Literature Review

Real-life examples of chatbots in banking and financial services

2017 witnessed the rise of AI in banking with many big names adopting chatbots. Chatbots are not only becoming popular in the US but also are becoming the centre of attraction across European, Asian and Australian banks.

Chatbots in US banks and financial institutions

Nearly every major bank in the world is planning to leverage chatbots nowadays. Notably:

Bank of America

Bank of America is one of the pioneer banks in technology and the inclusion of AI in banks. They have released Erica, their virtual financial assistant. Erica can help customers check their account summaries, lock/unlock cards. Keep up with your e-bills, etc. It takes both text and voice as inputs.

Wells Fargo

Wells Fargo became the first US bank to provide a Facebook Messenger chatbot. The chatbot, Wells Fargo Banking Assistant has a goal to deliver information ‘at the moment’ and provide the ‘Aha! moment’ to customers. The chatbot currently responds to basic questions about deposit and credit card accounts, transactions, and branch or ATM locations.

Capital One

Capital One's Eno is a text-based chatbot that is trained meticulously to accommodate all their audience. Eno helps customers detect frauds, monitor charges, track expenditures, and answer basic FAQs.

J.P. Morgan Chase

J.P. Morgan Chase is using chatbots for a different purpose. They are streamlining their back-office operations using a chatbot. COIN, their virtual assistant helps employees review the complex loan agreement documents in seconds. It is less error-prone than humans. Reportedly, it saves 360,000 manhours each year.

USA

USAA has partnered with a machine learning company to build a text and voice-based, natural language chatbot. The chatbot relies heavily on customer conversation and learns with every query coming in.

SEB Sweden

SEB Sweden has released Amelia, a virtual assistant which learns from customer conversations. "Our belief that this technology can create positive customer experiences is based on the good results we have seen in tests in IT support. During the first three weeks, over 4,000 conversations were held with 700 employees, and Amelia solved the majority of issues without delay," says Rasmus Järborg, SEB's Chief Strategy Officer.

Santander UK

Santander UK is the first bank in the UK to provide voice-assisted banking. Customers can just ask the chatbot to make payments, report lost cards, and check account statements, and bills.

Commonwealth Bank

Commonwealth Bank's Ceba is trained to assist customers in more than 200 banking tasks. Ceba can recognize approximately 60,000 different ways customers ask for the 200 banking tasks (such as activating their card, checking account balance, making payments, or getting cardless cash) and will eventually be able to tell customers what they are spending their money on.

HDFC Bank

HDFC Bank has released India's first AI banking chatbot, Eva. Powered by natural language processing, Eva has already answered more than 5 million queries from around a million customers with more than 85% accuracy. Eva holds more than 20,000 conversations every day with customers from all over the world.

Hang Seng Bank

Hang Seng Bank, Hong Kong has developed two chatbots HARO and DORI. While HARO (Helpful, Attentive, Responsive, Omni) answers customer queries about their account, cards, loans, mortgage, and other products. It also simplifies application processes for new products. DORI (Dining, Offers, Rewards, Interactive) provides customers with various merchant offers on dining and lifestyle. It can also make reservations at restaurants.

In addition to this, other banks such as American Express, Ally Bank, Mastercard, HSBC, RBS, and SBI have also made significant advances in using chatbots.

Reviews

2.1 Banking technologies' adoption by customers

The banking industry has been profoundly influenced by technological evolution in recent decades and consumer adoption of banking technologies is a widely researched topic in the literature. Thus, a more in-depth look into the processes behind the adoption of banking chatbots can be gained through the review of the existing literature on the adoption of other technologies applied in the banking sector, such as i-banking and m-banking.

Several theories have been implemented in order to analyze the adoption of different IT systems. According to Hanafizadeh and Khedmatgozar (2012), the most influential theoretical models applied in i-banking adoption studies, are the Diffusion of innovation theory (DIT), the Technology acceptance model (TAM), the Decomposed theory of planned behavior (DTPB), the Extended technology acceptance model (TAM2) and the Unified theory of user acceptance of technology (UTAUT), the latter becoming dominant in the literature in recent years. Shaikh and Karjaluoto (2015) analyzed and synthesized existing studies of m-banking adoption and concluded that the most frequently used adoption models were TAM, followed by DIT and UTAUT, while several studies applied a combination of different technology acceptance models (e.g. TAM and DIT).Several of the above mentioned models are composed of intention to use or actual usage as the dependent variables. Consequently, the key dependent variables in the i-banking adoption literature (Yousafzai, 2012) are behavioral intention to use and actual usage of the technology, while in m-banking adoption, besides the two earlier mentioned dependents, attitude is also adopted in order to analyze technology acceptance (Shaikh and Karjaluoto, 2015).

