Article

An Assessment of Digitalization Techniques in Contact Centers and Their Impact on Agent Performance and Well-Being

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Abstract: The role of contact centers in improving the operational efficiency of numerous organizations is of utmost importance. Presently, digitalization technology has enabled contact centers to deliver exceptional customer service and support, while minimizing the adverse impact on agent well-being. Artificial intelligence techniques such as topic modeling and sentiment analysis can aid agents in addressing specific queries, providing real-time support and feedback, and helping them build stronger relationships with customers. This study aims to investigate the advantages of integrating these techniques in the analysis of customer–agent conversations within contact centers. This study examines whether there is a discernible advantage in analyzing customer–agent conversations in real-time and whether it is worth using this type of digitization to enhance agent performance and well-being. Furthermore, this study explores the impact of these technologies on European privacy, business, real-time agent support, the value of conversation data, brand reputation, and customer satisfaction. The results of this study demonstrate the significance of incorporating topic modeling and sentiment analysis into the analysis of customer–agent conversations at contact centers.

Keywords: topic modeling; sentiment analysis; contact centers; agent performance; agent well-being

1. Introduction

The utilization of advanced technologies in contact centers is crucial for businesses aiming to deliver superior customer service and support, which ultimately enhances brand reputation and customer loyalty. The integration of digital technology has significantly increased the efficiency of contact centers in providing exceptional customer service and support while mitigating the negative impact on agent well-being. Automation of contact centers through digitalization has the potential to alleviate the workload of agents by automating mundane and time-consuming tasks. This can lead to improved productivity, resulting in cost savings and environmental benefits, which can contribute to the achievement of sustainability objectives. However, when agent well-being is low, it can lead to a range of negative outcomes, including distractions, absenteeism, and burnout, which can have a detrimental effect on overall performance and lead to increased turnover rates, resulting in the need for more frequent recruitment and training, which can be costly and resource intensive.

The relationship between the welfare of agents and the objectives of sustainability in the contact center is indisputable. When agents are adequately trained, motivated, and provided with support, they become more driven and engaged, resulting in increased productivity and efficiency. This can optimize resources and minimize the environmental impact of the contact center's operations.

Furthermore, there is a close association between the welfare of agents and the management of contact centers. Leaders who prioritize the welfare of their employees are

perceived as more socially responsible and sustainable. This enhances a company's reputation and can lead to increased business opportunities. In essence, the welfare of workers is critical for the sustainability of contact centers. By investing in the development of their employees, contact centers can improve their performance, reduce costs, and build their reputation as socially responsible and sustainable businesses.

Digitalization techniques can enhance the efficiency of contact centers by automating repetitive tasks, thereby allowing human agents to focus on complex issues. This can reduce energy consumption and waste and ultimately contribute to a more sustainable business model. Two techniques, topic modeling and sentiment analysis, have emerged as fundamental tools for contact center agents [1,2]. Topic modeling, which is a text analysis method, uncovers the primary themes within a conversation transcription, whereas sentiment analysis identifies emotional undertones in the language used. The incorporation of these techniques into the analysis of customer–agent conversations within contact centers enables a comprehensive understanding of customer needs and sentiments, equipping companies with the ability to respond more effectively [3].

Topic modeling is an unsupervised data analysis technique designed to uncover the principal themes present within a collection of documents. By detecting recurring themes and employing keyword extraction, this method constructs a mathematical model that handles large amounts of data, thereby enabling the extraction of essential information [4]. Sentiment analysis categorizes text based on expressed sentiments and analyzes language to identify emotional tones or judgments [5]. Its applications extend from understanding customer sentiments regarding products/services to enhancing the interactions between agents and contact center customers, ultimately improving service quality [6].

The incorporation of topic modeling and sentiment analysis in the analysis of customer–agent conversations offers a comprehensive understanding of both the topics covered and the sentiments expressed by customers while simultaneously enhancing companies' ability to evaluate customer needs and opinions [7,8]. These techniques can be utilized to analyze interactions in real-time as well as the tone and emotional content of customer interactions, providing real-time feedback to agents and assisting them in improving their performance and feeling more supported. By doing so, companies can gain a deeper understanding of the types of inquiries that agents handle and the common issues that customers face. This integration not only enhances the efficiency of the contact center agents but also improves the response times and service quality. The information provided by this integration can be utilized in several ways, including:

(i) Enhancing training programs and providing agents with the necessary resources to handle customer inquiries more effectively, such as enabling targeted and timely responses to customer inquiries;

(ii) Addressing critical product- or service-related issues, thereby facilitating swift improvements;

(iii) Analyzing customer interactions and identifying common themes and sentiments can also help agents better understand customer needs, provide more effective support, offer more personalized support, and build stronger relationships with customers;

(iv) Identifying instances where customers and/or agents may be particularly upset or frustrated and providing additional support or training to agents to help them handle these situations more effectively.

