Bank Digitalization and Virtual Agents Driving Financial Inclusion and Data Protection

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Abstract

The rapid digitalization of the banking sector, coupled with the integration of AI-powered virtual agents such as chatbots and robo-advisors, is reshaping financial services and expanding access. These tools enhance financial inclusion by providing 24/7 support, personalized financial education, and automated assistance, particularly bene-fiting underserved communities. This study explores the role of virtual agents in promot-ing financial inclusion within the broader context of digital banking transformation. Us-ing a qualitative methodology and case studies from Romanian banks—including Banca Transilvania, BCR, and CEC Bank—the research identifies best practices, challenges, and the impact of AI tools on accessibility. Findings indicate that virtual agents reduce costs, improve user engagement, and support decision-making for unbanked or un-derbanked individuals. However, key challenges remain, including digital literacy gaps, cybersecurity threats, and data protection risks. The paper also examines whether AI-driven services enhance or compromise data subject rights, with a focus on transparency, ethical use of AI, and GDPR compliance. By addressing both opportunities and limita-tions, the study contributes to a more inclusive, secure, and trustworthy digital financial ecosystem.

Keywords: *financial inclusion, banking financial system, bank digitalization, virtual agents, artificial intelligence, data protection.*

JEL Classification: A10, K10, K33

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1. Introduction

The digital transformation of the banking sector has reshaped how financial services are delivered, creating new opportunities to enhance operational efficiency and financial inclusion. The transition from traditional banking models to digital platforms has enabled faster and more accessible banking services.[3]

At the core of this transformation are artificial intelligence (AI)-powered virtual agents — such as chatbots and embodied conversational agents (ECAs) — which simulate human interaction using natural language processing (NLP), machine learning (ML), and data analytics. These technologies are increasingly integrated into customer service platforms, personal financial management tools, and sales processes, allowing banks to provide round-the-clock, scalable, and personalized assistance.[4]

Virtual agents — also referred to as AI assistants or AI agents — are intelligent software applications powered by artificial intelligence that simulate human-like interactions with users through text or voice-based communication. By leveraging AI and natural language processing, these agents can interpret user intent, deliver personalized responses, and improve over time through continuous learning. They are increasingly implemented in customer service environments to automate support, enhance self-service experiences, and assist human agents in delivering more efficient service.[5]

The use of virtual customer assistants as an alternative to customer service assistants is one of the most common use-cases of AI in banking.[6]

Financial inclusion refers to the ability of individuals and businesses to access a range of financial products and services such as bank accounts, savings, loans, and insurance that empower them to manage money effectively, including saving, receiving, and transferring funds.[7]

Despite growing global access, approximately 1.4 billion adults remained unbanked in 2021, most of them in developing economies.[8] The COVID-19 pan-

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[3] Isabelle-Margareta Oprea, Liviu-Gelu Draghici (2024). „Bank Digitalization, Financial Literacy, and Inclusion in Romania", *Manager*, 39(1): 22-38. The document is available online at: https://manager.faa.ro/?p=8965, accessed on 12.05.2025.

[4] Hana Demma Wube, Sintayehu Zekarias Esubalew, Firesew Fayiso Weldesellasie and Taye Girma Debelee (2022), „Text-based chatbot in financial sector: A systematic literature review". *Data Science in Finance and Economics*, 2(3): 209–236. https://doi.org/10.3934/DSFE.2022011.

[5] Jeanine Desirée Lund, *What is a virtual agent?*, 2025. The document is available online at: https://www.puzzel.com/blog/what-is-a-virtual-agent#what-is-a-virtual-agent, accessed on 12.05. 2025.

[6] Daniela Duță, Isabelle Oprea, „The Role of Artificial Intelligence in the Digital Banking System", in Cristina Elena Popa Tache, Renata Treneska Deskoska, Nathaniel Boyd (coordinating editors), *Adapting to Change Business Law insight from Today's International Legal Landscape*, ADJURIS – International Academic Publisher, Bucharest, Paris, Calgary, 2023, p. 230-244.

[7] Isabelle-Margareta Oprea, Liviu-Gelu Draghici. *op. cit,* p. 25.

[8] World Bank, *The Global Findex Database 2021: Financial Inclusion, Digital Payments, and*

demic further highlighted the importance of digital financial services in maintaining access during crises, particularly for underserved communities.[9]

AI-powered virtual agents are uniquely positioned to address financial exclusion by providing round-the-clock customer service, personalized financial education, and data-driven credit assessments that bypass traditional credit history requirements.[10]

For instance, virtual assistants such as chatbots and voice-based technologies are increasingly integrated into mobile banking applications to support users with financial transactions, expense management, and tailored product suggestions. Automated investment platforms, known as robo-advisors, allow individuals to handle investments and oversee their portfolios at significantly lower costs than traditional financial advisors, thereby expanding wealth-building access for users with limited incomes.

