

# Toward the utilization of chatbots in the banking sector

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**Abstract.** *The increasing interest in artificial intelligence led many industry sectors to incorporate this technology in order to remain competitive. The integration of artificial intelligence chatbots in the banking sector has brought significant changes. While chatbots offer efficiency and convenience, they also have limitations in handling complex situations. This research examines the impact of chatbot technology in the banking sector, specifically its application for client communication, and assistance in banking activities. To analyze chatbot capabilities, two use case scenarios are defined, representing real banking services of varying complexity and human involvement. SWOT analysis was used to explore the benefits and limitations of the chatbot application.*

**Keywords.** artificial intelligence, banking sector, chatbot, SWOT analysis

## 1 Introduction

The concept of artificial intelligence has fascinated the scientific community for centuries, even predating the invention of computer systems. Philosophers throughout history have pondered and explored the possibilities of developing intelligence in forms other than humans. The term "artificial intelligence" was first recorded by (McCarthy et al., 1955), and has since been used to encompass a wide range of intelligent behaviours exhibited by computers.

The primary goal of artificial intelligence has always been to enable machines to reason and draw conclusions in a manner similar to human beings. Over the years, there have been both successful and unsuccessful attempts to achieve this goal, with different implementations and intentions. One commonly used benchmark for assessing machine intelligence is the Turing test, originally proposed by Alan Turing in the 1950s. The test involves a scenario where an interrogator engages in conversation with either a human or a machine in a separate room. The interrogator's objective is to determine whether they are communicating with a real person or a machine (French, 2000). If the interrogator is unable to distinguish between the responses of the human and the

machine, the machine is considered to have passed the Turing test. The Turing test is particularly useful for evaluating programs designed for human interaction, as well as digital avatars and more recently, digital humans.

The COVID-19 pandemic has significantly influenced consumer behaviour, with more people embracing digital solutions and conducting business from the comfort of their homes (Iancu & Iancu, 2023). This shift in preferences and habits has created a demand for online services, prompting companies to adapt and meet the evolving needs of their customers. One notable response has been the implementation of chatbots that can provide customer support and answer inquiries in a manner similar to human employees. The implementation of chatbots has proven to be an effective solution for meeting the growing demand for online services during the pandemic and beyond (Güler et al., 2022).

Artificial intelligence has found applications in numerous domains, including healthcare, finance, transportation, and entertainment. From virtual assistants to autonomous vehicles, artificial intelligence technologies have become an integral part of daily lives (Luo et al., 2022). This paper delves into the application of artificial intelligence and chatbot technology within the banking sector. The research explores how banks are utilizing these technologies to enhance communication with clients and provide assistance across various banking activities. The aim is to identify the benefits and limitations associated with the chatbot technology application in the banking sector by examining its implementation in the Serbian market. To showcase the practical application of chatbots, the research presents two real-life use case scenarios that represent common banking services. A comprehensive SWOT analysis is conducted to evaluate the overall effectiveness of chatbot technology in the banking sector, drawing insights from the specific use cases.

The paper consists of eight main sections. The introduction provides a brief overview of the research topic and the motivation behind the study. The chatbot overview section provides a comprehensive understanding of chatbot technology and its capabilities. The state-of-the-art section presents an

overview of existing studies related to the digitalization of the banking sector. The research purpose section states the objectives of the study that will be addressed. The research method section describes the approach and methods used to address the research objectives. Next, the specific use cases are defined and described in a separate section. The analysis section evaluates and discusses the findings of the research. The conclusion section summarizes the key findings and insights from the research and provides directions for potential areas of future research.

## 2 Chatbots: An overview

A chatbot is a computer program that utilizes natural language processing (NLP) and artificial intelligence techniques to simulate human conversation. It can understand and interpret user questions or inputs and provide automated responses in a conversational manner. Also known as “conversational agents”, chatbots can mimic human speech, written or spoken, for the purpose of simulating a conversation or interaction with a real person. Artificial intelligence enables chatbots to interact with users through text-based inputs, voice commands, or a combination of both (Ridha & Haura Maharani, 2022). They can be integrated into various platforms such as messaging apps, websites, and social media platforms, allowing real-time communication with users. Chatbots are commonly offered as web-based applications or standalone apps.

