



## Chatbot in business

Milan Puvača<sup>a\*</sup>, Ivan Kunac<sup>b</sup>

<sup>a</sup> Ofir d.o.o., Osijek, Croatia

<sup>b</sup> A. G. Matoš Elementary School, Tovarnik, Croatia

### Article info

#### Review paper

DOI:

<https://doi.org/10.46793/ICEMIT23.219P>

UDC/ UDK:

070.3:004.8

### Abstract

*The cost of today's employee education is extensive, but also dynamic due to the global challenges of business that encompasses each activity. The special expression of the aforementioned is outlined in the elements of customer support provided to visitors or potential clients through the websites of companies or other institutions. In order to somewhat bridge the gap of new training and training of customer support, companies are forced to seek new models of communication with users and resolve their inquiries as soon as possible. As a solution, the implementation of chatbots in websites is imposed as the first phase of communication with users and the resolution of simple queries by users. Full business automation is a constant focus of corporations precisely because of the global market and increasingly demanding clients. The last year has been marked by the increasing availability of artificial intelligence, advanced computing, or big data processing. The orientation of this technology towards customer satisfaction, and through the use of advantages of chatbot as a "first line" of conversation with visitors enables unprecedented functionality. Through research of available literature and publicly available examples of good practice, the advantages, and disadvantages of implementing chatbots as a substitute for customer support will be observed.*

**Keywords:** modern business, chatbot, information and communication technology, digitization

## 1. Introduction

In the current landscape of the global market, rapid and swift transformations are reshaping both corporate and personal spheres. This dynamic environment leaves minimal margin for errors or lack of readiness in responding to the fluid and evolving conditions. As a result, the imperative to adapt to these changes swiftly and adeptly is paramount for success. Companies across all sectors are facing the impact of global crises and challenges (post-Covid, inflation, war situation in Ukraine), necessitating strategic responses to maintain resilience and competitiveness. Cost optimization and efficient resource allocation, particularly concerning human capital, have become imperative to ensure sustained operations and growth. Moreover, the recruitment and retention of skilled employees present additional complexities in this dynamic landscape.

Amidst these challenges, enterprises must continuously innovate, embrace digital transformation, and cultivate a corporate culture that fosters adaptability and agility. Utilizing technology, data-driven insights, and market intelligence is essential to predict customer needs, react to emerging trends, and stay competitive. Embracing sustainability practices and incorporating ESG (Environmental, Social and Governance) considerations can also enhance a company's reputation and attractiveness to investors and consumers in an increasingly conscious market.

In this ever-changing global market, strategic decision-making, proactive risk management, and a relentless commitment to excellence are essential for organizations to navigate uncertainties and thrive in the face of multifaceted challenges. Mentioned digital approach is definitely here to stay and with new AI (artificial intelligence) benefits is getting more and more available to any company. Special care is considered in terms of human related work and switching repetitive tasks to information technology. Global popularity of Chat GPT (OpenAI, L.L.C., 2023.) pushed such technology even faster and made thinking about practical implementations on highest rank in numerous businesses.

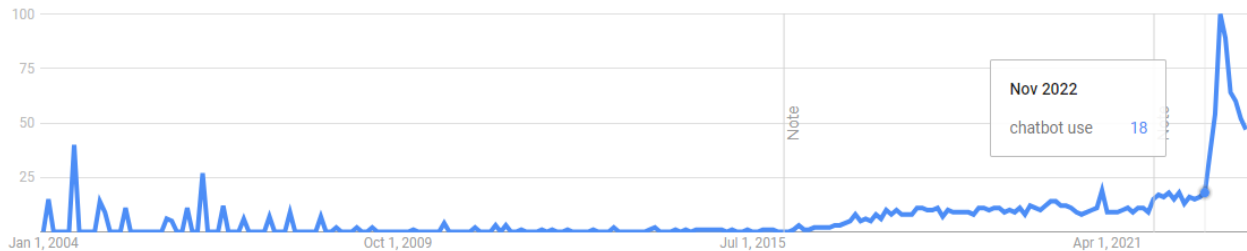
---

\*Corresponding author

E-mail address: [milan@ofir.hr](mailto:milan@ofir.hr)