The impact of artificial intelligence (AI) on the economic sector of contact centers has been significant in recent years, particularly because of its ability to analyze large volumes of data and provide valuable insights into customer behavior and preferences. Despite the complexity and multifaceted nature of the broader implications of AI in the contact center sector, this study specifically examines the effects of incorporating topic modeling/sentiment analysis in the assessment of customer–agent conversations in contact centers, with a focus on their influence on agent performance and well-being. To achieve this, a comprehensive literature review is conducted, which allows for the identification of the crucial themes and findings necessary for understanding the context. Furthermore, a

real-world case study and novel framework are presented. The case study was conducted in a practical business setting, and the proposed framework provides insights into real-time assistance for contact center agents.

The ultimate goal of this study is to provide thorough insight into the influence of these technologies on businesses and their role in enhancing customer satisfaction and overall business success in terms of agent performance and well-being within contact centers. The results of this study may be of interest to various stakeholders, including contact center managers, policymakers, and researchers in the field.

The remainder of this paper is organized as follows. Section 2 examines the strategies implemented to improve agent well-being, while incorporating topic modeling and sentiment analysis in contact centers. Section 3 discusses the benefits and opportunities of using new technologies in the contact center domain. Section 4 describes a case study conducted in a real contact center in which the agents who participated in the study demonstrated performance levels that surpassed their previous achievements owing to the implementation of the topic modeling/sentiment analysis tool. Section 5 discusses the findings, provides conclusions, and outlines the implications of this research for future studies.

2. Contact Centers and Well-Being of Agents

Call centers were initially designed to handle a high volume of inbound calls from customers seeking assistance or information. However, over time, the role of call center operators has evolved to include outbound calls to customers and to manage and track customer interactions across multiple channels such as email and chat. This evolution has resulted in the emergence of contact centers designed to handle all customer interactions across multiple channels and provide a seamless and consistent customer experience.

In modern contact centers, agents play a pivotal role in managing customer interactions across all channels and providing support and assistance to customers. They are often equipped with advanced technology and tools such as customer relationship management (CRM) software to help manage customer interactions and provide personalized services. The primary responsibility of agents in modern contact centers is to be problem solvers, communication experts, and customer advocates. They are responsible for managing customer inquiries, providing information and support, and resolving problems in a timely, efficient manner. They must adapt to changing customer needs and expectations and continuously learn and develop their skills to deliver the best possible service.

In the domain of contact center operations, the welfare of agents is of paramount importance in fostering a positive relationship between the organization and its customers. It is widely recognized that pleased and gratified agents are better suited to address customer inquiries and promptly resolve issues. Furthermore, they tend to engage in constructive and beneficial interactions with customers, resulting in elevated customer satisfaction and loyalty. Moreover, an agent who is comfortable and supported is more likely to remain in their position, reducing turnover and training expenses for the organization. Consequently, when agents feel valued and stimulated, they are more inclined to perform at their peak and contribute to the overall success of the contact center.

The contact center is committed to the well-being of its agents, which encompasses more than traditional customer services. This dedication is exemplified by the implementation of strategic initiatives to reduce the burden on agents [9]. These initiatives include the utilization of advanced technologies such as sentiment analysis and topic modeling to identify and address genuine customer needs. However, merely equipping agents with cutting edge tools is insufficient. Organizations must invest in comprehensive training programmes to ensure that agents can effectively utilize these tools. Furthermore, respecting customer privacy and adhering to ethical standards in data handling are essential for establishing and maintaining customer trust in contact centers.