In the past, chatbots were primarily text-based and programmed to respond to a limited set of straightforward questions using pre-written responses. While they performed well within the scope of these predefined questions, they struggled with more complex questions or the ones that hadn't been predicted by the developers. As technology progressed, more rules and natural language processing have been integrated into chatbots making it possible for users to interact with chatbots in a manner that resembles human conversation. The latest generation of chatbots (Luo et al., 2022), often referred to as "virtual assistants," are context-aware and possess the ability to learn from exposure to a growing volume of human language data.

Natural language processing is a branch of artificial intelligence that focuses on enabling computers or computer programs to understand, analyze, and generate human language. This is achieved through the use of machine learning algorithms designed to identify patterns and structures in textual data. One key aspect of NLP is natural language understanding (NLU), which is used to extract context and meaning from user inputs in natural language and provide appropriate responses in accordance with user intention. By understanding the intent behind user inputs, chatbots can provide appropriate responses and

take the necessary actions (Adamopoulou & Moussiades, 2020).

Chatbots operate based on the knowledge they have been provided with. They rely on a knowledge model that contains information and responses to questions based on compiled keywords. (Ridha & Haura Maharani, 2022) Chatbots can be designed to handle different types of tasks, and classified depending on different parameters. One classification parameter is based on the amount of data a chatbot can access. Open-domain chatbots can engage in conversations about general topics, while close-domain chatbots are more focused on specific domains or industries. (Nimavat & Champaneria, 2017). Chatbots can also be classified based on the service they provide, taking into consideration the level of interaction and emotional connection they establish with the user. Additionally, they can be classified based on the goals they aim to achieve or according to the permissions provided by their development platforms (Adamopoulou & Moussiades, 2020).

Considering the input processing and response generation method, chatbots can be classified as rule-based, retrieval-based, or generative (Adamopoulou & Moussiades, 2020).

Rule-based chatbots utilize a fixed set of predefined rules to determine appropriate responses based on recognized text inputs. The knowledge used by these chatbots is manually coded by humans and organized using conversational patterns (Ramesh et al., 2017). They are not robust when it comes to handling spelling or grammatical mistakes in user inputs. Since they strictly adhere to predefined rules, any deviation from the expected input format can lead to inaccurate or inappropriate responses.

Retrieval-based chatbots operate by retrieving relevant responses from a repository or pool of pre-existing responses when presented with a user's message (Ji et al., 2014). The system compares the user's input to the available responses and selects the most suitable or reasonable response. However, they cannot generate entirely new answers for novel or unseen questions. Compared to rule-based chatbots, retrieval-based chatbots offer more flexibility by utilizing APIs to query and analyze available resources (Wu et al., 2016).

On the other hand, generative chatbots approach conversations as an input-output mapping problem and learn to generate responses based on training with a large dataset (Peng & Ma, 2019). These chatbots require more sophisticated NLP algorithms as they have the ability to generate new responses, making them more adaptable to handling novel or unseen questions.

## 3 State-of-the-art

It becomes challenging to pinpoint the exact moment when individuals started placing increasing reliance on

machines and developing trust in artificial intelligence. The COVID-19 pandemic has significantly impacted our society, particularly in terms of digitalization. The authors (Güler et al., 2022) provide a comprehensive description of the effects that brought this shift toward digitalization in a post-COVID-19 world. The group of authors (Negoita et al., 2022) aim to provide a comprehensive overview of the state of digitalization, shedding light on its impact and implications for businesses in terms of skill requirements and the potential for automation.

To maintain competitiveness in the market, it is crucial for companies to align with industry trends and keep up with technological advancements. The author (Stjepić, 2017) discusses determinants for the adoption of new technologies, with a particular focus on SMEs.

