Artificial Intelligence in Customer Service: implementation in Brazilian premium pool industry

Inteligência Artificial no Atendimento ao Cliente: implementação na indústria brasileira de piscinas premium

Inteligencia Artificial en la Atención al Cliente: implementación en la industria de pool premium Brasileña

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Abstract
Objective: to implement a chatbot to enhance customer interaction, provide instant answers to frequently asked questions, and streamline communication processes.
Methodology: applied quantitative action research using the Twilio platform to develop the chatbot. The process involved analyzing existing service flows, creating conversational pathways, and conducting a one-month testing phase, during which pre- and post-implementation analyses were compared.
Originality/Relevance: the study demonstrates the impact of a chatbot on improving customer service in a Brazilian company that manufactures luxury swimming pools for the construction industry. By providing empirical evidence, it reinforces the role of artificial intelligence in enhancing customer engagement and improving sales processes.
Results: the results showed significant improvements, such as the average response time was moderated to 94% (from 16 to one minute during business hours) and the time to classify customers was reduced by 69%. Additionally, the chatbot facilitated a 142% increase in quote deliveries within 12 hours.
Theoretical contributions: the research explores the theoretical foundations of chatbots, customer relationship management (CRM) and their application in business contexts.
Contributions to management: an improvement has improved the effectiveness of customer contact and operational efficiency. The study focused on addressing inefficiencies in traditional customer service, improving response times and optimizing operations.

Keywords: chatbot; business administration; customer service; civil construction; efficiency; automation; Customer Relationship Management (CRM); productivity.

Resumo
Objetivo: implementar um chatbot para aprimorar a interação com o cliente, fornecer respostas instantâneas a perguntas frequentes e agilizar os processos de comunicação.
Metodologia: pesquisa-ação quantitativa aplicada, utilizando a plataforma Twilio para desenvolver o chatbot. O processo envolveu a análise de fluxos de serviço existentes, a criação de caminhos conversacionais e a condução de uma fase de testes de um mês, durante a qual métricas pré e pós-implementação foram comparadas.
Originalidade/Relevância: o estudo demonstra o impacto de um chatbot para melhoria do atendimento ao cliente em uma empresa brasileira fabricante de piscinas de luxo da construção civil. Ao fornecer evidências empíricas, reforça o papel da inteligência artificial no aprimoramento do engajamento do cliente e na melhoria dos processos de vendas.
Principais resultados: os resultados mostraram melhorias significativas, tais como o tempo médio de resposta diminuiu 94% (de 16 para um minuto durante o horário comercial) e o tempo de classificação de clientes foi reduzido em 69%. Além disso, o chatbot facilitou um aumento de 142% nas entregas de orçamentos em 12 horas.
Contribuições teóricas: a pesquisa explora os fundamentos teóricos dos chatbots, da gestão de relacionamento com o cliente (CRM) e sua aplicação em contextos de negócios.

Contribuições para a gestão: a implementação aumentou a eficácia do contato com o cliente e a eficiência operacional. O estudo se concentrou em abordar as ineficiências no atendimento tradicional ao cliente, melhorando os tempos de resposta e otimizando as operações.

Palavras-chave: chatbot; administração de empresas; atendimento ao cliente; construção civil; eficiência; automação; Gestão de Relacionamento com o Cliente (CRM); produtividade.

Resumen
Objetivo: implementar un chatbot para mejorar la interacción con el cliente, proporcionar respuestas instantáneas a preguntas frecuentes y optimizar los procesos de comunicación.
Metodología: investigación-acción cuantitativa aplicada utilizando la plataforma Twilio para desarrollar el chatbot. El proceso implicó analizar los flujos de servicio existentes, crear canales de conversación y realizar una fase de prueba de un mes, durante la cual se compararon los análisis previos y posteriores a la implementación.
Originalidad/Relevancia: el estudio demuestra el impacto de un chatbot en la mejora del servicio al cliente en una empresa brasileña que fabrica piscinas de lujo para la industria de la construcción. Al proporcionar evidencia empírica, refuerza el papel de la inteligencia artificial en la mejora de la interacción con el cliente y la optimización de los procesos de venta.
Resultados: los resultados mostraron mejoras significativas, como una moderación del tiempo promedio de respuesta del 94% (de 16 a un minuto en horario comercial) y una reducción del 69% en el tiempo de clasificación de clientes. Además, el chatbot facilitó un aumento del 142% en la entrega de cotizaciones en 12 horas.
Contribuciones teóricas: la investigación explora los fundamentos teóricos de los chatbots, la gestión de las relaciones con los clientes (CRM) y su aplicación en el ámbito empresarial.
Contribuciones a la gestión: una mejora ha mejorado la eficacia del contacto con los clientes y la eficiencia operativa. El estudio se centró en abordar las ineficiencias de la atención al cliente tradicional, mejorando los tiempos de respuesta y optimizando las operaciones.

Palabras clave: chatbot; administración de empresas; servicio al cliente; construcción civil; eficiencia; automatización; Customer Relationship Management (CRM); productividad.

1. Introduction

Historically, customer service was a purely reactive function. Customers would get in touch, and companies would respond. Nevertheless, with globalization and digitalization, the dynamics have changed. Today's customers are more informed, more connected and, consequently, more demanding. They don't just want answers, they want them quickly, in a personalized manner and on platforms of their choice (Brachten et al., 2021) e (Dal Forno et al., 2016).

According to the Global Customer Experience Trends Report (Zendesk, 2024), in Brazil, 89% of the companies surveyed agreed that customer service directly impacts business performance. However, in practice there is still a gap when customers report that one of the main problems is the long waiting time. The survey was conducted with more than 97.000 customers, and each customer expectation that is not met decreases brand loyalty, in addition to the loss of revenue and damage to the organizations' image (Zendesk, 2024).