In the context of customer–agent interactions in contact centers, a proactive strategy involves the implementation of passive measures aimed at enhancing the overall experience. The utilization of AI-powered chatbots to address standard inquiries automates routine

problem-solving, enabling human agents to concentrate on more intricate issues and preserve their resources. Providing agents with a comprehensive record of customer interactions allows for personalized and efficient services as they can effortlessly access pertinent customer data. Additionally, promoting positive sentiments towards agents is not only a standalone objective; it is also interconnected with broader brand reputation management. In conjunction with efficient problem resolution, a company's dedication to customer satisfaction contributes to brand loyalty and a strong reputation within the market [10].

This comprehensive approach involves a company's efforts to enhance the efficiency of its agents and create a supportive environment that mitigates the negative effects of technostress and technoanxiety. By investing in both technological infrastructure and human resources, the organization aims to optimize its operations and cultivate a positive ecosystem in which customers feel valued and loyal to the brand. The successful implementation of these multifaceted initiatives results in a contact center that is not only adept at resolving issues, but also attentive to the well-being of its agents and the satisfaction of its customers. As illustrated in Figure 1, this approach encompasses strategies for promoting agent well-being and incorporating topic modeling and sentiment analysis into a company's contact centers.
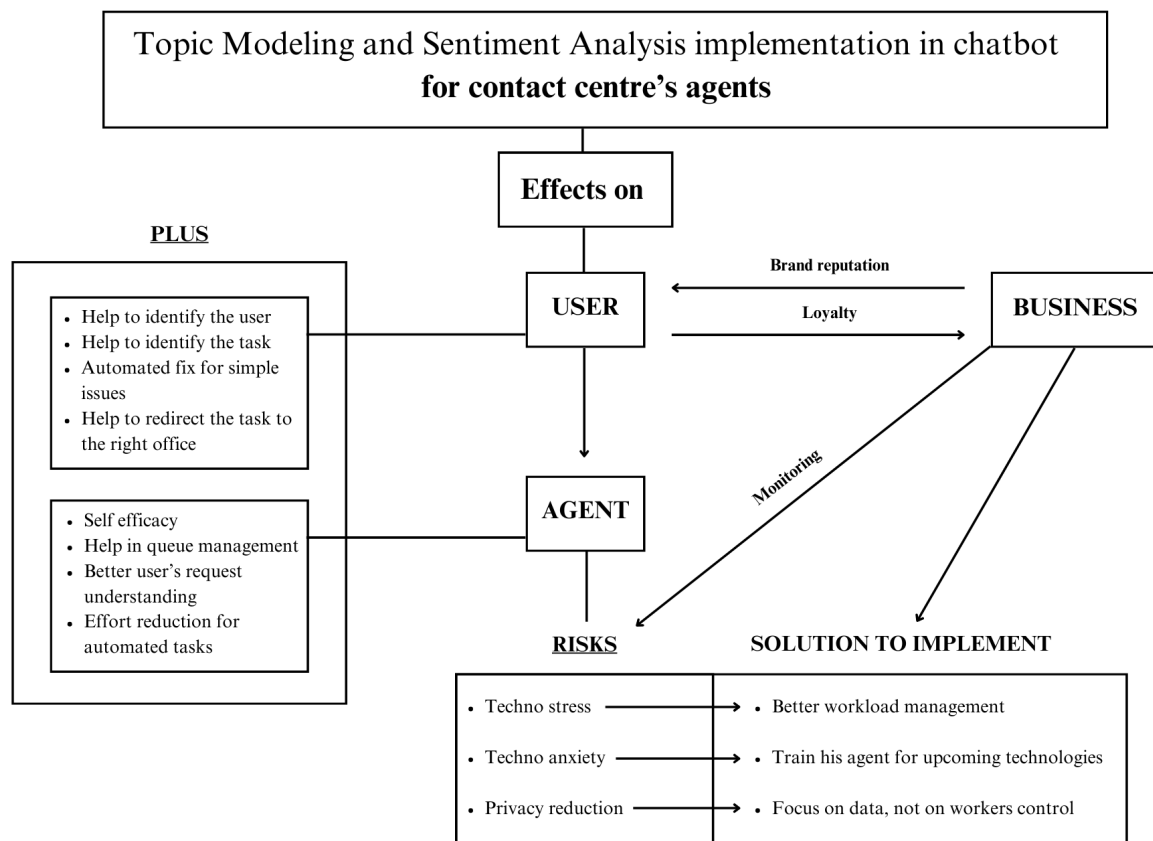

Figure 1. Diagram of the effects of the inclusion of topic modeling and sentiment analysis in favor of the well-being of contact center agents. Our elaboration.

