the customized financial advice and product recommendations made possible by this personalized approach to customer care.

CRM emphasizes the value of developing connections with customers and how businesses engage with them; as a result, communication is essential (Payne & Frow, 2004). J.P. Morgan's significant contribution to improving communication and connectivity was highlighted by his funding of transportation networks like the Erie Canal and the Northern Pacific Railroad. This indirectly supported enhanced channels that are essential for building and maintaining customer relationships (Smithsonian National Postal Museum, n.d.). Another move is J.P. Morgan's introduction of novel ideas, such as the Post Office card account (POca) in the UK, which shows a dedication to increasing financial services accessibility and meeting the demands of a larger population (J.P. Morgan, 2018).

7. Objectives and questions

This study's main objective is to investigate and analyze how artificial intelligence is developing into a game-changing tool that might significantly alter the banking sector going forward, with a particular emphasis on J.P. Morgan, while tracing J.P. Morgan’s strategic evolution from its inception. It attempts to analyze the different applications, uses, and advantages of AI technology within J.P. Morgan as well as the possible effects it may have on the interactions between banks and its stakeholders. Furthermore, the study aims to dissect the various ways in which AI has been utilized, such as in fraud detection, chatbots, and large-scale data analysis, while assessing its efficacy. This study aims to investigate how artificial intelligence (AI) has transformed banks' operating techniques and service offerings in light of technological breakthroughs, particularly the emergence of data-driven banking.

The motivation driving this endeavor stems from a personal fascination with artificial intelligence and the significant effects it has on a variety of industries, most notably banking, and its development. This study aims to examine J.P. Morgan's past operational strategies in conjunction with its ongoing AI initiatives, specifically in light of the company's noteworthy dedication to technological and artificial intelligence innovation.

Consequently, this paper focuses on elucidating J.P. Morgan's use of AI and its cutting-edge operational strategies, acknowledging the company as a global financial powerhouse well-known for its incorporation of AI into banking operations, as demonstrated by programs like chatbots and COiN (Contract Intelligence), which are intended to improve customer experiences and operational efficiency.

To achieve this objective, the research begins with a thorough examination of artificial intelligence and all of its dimensions, following the development of this technological tool from its inception to its present state. An analysis of the difficulties facing the banking industry and the necessity of digital transformation has followed. After gaining a solid understanding of artificial intelligence and the difficulties that banks face, the research moves on to examine the digitalization of the banking sector and the strong case for this revolutionary change. It then explores the evolutionary actions banks have made to keep up with technology, emphasizing how important this change has been to their continued existence. Moreover, the analysis will clarify several tools that have surfaced in the course of these technological developments, explaining their uses and importance within the banking domain. Lastly, it will analyze J.P. Morgan's present usage of artificial intelligence and look at how the business incorporates it into its daily operations.

It's critical to comprehend how industry leaders, such as J.P. Morgan, are using artificial intelligence (AI) to transform their operational tactics as we go deeper into the field of banking innovation. In light of this, we raise four important queries:

Questions:

- ➔ What is the current state of artificial intelligence in J.P. Morgan?
- ➔ How have new technologies influenced the banking industry?
- ➔ How has J.P. Morgan adapted to the new technological advancements?
- ➔ What are the main tools used by J.P. Morgan in its banking efforts?

8. Methodology

After the objectives are stated, this study uses a methodological framework to explain artificial intelligence integration in J.P. Morgan's operations in detail. The process includes collecting data in an organized manner, doing thorough analysis, and synthesizing the outcomes. In this instance, the investigation begins with examining the particular uses, applications, and outcomes of artificial intelligence inside J.P. Morgan and the banking industry. The study attempts to derive more general findings or insights about how AI is changing banking services and operations from these particular data. As such, it proceeds from particular cases to broader ideas or understandings in an inductive manner, therefore using an inductive methodology.

One of the most important parts of this study project is the literature review process, which develops gradually over time. It aims to provide an in-depth analysis of existing literature to demonstrate J.P. Morgan's integration of AI into its operational framework. Many information sources have been carefully chosen, with careful consideration given to elements like publication date, research provenance, and the qualifications of the relevant organizations or researchers. As the investigation continues, the synopsis offers fundamental knowledge that is essential for understanding the complex need to digitize the banking sector.