Therefore, it is possible to perceive a growing demand for immediate and personalized service, putting pressure on companies to change, since traditional customer service approaches, although still relevant, have begun to show their limitations (Jiang et al., 2022). Some authors, including (Dal Forno et al., 2013) have already mentioned that the lack of focus on the customer and the search for reducing wasted waiting are problems that have not yet been solved since the lean approach to the present day. Thus, with the evolution towards Industry 4.0 and more advanced artificial intelligence (AI) techniques, chatbots emerge as a promising solution. These automated conversational systems, powered by advances in AI and natural language processing, may be able to transform the way companies interact with their customers (Rapp et al., 2021). They offer the promise of 24/7 instant responses, with the ability to personalize interactions based on the customer's history and preferences. Nonetheless, the adoption of chatbots is not just a question of technology; it is a strategic response to the evolution of customer expectations. On the other hand, this type of tool does not exclude and should not minimize human interaction (Ashfaq et al., 2020).

The construction industry's share of Brazil's GDP is 5.8%, according to data from the Brazilian Institute of Geography and Statistics (IBGE, 2023). This article focuses on the high-end swimming pool market, which is growing 4% per year worldwide. Even though Brazil has the lowest share when considering the 2% in South America, this sector has grown above the world average (18% per year). On a global scale, North America has the largest market share (55%), followed by Europe (30%), Asia-Pacific (10%), the Middle East (3%) and South America (2%) (Mordor Intelligence, 2024).

The work by (Tickoo et al., 2024) analyzed the customer experience, satisfaction, and loyalty associated with chatbots for executive customers. The authors observed that both

chatbot and human services play an important role in customer engagement. However, the study focused on the banking and automotive sectors in India, which differs from this work, which analyzes the case of customers who are also executives purchasing high-end swimming pools, but in Brazil. The authors (Borges et al., 2021) criticize the lack of practical work on the strategic use of AI. They conducted a systematic literature review and found no work in the construction sector.

In (Lu et al., 2024), the objective was to validate the causal relationships and the strength of the relationships between the anthropomorphic design of the chatbot, expectations of customer service recovery, and intention to switch. However, the study assessed the behavioral intentions of customers when interacting with chatbots for the second time after service failures.

In turn, (Agnihotri & Bhattacharya, 2024) conducted research in the United Kingdom to investigate the characteristics of AI-based chatbots that make them perceived as trustworthy, lead consumers to forgive the company for service failures, and reduce their propensity to spread negative word of mouth against the company. It was observed that the perceived security of chatbots increases the capacity and empathy perceived by consumers, and anthropomorphism increases the benevolence and integrity of chatbots, that is, three characteristics of chatbots affect the components of reliability differently.

In this context, this article aimed to evaluate the impacts of implementing a chatbot in a Brazilian company that sells high-end swimming pools. The contribution is the comparison of indicators such as time for response to the customer and the number of customers who were left without a response, especially on weekends. The relationship between chatbots and human customers and in industrial applications was analyzed in the literature, as well as the acceptance of this AI tool in luxury markets, and the opportunities and challenges in the industrial environment such as business-to-business (B2B) and business-to-consumer (B2C) sales were evaluated. This analysis of the two types of businesses is also a differential, since (Lin et al., 2022) mentioned that 58% of chatbot implementations are in B2B and 22% in B2C.

Despite the increasing adoption of chatbots in sectors like banking and retail, there is a lack of empirical research on their strategic implementation in the luxury segment of the civil

construction industry. Moreover, few studies have addressed the hybrid role of chatbots and human agents from a CRM perspective in emerging economies.

To achieve this objective, section 2 outlines relevant research on chatbot, its concepts, advantages and disadvantages and some issues about customer behavior. Section 3, dedicated to the methodology, describes the steps of the action research in a company located in Brazil that manufactures high-end swimming pools and also the theoretical research. Section 4 describes the chatbot development in the company and the current situation found, with the tests and validations of the practical application described in section 5, dedicated to the results. Finally, section 6 highlights the conclusions, comparing the results obtained, theoretical and practical implications, in addition to suggestions for future work.

2. Theoretical Background

1.1 Chatbot definitions, vantages and disadvantages

Technological advancements have driven digital transformation across various sectors, especially in customer service. In this context, chatbots have emerged as an innovative solution, widely adopted by companies across different industries. According to (Chung et al., 2020) chatbots are considered digital services capable of assisting consumers, acting as efficient substitutes for human agents. (Y. Li et al., 2024) reinforce this perspective by defining chatbots as “computer programs that communicate with human beings through text or voice messages in real time, in a highly personalized way.”

Chatbots represent a significant application of AI focused on human-machine interaction. They are primarily text-based conversational agents designed to simulate natural dialogues with users (Ashfaq et al., 2020), featuring intrinsic characteristics such as personalization and 24/7 availability—attributes that enhance service quality (Chung et al., 2020). This constant availability ensures that customers receive personalized service at any time, regardless of their location. As (Lo Presti et al., 2021) describe, such innovations have transformed business interactions, making them more agile, personalized, and efficient, while also boosting purchase intentions by stimulating the decision-making process.

From a business perspective, chatbot adoption brings substantial advantages. (Bavaresco et al., 2020) concluded that chatbot implementation can lead to significant cost savings, allowing companies to better leverage available technologies and continuously improve service quality. In essence, chatbots are not merely tools, but represent a paradigm shift in customer service, benefiting both companies and consumers.