Based on the literature review, it could be concluded that usefulness and ease of use are fundamental variables in studying technology acceptance in the banking sector. It should also be highlighted that

compatibility was found as a key determinant for m-banking (Koenig-Lewis et al., 2010; Shankar and Kumari, 2016; Giovanis et al., 2019) and i-banking (Giovanis et al., 2012) adoption. Therefore, it is expected that compatibility will influence banking chatbot adoption as well. However, technology acceptance could be inhibited directly or indirectly (Moldovan and Săplăcan, 2018) by several factors, such as different types of risk factors. In some cases, perceived privacy risk was found to be a barrier for m-banking (Arif et al., 2016; Shankar and Kumari, 2016) and i-banking (A. N. Giovanis et al., 2012) adoption. Supposedly, perceived privacy risk will be a barrier in adopting banking chatbot as well.

2.2. Chatbot technology: description and previous research

A chatbot application is a computer program that mimics human conversations in its natural format, including text or spoken language, using artificial intelligence techniques, such as Natural Language Processing (NLP), image and video processing and audio analysis (Bala et al., 2017).
16 Chatbot applications offer benefits for both companies and consumers. First, chatbots enable consumers to get in touch with companies anytime from anywhere using their own mobile devices, thus they can get quick and relevant responses to their questions. Second, the implementation of these applications allows companies to target consumers in a more direct and personal way, and companies can save on personnel costs in the area of customer services. In addition to the benefits of the technology, the usage of chatbots may also involve several risk factors, including issues regarding data security and financial risks (Vieira and Sehgal, 2017; Richad et al., 2019).
Recently published scientific papers analyzed the adoption of chatbot technology in the tourism industry (Melián-González et al., 2021), in the health care industry (Laumer et al., 2020), and in the field of higher education (Almahri et al., 2020). Regarding the adoption of chatbots applied in the financial industry, only a few studies examined the

acceptance of these applications in the context of the insurance sector (Cardona et al., 2019) and the banking sector (Gupta and Sharma, 2019; Quah and Chua, 2019; Trivedi, 2019, Richad et al., 2019; Sarbabidya and Saha, 2020). Although several studies have examined the factors influencing the acceptance of chatbots, the findings carried out in different fields may not be transferable for financial services (Cardona et al., 2019). Specific research is required in the case of banking.

2.3 Chatbot technology in the banking industry

Chatbots applied in the financial industry can assist customers in managing financial transactions such as reviewing an account, reporting lost cards or making payments, renewing a policy or handling a refund (Tarbal, 2020). In the literature, there are several recently published studies that focused on chatbot technology applied in the financial industry (Cardona et al., 2019; Gupta and Sharma, 2019; Quah and Chua, 2019; Richad et al., 2019; Trivedi, 2019; Sarbabidya and Saha, 2020)

Cardona et al. (2019) studied the adoption and diffusion of chatbots in the context of insurance, concluding that the majority of the participant were familiar with the technology and would prefer to use it at the beginning of the advisory process, while one third of the participants rejected the adoption of chatbots. Gupta and Sharma (2019) examined the customers' attitude towards chatbots in the banking industry and the findings of the study revealed positive correlation between the positive attitude for chatbots and their utility, accessibility and threats. Quah and Chua (2019) explored the effectiveness of the use of chatbot technology in Singapore's banking industry and investigated chatbot functionality to determine if it would meet customer expectations. They found that detailed information provided by the banking chatbot was the most important factor for consumers, followed by fast response, functionality, interactivity, ease of use and data privacy and protection. It was also found that some of the users were not satisfied with the banking chatbot

because it didn’t provide an immediate answer when needed. Richad et al. (2019) investigated the acceptance factors of chatbot technology in the banking industry in Indonesia in case of Millennials based on TAM, and found that innovativeness, perceived usefulness, perceived ease of use and attitude towards using the chatbot had significant effect on behavioral