This study, which makes use of a qualitative research approach, places a strong emphasis on a thorough investigation of relevant academic literature to provide in-depth insights. Mining bibliographic data from databases such as Google Scholar is the process of information retrieval. Using a variety of sources, including books, journal articles, theses, and websites, this thorough review focuses on terms related to "banking," "artificial intelligence," "technological advancements," "digitalization," "consumer," and "information technologies." The search was done using keywords in both Spanish and English. Because AI is still in its infancy, reports from technology companies and consultancy organizations are relied upon, as scholarly literature is few. The goal of the data compilation is to aid in the empirical clarification of this subject and guarantee the distribution of succinct and impartial post-research results.

This study adopts a systematic literature review approach. It begins with the development of relevant research questions, which denotes the organized arrangement of

data. In chronological order, it offers background information on artificial intelligence, including its history, features, and current uses in the financial sector—with a particular emphasis on J.P. Morgan.

9. Analysis and discussion

J.P. Morgan has seen an unheard-of transformation in the banking sector from its modest origins as a financial services company in the 19th century to its current standing as one of the most powerful financial organizations globally. But the story of J.P. Morgan's transformation is merely a small portion of the larger story of the revolution of banking in recent decades. Banking practices have drastically changed from manual transaction management to technology-driven automation in a world where digitalization is the standard. As a result of the technology revolution, a new competitive landscape is emerging where digital formats are beginning to replace services that were previously exclusive to traditional banking. The outcome of this has been the industry-wide transition to digital format, driven by the ingenuity and enterprising spirit of recent entrants into the financial arena. This trend has been accelerated by the advent of AI, which has completely changed how banks function and interact with their customers. Its capacity to provide more effective services has completely changed the banking environment of today, benefiting both customers and financial organizations alike.

According to Tulsi *et al.* (2024), J.P. Morgan Chase, a prominent player in the global banking and financial services industry, is regarded as one of the main companies at the forefront of AI deployment. J.P. Morgan is ranked #1 in the world's top banks' assessment of artificial intelligence advancement and integration in the first Evident AI Index (2024). The Evident AI Index, created in 2023, is a publicly available benchmark that assessed 50 of the biggest banks in North America and Europe based on their asset size. The data was gathered from a range of sources, including job postings, research papers, and press releases. Furthermore, J.P. Morgan Chase, one of the biggest technology firms globally, invests around $14 billion in technology every year, and around half of that amount is spent on investments (J.P. Morgan Chase, 2023). This is a great illustration of how the bank has made significant investments in AI technology to take advantage of its advantages after realizing how important AI is in upending the financial landscape.

The Evident AI Index, according to Teresa Heitsenrether, Chief Data & Analytics Officer at J.P. Morgan Chase, highlights the increasing influence artificial intelligence is having on the world of finance (Thompsett, 2023). The bank's willingness to embrace AI technologies has resulted in notable advancements in operational speed, accuracy, and scalability. This is especially noticeable in the speed at which operational procedures are carried out, which enables more swift identification of fraudulent activity, risk management, and the use of advanced algorithms (Tulsi *et al.*, 2024). A LinkedIn article by Saigon Technology- Global Software Development Company (2024) explained that large volumes of transaction data can be managed and analyzed thanks to automated procedures and algorithms, which improves operational effectiveness and the company's ability to grow and successfully service a growing customer base (Saigon Technology, 2024). According to Forbes, the bank has applied AI initiatives and applications across a range of banking sectors, including risk administration, avoidance of fraud, investment banking trading, back-office automation, and customer interaction, placing a special emphasis on corporate banking (Davenport, 2019). The bank is ranked as the largest in the US and the sixth largest globally by total assets. According to Davenport (2019), J.P. Morgan's remarkable commitment to AI, extensive investment, recruitment of elite AI talent, and coherent approach to AI management stand it ahead of competitors in generating substantial business transformation.

The successful application of AI by J.P. Morgan Chase demonstrates the technologies' transformational capabilities in the financial services sector. More than 300 AI applications have been effectively integrated by the organization in a variety of fields, including risk management, marketing, customer prospecting, improving customer experience, and combating fraud (Lin, 2024). One outstanding example is the COiN (Contract Intelligence) System, which analyzes a variety of legal records, such as contracts for loans and invoices, using machine learning and natural language processing algorithms (Jain, 2023). In this manner, COiN lessens losses from commercial payment fraud by assisting in the detection of false or inaccurate information before the flow of cash (Tulsi *et al.*, 2024). Furthermore, the technology improves effectiveness by automating the acquisition and evaluation of important data from intricate contracts, such as loan agreements, greatly cutting down on processing time and human labor (Jain, 2023).