Among the primary benefits are immediate and continuous responses, which align with modern demands for speed and efficiency. These features optimize user experience and enhance organizational performance. However, as (Ashfaq et al., 2020) note, users may sometimes feel frustrated if the chatbot cannot fulfill their needs—highlighting the importance of combining automated excellence with human support.

Nevertheless, chatbots have limitations. According to (Massucato, 2023) they lack emotional capacity and struggle to maintain a humanized and empathetic interaction. They also rely on structured sequences to provide coherent responses. Another drawback is their potential unreliability, given that training data may not always be accurate, leading to communication issues.

(Giebelhausen et al., 2014) emphasize that despite offering benefits in efficiency and availability, chatbots cannot resolve all customer problems. Their pre-programmed and sometimes rigid nature makes it difficult for them to handle complex or unique situations requiring deeper understanding or a personalized approach. (Rapp et al., 2021) add that there is still insufficient evidence about user expectations and emotional responses during chatbot interactions. Unlike humans, chatbots cannot adapt tone, gestures, or facial expressions, limiting the depth of interaction.

Supporting these concerns, (Zhu et al., 2022) argue that lack of empathy is the main reason why chatbots fail in service recovery. Empathy, involving both affective and cognitive dimensions, is inherently human. Research suggests that the perceived empathy of chatbots can be influenced by their visual design and language style.

On the other hand, (Chen et al., 2022) point out that chatbots offer several advantages over human agents, including superior data storage capacity, computational power, learning capabilities, accurate personalized recommendations, emotional neutrality, and constant

availability. Table 1 summarizes the main advantages and disadvantages of chatbot use for both customers and companies.

Table 1
Summary of the advantages and disadvantages of using chatbots

Advantages	Disadvantages
Immediate response and continuous customer service availability (Ashfaq et al., 2020) (Giebelhausen et al., 2014) (Rapp et al., 2021) (Chen et al., 2022)	Lack of emotions and lack of humanized interaction and empathy with the customer (Massucato, 2023) (Rapp et al., 2021) (Zhu et al., 2022)
Personalized customer service (Chung et al., 2020)	Failures of communication with the client (Massucato, 2023)
Support for service quality (Chung et al., 2020)	Information updating and maintenance in artificial intelligence training (Massucato, 2023)
Business interaction expansion (Lo Presti et al., 2021)	Inability to solve more complex problems and gain a deeper understanding of customer issues (Giebelhausen et al., 2014)
High capacity of information storage, computational power and learning (Chen et al., 2022)	
More agile, personalized, and efficient business and savings for companies (Lo Presti et al., 2021) (Bavaresco et al., 2020)	
Stable service, without the influence of emotions (Chen et al., 2022)	

When implementing chatbots, it is crucial to consider the target audience. As noted by (Misischia et al., 2022), in luxury markets, customers expect highly personalized and exclusive service, making human interaction more relevant and effective. In conclusion, chatbots stand out by providing efficiency, personalization, and automation. When applied appropriately, with a well-defined balance between automated and human service, they have the potential to transform organizational processes and enhance user experiences through innovative human-machine interaction.

1.2 Modern Customer Behavior

The increasing demands of contemporary consumers have driven the widespread adoption of chatbots as a strategic tool to enhance the customer experience. According to (Jiang et al., 2022), customers generally respond positively to chatbot interactions, especially when their need for speed and convenience is met, leading to favorable attitudes and behavioral intentions toward the technology.

Modern society places a high premium on immediacy in commercial interactions, largely due to heightened market competition. (Wang et al., 2022) emphasize that chatbots offer numerous benefits to companies—not only in managing routine customer service but also in more strategic applications, such as identifying optimal moments to trigger promotions. Their study shows that both routine and occasional chatbot usage can positively influence a company's internal and external agility.

A chatbot's ability to understand context, interpret linguistic subtleties, and deliver personalized responses plays a pivotal role in customer satisfaction and in the overall effectiveness of the interaction. (Rese et al., 2020) argue that companies must evaluate how well their communication structure is accepted by customers. Despite advancements in AI, interactions with text-based chatbots often reach limitations quickly, ending prematurely. One proposed enhancement is to adopt voice-based chatbots, which may offer more natural, engaging, and extended conversations.

Furthermore, omnichannel integration has become crucial to meet the diverse communication preferences of today's consumers. The ability of chatbots to navigate seamlessly across various platforms—such as websites, social media, and email—is essential in delivering a consistent and ubiquitous customer experience. (C.-Y. Li & Zhang, 2023) found that chatbots help reduce wait times, respond effectively to customer inquiries, and improve overall service quality, thus strengthening communication processes and increasing value creation.

(C.-Y. Li & Zhang, 2023) also highlight that the interaction between employees and customers significantly affects value co-creation and response quality. When customers comprehend and accept human-AI collaboration, their comfort with automated services grows, enabling faster and more efficient problem resolution. Personalization, another critical element, relies on the chatbot's capacity to understand individual customer needs, history, and preferences. Anticipating customer demands and delivering tailored suggestions greatly contributes to satisfaction and loyalty.

Proactivity is another key characteristic that aligns with the expectations of modern consumers. Chatbots that initiate conversations or offer helpful insights demonstrate a brand's

commitment to customer-centric service. As (Ngai et al., 2021) show, chatbot adoption significantly reduces customer response times, increases accuracy, and minimizes the workload for human agents—resulting in greater efficiency in customer relationship management.

In summary, modern consumer behavior is closely tied to the evolution of chatbot technologies. The extent to which chatbots align with customer expectations—through immediate service, personalization, and proactive support—directly influences their effectiveness in enhancing the customer experience and achieving organizational goals.