Beyond convenience, virtual agents also serve as a conduit for financial education. By simplifying complex banking terms and processes, these tools can reduce information asymmetry and empower users to make better financial decisions. However, the success of such implementations depends heavily on the technological infrastructure, user trust, and the bank's capacity to manage data securely and ethically.[11]

Moreover, automation allows for more scalable, consistent, and efficient service delivery. Banks can personalize financial products using AI tools, based on real-time behavioral and transactional data, further offering customers the tools tailored to their needs.[12]

Despite the advantages, several risks accompany the growing reliance on virtual agents. One major concern is data privacy. As these agents collect and process sensitive customer information/data, ensuring data protection and privacy becomes critical. Improper handling of customer data can lead to breaches, ero-

Resilience in the Age of COVID 19, 2022, https://doi.org/10.1596/978-1-4648-1897-4. The document is available online at: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099818107072234182/idu06a834fe908933040670a6560f44e3f4d35b7, accessed on 12.05.2025.

[9] International Monetary Fund, *2023 Financial Access Survey*, 2023, The document is available online at: https://data.imf.org/?sk=E5DCAB7E-A5CA-4892-A6EA-598B5463A34C, accessed on 12.05.2025.

[10] Consultative Group to Assist the Poor (CGAP), *AI's promise: A new era for financial inclusion*, 2023. The document is available online at: https://www.cgap.org/blog/ais-promise-new -era-for-financial-inclusion, accessed on 12.05.2025.

[11] Luay Anaya, Asma Braizat, Ria Al-Ani (2024), „Implementing AI-based Chatbot: Benefits and Challenges". *Procedia Computer Science*, vol. 239: 1173-1179. DOI: 10.1016/j.procs.2024.06. 284.

[12] Gang Kou, Pei Yang, Yi Peng, Feng Xiao, Yang Chen, Fawaz E. Alsaadi (2020), „Evaluation of feature selection methods for text classification with small datasets using multiple criteria decision-making methods". *Applied Soft Computing*, Volume 86, 105836, https://doi.org/10.1016/j.asoc.2019.105836.

sion of trust, and regulatory penalties. Studies highlight that privacy, data protection, cybersecurity threats, and unclear legal accountability are major deterrents to chatbot adoption in the financial sector.[13]

As virtual agents collect, store, and analyze sensitive financial information, the risk of data breaches and misuse increases, highlighting the need for strict adherence to regulations such as the General Data Protection Regulation[14] and local data protection laws.[15]

The lack of transparency can erode trust, particularly among vulnerable groups who already face systemic barriers to accessing financial services. Ensuring fairness, accountability, and explainability in AI-driven decisions can prevent the reinforcement of existing biases and inequalities.[16]

Moreover, there are user experience challenges. While AI agents can handle routine inquiries effectively, their performance may deteriorate when faced with complex or emotionally nuanced interactions. Miscommunication, lack of empathy, and the "uncanny valley" effect where too-human avatars feel unsettling can negatively impact customer satisfaction.[17]

Financial institutions must therefore invest in inclusive user design and public education initiatives to ensure that technology serves as a bridge — not a barrier — to financial inclusion.

This paper aims to investigate how bank digitalization, particularly through the implementation of virtual agents, contributes to advancing financial inclusion while safeguarding data protection. To achieve this, the research is guided by two primary objectives: first, to explore how digital banking technologies, specifically virtual agents, facilitate financial inclusion; and second, to analyze the implications of these technologies on data protection. In alignment with these objectives, the study seeks to answer the following research questions: (1) How do virtual agents enhance financial inclusion? and (2) What are the risks and

[13] Hana Demma Wube, Sintayehu Zekarias Esubalew, Firesew Fayiso Weldesellasie and Taye Girma Debelee, *op. cit.*, p. 220.

[14] Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC.

[15] Juan Carlos Crisanto, Cris Benson Leuterio, Jermy Prenio and Jeffery Yong, *Regulating AI in the financial sector: Recent developments and main challenges*, Bank for International Settlements, 2024. FSI Insights No. 63. The document is available online at: https://www.bis.org/fsi/publ/insig hts63.htm, accessed on 12.05.2025.

[16] Reuben Binns (2018), „Fairness in machine learning: Lessons from political philosophy". In Sorelle A. Friedler, Christo Wilson (eds.) *Proceedings of Machine Learning Research* 81:1–11, Conference on Fairness, Accountability, and Transparency, p. 149–159. The document is available online at: https://proceedings.mlr.press/v81/binns18a.html, accessed on 12.05.2025.

[17] Maurice Wendt, Sebastian Schaefer, Mario Schaarschmidt (2025), *Empowering regional bank sales through embodied conversational agents: A multiple case study*, Spring 3-1-2025. Proceedings of SIGSVC Workshop 2024. The document is available online at: https://aisel.aisn et.org/cgi/viewcontent.cgi?article=1008&context=sprouts_proceedings_sigsvc_2024, accessed on 12.05.2025.

benefits related to data protection? These questions aim to frame the analysis and provide insight into the dual role those virtual agents play in modern banking systems, as both tools for inclusive financial outreach and potential vectors of data risk.

The research adopts a qualitative methodology through case studies of digital-first and traditional banks in Romania that have implemented AI-driven tools, analyzing both their successes and shortcomings. The research contributes to the growing discourse on digital finance by offering insights into how technology can shape a more inclusive, transparent, and secure financial ecosystem.