According to the work of Galeon (2017), the COiN algorithm has substantially enhanced productivity by reducing the number of person-hours required for yearly

inspections and reviews, which previously required 360,000 hours of manual labor from lawyers and loan officers at J.P. Morgan Chase. The system now completes these tasks in seconds instead of hours. J.P. Morgan has also successfully used the technology to decrease mistakes and speed contract review procedures. The automation of COiN reduces loan-servicing errors, which are mostly the result of human error in contract interpretation, processing more than 12,000 credit agreements yearly (Son, 2017). The system is an essential tool for analysts as it can analyze and evaluate hundreds of complicated financial papers per second, extract important data, and offer insights (Bernath, 2023). This much outperforms physical human assessment in terms of capability and enables almost instantaneous fraud monitoring of invoices.

Plus, it's crucial to note that COiN decreased the mistake rate in business payment fraud from 3% to around 1% in its first year of operation by detecting irregularities in invoices, saving J.P. Morgan Chase $150 million in fraud (Tulsi *et al.*, 2024). Through constant training on fresh data, artificial intelligence (AI) systems in banking are constantly improving. This improves their capacity to spot and prevent fraud and security threats by examining transaction patterns and habits. As a result, they are able to provide forward-thinking cybersecurity measures that better safeguard customer data and bank assets than reviewers who are humans (Saigon Technology, 2024). Furthermore, Santander's AI fraud prevention methods are anticipated to save around $150 million yearly, while J.P. Morgan's fraud prediction technology saves about $250 million per year (Tulsi *et al.*, 2024).

J.P. Morgan leverages AI to improve customer experience at several touchpoints, most notably through the incorporation of virtual agents into their customer support approach. Iris, an internal AI assistant, skillfully handles routine queries like frequently asked questions or information requests for more than 15,000 supported agents per day, which include customer service representatives, support workers, and any other individuals interacting with clients (Tulsi *et al.*, 2024). After installation, Iris reduces wait times from 5 minutes to less than 30 seconds by using dynamic conversations and natural language understanding to automatically fix 40% of these difficulties (Tulsi *et al.*, 2024). The bank has created OmniAI, an AI and ML platform intended to improve customer insights, expedite data scientist workflows, and enable quicker and more precise data evaluation (J.P. Morgan Chase, 2024b). Software developers and data scientists throughout the company use OmniAI, which has gained respect

in the market and represents a substantial improvement in the company's technical capabilities (J.P. Morgan Chase, 2024b).

In addition, artificial intelligence (AI) is used to evaluate interactions with AI-enabled virtual assistants, identify feelings in real-time, and quickly evaluate large amounts of consumer data to surpass customer expectations. This strengthens the bank's dedication to client happiness by enabling the forecasting of call volumes and the recommendation of tailored measures (McKinsey, 2021). By supporting the provision of easy, tailored, and compassionate client experiences, these programs enable the company to maintain its competitive edge through ongoing innovation in AI integration. Virtual assistants, or conversations with humans for customer service departments, are among the most widely utilized AI tools, according to McKinsey, which reports that they account for 32% (McKinsey, 2021).

Every message sent to J.P. Morgan's virtual assistant adds to a training dataset, which improves the AI's skills over time. Users may interact with the virtual assistant on a daily basis by putting inquiries into the chat window (J.P. Morgan, 2024). Additionally, it includes a number of services and responds to questions about transactions, cash position/balance, reports, statements, checks as well as wire status, and more (J.P. Morgan, 2024). Through the use of NLP chatbots for the automation of over 30,000 weekly chats, the banking institution has reduced processing time by 40%. Additionally, by utilizing NLP algorithms, the process of retrieving pertinent data from these papers has been expedited. This results in considerable time savings since jobs like data extraction, processing, and classification are now conducted more quickly (Tulsi *et al.*, 2024). J.P. Morgan's effectiveness in integrating and investing in AI technologies is demonstrated by the quality of its AI customer service. J.P. Morgan responds to 800,000 queries every month with an amazing 85% accuracy rate in less than a minute. However, according to Tulsi *et al.* (2024), Wells Fargo's AI service handles 300,000 queries with 60% accuracy and 3 minutes on average for response times.