3. Methodology

The theoretical part, for the understanding of concepts and analyses of publications related to the topic, was a systematic literature review. Web of Science and Science Direct databases were used, limited to documents from 2019 to 2023. Litmaps was used as support tool, making it possible to identify the "seed maps," which are the most cited articles in other publications and with greater relevance. After understanding the tool to be implemented, action research was developed, based on the implementation of a customized chatbot for a construction company focused on high-end swimming pools located in the city of Goiânia, state of Goiás (Brazil). The steps are shown in Figure 1.

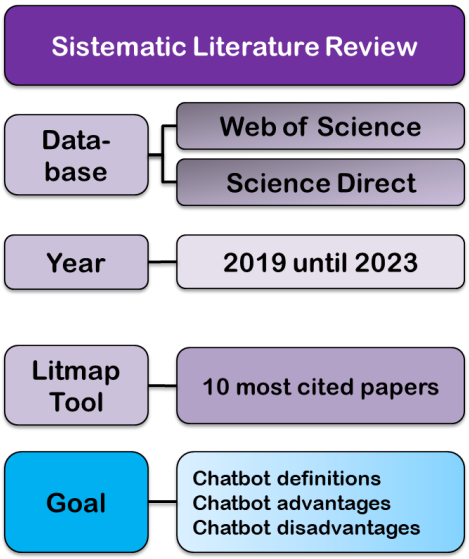

Figure 1. Criteria used in the theoretical stage of the research.

Table 2 shows the ten most cited articles related to the topic under study. Litmaps was used as support tool, making it possible to identify the "seed maps," which are the most cited articles in other publications and with greater relevance. Figure 2 shows an example of this map, in which the nodes represent each related work and the lines represent that one work was cited by another, and the larger the node, the greater the number of citations by other publications. (Sulisworo, 2023) adds that the visual representation provided by Litmaps can also facilitate the identification of significant citations, highlight articles with high impact or nfluence, and identify potential areas for further research in literature review process. In the case of Figure 2 and Table 2, the most cited article was by (Ashfaq et al., 2020)which is even linked to articles from 1989 and current ones, which can be seen in the network formed.

Table 2
The 10 most cited articles related to the topic of the study

Reference	Paper name	Number of Citations
(Ashfaq et al., 2020)	*Chatbot: Modeling the determinants of users' satisfaction and continuance intention of AI-powered service agents*	410
(Rapp et al., 2021)	*The human side of human-chatbot interaction: A systematic literature review of ten years of research on text-based chatbots*	283
(Rese et al., 2020)	*Chatbots in retailers' customer communication: How to measure their acceptance?*	212
(Jiang et al., 2022))	*AI-powered chatbot communication with customers: Dialogic interactions, satisfaction, engagement, and customer behavior*	74
(Ngai et al., 2021)	*An intelligent knowledge-based chatbot for customer service*	73
(Wang et al., 2022)	*How does artificial intelligence create business agility? Evidence from chatbots*	61
(Chen et al., 2022)	*Classifying and measuring the service quality of AI chatbot in frontline service*	60
(Misischia et al., 2022)	*Chatbots in customer service: Their relevance and impact on service quality*	44
(C.-Y. Li & Zhang, 2023)	*Chatbots or me? Consumers' switching between human agents and conversational agents*	28
(Zhu et al., 2022)	*Concrete or abstract: How chatbot response styles influence customer satisfaction*	4

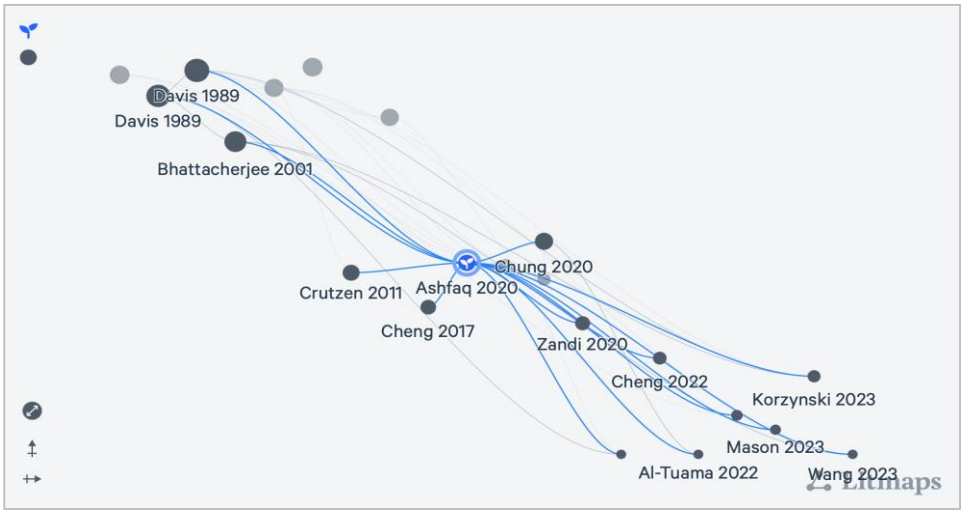

Figure 2. Most cited article according to Litmaps

After understanding the tool to be implemented, action research was developed, based on the implementation of a customized chatbot for a construction company focused on high-end swimming pools located in the city of Goiânia, state of Goiás.

The action research methodology is characterized by the participation of those involved, in which they solve a problem, analyzing data and taking action to change. It also differs from other methods by offering the bases and procedures for the researcher to expand scientific knowledge while intervening in the real environment and finding relevant practical solutions (Tripp, 2005).