(Adamopoulou & Moussiades, 2020) provides an overview of chatbots, covering their definition, creation process, basic elements, and design and development aspects. It offers a concise understanding of chatbot technology, including its structure and functionality, and outlines the considerations and techniques involved in designing and developing chatbots. The paper (Luo et al., 2022) thoroughly examines the computational approaches, usability, and applications of chatbots in various business sectors. It identifies research gaps and proposes new directions to enhance both academic research and practical business applications of chatbot technology.

(Ridha & Haura Maharani, 2022) examines the implementation of artificial intelligence chatbots and assesses their influence on service quality. The authors (Wube et al., 2022) provide a systematic literature review of text-based chatbots in the financial sector. They cover their implementation, adoption intention, user attitudes and experiences, and potential strategies for their advancement.

In (Fares et al., 2022) the authors offer a comprehensive review of the literature on the application of artificial intelligence in the banking sector. The authors conducted a systematic literature review, through thematic and content analysis, the study identifies research themes related to the use of artificial intelligence in banking. The impact of chatbot technology on bank revenues is analyzed in the paper (Hwang & Kim, 2021). It highlights the suitability of chatbots for different types of transactions and demonstrates how chatbots can enhance financial soundness and reduce operational costs.

The research on chatbots in the financial sector was inspired by prior influential works that emphasized the use of this type of artificial intelligence. The objective of this paper was to investigate the implications of chatbots for banking activities and the potential substitution of human interactions with digital assistants.

## 4 Research purpose

The main purpose of this research is to analyze the current trends in the digitalization of the banking sector, with a particular emphasis on how banks are utilizing artificial intelligence for client communication. The study investigates the use of chatbots and artificial intelligence by banks operating in the Serbian market to enhance customer service and streamline banking processes. The research aims to explore how these technologies are being employed by banks to communicate with clients, provide guidance, and offer assistance throughout different banking activities. By analyzing the current practices and trends in the utilization of chatbots by banks in Serbia, the research seeks to identify areas where banks can further enhance their implementation of artificial intelligence. The research also aims to uncover any limitations or challenges that may arise in the implementation of these technologies in the banking sector and provide recommendations for overcoming them.

### 4.1 Research objectives

Two main objectives pursued in this research are:

1. To identify the strengths and weaknesses of using chatbots in banking activities in Serbia

This objective involves evaluating the advantages and disadvantages of chatbot applications by banks operating in the Serbian market in areas such as customer service, banking service guidance, and assistance.

2. To assess the extent to which digital assistants have the capability to replace human employees in performing banking tasks within banks operating in Serbia

This objective involves examining the capabilities of chatbots in performing various banking activities within banks operating in Serbia and assessing their potential to handle customer interactions and other tasks traditionally performed by human employees.

## 5 Research method

To address the research objectives, this study followed a structured approach consisting of several phases. The first phase involved gathering relevant data from the existing literature. The aim was to establish a foundation of knowledge and identify key insights from previous studies. In the second phase, specific use cases were defined. These use cases were carefully selected to represent different scenarios that could be tested against a real chatbot. The intention was to cover a range of situations, from those that could be handled entirely by the chatbot to those that would require some level of human assistance. The third phase involved

simulating the defined use case scenarios on the chatbot within a commercial bank operating in the Republic of Serbia. Finally, a SWOT analysis was conducted on the application of chatbots in the defined use cases. The objective was to gain insights into the benefits and limitations of chatbot applications and identify future possibilities and potential challenges that may arise in the banking sector.

SWOT analysis is a strategic planning technique that helps evaluate an organization's competitive position by considering both internal and external factors (Namugenyi et al., 2019). Traditionally, organizations tend to focus on internal factors when making strategic decisions. SWOT analysis addresses this limitation by incorporating both internal and external data sources.

The analysis begins by identifying the organization's strengths, which are its internal advantages and capabilities that give it a competitive edge. Conversely, weaknesses are internal factors that hinder the organization's performance or put it at a disadvantage compared to competitors. Opportunities are external factors that can be leveraged to enhance the organization's performance or achieve strategic goals. By identifying opportunities, organizations can capitalize on favorable conditions to drive growth and success. On the other hand, threats are external factors that pose risks and challenges to the organization's operations. Recognizing threats enables organizations to develop strategies to mitigate or respond to them effectively. By considering both internal and external factors, SWOT analysis helps identify areas of strength to leverage, weaknesses to address, opportunities to seize, and threats to mitigate.