2. Case Study: Digital Banking and Virtual Agents in Romania

Romania has made notable strides in digital banking transformation, but the pace of adoption remains uneven across institutions. Technological solutions based on machine learning (ML) and artificial intelligence (AI) are primarily applied in areas such as data extraction and analysis, risk management, customer assessment through scoring models, and the detection and monitoring of fraud and anti-money laundering (AML) activities. Despite the fact that 81% of banks — accounting for 97% of the market share — view AI integration as a central element of their medium-term business strategies, the formal inclusion of these technologies within institutional governance structures remains limited.[18]

According to Chart 1, in Romania, AI is currently implemented by 9 banks, ML and cloud computing by 13 banks each, biometric systems for customer identification by 17 banks, optical character recognition (OCR) by 16 banks, while Big Data technologies are used by only 5 banks.[19] This disparity highlights the uneven maturity in digital capabilities and underscores the necessity for strategic alignment between innovation, infrastructure, and regulatory readiness.

According to the most recent report of National Bank of Romania published in June 2024, the first three largest bank in Romania in terms of assets are Banca Transilvania, BCR and CEC Bank. Although the paper analyses these three banks regarding the implemented virtual agents there is to be noted that the first chat bot in Romania was launched on 13th of March 2018, by Libra Internet Bank, ranked on 13th place on the list of Romanian banks in terms of assets.[20]

This pioneering virtual assistant was designed to facilitate user-friendly and fully online access to financial products, allowing individuals to open a bank
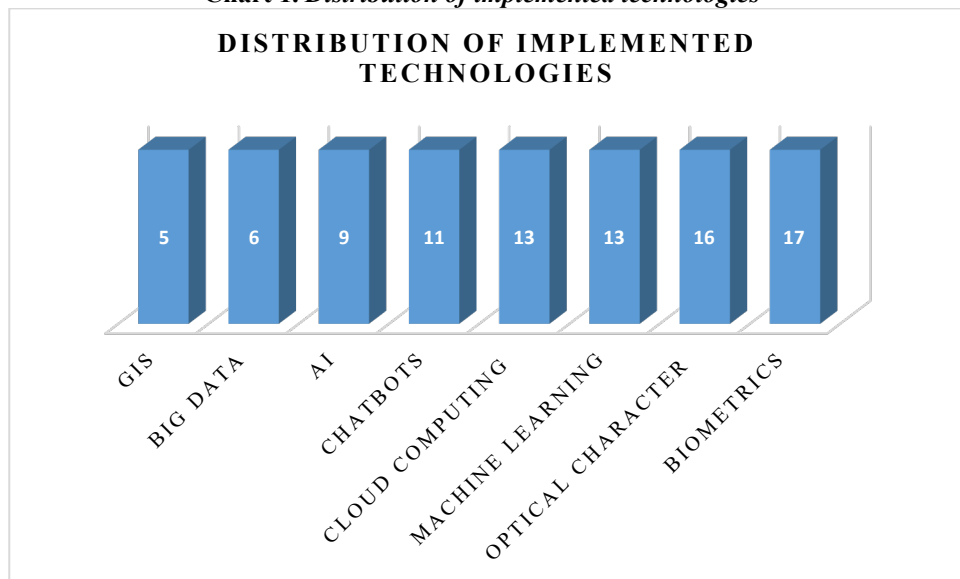
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[18] National Bank of Romania, *Raport asupra stabilitatii financiare*, 2024. The document is available online at: https://bnro.ro/Raportul-asupra-stabilita%C8%9Bii-financiare---decembrie-20 24-28873.aspx, accessed on 12.05.2025.

[19] Ibid.

[20] Ziarul Financiar, *BNR: Topul integral al băncilor din România după active în 2023. 15 bănci din 32 și-au schimbat poziția în top. CEC Bank a urcat cel mai mult, pe locul 3*, 2024. The document is available online at: https://www.zf.ro/banci-si-asigurari/bnr-topul-integral-al-banci lor-din-romania-dupa-active-in-2023-15-22412864, accessed on 12.05.2025.

account, apply for loans, or obtain credit cards without visiting a physical branch. Within a short period, the chatbot recorded over 10,000 interactions with users interested in digital banking solutions.[21]

Chart 1. *Distribution of implemented technologies*

DISTRIBUTION OF IMPLEMENTED TECHNOLOGIES

GIS: 5, BIG DATA: 6, AI: 9, CHATBOTS: 11, CLOUD COMPUTING: 13, MACHINE LEARNING: 13, OPTICAL CHARACTER: 16, BIOMETRICS: 17

Source: representation of authors based on BNR data (2024)

2.1. Banca Transilvania

Banca Transilvania (BT), Romania's largest bank by assets, has been a national leader in implementing artificial intelligence (AI) and virtual agents within its operations. The bank's AI journey began in 2017 with the launch of its first chatbot for customer interaction, followed by rapid development and deployment of more advanced tools in subsequent years.[22]

One of its first notable innovations was Livia, a virtual financial assistant integrated into the BT Pay app in 2018. Livia sends reminders about bills, offers

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[21] Libra Internet Bank, *Primul chatbot din România pentru vânzarea produselor bancare către clienţi noi a avut peste 10 mii de interacţiuni în primele patru luni de la lansarea sa de către Libra Internet Bank,* 2018, March 13. The document is available online at: https://www.libra bank.ro/ Stiri/Primul_chatbot_din_Romania_pentru_vanzarea_produselor_bancare_catre_clienti_noi_a_av ut_peste_10_mii_de_interactiuni_in_primele_patru_luni_de_la_lansarea_sa_de_catre_Libra_Inter net_Bank/2110, accessed on 12.05.2025.