Likewise, as mentioned earlier, J.P. Morgan makes use of advanced machine learning models that analyze extensive datasets to later evaluate credit threats, and enable improved credit, market volatility, and operational risk assessment, which later on empowers better risk-based decision-making (Verna, 2023). Regarding the AI-powered risk management tools the bank has invested in, we find the Katana Lens platform, which consolidates data from

800+ sources daily, using over 50 machine learning models to analyze it for risk exposures, suspicious activity patterns, and anomalies (Tulsi *et al.*, 2024). According to Tulsi *et al.* (2024), the effectiveness of the platform is evident in its ability to enable proactive resolution before major impacts, reducing severity by an average of 60%, while also increasing staff productivity by 25% post-integration. Additionally, its capacity to identify early risk events led to a significant 42% reduction in losses for JP Morgan, culminating in savings of over $500 million in the previous year alone (Tulsi *et al*., 2024). By identifying and addressing potential risks at an early stage, the company prevented these issues from escalating into larger problems that could have resulted in financial losses. The use of this platform then showcases the effectiveness of the risk management strategies implemented by the bank and solidifies its position as an innovator in risk management.

Integrating facial recognition software into all J.P. Morgan & Chase ATMs worldwide exemplifies the bank's dedication to industry digitalization, offering customers a complimentary facial scan upon account opening for convenient fund withdrawals and deposits (Hollinger, 2021). This offers various benefits in the banking sector since it not only enhances security by identifying suspicious behavior and known criminals to ensure safety but also expedites service delivery by replacing traditional customer authentication methods, streamlining access to services, and facilitating the transition to digital-first experience (Shashkina, 2024). While J.P. Morgan is not the sole bank implementing facial recognition technology for ATMs, its system boasts single-digit failure rates, whereas Deutsche Bank and UBS experience higher failure rates of 16% and 11% respectively (Tulsi *et al.*, 2024). This type of technology betters the overall customer experience by enabling personalized services, allowing businesses to tailor offerings based on individual preferences and behaviors, while also providing a more convenient and inclusive alternative to traditional authentication methods like PINs or paperwork, thereby increasing accessibility for individuals with visual impairments (Shashkina, 2024). Particularly in busy environments, the implementation of such technological tools proves highly beneficial. In the case of J.P. Morgan facial recognition technology is utilized across more than 5,000 bank branches to enhance security measures (Tulsi *et al.*, 2024).

The employing of AI algorithms to carry out trading techniques by examining market data and engaging in trading with high frequency, which entails the quick purchase and sale of financial assets like stocks, currencies, or derivatives, is yet another means that AI has

improved J.P. Morgan Chase's trading performance (Verma, 2023). Furthermore, the objective is to maximize trade success and improve portfolio surveillance through the utilization of AI-driven trading techniques' speed and efficacy (Verma, 2023). The bank quickly interprets market data and economic metrics using AI-powered predictive analytics and algorithmic trading tools, enabling it to make well-informed investment decisions and adjust to market volatility (Mco, 2023). Improved financial performance and enhanced competitiveness in the market are the results of the bank being able to take advantage of more attractive market possibilities through a larger percentage of executed successful deals.

Tulsi *et al.* (2024) report that J.P. Morgan Chase saw a substantial rise in their algorithmic trading win rate, from 52% to over 60%, revealing the success rate of AI in generating profitable transactions and also saving $25 million in slippage costs by implementing AI techniques like deep reinforcement learning. Similar to this, J.P. Morgan Chase's trade routing decision latency has been drastically lowered by this implementation, going from 50 milliseconds to less than 5 milliseconds. This has improved market responsiveness and efficiency by enabling speedier trade execution (Tulsi *et al.*, 2024).

According to the Investor Co. in a LinkedIn post (2024), AI is a major factor in increasing algorithmic trading's effectiveness and velocity of execution, especially in high-frequency trading (HFT), where orders must be fulfilled quickly to take advantage of market opportunities As previously indicated, traders may conduct deals in milliseconds by utilizing AI algorithms, such as those used by J.P. Morgan Chase, which allows them to handle high trading volumes with ease while retaining accuracy and efficiency. With this capacity, businesses may take advantage of short-lived market opportunities at scale and maintain a competitive advantage in ever-changing market conditions (The Investor Co., 2024).