Although SWOT analysis is mostly used to inform strategic planning and decision-making, it is a versatile framework that can be applied in various contexts to assess strengths, weaknesses, opportunities, and threats. In the study (Farrokhnia et al., 2023) focused on education, SWOT analysis is used to identify the specific strengths and weaknesses of chatbot applications in the educational sector.

## 6 Use cases

The main focus of this research is to evaluate the capabilities of chatbots within the banking sector in the Serbian market. To demonstrate the practical

application of chatbot technology in banking activities, the study introduces two use case scenarios: opening a checking account and applying for a mortgage loan. These scenarios represent real banking services that vary in complexity and the level of human involvement required. In the first scenario, opening a checking account, the process is relatively straightforward and can be handled with minimal human interference. In the second scenario, applying for a mortgage loan, the process is more complex and typically involves a higher level of human involvement. Both use case scenarios are based on the actual application of a chatbot within a commercial bank operating in the Republic of Serbia that implemented a chatbot to facilitate and guide customers through their online services. Figure 1 illustrates the initial interaction with the chatbot. By analyzing the chatbot's capabilities in these scenarios, the study aims to provide insights into the strengths, and weaknesses of implementing chatbot technology in the banking sector.

The first use case scenario in the research focuses on the process of opening a checking bank account. Traditionally, opening a bank account involved visiting a physical bank branch and completing various paperwork. However, with the emergence of digital technologies and the increasing popularity of online services, clients now expect the convenience of completing their obligations remotely. Clients can provide their personal data and submit the required documents electronically to prove their identity. The process may also involve signing agreements digitally and activating the account through online channels.

The second use case scenario portrays a more complex process: applying for a mortgage loan. This process typically involves multiple stages, such as gathering financial information, submitting loan applications, providing supporting documents, and undergoing credit checks. Traditionally, this process required extensive manual paperwork and in-person interactions with bank representatives. However, with the advancement of digital technologies, banks are increasingly offering the option for clients to apply for mortgage loans online.

Figure 2 displays a BPMN diagram representing a simulation of the online opening process of a checking account with chatbot assistance. The diagram illustrates each task involved in the account opening process. The chatbot interacts with existing or prospective bank clients, providing guidance and assistance at each step. It is important to note that while

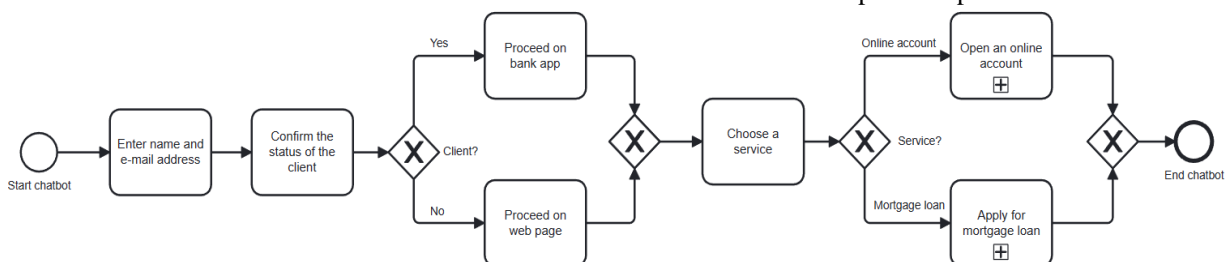
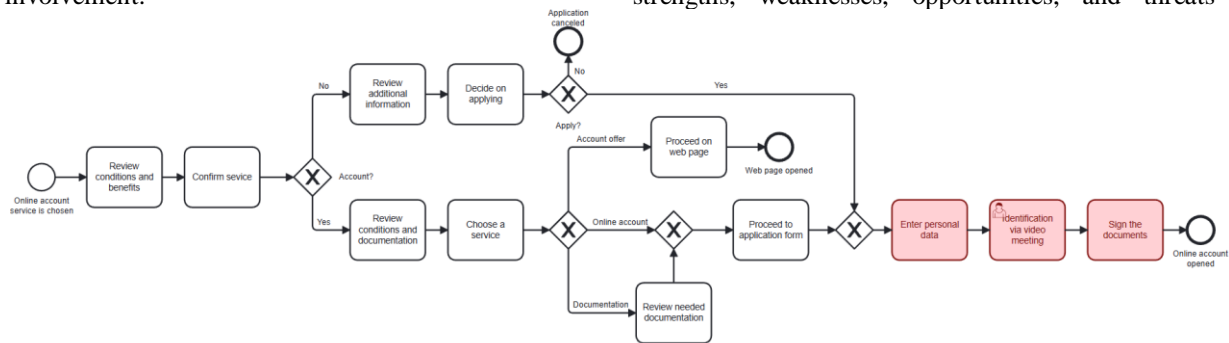