2.1. Enhancing Agent Performance and Well-Being

Contact centers play a vital role as the primary point of interaction between businesses and their customers, presenting an opportunity for companies to establish trust and deliver exceptional services through interactive communication [11]. However, managing conversations in these centers poses a significant challenge for agents, who often handle multiple interactions simultaneously while striving to maintain high levels of customer satisfaction.

In this context, integrating digital technologies, particularly text analysis techniques, is crucial for contact center operations. Techniques such as topic modeling and sentiment analysis can significantly impact agent performance and well-being. Topic modeling automatically identifies key conversation themes [12], whereas sentiment analysis determines the emotional tone of messages by categorizing them as positive, negative, or neutral.

By incorporating these digital tools into the analysis of interactions between agents and customers, businesses can gain a deeper understanding of customer needs, enabling agents to provide personalized services. For instance, sentiment analysis allows for the early detection of dissatisfying or uncomfortable messages from customers and empowers agents to intervene promptly and resolve issues [13].

Furthermore, real-time analysis of conversation transcription enables agents to instantly comprehend the conversation content and respond accordingly. This capability facilitates faster and more accurate responses to customer inquiries, enhances perceived synchronization [14] between agents and overall customer experiences [15], and ultimately elevates satisfaction levels.

2.2. Contact Centers and Customer Trust

The contact center plays a pivotal role as the central nexus connecting a company with its customers, providing a platform for the delivery of high-quality services, and ensuring a nuanced understanding of customer concerns. The trust established within this domain significantly influences the effectiveness of the rendered services. Failure to comprehend customer needs or to provide effective solutions can undermine this trust, prompting customers to explore alternatives.

In light of evolving customer service dynamics, it is imperative for companies to not only prioritize a positive and personalized customer experience [16] but also to integrate with the broader ecosystem of customer complaints and ratings prevalent on social networks [4]. While our previous discussion emphasized the efficiency and quality of service within the contact center, it is crucial to acknowledge the transformative impact of social media on customer service in recent years.

In response to the ever-growing influence of social networks, companies are compelled to enhance their customer service strategies and recognize their pivotal role in business management, marketing, and communication. Acknowledging its correlation with reputation, customer service has become a key element in shaping the overall consideration and valuation of brands, serving as an indispensable component of public relations. It is essential to recognize the interconnected nature of the contact center and the broader social media landscape, with both contributing significantly to the overall perception of a company.

The integration of topic modeling and sentiment analysis, as previously discussed, becomes even more critical in this context. These tools empower agents not only to understand and address customer needs within the contact center, but also to navigate the challenges posed by social media dynamics. Analyzing customer conversations on social networks provides invaluable insights into prevalent issues and sentiments, enabling companies to proactively address concerns and maintain a positive brand image.

In conclusion, the amalgamation of topic modeling and sentiment analysis not only enhances the efficacy and quality of service within the contact center, but also enables companies to navigate and respond effectively to the evolving landscape of customer complaints and ratings on social media. This comprehensive approach fortifies customer trust [17], contributes to brand valuation, and seamlessly aligns with the multifaceted role of customer service in modern business management and public relations.

2.3. Personalization of the Offer

Personalization of the offer represents one of the main objectives of a modern contact center, which can differentiate the customer experience and, therefore, increase customer satisfaction [18] and loyalty to the company [19].

One of the main objectives of modern contact centers is to provide personalized services to customers. This implies tailoring the offer to each customer's specific needs and preferences. Personalization of an offer can lead to increased customer satisfaction, loyalty, and repeat business. By understanding the customer's history with the company, their preferences, and their current needs, a contact center can provide a more relevant and effective offer. This can lead to more efficient and successful customer interactions as well as a better overall customer experience. Additionally, personalization can also help the contact center stand out from competitors and differentiate itself in the market.

Personalization implies in-depth knowledge of the customer, their needs, and preferences and requires careful analysis of the data collected by the contact center. Topic modeling and sentiment analysis can play an important role in the personalization of offerings, enabling the identification of topics of interest to customers and assessment of customer satisfaction with specific products or services [20]. In addition, sentiment analysis can help identify any critical issues or problems encountered by the customer, enabling the agent to take timely action to resolve the situation and improve the customer experience [21].