Therefore, the action research began with the identification of customer service processes, in which unstructured interviews were conducted with managers to understand customer classification and the main difficulties. Then, meetings were held with the sales team to understand the process of customer acquisition, seeking to develop the conversation flow to be used in the chatbot. In this phase, brainstorming was also used to identify the main tools to be employed and platform for the chatbot implementation. The subsequent stage was dedicated to testing, which lasted two weeks. In the first week, testing took place within the development platform, with message delivery in the same way as in a real environment. In the second week, testing was carried out on the service channel itself, when interactions of 65 customers with the company were simulated, with all possible conversations in the developed flow. Finally, in the

last stage, the results obtained with the chatbot implementation were analyzed; the indicators before and after implementation were compared and the graphs, other visual representations and the feedback received were analyzed. Triangulation was applied through (i) unstructured interviews with sales managers, (ii) customer message logs from August and October 2023, and (iii) observations from simulated customer interactions during testing. This multi-source approach aimed to validate both the technical and experiential dimensions of the chatbot implementation.

4. Chatbot Implementation in the company

4.1 Company profile

The company under study, where the chatbot was implemented, sells high-end residential pools made of fiberglass-reinforced polyester composite material (see Figure 3). The branch is located in Goiânia/Brazil, and the brand, through a wide range of options in finishing, shapes, sizes and accessories, offers several possibilities for those seeking exclusivity and quick installation and stands out positively when compared to a conventional masonry pool, as it offers a longer lifespan, water tightness and safety.

The company has been operating since 1995 in southern Brazil and it is currently present in more than 50 countries, with a turnover of 952 million reais (approximately 160 million dollars) in 2020.

Figure 3. Product of the company studied (Source: company website)

4.2 Customer acquisition and classification

The main customer acquisition process is related to traffic from social networks, whether from a paid traffic strategy or organically. In this way, there is an average weekly acquisition of 30 to 40 new customers, who contact the company's sales team, generating different time criteria, such as:

- Time for customer classification: time in minutes required to classify customers into: customer who does not have purchasing power; end customer (looking for a pool for their project); small builder (purchase limited to 10 pools for their projects); land developer (projects with negotiations for more than 10 pools);
- Time for response to the customer: time in minutes for the first response to the customer;
- Time for service conclusion: time in minutes required to deliver a final quotation to the customer.

When analyzing the customer portfolio served by the company, it was found that the main frequent contacts were land developers that have a longer sales process, requiring detailed attention to large-scale pool sales, generating a large number of messages daily. A filter for this customer type is necessary, since this is an approach different from that one to an end customer seeking to purchase a pool for their project.

Figure 4. Classification of customer types

On the other hand, the service for the end costumer is faster when compared to the time from the beginning of the service to the completion of the sales contract regarding the land developer. In addition, when analyzing the percentage of end costumers with regard to the acquisition of new customers, it is found that it is 80% to 89% of the total, on average. In view

of this great demand from customers seeking a value-added product, it was extremely important to design strategies to improve both the service team and the metrics that seek service quality. In Figure 4, it is possible to understand that the pool acquisition process is classified into B2B and B2C customers.

4.3 Development of conversation flow

Early in the development of the customer acquisition flow, it was identified that a quick and accurate customer classification is essential to determine the most appropriate service approach. To this end, a detailed analysis was conducted with the customer service team. This analysis focused on understanding the main questions customers had; assessing the percentage of those who already had in-depth knowledge of the product; identifying those who were aware of the company's differentials, and discerning those who fit within the logistical limits of delivery. These factors were crucial to an effective customer categorization, thus enabling the provision of personalized and agile service, aligned with each customer's specific needs and expectations.

This understanding of customers not only sped up the classification process, but also brought significant benefits to the service team. With this data in hand, attendants were able to personalize their interactions, approaching customers with information and solutions that directly aligned with their needs and level of knowledge, resulting in more efficient communication, reducing service time, and increasing the chances of conversion. Additionally, by anticipating customer questions and concerns, the team was able to provide proactive responses and solutions, improving the customer experience and increasing satisfaction rates. This data-driven approach also allows the service team to identify trends and patterns, making it easier to adapt strategies and create standardized responses to the most common queries.

4.4 Definition of chatbot platform

The Twilio platform was chosen to implement the chatbot, which represents a significant step in the automation and optimization of customer service. (Chaidrata, 2021) states that Twilio is recognized globally for its robust cloud communication solutions, offering a

versatile platform that is widely used by companies around the world. Its ecosystem allows the integration of various communication features, including voice and instant messaging, making it an ideal choice for chatbot implementation.

According to (Varfa, 2023) the platform allows the chatbot implementation in a practical and commercial manner, and has an environment with tutorials and tests on the main features offered. Therefore, it was necessary to select the packages and tools to solve the existing problems and develop the logic to structure the conversation flow behind the chosen strategy.

4.5 Code programming and service transition

The first crucial step was the logical design of the detailed conversation flowchart, following all the steps of the conversation flow strategically designed to solve problems cited by the study made along with the customer service team. An example of this detailing can be seen in Figure 5, in which the flowchart serves as the backbone for the implementation, structuring all possible paths of interaction with the user. The objective was to simulate various scenarios, including standard responses, no-response situations, and cases of unconventional responses.