[22] Banca Transilvania, *Chatbots of BT*, 2020. The document is available online at: https://www.ban catransilvania.ro/news-files/chatbots-of-bt-en/whitepapers_chatbotofbt_septembrie2020_en.pdf, accessed on 12.05.2025.

savings suggestions, and delivers real-time notifications, thereby increasing customer engagement and enabling financial self-management.[23]

Accessible via Facebook Messenger, Skype, and phone, Livia has become a widely used tool, processing nearly 15 million messages and assisting over 90,000 customers. Its widespread adoption has contributed to a significant reduction in the volume of basic inquiries directed at human agents.[24]

Building on this momentum, BT launched Raul in 2018, a chatbot specifically designed to support entrepreneurial clients. Raul assists with account information, outstanding balances, credit card limits, and other services essential to small business owners. Available across multiple platforms including Facebook Messenger, Skype, and WhatsApp, Raul has responded to approximately 830,000 messages and supported more than 20,000 entrepreneurs. The chatbot became especially valuable during the COVID-19 pandemic, enabling entrepreneurs to access key services remotely when physical interactions were restricted.[25]

In response to the health crisis in 2020, the bank developed a new virtual assistant named Ino. Built in less than three days, Ino was launched to assist customers with questions about loan installment deferrals and the rescheduling process. Integrated into the BT website, Ino guided users through application steps and clarified terms of eligibility. Although designed as a temporary solution, Ino demonstrated the agility and scalability of BT's AI infrastructure, and plans were set in motion to expand its functionality to other banking areas such as NeoCont and customer data updates.[26]

Internally, Banca Transilvania has also implemented AI solutions to support its workforce. David, an AI-based virtual assistant developed on DRUID's platform, automates tasks within the bank's operations helpdesk. Deployed across more than 500 BT offices, David performs tasks such as interest rate calculations, generating internal reports, and resolving IT issues. By reducing the time and errors associated with routine operations, David has improved employee productivity and service quality.[27]

In the area of human resources, BT introduced Aida, a digital assistant that supports internal administrative processes. Aida helps employees manage documents, book appointments, and access internal HR services. As a task-oriented chatbot, Aida embodies BT's broader strategy of digital enablement across

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[23] Ibid.

[24] Ibid.

[25] Ibid.

[26] BankingNews, *Banca Transilvania a lansat un nou chatbot. Ino este un asistent virtual dedicat clienților care vor informații despre amânarea ratelo*r, 2020, April 30. The document is available online at: https://bankingnews.ro/amanarea-platii-creditelor-banca-transilvania-chatbot-ino.html, accessed on 12.05.2025.

[27] DRUID AI., *Banca Transilvania uses DRUID's AI agent to boost productivity, 2023*. The document is available online at: https://www.druidai.com/case-studies/conversational-ai-chatbot-banking-employee-support-btrl, accessed on 12.05.2025.

all operational layers.[28]

In 2023, Banca Transilvania significantly expanded its AI capabilities by integrating Microsoft Azure OpenAI into its customer service platform, particularly on the "Întreb BT" (Ask BT) website. This platform uses AI-powered search functionality to deliver detailed answers to user questions, thus enhancing accessibility and improving the digital experience.[29]

In 2024, BT further embedded AI into its internal workflows by adopting Microsoft 365 Copilot and GitHub Copilot. These AI assistants help improve productivity by automating document creation, summarizing data, and supporting software development teams.[30]

Banca Transilvania's commitment to enhancing digital banking experiences is further demonstrated by the integration of ChatBT, a conversational AI assistant embedded directly within the BT Pay mobile application. Launched in collaboration with DRUID in 2025, ChatBT offers real-time assistance to customers by answering a wide range of inquiries—from checking account balances and transaction history to providing personalized financial advice. The virtual agent also enables users to initiate payments, manage their cards, and receive guidance on banking procedures, all through a simple, user-friendly interface. One of the key innovations of ChatBT is its hybrid support functionality, which ensures seamless escalation to human agents when needed, maintaining both efficiency and personalization in customer interactions. The integration of ChatBT into BT Pay represents a strategic step toward human-centered automation, improving accessibility, convenience, and satisfaction for users who rely on mobile banking for their day-to-day financial management.[31]

As part of BT's broader digital transformation agenda, ChatBT exemplifies the role of intelligent virtual agents in transforming mobile banking into a smart, responsive, and adaptive financial platform. Banca Transilvania is developing a unique feature in Romanian banking called "proactive support," aimed at improving the efficiency of call center interactions. This system will enable operators to anticipate the reason behind a customer's call even before the conversation begins. By analyzing real-time data and recent customer activities such as failed online payments, expired cards, or transaction errors, the bank can predict

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[28] Banca Transilvania, *Chatbots of BT*. 2020. The document is available online at: White-Papers_Chat-Bot-of-BT_septembrie-2020_RO (bancatransilvania.ro), accessed on 12.05.2025.