2.4. Agents' Real-Time Support

Real-time support is a critical domain in which topic modeling and sentiment analysis can profoundly benefit contact center operations. The capacity to analyze ongoing conversations between agents and customers enables proactive support for agents during customer interactions [22,23]. Specifically, topic modeling serves to pinpoint the primary conversation themes, empowering agents to focus on critical aspects and deliver tailored responses to customer inquiries [24].

Moreover, sentiment analysis is invaluable for gauging a customer's mood during interactions, allowing agents to adapt their tones and styles to increase customer satisfaction. Integrating topic modeling and sentiment analysis tools for real-time support has emerged as a competitive advantage for businesses. This integration significantly enhances the customer experience, amplifies customer satisfaction, and fosters loyalty.

This approach not only fortifies customer relations but also directly affects the performance and well-being of agents by providing them with tools to efficiently navigate conversations, respond effectively, and attune their communication to meet customer needs. This aligns seamlessly with the overarching goal of reviewing digitalization techniques and their influence on agent performance and well-being in contact-center settings [25].

The application of integrated topic modeling and sentiment analysis to real-time customer–agent conversations in Italian is illustrated in Figure 2 with regard to a utility company. Italian, with its numerous inflections, conjugations, and declensions, presents a formidable challenge in identifying and extracting topics. Nevertheless, recent advancements in topic modeling and sentiment analysis have facilitated the examination of real-time conversations across multiple languages [2].

In the customer–agent conversation depicted in Figure 2, seven relevant topics are highlighted. Each topic, represented by a word cloud that displays the most frequently used words, allows for quick identification of the most significant themes in the conversation. Furthermore, the agent is provided with a Pareto diagram that depicts the relative importance of different topics in the topic modeling output. The diagram displays the relative importance of each topic, with the largest bar representing the topic that occurred most frequently during the conversation. By examining the Pareto diagram, the agent can promptly identify the most dominant topics in the conversation and gain a better understanding of the text's overall content.

Sentiment analysis is also incorporated into the real-time analysis of customer–agent conversations. This is used to determine the emotional tone of a conversation. It can be utilized to determine whether a conversation is generally positive, negative, or neutral and can also be used to identify specific words or phrases associated with specific emotions.
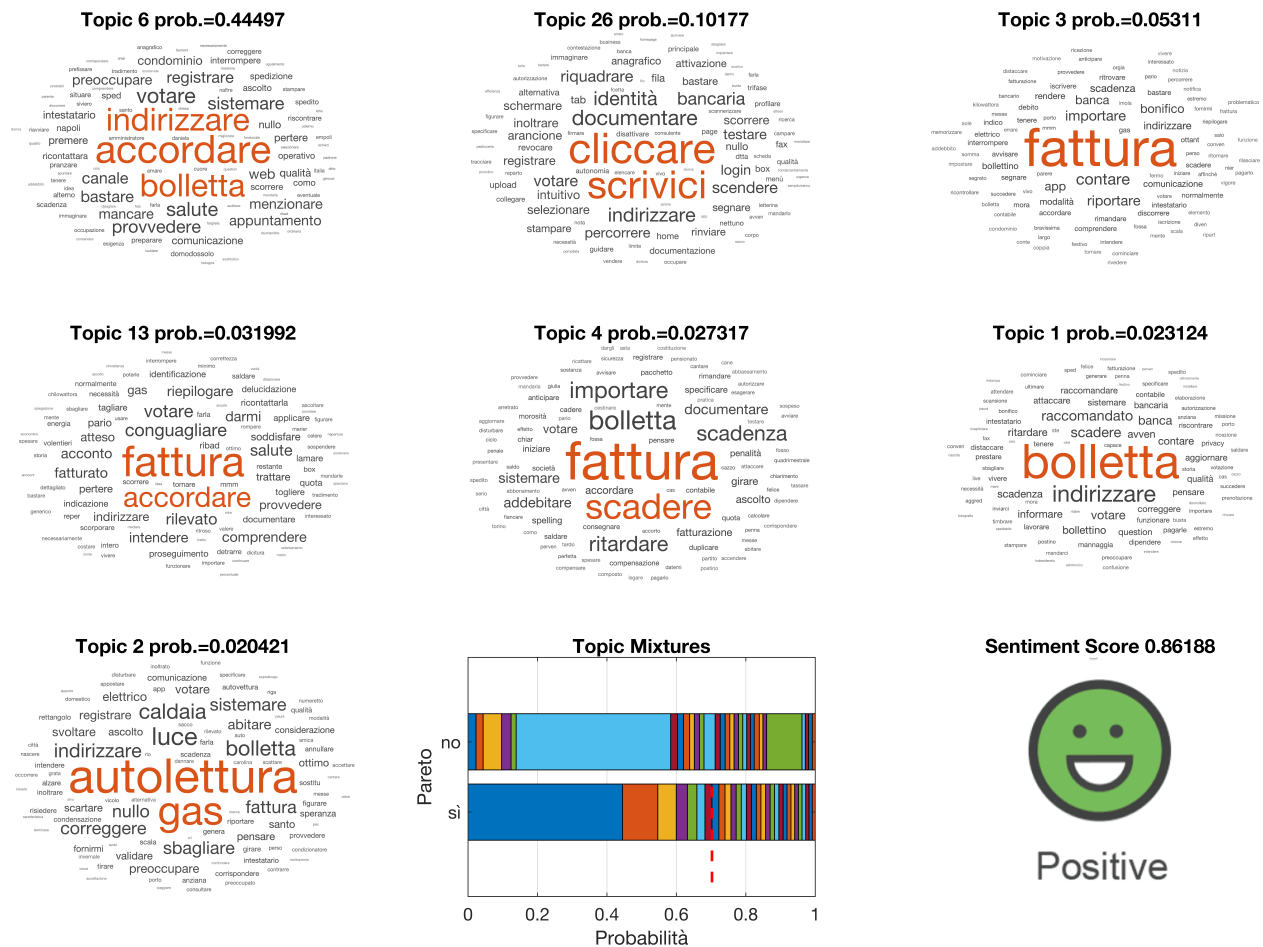
Figure 2. Example of integrated topic modeling and sentiment analysis of real-time customer–agent conversation in Italian natural language. The Pareto Diagram (bottom-middle figure) employs various colors to designate a topic. The red dashed line illustrates that the first seven most significant topics, when considered together, account for a cumulative probability of 70.3% as the central theme of the conversation.