An exemplary IT solution, widely recognized for its potential to enhance employee productivity, is the implementation of a chatbot. By automating routine tasks and providing efficient customer support, chatbots can liberate valuable time for employees, enabling them to focus on more strategic and value-added activities. It is quite noticeable how chatbot popularity is growing in previous years as shown in Figure 1. The increased availability and utilization of chatbots can be primarily attributed to their heightened adaptability and simplified implementation processes. Furthermore, a significant reduction in the costs associated with their development and deployment has played a pivotal role in their widespread adoption. These combined factors have synergistically contributed to the pervasive integration of chatbot technology across diverse sectors (Dashly Ltd., 2023). As a result, chatbots have emerged as versatile tools with the potential to revolutionize interactions between users and automated systems.

**Figure 1.** Google search frequency for "chatbot use" keyword



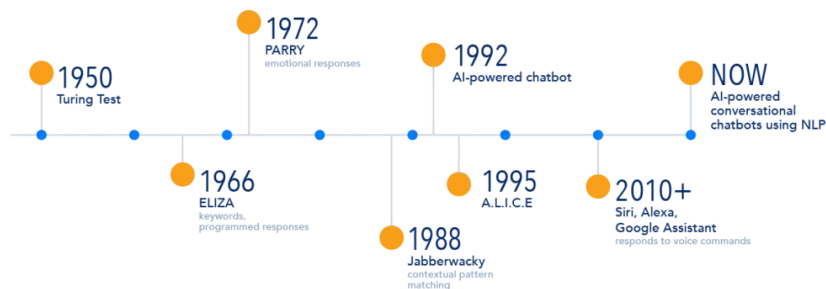
Source: Author work with Google trends tool (Google Inc., 2023.)

## 2. Theoretical grounds

In today's rapidly growing world of technology, the chatbot has emerged as an innovative virtual assistant that aids in communication between humans and computers. A chatbot is computer program, which responds like a smart entity when conversed with through text or voice and understands one or more human languages by Natural Language Processing (NLP) (Adamopoulou, 2020). These programs utilize artificial intelligence (AI) and natural language processing to understand user queries and provide relevant responses. The rapid information processing and concurrent query handling capabilities of chatbots have solidified their significance in contemporary communication landscapes across diverse domains such as customer support, e-commerce, and banking. These versatile tools offer multifaceted benefits, enabling efficient interactions between businesses and customers. Chatbots come in several distinct types, each meticulously designed to serve specific purposes and address varying user needs. By seamlessly integrating into various sectors, chatbots enhance operational efficiency and user experiences, marking a pivotal advancement in modern communication paradigms.

The historical development of chatbots is traced, starting from early chatbot pioneers like ELIZA and PARRY to modern examples like Siri, Google Assistant, and ChatGPT. The evolution of chatbot technology demonstrates their transformation from basic pattern matching to sophisticated language models with potential applications in diverse fields.

**Figure 2.** Evolution of Chatbots for 70 years



Source: Capacity (2023, June 15)

According to Nesterchuk et al. (2021), the primary difference between gastronomic and other forms of tourism is the fact that this type of tourism is based on the concept of getting to know, research, tasting and enjoying the culture of gastronomy of a certain country, area, region, or place. Starting precisely from the aspect of experience, Smith and Xiao (2008) define this term as any journey through which the tourist enjoys and acquires knowledge about local gastronomic products and thus experiences different experiences in contact with food. Some authors point out that gastronomic tourism is actually a subcategory of cultural tourism (Lin et al., 2021; Zvirbule et al., 2023), bearing in mind that Long (2004) believes that this form of tourism allows tourists to get to know the culture and traditions of a certain place through the consumption of food. destinations. This fact can be explained by the fact that through the consumption of food and different tastes, tourists learn about different cultures, accumulate knowledge, and gain an authentic experience (Gheorghe et al., 2015). In accordance with the previous researches, it is evident that this form of tourism is a complex category, which implies a combination of various aspects of the tourist experience through the consumption of food, contributing to the economic revitalization of destinations and differentiating the tourist offer with the aim of achieving competitiveness on the gastronomic tourism market.