[29] Banca Transilvania, *Banca Transilvania integrates Microsoft Azure OpenAI in customer communication,* 2023. The document is available online at: https://en.bancatransilvania.ro/news/comunicate-de-presa/banca-transilvania-integreaza-microsoft-azure-openai-comunicarea-cu-clientii, accessed on 12.05.2025.

[30] Banca Transilvania, *BT integrates Microsoft 365 Copilot and GitHub Copilot AI assistants*, 2024. The document is available online at: https://en.bancatransilvania.ro/news/comunicate-de-presa/BT-integreaza-microsoft-365-copilot-si-github-copilot-asistenti-ai, accessed on 12.05.2025.

[31] DRUID AI, *DRUID AI Brings ChatBT to Banca Transilvania's BT Pay App, 2025.* The document is available online at: https://www.druidai.com/news/druid-and-banca-transilvania-integrate-chatbt, accessed on 12.05.2025.

the issue and notify support staff of potential scenarios. The system will later be improved using artificial intelligence and machine learning to further refine its predictive capabilities.[32]

2.2. Banca Comercială Română (BCR)

Banca Comercială Română (BCR) is the second largest bank in Romania in terms of assets and, in terms of digitalization, in the 2023 FinnoScore report, it achieved an impressive third place internationally, scoring 6.81 out of 10. This ranking reflects BCR's significant advancements in digital banking, particularly through its George mobile application, which has improved customer onboarding and online banking experiences.[33]

This bank, has made substantial progress in integrating artificial intelligence (AI) into its operations, focusing primarily on customer engagement and operational efficiency. A key component of this digital transformation is the virtual assistant ADA, launched in 2022. ADA is an algorithmic artificial intelligence model based on generative AI technology, with its main function being to respond to user inquiries on the bank's website and the app, specifically related to BCR's Internet Banking and Mobile Banking services.[34]

ADA, Banca Comercială Română's virtual assistant, offers comprehensive support for a wide range of banking needs, providing users with instant access to personalized information. It can display current account balances and IBANs, as well as details related to savings and term deposit accounts, including maturity dates and available funds. For loan management, ADA provides repayment schedules, outstanding balances, due dates, and options for early repayment or changing installment dates. It also supports credit card management, offering data on available balance, minimum payment, due dates, and plan subscriptions. Additionally, ADA can assist with card services such as blocking, PIN regeneration, limit adjustments, and delivery address changes. The assistant offers detailed updates on account garnishments and helps users register complaints or

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[32] Wall-Street, Future Banking Summit | *Banca Transilvania vrea să „citească gândurile" clienților care sună în call-center, 2024.* The document is available online at: https://www.wall-street.ro/articol/Finante-Banci/311247/future-banking-summit-banca-transilvania-vrea-sa-citeasc a-gandurile-clientilor-care-suna-in-call-center.html, accessed on 12.05.2025.

[33] Economedia, *Topul celor mai competitive bănci privind digitalizarea: BCR, Banca Transilvania și OTP Bank în top 3 internațional; BCR se află pe locul al treilea*, 2023, June 22. The document is available online at: https://economedia.ro/topul-celor-mai-competitive-banci-privind-digitalizar ea-bcr-banca-transilvania-si-otp-bank-in-top-3-international-bcr-se-afla-pe-locul-al-treilea.html. Retrieved April 17, 2025, accessed on 12.05.2025.

[34] Banca Comercială Română, *BCR lansează chatbot-ul ADA, primul asistent virtual care poate oferi suport rapid și informații personalizate*, 2022. The document is available online at: https:// www.bcr.ro/ro/presa/informatii-de-presa/2022/04/14/BCR-lanseaza-chatbot-ul-ADA-primul-asis tent-virtual-care-poate-oferi-suport-rapid-si-informatii-personalizate-atat-pentru-persoane-fizice-cat-si-solutii-de-finantare-pentru-companii, accessed on 12.05.2025.

schedule branch visits, enhancing both convenience and digital self-service capabilities. It is accessible 24/7 via multiple platforms, including the BCR website, George Web, George Mobile, and WhatsApp, making it a versatile and easily accessible solution for clients.[35]

ADA was designed to reduce pressure on human customer service representatives by providing fast, automated responses. According to BCR's 2024 half-year report, the virtual assistant handled over 455,500 conversations in the first six months of the year, with approximately 35% of those interactions fully automated, requiring no human intervention. ADA is capable of addressing nearly 2,000 types of inquiries, significantly enhancing self-service capabilities for customers.[36]

In addition to ADA, BCR has implemented other AI-driven tools to further improve its customer service infrastructure. The Conversational Interactive Voice Response (IVR) system deployed in the BCR Contact Center delivered over 82,000 personalized responses in the first half of 2024 without requiring human assistance. This IVR system allows customers to speak naturally rather than navigating through traditional menu options, streamlining their experience and saving time.[37]

Furthermore, BCR has introduced Voice ID, a biometric authentication feature based on voice recognition, which was used by nearly 266,000 customers during the same reporting period. This technology improves both security and convenience, enabling quick and secure customer identification during interactions with the Contact Center.[38]