17 intention. Trivedi (2019) examined customer experience of using banking chatbots and its impact on brand love adopting the Information Systems (IS) success model among. The results showed that system quality, information quality and service quality had significant impact on customer experience, system quality being the strongest predictor. Perceived risk reduced the impact of the three quality dimensions on customer experience, and customer experience of using the chatbot led to love for the brand that provided the technology. Sarbabidya and Saha (2020) found that the role of chatbots in customer service of the banking industry was positively affected by advisory services, ease of use and convenient service, cost effective and efficient service, customer-friendly service, customized service, relationship banking services, responsive service, trustworthy service, value-based useful service and maintaining customers security and privacy.

Table 1: Summary of studies regarding banking chatbots

Authors	The aim of the study	Theories/Studied variables	Research method/ sample	Data analysis
(Cardona et al., 2019)	Adoption and diffusion of chatbots in the German insurance sector	DOI: relative advantages, compatibility, complexity, trialability, observability TOE: top management support, IS infrastructure, costs, environmental threats, competitive pressure, collaborative networks TAM: perceived usefulness, perceived ease of use, perceived behavioral control	Qualitative, quantitative Semi-Structured Expert Interviews, N=7 Web-based cross sectional survey, N=300 Data collected in Germany in 2018	Descriptive
(Gupta and Sharma, 2019)	Analysis of customers' attitude towards the chatbots in banking industry of India	attitude observed utility (ease of use, ease of process, engagement with customer service) observed accessibility (easy for basic transactions, speedy process, user friendliness) observed threat and awareness (data security and privacy, social awareness, friends and family using it)	Quantitative Data collected via Facebook and WhatsApp, N=72 Data collected in India in 2019	Bivariate analysis
(Quah and Chua, 2019)	Analysis of the effectiveness of the current use of chatbots in Singapore's banking industry	user experience: response rate, functionality and usability satisfaction: interactivity, informative, data privacy and protection	Quantitative, qualitative Interviews Qualitative user tests	Descriptive
(Richad et al., 2019)	Analysis of the factors that influence millennial's technology acceptance of chatbots in the banking industry in Indonesia	TAM attitude towards usage, behavioral intention innovativeness, perceived usefulness, perceived ease of use	Quantitative Simple random sampling technique, N=400 Data collected in Indonesia in 2018	SEM

Authors	The aim of the study	Theories/Studied variables	Research method/ sample	Data analysis
(Trivedi, 2019)	Examination of customer experience of using banking chatbots and its impact on brand love in India	Information Systems (IS) success model customer experience, brand love system quality, information quality, service quality, perceived risk	Quantitative Online questionnaire sent to Gen Z individuals, N=258 Data collected in India in 2018	SEM
(Sarbabidya and Saha, 2020)	Examination of the role of chatbots in customer service of the banking industry of Bangladesh	customer service advisory services, ease of use and convenient service, cost effective and efficient service, customer-friendly service, customized service, relationship banking services, responsive service, trustworthy service, value based usefulness, security and privacy	Quantitative Judgment sampling method, N=125 Data collected in Bangladesh in 2019	Regression

Reference Articles (Should be used as the Literature review)

1. Salesforce Research. 2019. "State Of Service Report, Third Edition". https://c1.sfdcstatic.com/content/dam/web/en_us/www/documents/repo rts/salesforce-research-third-edition-state-of-service.pdf.

2. Adamopoulou, Eleni, and Lefteris Moussiades. "An overview of chatbot technology." In IFIP International Conference on Artificial Intelligence Applications and Innovations, pp. 373-383. Springer, Cham, 2020.

3. Cahn, Jack. "CHATBOT: Architecture, design, & development." University of Pennsylvania School of Engineering and Applied Science Department of Computer and Information Science (2017).

4. Hien, Ho Thao, Pham-Nguyen Cuong, Le Nguyen Hoai Nam, Ho Le Thi Kim Nhung, and Le Dinh Thang. "Intelligent assistants in higher-education environments: the FIT-EBot, a chatbot for administrative and learning support." In Proceedings of the ninth international symposium on information and communication technology, pp. 69-76. 2018.

5. Waterman, Chinia. 2018. "Consumer Online Banking Trends 2018". Humley. https://humleyai.com/2018/09/18/consumer-online-banking-trends-2018/.