J.P. Morgan Chase has made significant financial investments and cooperative efforts to advance AI; in 2019, the company earmarked $11.4 billion for technology (Harvard, 2020). Organizational structures within the company, such as the AI/ML Council and the Machine Learning Center for Excellence (MLCOE), facilitate the sharing of technological innovations which include analysis of time series, graph statistical analysis, massive amounts of computing, and recommender systems, among other things (J.P. Morgan Chase, 2024a). Moreover, strategic alliances with other organizations such as Roostify and OnDeck hasten

the creation of innovative goods and services, such as self-servicing mortgage venues and quick online channels for small business loans (Harvard 2020).

According to a 2023 NVIDIA poll, 36% of banking and financial services experts said that using AI reduced their company's annual expenditures by more than 10%, both in terms of economic growth and cost savings (Pressley, 2024). In a similar vein, J.P. Morgan set a goal to produce $1 billion in "business value" using AI by 2023. At its investor day in May, the objective was increased to $1.5 billion (Ghosh, 2024). Teresa Heitsenrether highlighted some of the advantages of these developments, including the supply of insights to client-coverage teams and customized suggestions to card industry clients (Doherty, 2023). For example, the bank has invested over $9 billion in the creation of advanced neural networks that examine over 100 million data inputs to anticipate fraud with an accuracy percentage of 95% (Tusli *et al.*, 2024). These days, it makes sense to invest in cutting-edge technology for fraud forecasting, like these neural networks, as it improves the precision and effectiveness of fraud detection procedures, protecting financial institutions from possible losses and harm to their reputation.

In terms of keeping AI specialists in the banking business, Greg Larkin's (2023) LinkedIn article claims that J.P. Morgan leads the industry with a far lower turnover rate than its rivals. According to Larkin (2023), J.P. Morgan has seen a very favorable retention trend, having hired 318 AI professionals in the previous 24 months while only having 204 leave. Conversely, within the same period, major banks lost 708 and hired 767 AI workers. For instance, according to Larkin (2023), Goldman Sachs recruited 43 employees but saw 75 leave. Additionally, J.P. Morgan CEO Jamie Dimon has said that artificial intelligence (AI) may one day enable companies to shorten the workweek to only 3.5 days, and the firm is hiring for many AI-related positions (Doherty, 2023). Heitsenrether says that the bank uses AI to supplement human work rather than to replace it, allowing for ongoing growth without the need to hire more employees to manage it (Doherty, 2023).

Furthermore, the previous section's discussion of diffusion theory offers a useful foundation for comprehending J.P. Morgan's present stance on the application of AI technology in the banking industry. Based on their inclination to accept new technology, businesses may be divided into many groups using Everett Rogers' approach. Representing around 13.5% of adopters in the diffusion process, J.P. Morgan's history of the adoption of AI

in the banking industry places it as one of the early adopters, if not the early adopter, given the steps outlined in the diffusion theory (Kaminski, 2011). J.P. Morgan's substantial investments in artificial intelligence (AI) technologies, proactive commitment to innovation, and strategic partnerships with technology firms serve as proof of this.

J.P. Morgan's dedication to using cutting-edge technology to boost productivity, reduce risk, and improve the customer experience is demonstrated by the company's deep integration of AI into many areas of its business. J.P. Morgan's proactive approach to using innovation for operational efficiency and risk management is demonstrated by its early embrace of AI technologies, such as the COiN (Contract Intelligence) system for contract analytics and fraud detection. In a similar vein, the introduction of face recognition software at ATMs demonstrates the company's dedication to customer-centric innovation and establishes a standard for the industry's acceptance of AI-based solutions. Strategic alliances and large investments in AI, including the Machine Learning Center of Excellence (MLCOE), further reinforce J.P. Morgan's position as a leader in the adoption of AI.

Thus, J.P. Morgan has shown a widespread use of AI-based solutions, ranging from fraud detection systems to virtual assistants to algorithmic trading platforms. All things considered, J.P. Morgan's aggressive approach to the adoption of AI, demonstrated by its early investments, clever alliances, and thorough integration throughout its operations, is very consistent with the diffusion theory framework for technological adoption. Being an early adopter, J.P. Morgan not only gains from AI-driven breakthroughs but also establishes the framework for a more extensive industry change, utilizing cutting-edge technology to shape the future of banking.