Figure 1. Chatbot application in banking services

the entire account opening process can be completed online, the chatbot's assistance alone may not be sufficient for certain activities. There are still specific tasks within the process that require human involvement.

specific focus on client communication and assistance. Opportunities and threats are also discussed. The research findings are summarized in Table 1, which presents a comprehensive overview of the identified strengths, weaknesses, opportunities, and threats



**Figure 2.** Use case 1: Opening a checking account online (tasks in red – chatbot assistance available only in Serbian, user task – human involvement required)

The second use case scenario involves applying for a mortgage loan, which is a more complex process compared to the first use case scenario. The focus is on the mortgage application phase where a chatbot is utilized to guide and assist clients through the process. The BPMN diagram, represented in Figure 3, represents a simulation of this phase in a previously mentioned bank. The diagram showcases each task involved in the mortgage application phase, with each task corresponding to an activity performed by existing or prospective bank clients. The chatbot plays a significant role in providing guidance and assistance to clients at each step of the process. Despite the chatbot's involvement, the mortgage application cannot be completed entirely online. The complexity of the mortgage application necessitates human involvement, particularly for tasks that cannot be digitized or automated. This means that clients will still need to visit a bank branch to fulfill certain requirements and provide the necessary documentation.

associated with chatbot technology in the banking sector, drawing insights from the defined use cases.

**Service available constantly**

One significant advantage of chatbots is their availability 24/7. Unlike human bank employees and customer support representatives who work within specific operating hours, chatbots can provide guidance and assistance at any time.

**Quick response**

Chatbots offer the advantage of instant response to client inquiries. The automated nature of chatbots enables them to provide prompt responses, eliminating the need for customers to wait in queues or endure long hold times on customer support phone calls.

**Interaction with multiple customers at once**

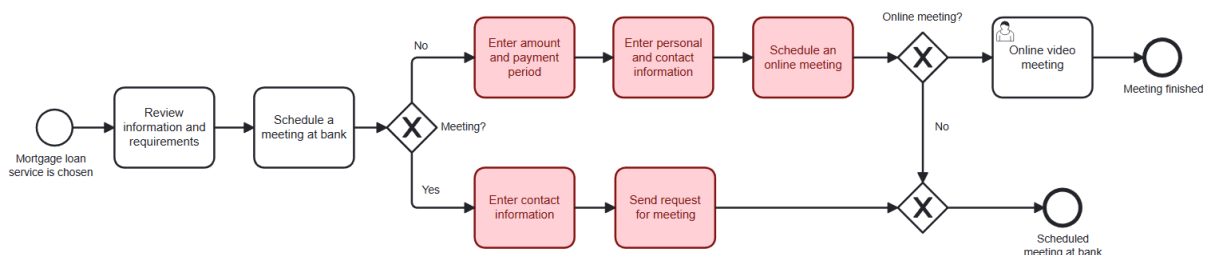
One of the key advantages of chatbots is their ability to handle multiple client interactions simultaneously. Unlike bank employees and customer support representatives who typically interact with one client at a time, chatbots have the capacity to engage with multiple clients simultaneously.