One of the key advantages of this approach is the continuous availability to customers. The constant availability of such support allows timely access to information regardless of the user's location or time zone. This approach often leads to increased customer satisfaction and fosters a sense of reliability and trust in the product or company. Moreover, a chatbot is capable of handling multiple user queries simultaneously without compromising the quality of responses or the ability to address user inquiries. By resolving simple queries promptly, chatbots enable human customer support to focus on complex issues, optimizing overall efficiency and improving the effectiveness of customer support.

Another advantage of chatbot-based customer support is the consistency in response and problem-solving. Traditional customer support may vary in terms of knowledge and skills of the agent providing it, whereas a chatbot follows a predefined response scenario, ensuring consistent quality and scope of service. Such predefined scenarios provide reliable solutions to frequently encountered problems. Through algorithmic machine learning, chatbots can analyse all interactions with users and continuously improve their responses and problem-solving capabilities, enhancing their performance and usefulness over time.

Despite the significant advantages of chatbot-based customer support over traditional methods, chatbots cannot fully replace them. There are moments when emotional intelligence, de-escalation of situations, and complex problem-solving, which only human customer support can demonstrate and provide, are necessary. Given these factors, a strategic approach to optimizing customer support involves the integration of both chatbot-driven automation and human assistance, culminating in a hybrid solution. Such a synergistic framework capitalizes on the strengths of each component, leveraging the efficiency of chatbots for routine inquiries while harnessing human expertise to handle intricate and contextually nuanced interactions. By fusing these capabilities, an enhanced customer experience can be delivered that strikes a harmonious balance between automation and personalized engagement.

A limitation associated with employing chatbots for customer support lies in their inherent inability to fully grasp intricate inquiries and nuanced linguistic variations specific to different counties and regions. This constraint arises from the complexity of natural language understanding and the challenges posed by local dialects and idiomatic expressions. Addressing this limitation requires advancements in natural language processing algorithms and cross-cultural linguistic modelling to enable chatbots to effectively navigate the diverse landscape of customer interactions. Chatbots rely on keyword recognition, which can sometimes result in inaccurate or incomplete responses to user inquiries. They might struggle with local languages, idiomatic expressions, or sarcasm, resulting in repetitive responses that users may interpret as a lack of accessibility and unprofessionalism. (Zumstein, 2018.)

### **3. Different concepts of chatbot training**

The training of a chatbot encompasses a variety of approaches and methodologies that are tailored to its specific intended function. These techniques are diverse, accommodating the unique requirements and objectives of each chatbot implementation. Here are some common ways:

#### *Rule based training*

In this approach, the chatbot is trained using a set of predefined rules. These rules are created based on anticipated user queries and corresponding responses. The chatbot matches user input with specific rules to generate appropriate replies. While rule-based training is relatively straightforward to implement, it requires extensive manual rule creation and may not handle complex or unexpected queries effectively. (Thorat, 2020)

### *Supervised learning*

In supervised learning, the chatbot is trained using labelled data. Human experts provide conversations or dialogues, with each input paired with its corresponding desired output. These paired examples serve as training data to teach the chatbot how to generate appropriate responses based on given inputs. Supervised learning requires a substantial amount of labelled data, and human experts' involvement is necessary to curate the training dataset. (Upetry, 2022)

### *Reinforced learning*

Reinforcement learning involves training the chatbot through a trial-and-error process. The chatbot interacts with users and receives feedback on its responses. Based on the feedback (reward or punishment), the chatbot learns to improve its conversational abilities over time. Reinforcement learning requires careful design of reward systems and may involve more complex training algorithms. (Ricciardelli, 2019)

It's important to remember that these approaches can be mixed or adjusted depending on what's needed and the resources available for training a chatbot. This flexibility allows for better training strategies to match each chatbot's unique requirements.

In addition to mentioned techniques or as its follow up, Large Language Models and its usage as a “base” for Chatbots became fascinating thing. This integration allows chatbots to provide contextually relevant and coherent answers, enhancing customer engagement and satisfaction (Li, 2023). Ability of LLM to interact in “almost human” way provided unbelievable results which are waiting to be implemented in months to come (Ornes, 2023). Also, many programming solutions are getting prepared for own / custom LLM-Chatbot implementations (ex. (Github, 2023)). Practical examples on how it should be done together with its advantages are publicly available (Adams, 2023).