2.3. CEC Bank

CEC Bank, Romania's oldest bank, has actively pursued digital transformation in recent years. A key element of this strategy has been the implementation of virtual agents and low-code platforms to improve customer service and internal operations. CEC Bank introduced a virtual assistant named "Raluca" which was designed to improve customer service by offering real-time support for basic banking inquiries on the bank's official website. "Raluca" uses Google's Dialogflow platform for natural language processing, allowing it to interpret and respond in Romanian. Raluca's main function is to provide general information regarding CEC Bank's products and services. It can answer frequently asked questions, guide users through banking processes, and direct them to relevant

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[35] Banca Comercială Română, *BCR Group H1 2024 results: Continuous support for raising financial literacy and multiplier investments in community*, 2024, August 2. The document is available online at: https://www.bcr.ro/en/press/press-release/2024/08/02/BCR-group-H1-2024-re sults-continuous-support-for-raising-financial-literacy-and-multiplier-investments-in-community, accessed on 12.05.2025.

[36] Ibid.

[37] Ibid.

[38] Ibid.

sections of the website. For example, it helps users understand how to open an account, locate ATMs or branches, and learn more about personal or business banking options. An important aspect of Raluca's design is its strict adherence to data privacy regulations. According to the bank's chatbot compliance statement, Raluca does not collect or store personal data. This ensures full alignment with the data protection regulation.[39]

Users are informed clearly that any queries requiring personal banking data must be redirected to secure channels or physical branches. Raluca provides real-time support, significantly reducing the load on human customer service teams. Because the chatbot is accessible 24/7, customers can get answers to routine inquiries during weekends, holidays, or late-night hours. This enhances overall customer satisfaction and ensures that basic service remains uninterrupted, even outside of traditional banking hours. Currently, Raluca functions in a read-only informational capacity meaning it provides answers and guidance, but it does not perform direct transactions or account-specific actions. However, its successful implementation suggests that future versions might integrate more advanced AI capabilities, including secure identification and transaction processing, as long as these developments remain GDPR-compliant.[40]

2.4. Comparative Analysis of Virtual Agents at Banca Transilvania, BCR, and CEC Bank

Virtual agents have become integral to the strategic evolution of Romania's banking sector, particularly among leading institutions like Banca Transilvania, Banca Comercială Română (BCR), and CEC Bank. While their functionalities often align with broader goals of digital efficiency, a closer look reveals distinct technological trajectories and strategic nuances.

A defining trend across all three banks is the operational convergence of AI-enabled automation with customer experience design. However, Banca Transilvania's architecture is notably more diversified. Its deployment of multiple agents tailored to specific business needs such as Raul for entrepreneurs and Aida for HR, illustrates a modular design strategy. This layered AI implementation allows for task-specific optimization, an approach consistent with global best practices in intelligent automation where organizations shift from single-agent deployment to orchestrated ecosystems.[41]

In contrast, BCR has positioned its virtual agent ADA not as an isolated chatbot, but as an extension of its George digital ecosystem. This integration re-

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[39] CEC Bank, *Acord de conformitate – Chatbot – CEC Bank SA*, 2023, November 7. The document is available online at: https://www.cec.ro/termeni-conditii/conditii-chat, accessed on 12.05.2025.
[40] Ibid.
[41] Hana Demma Wube, Sintayehu Zekarias Esubalew, Firesew Fayiso Weldesellasie and Taye Girma Debelee, *op. cit*, p. 221.

flects a holistic digital channel strategy where virtual agents act as customer-facing gateways to broader platform capabilities. From a digital transformation perspective, this aligns with research indicating that embedded AI within omnichannel systems improves both service cohesion and user retention.[42]

ADA's implementation of biometric security and voice-based navigation further underscores BCR's investment in frictionless digital identity verification, a trend gaining prominence in European financial technology markets.[43]

CEC Bank, on the other hand, adopts a minimalistic model characterized by compliance-first principles and limited functional scope. Its virtual agent, Raluca, operates as an informational layer without backend integration. While this limits transactional utility, it positions the bank favorably in terms of data protection and regulatory adherence — critical considerations amid increasing scrutiny over algorithmic governance in finance.[44]

The differential pace and purpose of AI deployment in these banks also highlight a divergence in digital maturity. While large Romanian banks share similar goals of automation and customer-centricity, their internal investment capacity and technological infrastructure strongly influence outcomes. BT's AI roadmap, characterized by quick prototyping and user-responsive iteration, exemplifies agile governance frameworks rarely matched by institutions with more hierarchical or risk-averse cultures.[45]

Furthermore, these virtual agents serve not only as tools for client interaction but as symbols of each bank's strategic orientation. Banca Transilvania's agents promote productivity and internal digitization, while BCR's ADA represents platform expansion and identity security. CEC Bank's Raluca, although limited in function, reflects a trust-centric model that prioritizes user safety over innovation.

3. Discussion

The integration of virtual agents in Romanian banking institutions — such as Banca Transilvania, BCR, and CEC Bank — demonstrates both the transformative potential and the complex challenges of AI-driven customer service platforms.

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[42] Oskar Bladh, Hedvig Henrekson & Ida Modée (2018). *The Impact of Virtual Agents on Customer Loyalty in Major Swedish Banks.*, 2018. The document is available online at: http:// www.diva-portal.org/smash/get/diva2:1213804/FULLTEXT01.pdf, accessed on 12.05.2025.