6. "Chatbots, A Game Changer For Banking & Healthcare, Saving $8 Billion Annually By 2022". 2017. Juniperresearch.Com. https://www.juniperresearch.com/press/chatbots-a-game-changer-for- banking-healthcare.

7. Pal, Singh Netra, and Devender Singh. "Chatbots and virtual assistants in Indian banks." Industrija 47, no. 4 (2019): 75-101.

8. Roznovsky, Alexander. 2020. "Chatbots In Banking Sector: Benefits, Examples, And Future". Light-It.Net. https://light-it.net/blog/chatbots-in-banking-industry-benefits-forecasts-and-more/.

9. Morgan, Blake. 2017. "5 Ways Chatbots Can Improve Customer Experience In Banking". Forbes. https://www.forbes.com/sites/blakemorgan/2017/08/06/5-ways-chatbots-can-improve-customer-experience-in-banking/.

10. R, Daria. 2018. "7 Reasons To Create An AI Chatbot For A Banking App". Rubygarage.Org. https://rubygarage.org/blog/chatbots-in- banking-apps.

11. FÃ¸lstad, AsbjÃ¸rn. "Improving Conversations: Lessons Learned from Manual Analysis of Chatbot Dialogues." In Chatbot Research and Design: Third International Workshop, CONVERSATIONS 2019, Amsterdam, The Netherlands, November 1920, 2019, Revised Selected Papers, vol. 11970, p. 187. Springer Nature, 2020.

12. Duijst, DaniÃ«lle. "Can we improve the user experience of chatbots with personalisation." Master's thesis. University of Amsterdam (2017).

13. Infosys. 2019. "Power Of Conversational Banking: Best Practices For Chatbots". https://www.infosys.com/about/knowledge-institute/insights/documents/conversational-banking.pdf.

Which banks have chatbots? A roundup of the 10 best-of-the-best banking chatbot solutions

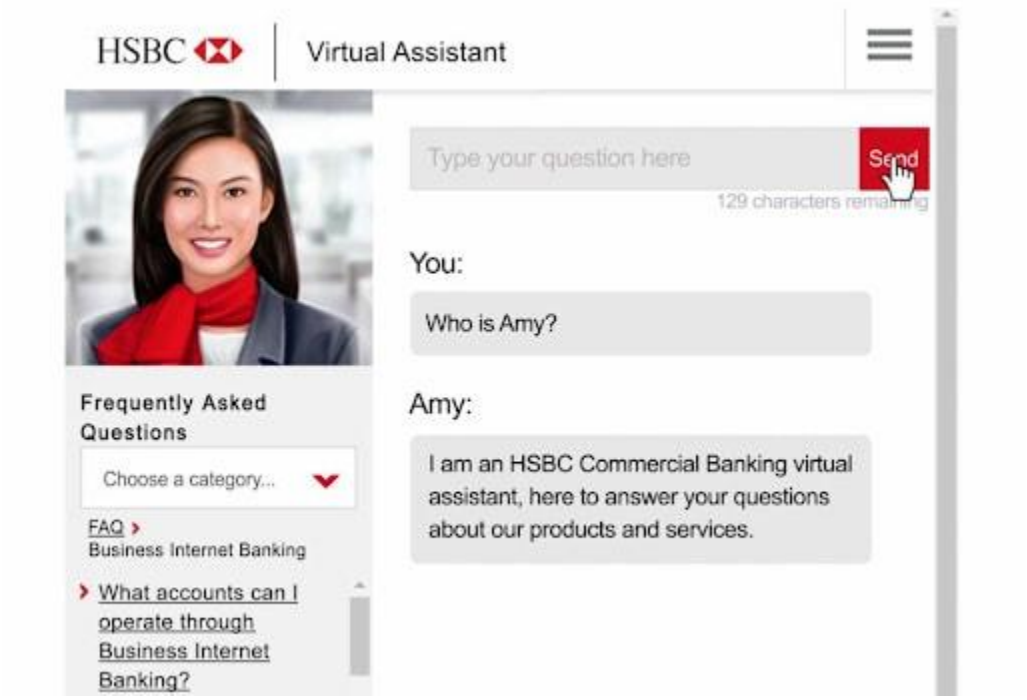
Here are some of the most well-known banking chatbots.