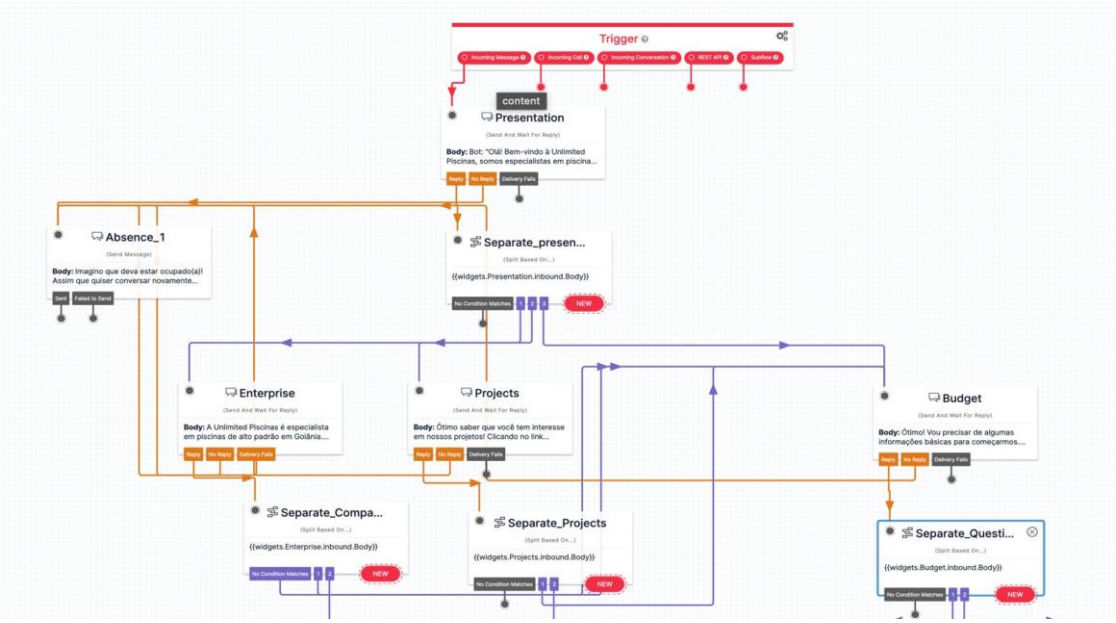

Figure 5. Flow breakdown for chatbot programming

This planning stage was essential to ensure that the chatbot could organize the various dialogue situations effectively, facilitating the flow for the customer to understand the product, thus increasing the chances of a quotation being requested. This process was also important to encourage the customer to answer the questions that would make their rating, generating continuous interaction until they click on the link that will forward them to the sales team.

The structural part of the chatbot implementation (conversation flow programming) is stored on a database on the platform itself, and can be accessed and updated remotely. In this sense, when the customer contacts the sales team, the implemented chatbot acts as an immediate attendant, providing information about the company to the customer, directing them to request a quotation, asking the initial questions that will allow the customer to be rated and generating a link that will provide the customer with service. When implementing the code, for each question asked to the customer, the selected answer is linked to a part of the final link that, when generated, takes the customer to the human attendant's WhatsApp account, and the service will be provided with the team already knowing the information about the customer's interest. The conversation flow was implemented in partnership with the customer service team. Based on knowledge of the contacts made by the company's last customers, standard questions were developed to classify the customer during the service. When the customer clicks on the link provided by the chatbot, a message is generated with the information answered by the user. In this way, the attendant who will provide the service has the customer's classification instantly as soon as they begin to talk to the customer.

4.6 Tests and validations

Chatbot implementation and validation were planned in a structured three-and-a-half-week schedule. The first phase, which lasted approximately one and a half weeks, focused on setting up and development. This period was crucial for configuring the platform, developing the dialogue scripts and integrating the chatbot with existing systems, ensuring that the technological base and conversation logic were aligned with customer service objectives. Then, the following two weeks were for the testing and adjustment phase. During this period, several interaction scenarios with users were simulated to identify and correct any flaws or usability

issues. These tests ranged from standard responses to more complex situations, such as no response or non-standard requests. At the end of this period, the final review and necessary adjustments were carried out, culminating in the finalization and effective launch.

To validate the results, a test was structured over a one-month period to collect message data and structure the metrics collected for comparison.

5. Analysis of results

To assess the changes generated in the customer service sector, a comparative analysis was conducted during two similar periods in terms of days, one before and one after the chatbot implementation. This analysis focused on a quantitative evaluation of the conversations, using specific metrics to measure and compare the service performance.

First, to analyze the metrics, all the messages that the company received from new customers during the period from August 1 to 31, 2023 – a total of 157 new customers – were analyzed. This generated the table in Appendix A, which contains the following metrics:

- Date and time of first message;
- Waiting time for receiving a response (min);
- Time for classification (min);
- Time until proposal delivery (min).

These data were manually analyzed and filled out to develop a comparison, in order to validate a possible improvement in customer service with the chatbot implementation. In this way, it was possible to analyze the waiting time for each customer until receiving the first response. In the case of customer service provided during business hours, it was possible to analyze those interactions occurred outside business hours generated an unusual waiting time. In addition, there were four peaks related to weekend interactions that are only answered on Mondays from eight o'clock in the morning.

The average time for response on weekends was 557 minutes, well above the standard when compared to the daily data in the time list. In this sense, three filter options were developed to help analyze the results. First, the average time for response to the customer, selecting only messages received during business hours, is 16 minutes, leading to the

assumption that if interactions only occurred during business hours, the average time for response would be significantly lower than the total average. Next, the average time for response is analyzed, filtering only interactions that occurred on Saturdays, totaling 2523 minutes (42 hours), and on Sundays, with 1100 minutes (18 hours). Thus, it can be stated that this lack of immediate service on weekends generates points that are very far from the averages on weekdays, which can result in customer dissatisfaction or even in customers giving up on buying.