**Web page navigation guidance**

Chatbots in banking can serve as helpful guides for clients navigating banking websites. Based on the

**7 SWOT analysis of chatbot application in banking services**

Guided by a SWOT analysis framework, this review outlines the strengths and weaknesses of a chatbot technology application in the banking sector, with a



**Figure 3.** Use case 2: Mortgage loan application (tasks in red – chatbot assistance available only in Serbian, user task – human involvement required)

client's query, the chatbot can provide relevant and personalized responses, directing the client to the appropriate web page or section of the banking website.

contain additional information. One potential drawback of the chatbot's functionality is that being redirected to a web page may disrupt the flow of the conversation and result in the loss of the entire previous conversation. In such cases, if users wish to continue

**Table 1.** SWOT analysis of chatbot application in banking services

Strengths	Weaknesses
Service available constantly Quick response Interaction with multiple clients at once Web page navigation guidance Online process completion (use case 1) Process completion outside of working hours (use case 1) Simplified initial contact (use case 2)	Name and e-mail required Previous conversation loss Language switch Lack of empathy Human involvement required Bank visit required (use case 2) Inability of understanding situation peculiarity
Opportunities	Threats
Service personalization Human employees available to handle more complex tasks Client satisfaction increase Clients' expectations of online process completion	System crash Technological literacy More sophisticated solutions Scepticism of technological assistance Dissatisfaction due to not meeting client requirements Privacy protection

### Online process completion

Traditionally, banking services required clients to visit a physical bank branch and complete various paperwork. Chatbots can assist clients by providing step-by-step instructions and guiding them through various processes online. For instance, if a client intends to open an online bank account, the chatbot can provide clear instructions on the necessary steps.

### Process completion outside of working hours

Unlike humans, chatbots can provide guidance and assistance to clients even outside of regular bank working hours. This 24/7 availability allows clients to complete banking processes and seek assistance at their convenience, without having to take time off from work or adjust their schedules.

### Simplified initial contact

Bank processes can be fully or partially completed online, while certain initial steps, such as applying for a banking service or scheduling a meeting, can be accomplished entirely through online channels.

### Name and e-mail required

In order to access the chatbot that was used in the research, users are required to enter their name and email information. While registration is not mandatory, the chatbot cannot be used if the name and email details are not provided beforehand.

### Previous conversation loss

During the conversation with the chatbot, users are often provided with links to relevant web pages that

the conversation, they are required to enter their name and email again before accessing the chatbot.

### Language switch

Although the conversation with the chatbot, at the time of this research, is available in both English and Serbian languages, web pages supporting banking processes are currently available only in Serbian.

### Lack of empathy

While chatbots are designed to efficiently perform repetitive tasks, there is a risk of them being perceived as impersonal if the designers do not consider the practical and emotional needs of users seeking assistance. Unlike human agents, chatbots can sometimes lack the ability to convey empathy effectively.

### Human involvement required

Chatbots play a significant role in guiding and assisting clients throughout various banking processes, but it is important to recognize that their assistance may not be sufficient for certain activities. In both the online account opening and mortgage loan application scenarios, there are specific tasks within the process that still require human involvement.

### Bank visit required

Although chatbots can offer valuable assistance and guidance throughout various banking processes, certain activities still require clients to visit a bank branch. For example, while applying for a mortgage loan can be initiated online, subsequent steps in the process necessitate in-person interactions at the bank.

### **Inability of understanding situation peculiarity**

Unlike human agents, chatbots rely on pre-programmed responses and may not fully understand the unique context or emotions of a situation. Human agents can empathize with clients, understand their specific needs, and provide tailored solutions accordingly. In certain situations, such as when applying for a mortgage loan, there can be specific document conditions that require careful attention and clarification.

### **Service personalization**

By utilizing chatbot analytics, banks can gain valuable insights into user behaviour, trends, and patterns, which can be leveraged to deliver relevant and personalized services and offers to their customers. By understanding customer behaviour and preferences, banks can tailor their services and offer to match individual customer requirements.