Using new features of modern business as Big Data, Machine Learning, LLM together with experience having from the past will undoubtedly allow companies to grow, make new comparative advantage and provide fresh experiences for their customers. Remaining question is, how long will it take for firms to realize this potential and what would be a client's feedback.

This paper will investigate the utilization of chatbots as customer support agents, irrespective of their training methods. The focus is on exploring their effectiveness in customer service roles.

## **4. Case studies – practical examples**

T.S. Nguyen (Nguyen, 2019) case study examines a software company in the software industry that provides applications on multiple platforms (Android, iOS, Windows) and experiences complications in the installation process and customer support. The traditional customer support model involves an FAQ section on the company's website and email responses. The company experiments with a chatbot during periods of increased user activity to improve response times and reduce the load on human support personnel. A questionnaire is designed to assess various dimensions of user experience. Case study consist of two research questions: potential effects of the chatbot on customer Support and impact of chatbot Assistance. In first research question the study analysed ten dimensions of customer experience, including information quality, system quality, service quality, usefulness, and user satisfaction. The results indicated that the chatbot's presence led to improved responsiveness, reducing customer support response times. However, no significant differences were observed in information quality or system quality measures between the chatbot-enabled and traditional systems. This suggests that while the chatbot improved response time, it did not significantly enhance the quality of information provided to customers. In second research question the study examined cases where the chatbot was unable to fully resolve customer issues, leading to human agent involvement. Contrary to initial expectations, the study found that unsuccessful chatbot interactions did not significantly worsen the overall customer experience. While there were no significant differences in information quality, system quality, and user satisfaction measures, the ratings in scenarios involving human agent assistance tended to be more consistent around the medians. This suggests that customers who experienced chatbot-to-human escalation did not necessarily have a worse experience. The study suggests that the chatbot's presence positively influences certain aspects of service quality and user satisfaction. However, human involvement is important when the chatbot can't solve problems by itself, especially in maintaining information quality and certain service quality dimensions.

The case study acknowledges limitations and suggests further research to explore additional dimensions and factors that could influence user experience with chatbots in customer support scenarios.

Case study conducted by Park et al. (Park S., 2019) aims to design a conversational sequence for a brief motivational interview (MI) for stress management and explore its effectiveness on a Web-based text messaging application. The study sought to understand users' perception of the conversation, its impact on coping with stress, and suggestions for improving mental health support. The researchers developed a chatbot called "Bonobot" that utilized MI skills, including questioning, reflections, and MI-adherent statements, to engage users in a structured conversation. The study involved

graduate students who engaged in conversations with Bonobot about their stress-related concerns. Main findings are as follows: Participants generally showed a preference for Bonobot's use of thought-provoking questions, which encouraged them to reflect on themselves and explore potential changes. While feedback from Bonobot, including reflections and supportive statements, was well-received, certain participants found it to be repetitive or lacking contextual accuracy. The non-judgmental and empathetic approach adopted by Bonobot was highly valued by participants, making it easier for them to open up and address their concerns. Participants expressed a desire for more personalized and context-specific feedback, along with informational assistance and specific action plans to better cope with stress. There was a range of responses to the problem-solving and change-oriented aspects, with some participants resistant and others finding the conversation to be motivating and inspirational. The study highlights the potential of using a chatbot to conduct MI for stress management. It emphasizes the importance of combining technical and relational components in designing chatbot conversations. While participants generally found the conversation helpful, there were limitations, such as the chatbot's inability to provide fully context-aware responses.

Future research could explore different conversation sequences, incorporate multimedia elements, and develop assessment tools to measure the effectiveness of chatbot-client interactions in a therapeutic context.

A case study conducted by Miri Heo and Kyoung Jun Lee (Heo Miri, 2018) discusses the rise of chatbot-based messaging applications as a potential alternative to traditional web browsers. It highlights the growth of messaging apps like KakaoTalk, Tencent, Line, and Whatsapp, which are incorporating chatbots as a part of their ecosystem. The article explores the evolution of Naver TalkTalk, a card-based chatbot application developed by Naver, a major internet company in Korea. Initially, Naver's attempt to engage users through direct picture uploads for offline stores did not work as anticipated. Online communication between consumers and stores was better facilitated through competitors like KakaoTalk. This led to the creation of Naver TalkTalk, a chatbot-based platform that allowed users to engage with offline store owners more efficiently. Naver TalkTalk's success was attributed to its user-friendly cardbot interface, where users could select options from predefined categories, simplifying the interaction process. The article also discusses Naver's progression from simple chatbots to cardbots, which allowed users to choose scenarios and predefined options. The introduction of cardbots led to increased success rates and higher conversion rates for online purchases. The implementation of chatbots, particularly cardbots, resulted in improved user experience, efficient order placements, and increased customer satisfaction. Naver's efforts to further enhance automation through robotic process automation are also highlighted. The company aimed to increase automation rates for various tasks, such as checking shipping status, through robotic process automation, which could lead to reduced costs and improved customer satisfaction.