1. Ally Assist from Ally Bank

One of the first banks to launch a chatbot, Ally Bank rolled out Ally Assist in 2015 in an effort to provide users with seamless personalized customer service to manage their account. Accessible within the Ally Bank iPhone app, Ally Assist performs bill payment, transfers and account information requests. The bank also launched an Ally Skill on Amazon's Alexa giving people perform simple banking tasks via voice commands.

2. Amy from HSBC

HSBC's Virtual Assistant Chatbot Amy is available on the bank's website on various product pages. Amy understands English, Traditional and Simplified Chinese and helps customers get instant answers to common questions on the bank's products and services.

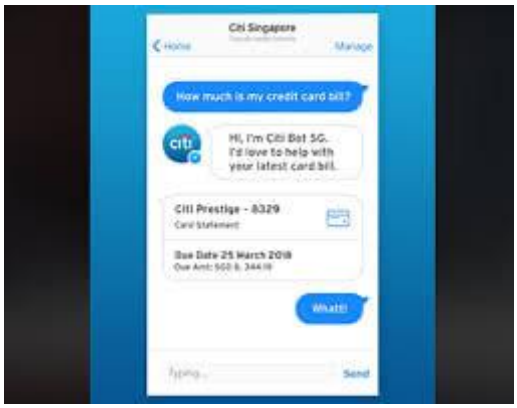


3. Ceba from Commonwealth Bank (Australia)

Ceba is a virtual banking assistant that answers a range of day-to-day banking questions. Ceba is available on the bank's app and Website. Ceba is one of the only banking chatbots to have human escalation and directs customers to other channels based on their specific need.

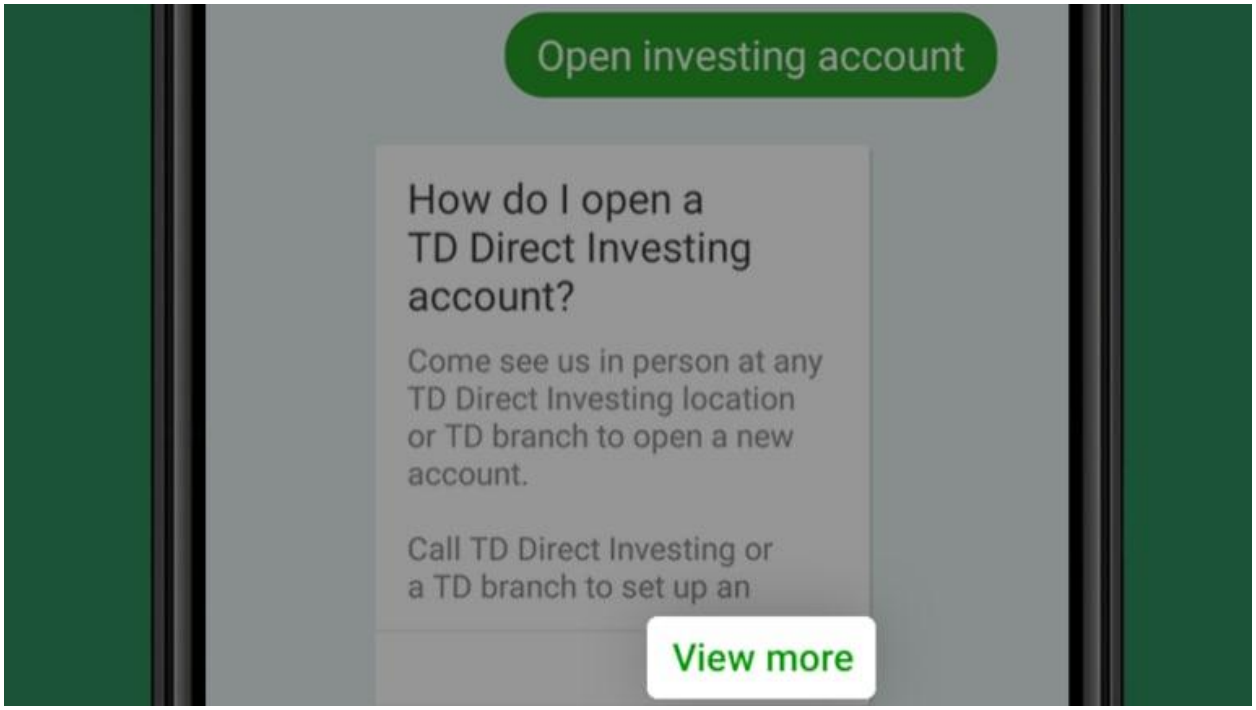
4. Citi Bot SG from Citi

Citi Bank's Citi Bot SG is a chatbot that enables customers to ask about basic account information through Facebook Messenger. Customers can get answers to questions around account balance, transactions, rewards and payment information for credit cards, checking and savings accounts.