Another metric analyzed is the average time for customer classification, which is the average time counted from the moment the attendant responded to the customer until the moment they were able to classify such customer, already knowing which and how to pass on the pertinent information. In this manner, the total average time for customer classification is 49.73 minutes, but, when analyzing the table in Appendix A, it was possible to observe that there are points outside the standard; this occurs because such classification depends on the customer's responses, and it is possible that they are not able to carry out the entire response process continuously, then a filter was generated excluding the points above 120 minutes of time for classification, generating a result of 33.22 minutes for the average time for classification with filter.

For a more in-depth analysis of the customer's purchase interest, one also analyzed how long it takes for a complete quotation interaction to occur, in which the customer gets in touch, is classified, and receives their quotation. Therefore, out of a total of 157 customers, 21 received no response (no quotation was delivered), 38 received feedback after 24 hours, 56 received feedback between 12 and 24 hours, and 42 customers received feedback within 12 hours, as can be seen in Figure 6.

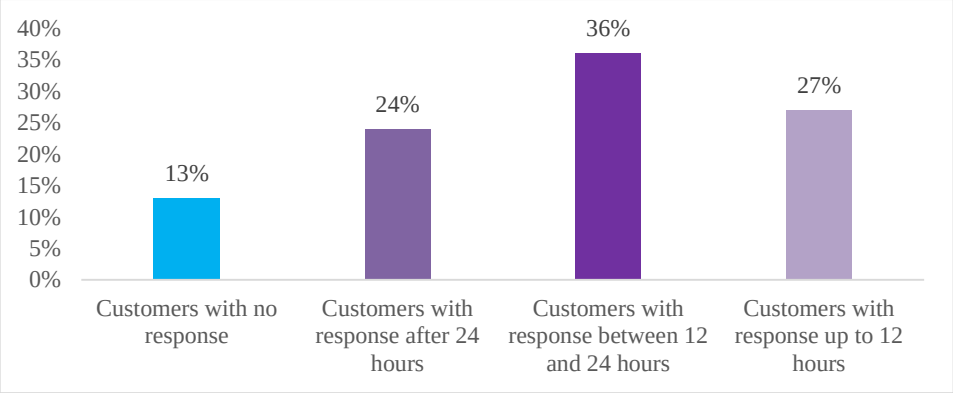

Figure 6. Customer classification according to response

After chatbot implementation, for an effective comparison of the results obtained, the metrics analyzed followed the same patterns before the chatbot implementation. The month of October was also considered in its entirety (from October 1st to October 31st, 2023), with a total of 169 new customers.

With the implementation in operation, the waiting time for receiving a response with the chatbot was analyzed, and the time remained constant (one minute in all interactions), and this is due to the fact that the logic developed seeks that, regardless of the date or time, the response will be automatic and immediate.

When the time for classification was analyzed with the implementation in operation, the average was 10 minutes, both for the total and for the application of the filter, given that if the customer does not respond to the messages for a long period, the chatbot restarts its operation. Therefore, no times outside the standard were verified, and the averages were maintained.

Then, in the customer classification regarding the interaction time until the quotation was returned, of the 169 customers analyzed in the month of August, 10 customers received no response (no quotation was delivered), 29 received feedback after 24 hours, 28 received feedback between 12 and 24 hours, and 102 customers received feedback within 12 hours (see Figure 7).

The chatbot implementation in the customer service structure marked a significant step in the optimization of sales processes. When analyzing the three metrics, that is, time for customer classification; time for response to the customer, and time for service conclusion and customer satisfaction, a notable improvement was observed, especially with regard to the

effectiveness of the sales team. One of the impacted metrics was the time for customer classification, which varied between 10 and 33 minutes, where the shortest time was verified with the use of the chatbot and the longest without its use.

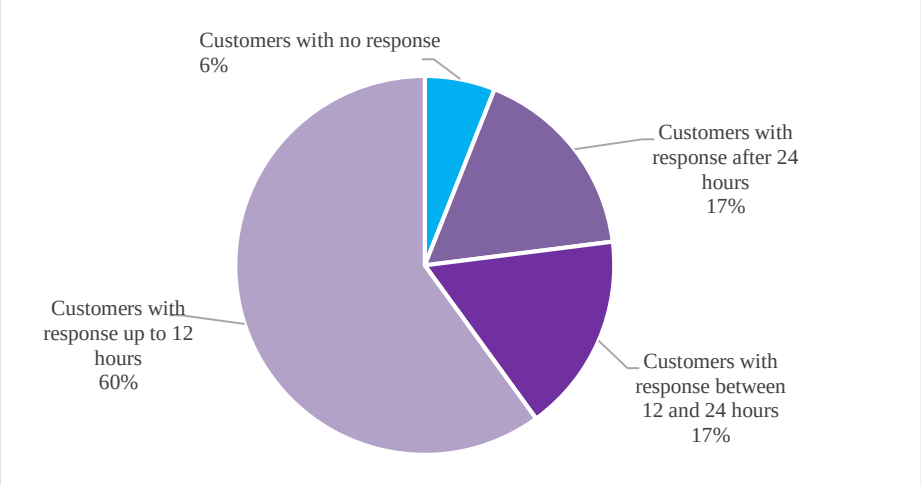

Figure 7. Customer classification according to interaction time

This improvement in time for classification had direct effects on other areas of service. With classification being done more quickly and accurately, a significant reduction in the time for response to the customer was observed, which, in turn, contributed to speeding up the time for service conclusion. These operational improvements had a positive impact on the company's dynamics in relation to directing customer traffic to the appropriate department.