In conclusion, the article emphasizes the value of chatbots, particularly cardbots, in business communication and customer engagement. It discusses Naver's journey in developing and implementing chatbot solutions, highlighting their impact on customer satisfaction, efficient communication, and potential benefits for small businesses and offline service providers. A case study of Siri (Lee, 2019.) begins by introducing chatbots as computer programs designed to mimic human conversations. It categorizes Siri as a general-purpose chatbot that can handle a wide array of queries for specific task. It explains how rule-based chatbots use question-and-answer knowledge bases, while recent advancements in deep learning have significantly improved chatbot performance, allowing them to engage in more sophisticated conversations. However, challenges remain, particularly in understanding multi-turn conversations. The study's methodology is detailed, focusing on sentiment analysis conducted on posts from Weibo, a Chinese social networking site. By categorizing sentiments as positive or negative, the study sought to gauge users' opinions about Siri. The analysis of positive sentiments revealed that users generally hold favourable views of Siri. Commonly associated terms included "Apple," "voice," and "intelligent," reflecting positive discussions. On the flip side, the analysis of negative sentiments unveils a range of issues. Users express dissatisfaction stemming from unexpected sound outputs, often leading to embarrassing or awkward situations. High user expectations also contribute to negative sentiments, as users anticipate Siri to fulfil complex requests or tasks beyond its capabilities. The article subsequently draws a meaningful juxtaposition between Siri and Alime, Alibaba's intelligent shopping assistant. Notable distinctions between the two chatbots emerge, particularly in terms of input methods and functionalities. While Siri predominantly relies on voice interactions, Alime leans towards text-based input, although it does offer limited voice functionalities. Moreover, Siri, as a general-purpose chatbot, spans a broad array of applications, whereas Alime is tailored for e-commerce, assisting customers with shopping-related inquiries and tasks. An intriguing observation from the study is the phenomenon of users "coming on to" chatbots, especially evident with phrases like "I love you." This curiosity-driven behaviour, while unconventional, underscores users' desire to explore the boundaries of human-chatbot interactions. Developers are encouraged to consider and craft responses that handle such interactions tactfully, potentially infusing humour and creativity into the chatbot's repertoire.

In conclusion, the sentiment analysis provides valuable insights into users' perceptions of Siri. Users generally exhibit a positive sentiment towards Siri, appreciating its functionalities and the engagement it fosters. The study accentuates the importance of adeptly managing interactions, humorously addressing unconventional queries, and ensuring consistent user satisfaction. It also underscores the potential for further research in sentiment analysis across diverse platforms and demographic groups, broadening our understanding of chatbot adoption and user engagement.

One of local examples on how chatbot can be used is presented on [digitalnakomora.hr](http://digitalnakomora.hr) (Croatian Chamber of Commerce, 2023). The "Digital Chamber," a communication platform designed for business entities, public administration, and citizens, represents an initiative led by the Croatian Chamber of Economy. This project has received co-financing from the European Regional Development Fund through the Operational Programme Competitiveness and Cohesion. The platform encompasses various digital initiatives, including e-government authorizations, online learning, digital legislation, virtual trade fairs and promotions, electronic financing, membership management through online platforms, and digital economic information dissemination. Large set of services which are provided with Digital Chamber is sometimes confusing and difficult to follow, especially for new entrepreneurs. Idea of implementing a chatbot on platform appeared exactly in order to simplify the onboarding process of SMEs which are main clients of this solution.