### **Human employees available to handle more complex tasks**

Chatbots allow banks to address clients' inquiries at any time without the need for human intervention. By leveraging chatbots to handle routine tasks and provide basic assistance, banks can ensure that their employees can allocate their skills and knowledge to more critical and complex issues.

### **Client satisfaction increase**

Financial institutions face significant client acquisition costs, making client retention crucial for their success. To meet changing clients' expectations, many financial institutions, banks in particular, are turning to chatbots as valuable tools. Chatbots offer a range of benefits, including quick response times, round-the-clock availability, and assistance or guidance throughout various processes. The convenience and efficiency offered by chatbots can help attract and retain clients, leading to improved client loyalty.

### **Clients' expectations of online process completion**

The implementation of new capabilities enables banks to provide services through digital platforms, allowing clients to access and complete their obligations remotely. Chatbots serve as virtual assistants, addressing client inquiries and providing relevant information. Moreover, chatbots offer assistance in completing entire processes online, such as opening a bank account or applying for loans.

### **System crash**

Chatbots have been designed using sophisticated technology, but it does not rule out possible disturbances in operation. For retrieval-based, there is a risk of reaching a conversational dead-end if the chatbot is unable to understand the user's intent or if

there are no appropriate responses available in its knowledge base.

### **Technological literacy**

Banks are embracing digital technologies to provide their services online, offering convenience and accessibility to their clients. However, a potential challenge lies in the technological literacy of bank clients or potential users. Not all individuals have the same level of familiarity or comfort with digital technologies.

### **More sophisticated solutions**

The development of chatbots is a rapidly evolving field, with many developers actively working to enhance and improve the technology. More sophisticated and advanced chatbot solutions can be expected in the future and provide competition with a competitive advantage.

### **Scepticism of technological assistance**

Despite the increasing integration of technology in various aspects of people's lives, the level of technology acceptance, especially regarding artificial intelligence, varies among individuals. While some people embrace and adopt new technologies readily, others may still hold reservations or scepticism.

### **Dissatisfaction due to not meeting client requirements**

Satisfied clients are more likely to remain loyal and continue using the bank's services. On the other hand, failing to meet client requirements can result in dissatisfaction, leading to negative feedback and potential loss of business. In the banking industry, where client acquisition costs are high, retaining existing clients is often more cost-effective than acquiring new ones.

### **Privacy protection**

The use of chatbots in collecting and analyzing user data can potentially raise privacy concerns. Chatbot interactions may involve the collection of personal information, and users may have concerns about how this data is stored, used, and protected.

## **8 Conclusion**

Chatbots have emerged as valuable digital assistants across various sectors, particularly in customer support operations. The adoption of chatbots is a response to the increasing usage of digital technologies and evolving expectations of clients to complete their obligations remotely. In the banking sector in Serbia, chatbots have been deployed to address client inquiries and provide guidance for online services. Addressing the first research objective, this study utilized the

SWOT analysis framework to assess the effectiveness of a chatbot application in banking activities. The research outlines the strengths and weaknesses of chatbots in the banking sector and explores the opportunities and threats associated with their implementation.

Although chatbots excel in handling routine tasks, offering guidance, and providing assistance to clients, there are limitations to their capabilities. Certain activities within the banking sector still necessitate human involvement. Addressing the second research objective, this study examines two specific use cases to showcase the extent to which chatbots can replace human employees and handle tasks traditionally carried out by humans. However, the importance of human involvement and personalized service cannot be overlooked. Human employees bring a unique level of empathy, critical thinking, and problem-solving skills that are essential in complex financial situations and addressing the diverse needs of clients.

### 8.1 Future research

Possible future areas of improvement of this research topic include:

- a) Quantitative questionnaire-based research approach to evaluate client satisfaction and their overall impression of communication after the introduction of chatbots,
- b) Further refining and expanding the chatbot language base with domain-specific terminology for banking sector,
- c) Investigating possible ways to connect chatbot functionality with a digital human to create a more human-like experience for users.

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