One of the most significant results of the chatbot implementation was the significant improvement in the time for response to the customer. When analyzing the data for the month of August, before the chatbot implementation, it was observed that the average time for response to the customer, considering only business hours, was 16 minutes in the best of situations. After the chatbot implementation, there was a notable transformation, with the average time for response dropping to approximately one minute. This represented a 94% improvement when compared to the period before the implementation.

This reduction in the time for response represents not only a significant operational improvement, but also an important advance in the customer experience. The chatbot allowed

for almost instant service, which is essential in a scenario where speed of response can be decisive for customer satisfaction and sales.

Practical observation revealed that immediate service had a significant impact on customer service. It was noted that, when receiving a response at the exact moment they are interested in making a purchase, customers tend to have a lower dropout rate. After implementation, there was a 52% reduction in the absence rate in conversations, as the number of customers served increased from 42 to 102. The presence of the chatbot may have created a more dynamic environment, encouraging customers to interact more quickly and consistently. This is an important indication that the chatbot not only facilitated initial communication, but also helped maintain customers entertained, thus reducing the likelihood of lost communication or delays in responses.

With the development and analysis of these metrics, the improvement in the management of customer acquisition for the sales team is evident. In this way, the routine became more practical and a standard was structured in terms of communication. The immediate response generated continuity in service and a quick classification, facilitating traffic to the appropriate service and with the approach that best adapts to the selected audience.

It was not possible to concretely satisfy the customer with the chatbot implementation given the few months of test evaluation. There is an approach that needs to be implemented after the end of communication with the attendant. However, with the strategy developed, the chatbot initially participates by providing a form analysis and generating traffic for the attendant. To solve and analyze customer satisfaction and maintain customer service, it is necessary to integrate the chatbot with a CRM platform, making each customer who contacts the company automatically generate data for monitoring all communication.

Table 3
Comparison between metrics analyzed before and after the chatbot

Metrics analyzed	Before	After	Improvement %
Time for response (min)	16.03	1.00	94
Time for classification (min)	33.22	10.23	69
Number of customers with no response	21	10	52
Number of customers with responses within 12 hours	42	102	142

With the final analysis of the results, it became clear that the chatbot implementation in the company's customer service sector generated significant results, and it is possible to see a positive analysis for this type of change and how it can impact contact with customers. In addition, it is possible to verify that there are new types of implementations that can generate positive results in customer service. Table 3 compares the gains obtained.

6. Conclusion

This article aimed to evaluate the impacts of implementing AI in the form of a chatbot in a Brazilian company that sells high-end swimming pools. The main result obtained was a reduction both in the time for response to the customer and in the number of customers with no response, indicators directly related to customer satisfaction. The incorporation of this technology into the company's strategy confirmed existing research in the literature and reinforced the advantages of using chatbot for industries and in the relationship with the end customer.

The differences were the analysis of how these high-end customers, both B2B and B2C, reacted to robotic service, and to respond to the challenge of customers not being left without a response, especially on weekends, which could last more than 48 hours. Research by (Gursoy et al., 2019; Wirtz et al., 2018) had already tested how the implementation of AI-powered technologies, including service robots, chatbots, smart speakers and other intelligent assistants, interacted with customers on the "front line." Nevertheless, analysis of the impacts for B2B and B2C customers had not been performed.

The principle of not responding to the customer and identifying the acceptance of chatbot service by high-end market customers was the main motivation for this research, contributing to expanding the applications of AI technologies beyond complex environments, including banks and healthcare systems (Dwivedi et al., 2023), where preserving data security is a challenge. From the classification of the four types of customers analyzed in the company under study – customer outside the target audience, end customer, little builder, and land developer – the acceptance of the chatbot was greater for the end customer, a new customer that generally invests fewer resources than construction companies and for whom receiving

company's information, product catalog and basic information is already enough, enabling to continue the service in a humanized manner. Therefore, there are differences in the application of AI for different business models and sectors, including for the customer types (B2B or B2C).

The studies analyzed showed that there is no consensus on the unique service (exclusively by chatbot or human), but all point to a hybrid model, in which artificial intelligence has an advantage in providing quick responses, scalability and cost-effectiveness, while the service provided by people offers personalized experiences (Tickoo et al., 2024).

The gains were also for the sales team, given that the reduction in the average time for response to the customer showed a significant improvement of being 16 times faster compared to standard service with interactions during business hours. However, this improvement has even more impact when considering the waiting time on weekends, since without the chatbot the customer would not receive a response for this entire period.

Another indicator that had positive results for the company was the average time for customer classification, which generated a result at least three times faster when compared to manual service. Other possible analyses were also generated with the data obtained, such as the increase in customers who received their quotations within a 12-hour window. This was only possible because the chatbot provides an almost immediate response and allows for faster and more efficient customer classification when the attendant takes over the communication.

The contributions of this research were also related to the evolution of the topic related to chatbots and customer satisfaction, since the combination of hybrid artificial intelligence systems with human service increasingly raises customer satisfaction standards. In addition, the development of this work is still ongoing in the company, where the data analyzed will be effective for updating and maintaining the chatbot and mainly for structuring the CRM for the customer service team.

For future implementation the suggestion is the integration of a CRM system that promises not only the consolidation of customer information, but also a more in-depth analysis of the data, allowing a more detailed understanding of customer needs and behaviors. Furthermore, this work can be replicated for other sectors and thus generate a benchmarking of the relationships between types of industries and their relationships with customer satisfaction,

in addition to cultural issues that may also have an impact, as well as each costume's category and level of demand.

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Appendix A. Customer time data in August 2023

Data can be accessed in https://drive.google.com/file/d/1H7TxfPK-nNEnu-8kkNuUNQ4W5sGLMUbe/view?usp=sharing

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