It should be mentioned, nonetheless, that considering the recent developments and ongoing growth of AI applications in the financial sector, this indicates that we may be in a transitional stage leading up to a wider implementation. Even if the phase of broad adoption has not yet been achieved, J.P. Morgan—Wells Fargo, UBS, Deutsche Bank, and others—are making great strides in integrating AI into their daily operations, which points to a rapid progression in the direction of wider adoption shortly.

10. Conclusions and proposals

Following an analysis of artificial intelligence's effects on the financial industry, the significance of J.P. Morgan's AI adoption in transforming the banking industry is emphasized.

J.P. Morgan has distinguished itself as an early adopter of AI through smart investments, reaping benefits in critical domains including risk management, fraud detection, and customer service. While lowering risks, the integration of AI technologies has greatly enhanced operational effectiveness and customer experience, such as COiN and face recognition technology. Notwithstanding the manifold advantages that come with incorporating AI, it's critical to acknowledge the possible hazards and obstacles. Nevertheless, a significant danger that financial institutions must consider when implementing AI is possible technological reliance. When an organization depends too much on automated processes, it may be more susceptible to interruptions from cyberattacks, system failures, or other unfavorable circumstances. For this reason, having sufficient backup plans and contingency plans in place is essential to ensuring company continuity and safeguarding financial assets.

A primary advantage of incorporating artificial intelligence (AI) into J.P. Morgan is the notable enhancement in operational efficiency, precision, and expandability. With the use of AI-powered solutions, the bank has been able to better manage risks, spot fraudulent behavior faster, and enhance decision-making across the board. Data protection, however, is a major issue as gathering and analyzing vast amounts of data can give rise to worries about the security and privacy of clients' personal information.

The possibility of biases or mistakes in AI systems, which might lead to unfair or inaccurate judgments, is yet another significant issue. Organizations must establish strong control and auditing procedures to guarantee the impartiality and accuracy of AI systems to mitigate this danger.

It is crucial to make sure that employees are adequately taught to comprehend and utilize these tools as businesses implement more sophisticated AI technology. Implementation mistakes and incorrect interpretation of findings might arise from a lack of understanding and expertise in using AI. Consequently, it is acknowledged that proper

training on the application of AI and its ethical ramifications is necessary. To mitigate these hazards, it is critical to stress how important it is to correctly comprehend and use AI tools. Even though using AI in Salesforce marketing efforts might have significant advantages, it is crucial to reduce any possible hazards by providing thorough training and instruction on the ethics and application of AI.

Regarding AI's generalization, it may be connected to the diffusion theory, which explains how innovations disseminate across social system participants. While J.P. Morgan and other prominent financial companies may have been at the forefront of AI adoption, it is probable that these technologies will eventually spread and be incorporated into the daily operations of the majority of banking businesses. As more businesses make use of AI's advantages, this might result in a better standardization of procedures and practices as well as increased market competitiveness.

It's also critical to address the rising worries about automation led by AI leading to job losses. While the use of AI technology may lead to a reorganization of duties and responsibilities in the workplace, it may also result in job losses in sectors where jobs can be readily automated. It is critical to acknowledge this danger and take action to reduce it by reallocating and retraining talents to adjust to a changing workplace powered by AI. Automation may lead to new work prospects and the development of skills in cutting-edge technology, despite certain limitations.

Although incorporating something as novel as artificial intelligence into the banking industry carries a certain amount of risk, it's also critical to realize that the potential advantages build over time and are evident in observable metrics like ROI, customer acquisition, and enhanced operational effectiveness. Even if using AI might be difficult, technological advancements are nonetheless helpful in changing the banking sector.

To illustrate this argument, it is important to see how other banks—such as Wells Fargo, UBS, and Deutsche Bank—are likewise assiduously incorporating artificial intelligence technology into their business practices. Like J.P. Morgan, these financial institutions understand the potential of AI to optimize risk reduction, improve client happiness, and increase overall efficiency. Their commitment to technological innovation

shows that the banking sector's use of AI is a fundamental advancement rather than a passing trend that other companies must follow to be competitive in the market.

Therefore, it is imperative that financial institutions stay abreast of the most recent advancements in artificial intelligence and strategically integrate these technologies into their business processes. Businesses that can adapt to change and fully utilize AI will be better equipped to face future difficulties and provide their clients with more sophisticated and individualized financial services.

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