[43] Luay Anaya, Asma Braizat, Ria Al-Ani, *op. cit.,* p. 1175.

[44] Zeyu Tang, Jiji Zhang, Kun Zhang (2023), „What-is and how-to for fairness in machine learning: A survey, reflection, and perspective." *ACM Computing Surveys*, 2023, 55(13s): 1-37. https:// doi.org/10.48550/arXiv.2206.04101.

[45] Daria Maria Sitea, Carolina Țîmbalari (2022), „Measuring the Banking Competitiveness. A Case Study of Romania". *Revista Economică*, 74(2): 59-69, DOI: 10.56043/reveco-2022-0018.

3.1. Impact on Financial Inclusion

Virtual agents enhance financial inclusion in Romania by providing accessible, real-time, and user-friendly digital banking services that help overcome traditional barriers such as limited physical bank branches and low financial literacy.

By enabling 24/7 customer interactions, chatbots like BCR's ADA and BT's Livia offer autonomous banking assistance and perform banking operations independently at any time, such as checking balances, retrieving IBANs, managing security devices, and accessing product information, making banking more accessible especially for those who cannot easily visit branches.

In terms of cost reduction and scalability, virtual agents represent a major advancement. They reduce the need for large customer support teams and can scale seamlessly during peak times without performance loss and simplify the financial services for customers.

The deployment of virtual agents has had a tangible impact on financial inclusion in Romania. CEC Bank's Raluca chatbot, while limited in functionality, serves as an accessible entry point for first-time digital users, while BCR's ADA and BT's ecosystem enable deeper engagement through account management and advisory features. Digital financial services can reduce institutional biases and extend services to migrant workers, low-income groups, and rural populations.[46]

Furthermore, these tools facilitate personalized financial education. AI algorithms integrated into virtual assistants are increasingly capable of offering tailored advice based on user behavior, spending patterns, or financial goals. This personalized approach is particularly important in addressing gaps in financial literacy — a persistent issue in Romania.[47]

However, several challenges limit the full realization of these benefits. One primary issue is the digital literacy gap. Many users, particularly elderly populations and those in rural areas, may not possess the skills required to interact effectively with virtual banking platforms. Cybersecurity threats present another serious concern. As more sensitive financial transactions are conducted via virtual agents, the systems become prime targets for cyber-attacks.

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[46] Claudiu Negrea, Ela Scarlat, „Challenges and opportunities for consolidating the availability of financial services in Romania". In: *Economic growth in the conditions of globalization: conference proceedings: International Scientific-Practical Conference*, XVIth edition, October 12-13, 2022, Chisinau. Chisinau: INCE, 2022, volume II, pp. 159-173. ISBN 978-9975-3583-9-2; ISBN 978-9975-3385-6-1 (PDF). https://doi.org/10.36004/nier.cecg.III.2022.16.13.

[47] Isfandyar Zaman Khan, Natalie Nicolaou, Saniya Ansar, Juan Buchenau Hoth, Danilo Palermo Queiroz, Panayotis N. Varangis, (2020), *Financial Inclusion in Romania: Issues and Opportunities*. World Bank Group. Report. The document is available online at: https://documents.worldbank.org/en/publication/documents-reports/documentdetail/830431587015032573/financial-inclusion-in-romania-issues-and-opportunities, accessed on 12.05.2025.

3.2. Data Protection Concerns

Trust and user acceptance remain also very important. Despite improvements in natural language processing and chatbot design, many users still perceive human agents as more trustworthy and competent, especially for complex financial decisions. While chatbot service can approximate human interaction in some scenarios, many customers still prefer human agents, especially when trust and service complexity are at stake. The research showed that customer outcomes were influenced by levels of trust in chatbot service, and even light human intervention could improve satisfaction — implying a clear preference for human agents in contexts requiring confidence or emotional intelligence.[48]

Additionally, when chatbot service fails — regardless of how "human-like" the chatbot appears — customers often switch to a human agent. This switching behavior is driven by expectations that only a human can manage recovery well in service failure scenarios. Thus, banks must invest in hybrid models that blend automated services with human support to foster trust and increase adoption.[49]

In parallel, data protection challenges must also be considered, as virtual agents collect, store, and process large volumes of data. Privacy and data protection risks, such as unauthorized access, data breaches, or the misuse of personal information, can undermine user trust and may lead to legal sanctions under GDPR regulation.

To mitigate these risks, the financial institutions must implement strict cybersecurity measures, ensure transparency in data processing, and provide customers with real control over their personal information/ information, including the right to information, access, rectification, and erasure. In this context, digital trust becomes a fundamental pillar for the sustainable adoption of virtual agents in the banking sector.

3.3. Recommendations

The integration of virtual agents in Romanian banking, as explored through case studies of Banca Transilvania, BCR, and CEC Bank, highlights both transformative potential and systemic risks. The following recommendations target banks, policymakers, and developers to ensure that digital banking technologies support inclusive, secure, and ethical financial ecosystems.

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[48] Rusty Stough, Dmitri Markovitch, Dongling Huang (2024), „Can chatbot customer service match human agents on customer satisfaction?" *Journal of Retailing and Consumer Services*. Volume 76, January, 1036002024, https://doi.org/10.1016/j.jretconser.2023.103600.