Chatbot is always located in right bottom corner of the screen (desktop and mobile solution) which is one of the best user experience guidelines for its implementation (Lee, 2023). Digital Chamber chatbot is trained on rule basis approach where it expects specific keywords and user queries where it has prepared replies. In situations where it cannot help the user or it does not understand the question it suggest typing "HELP" in order to see main categories where help can be provided. This approach as "zero level" support is good enough, reducing unnecessary calls or emails where already written answers will be provided. However, at the moment better understanding or user guidance through the platform is missing and is considered as chatbot update. Previously mentioned correlates with different conducted studies where "trust" in chatbots is getting noticeably higher as they are providing wider understanding of user queries. (Wang, 2023).

The process of integrating a chatbot with a learning phase is time-consuming and often involves significant financial expenditures. Like other emerging technologies, there are strategies that prioritize the streamlining of the implementation process, ultimately making it more accessible to a broader range of users. These approaches aim to reduce the complexities associated with deploying a chatbot while also minimizing the financial burden. Consequently, the evolution of this technology is marked by a effort to enhance efficiency and affordability, aligning it with the goals of widespread adoption. Great example of this approach is FlowiseAI, an Open-source user interface visual tool to build your customized LLM flow (FlowiseAI, Inc, 2023). With a lot of resources even non-technical user can understand basic concepts of this tool. Mainly with trial-and-error approach it is possible to prepare a custom chatbot ready to be implemented on any web site. It will be able to reply on custom queries related to client's database, documents or even web sites by using OpenAI (ChatGPT) conversational agents or LLM chains. Further automatization is available in cases when such chatbot cannot provide clear answer and should provide direct message to a company or connect a customer to a live support. Introduced in the first quarter of 2023, FlowiseAI is a nascent tool that serves as a prominent illustration of the ongoing advancements in business optimization geared towards achieving the pinnacle of customer experience. Its recent inception underscores the dynamic evolution within this field, highlighting the pursuit of elevated customer satisfaction and operational excellence.

## 5. Conclusion

Chatbots offer distinct advantages that contribute to improved customer experiences. The continuous availability of chatbots ensures timely access to information, enhancing customer satisfaction and building trust. The ability of chatbots to handle multiple queries simultaneously, coupled with their consistent and algorithmically improving responses, optimizes overall efficiency in customer support. However, while chatbots offer significant benefits, they are not without limitations. Their inability to fully comprehend complex queries, nuanced language variations, and emotional intelligence underscores the importance of a hybrid customer support approach that combines chatbots with human assistance. This fusion ensures a balance between efficiency and the human touch that is crucial for resolving intricate issues and cultivating customer loyalty.

The case studies presented highlight the real-world applications and impacts of chatbots in diverse business scenarios. From improving responsiveness in customer support to facilitating motivational conversations for stress management, chatbots showcase their potential across various domains. The success of these implementations underscores the importance of thoughtful design, user-friendly interfaces, and continuous adaptation to user feedback.

The integration of chatbots into modern business operations represents a significant step toward efficiency, responsiveness, and enhanced customer experiences. Special role and new improvements are played by artificial intelligence and its "variations" seen as Large Language Models. Integrating natural language capabilities into chatbot responses represents a significant step forward in minimizing miscommunication and addressing information gaps. This enhancement is anticipated to significantly improve the quality of bot-client interactions by fostering a heightened sense of confidence and assurance through seamless and effective communication. The continuous advancement of technology is paving the way for the creation of interactive tools (easy to use) designed for crafting customized chatbots, thereby progressively bridging the gap towards broader acceptance and integration. Comparison of previously implemented chatbots versus new LLM enhanced ones is a theme for next paper where authors are aiming to measure scale of seriousness and real-human feeling in chatbot communication while using it in e-commerce solution. Only companies which will be able to use this potential will continue to grow and assure leading place in global markets.