5. Clari from TD

Available within the TD banking app, Clari answers common banking questions. Clari can find information on spending, bank accounts and more. Banking customers can ask about opening an investing account, account balance, historic spending and categories, and sending money.



6. Eno from Capital One

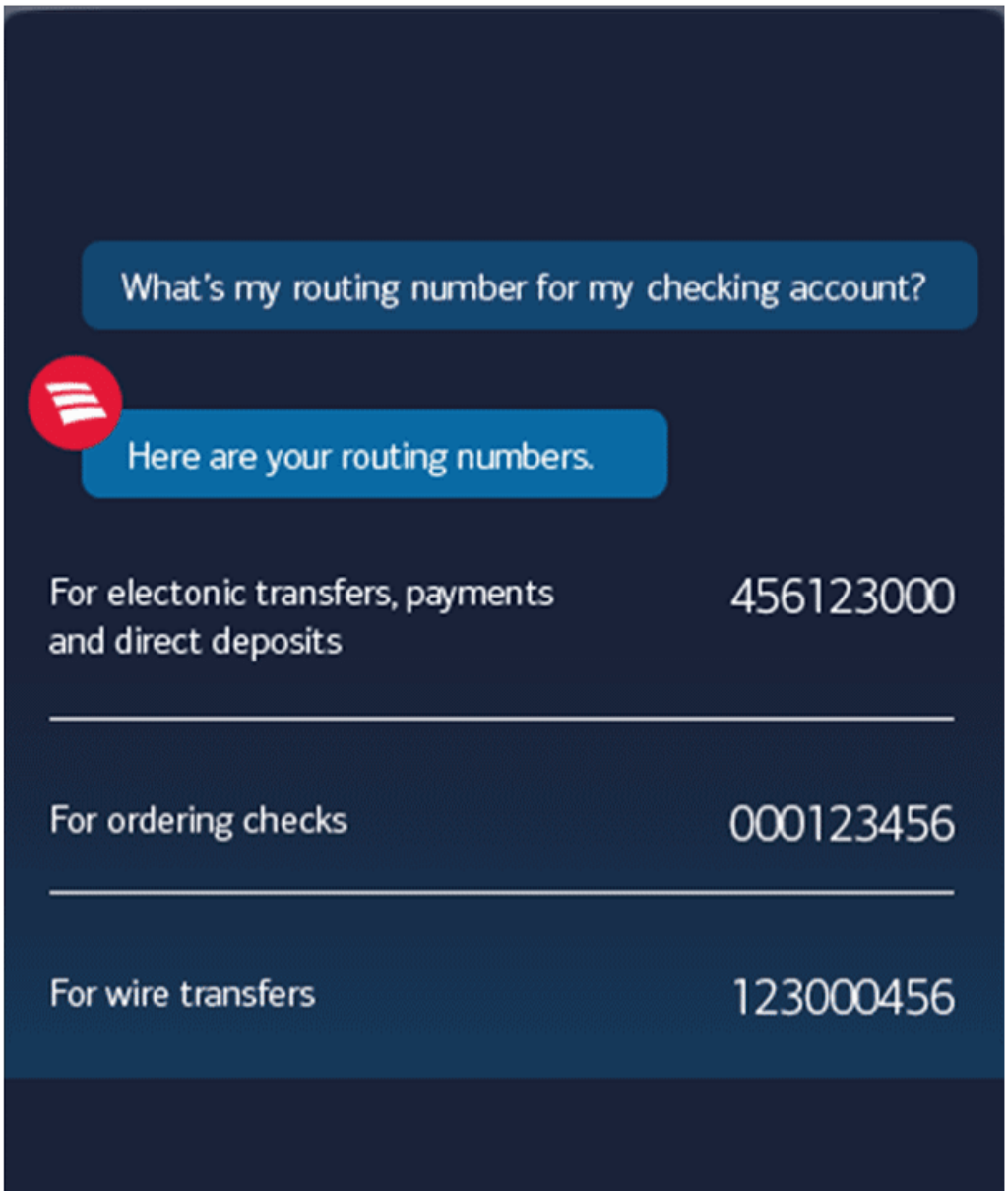
Available on the bank's website, mobile app and SMS, Capital One's digital assistant Eno uses sophisticated natural language processing to understand 2,200 different ways someone might ask for their balance. Eno also proactively reaches out if a bill is higher than normal, if it suspects fraud, or if it detects a particularly high tip. Another unique feature is monitoring free-trials to remind customers before they end.