[49] Zhenzhen Lu, Qingfei Min, Lintong Jiang, Qi Chen (2024), „The effect of the anthropomorphic design of chatbots on customer switching intention when the chatbot service fails: An expectation perspective". *International Journal of Information Management*, Volume 76, 102767, https://doi.org/10.1016/j.ijinfomgt.2024.102767.

For banks, one of the most significant barriers to effective use of virtual agents remains digital literacy, particularly among elderly populations and users in rural areas. Banks should invest in public-facing educational campaigns that provide users with the skills needed to confidently engage with AI-powered financial services. The success of chatbot integration depends not only on technological functionality but also on user readiness and training.[50]

By offering tutorials, in-branch support for digital tools, and multilingual content, banks can increase adoption across all demographics. For long-term customer trust and institutional integrity there must be implemented ethical AI. Banks must proactively mitigate algorithmic bias, ensure transparency in decision-making processes, and embed fairness and accountability into AI systems. Fairness in AI is not merely a technical concern but an institutional imperative that demands cross-functional collaboration between IT, compliance, and legal teams.[51] Romanian banks can lead in this space by publishing ethical AI guidelines, performing regular audits, and providing customers with clear information on how AI systems impact decisions related to loans, credit scoring, and service eligibility.

As virtual agents become increasingly embedded in banking operations, the cybersecurity threat surface also expands. Banks must strengthen their security protocols to protect sensitive customer data from breaches and misuse. Investments in encryption technologies, real-time threat detection, and multi-factor authentication are now industry standards. The Bank for International Settlements (2024) recommends a layered cybersecurity framework that includes AI-specific risk assessments, robust incident response systems, and employee training on cyber hygiene practices.[52]

4. Conclusion

This study has examined the intersection of digital banking transformation and the implementation of virtual agents in Romania, with a focus on their dual role in fostering financial inclusion and protecting customer data. The research reveals both the opportunities and the limitations posed by AI-powered customer service solutions by analyzing the cases of Banca Transilvania, BCR, and CEC Bank.

Virtual agents have proven to be key enablers of financial inclusion by increasing accessibility, scalability, and personalization of financial services. Their ability to provide 24/7 assistance, deliver tailored financial education, and

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[50] Hana Demma Wube, Sintayehu Zekarias Esubalew, Firesew Fayiso Weldesellasie and Taye Girma Debelee, *op. cit.,* p. 223.
[51] Zeyu Tang, Jiji Zhang, Kun Zhang, *op. cit.,* p. 20.
[52] Bank for International Settlements, *Regulating AI in the financial sector: Recent developments and main challenges*, 2024, FSI Insights No. 63. The document is available online at: https://www.bis.org/fsi/publ/insights63.htm, accessed on 12.05.2025.

automate processes such as account inquiries and credit simulations has helped remove barriers that traditionally excluded rural, low-income, and underserved populations from formal banking systems. As demonstrated by tools such as BT's Livia and Raul, BCR's ADA, and CEC Bank's Raluca, virtual agents can effectively extend the banking network digitally — aligning with findings from CGAP and the World Bank, which highlight digital finance as a powerful tool for development.

Moreover, the study emphasizes that financial inclusion is no longer limited to mere access but extends to the quality and usefulness of the services provided. AI agents, when integrated into broader ecosystems — as exemplified by BCR's ADA within the George digital platform — can improve the autonomy of users and improve engagement through personalized, data-driven insights. However, the extent of these benefits remains contingent on digital literacy, infrastructural readiness, and institutional capacity to scale these tools equitably.[53]

Simultaneously, the paper highlights the emerging risks that accompany the use of virtual agents — especially in terms of data protection. While automation introduces efficiency, it also amplifies vulnerability to data breaches and misuse. Institutions like CEC Bank have responded by limiting the data access capabilities of their virtual agents to ensure compliance with GDPR. In contrast, more advanced implementations, like BCR's voice biometric systems or BT's ChatBT, necessitate rigorous data governance frameworks to ensure transparency, ethical AI use, and customer trust.

Furthermore, the research addresses user trust and behavioral dynamics. Studies such as Huang et al.[54] and Lu et al.[55] confirm that despite advances in natural language processing and human-like interaction, users continue to prefer human agents — especially when dealing with emotionally complex or high-stakes transactions. This highlights the need for hybrid models where AI supports, rather than replaces, human interaction.

Ultimately, the paper contributes to both academic and practical understanding by presenting a comprehensive evaluation of how digital banking tools — when implemented responsibly — can contribute to a more inclusive and secure financial ecosystem. It also underscores the need for coordinated efforts among banks, regulators, and technology providers to build infrastructures that are both innovative and ethically sound.

As Romania's banking sector continues to digitalize, stakeholders must prioritize not only technological advancement but also user empowerment, regulatory alignment, and ethical considerations. The future of banking lies not just in automation, but in designing systems that promote equity, security, and resilience across all customer segments.

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[53] Luay Anaya, Asma Braizat, Ria Al-Ani, *op. cit.,* p. 1175.
[54] Rusty Stough, Dmitri Markovitch, Dongling Huang (2024), *op. cit.*
[55] Zhenzhen Lu, Qingfei Min, Lintong Jiang, Qi Chen (2024), *op. cit.*

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