## References

- Adamopoulou, E. M. & Moussiades, L. (2020). An Overview of Chatbot Technology. In I. Maglogiannis, L. Iliadis, & E. Pimenidis (Eds.), *IFIP Advances in Information and Communication Technology IFIPAICT*: vol. 584 (pp. 373-383). Springer. [https://doi.org/10.1007/978-3-030-49186-4\\_31](https://doi.org/10.1007/978-3-030-49186-4_31)
- Adams, F. (2023, July 15). Unleashing the Power of Large Language Models: Building an AI Chatbot for Private Knowledge Base Queries. *Medium*. <https://medium.com/@FrankAdams7/unleashing-the-power-of-large-language-models-building-an-ai-chatbot-for-private-knowledge-base-eb8cf31c7fcc>
- Capacity. (2023, June 15). Evolution of Chatbots. *Capacity*. <https://capacity.com/chatbots/evolution-of-chatbots/>
- Croatian Chamber of Commerce. (2023, August 5). Home. *Croatian Chamber of Commerce*. <https://digitalnakomora.hr/home>
- Dashly Ltd. (2023, June 15). Dashly blog. Chatbot statistics crucial to know in 2023. *Dashly Ltd*. <https://www.dashly.io/blog/chatbot-statistics/>
- FlowiseAI, Inc. (2023, July 28). Build LLMs Apps Easily. *FlowiseAI*. <https://flowiseai.com/>
- Github (2023, June 23). GitHub - deep-diver/LLM-As-Chatbot: LLM as a Chatbot Service. *GitHub*. <https://github.com/deep-diver/LLM-As-Chatbot>
- Google Inc. (2023, July 17). Google trends. *Google Inc*. <https://trends.google.com/trends/>
- Heo Miri, L. K. (2018). Chatbot as a New Business Communication Tool: The Case of Naver TalkTalk. *Business Communication Research and Practice*, 1(1), 41-45. <https://doi.org/10.22682/bcrp.2018.1.1.41>
- Io, H.N., & Lee, C.B. (2019). Understanding the Adoption of Chatbot. In K. Arai, S. Kapoor, & R. Bhatia (Eds.), *Advances in Information and Communication Networks Proceedings of the 2018 Future of Information and Communication Conference (FICC)*, Vol. 1 (pp 632–643). Springer. [https://doi.org/10.1007/978-3-030-03402-3\\_44](https://doi.org/10.1007/978-3-030-03402-3_44)
- Lee, M. (2023, July 25). Considerations for your chatbot design. *UX Magazine*. <https://uxmag.com/articles/considerations-for-your-chatbot-design-banner>
- Li, J. e. (2023, June 22). ChatGPT: Large-Scale Language Models for Conversational Agents. *CDN Openai*. <https://cdn.openai.com/better-language-models/chatgpt.pdf>
- Nguyen, T. (2019). *Potential effects of chatbot technology on customer support: A case study* [Master's Thesis]. Aalto University School of Science.
- OpenAI, L.L.C. (2023, July 22). ChatGPT. *ChatGPT*. <https://chat.openai.com/>
- Ornes, S. (2023, May 20). Quanta Magazine. The Unpredictable Abilities Emerging from Large AI Models. *Quantamagazine*. <https://www.quantamagazine.org/the-unpredictable-abilities-emerging-from-large-ai-models-20230316/#>
- Park, S.H., Choi, J., Lee, S., Oh, C., Kim, C., La, S., Lee, J., Bongwon Suh, B. (2019). Designing a Chatbot for a Brief Motivational Interview on Stress Management: Qualitative Case Study. *Journal of Medical Internet Research*, 21(4), 1-19. doi:10.2196/12231
- Ricciardelli, E., & Biswas, D. (2019). Self-improving chatbots based on reinforcement learning. In S. Singh (Ed.), *4th Multidisciplinary Conference on Reinforcement Learning and Decision Making* (pp. 1-4). McGill University.
- Sudan, P.U., & Jeong, S.R. (2022). The Impact of Semi-Supervised Learning on the Performance of Intelligent Chatbot System. *Computers, Materials & Continua*, 71(2), 3937–3952.
- Thorat, S. A. (2020). A Review on Implementation Issues of Rule-based Chatbot Systems. In *Proceedings of the International Conference on Innovative Computing & Communications (ICICC) 2020*. SSRN. <https://dx.doi.org/10.2139/ssrn.3567047>
- Wang, X., Lin, X., & Shao, B. (2023). Artificial intelligence changes the way we work: A close look at innovating with chatbots. *Journal of the Association for Information Science and Technology*, 74(3), 339–353.
- Zumstein, D., & Hundertmark, S. (2018.). Chatbots: an interactive technology for personalized communication and transaction. *IADIS International Journal on WWW/Internet*, 15(1), 96–109.