7. Erica from Bank of America

Available within the BofA app, the virtual financial assistant Erica is designed to help customers more easily manage their money. Within the interactive interface, Erica provides reward and account balances, spending summaries, refund confirmations and credit scores. She can also identify duplicate charges and send bill reminders.

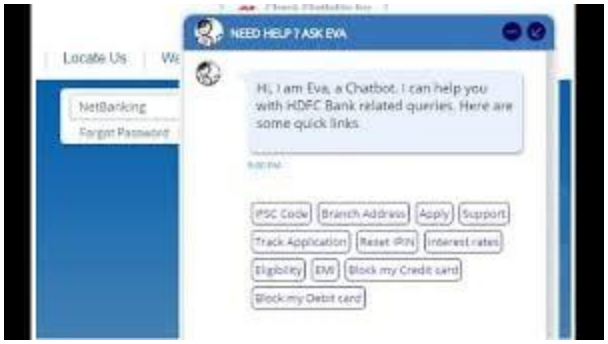
The AI-powered chatbot's capabilities don't stop there: Erica helps support BofA subsidiary Merrill clients through insights on portfolio performance, trading, investment balances, quotes and holdings.

In 2020, Erica helped more than 5 million customers complete over 75 million requests. Since launching in 2020, Erica has helped 15 million customers with over 175 million requests. Every day, Erica engages in approximately 400,000 interactions.



8. Eva from HDFC

Eva helps customers with everyday banking needs: checking on a loan status, facilitating payments and getting instant answers to FAQs. Eva can also help customers apply for various loans.

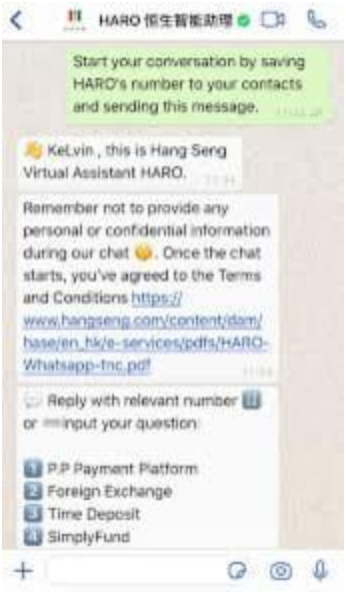


9. HARO and DORI from Hang Seng Bank

With the ability to communicate in Chinese and English, and also understand Cantonese as well as the mixing of English and Chinese, the two bots from Hang Seng Bank in Hong Kong get retail customers instant answers to a variety of needs. HARO and DORI use a combination of natural language processing and machine learning to have human-like conversations, helping banking customers get answers in real-time.

HARO stands for ‘Helpful; Attentive; Responsive; Omni” and interacts with customers on the bank’s website, mobile app and WhatsApp and answers questions related to mortgage, personal loan, credit card, medical insurance and travel insurance services.

Available on Facebook Messenger, DORI (‘Dining; Offers; Rewards; Interactive’) helps customers discover shopping and dining offers.



10. NOMI from Royal Bank of Canada

NOMI is a banking chatbot that hails from the Royal Bank of Canada, the country's largest bank. NOMI is a chatbot that sends alerts, reminders, and tailored insights based on a person's banking habits. Available in the RBC mobile app, it provides tools to help people manage day-to-day spending, including a calculated budget recommendation based on unique spending habits.

The use of virtual assistants by financial institutions to help banking customers save money, manage their bank accounts and XYZ is on the rise. Customers

increasingly expect effortless and proactive customer support and banking bots are delivering the experience that customers expect.