The data depicted in Figure 2 reveal that `Topic 6` is the most prevalent theme in the current conversation, with an estimated probability of 44.5%. This topic is characterized by the Italian words ``indirizzare'', ``accordare'', and ``bolletta'', which translate to "addressing", "grant", and "payment-bill" respectively. The next most prevalent themes were `Topic 26` (probability of 10.2%), `Topic 3` (5.3%), `Topic 13` (3.2%), `Topic 4` (2.7%), `Topic 1` (2.3%), and `Topic 2` (2%). Together, these seven topics accounted for a combined probability of 70.3% as the primary theme of the conversation. The outcome of the topic modeling suggests that the current conversation is focused on address change inquiry, and the emphasis is on modifying the payment bill's address, making it reasonable to infer that the agent should concentrate on addressing this request. Furthermore, a non-negative sentiment score of 86.2%, as opposed to a negative sentiment score of 13.8%, indicates a positive customer mood, suggesting that the agent provides a satisfactory response to the customer inquiry.

2.5. About the Value for the Customer

The significance of customers' feelings understood and supported during their contact center experiences cannot be overstated. Interactions between the customer and the contact center agent often encompass highly emotional and intricate dialogue [26]. Customers express concerns, uncertainties, and frustrations regarding the product or service under

discussion [27]. When agents grasp both the subject matter and sentiment behind customer messages, they can deliver tailored and precise responses that cater to individual customer needs, thereby elevating customer satisfaction and fostering loyalty to the company [28].

From a self-efficacy standpoint, comprehending the sentiments behind customer messages empowers agents to promptly address customer needs, thereby enhancing efficiency and reducing customer wait times [29]. This improvement contributes to increased customer satisfaction and, in turn, an increased probability of continued utilization of the company's services [30].

The ability to interpret customer sentiment is of great value to enterprises as it provides important insights into customer needs, desires, and concerns. This information can be leveraged to enhance products or services offered. For instance, if multiple customers voice similar concerns about a product or service, the enterprise can take appropriate actions to enhance its quality, thereby resolving customer issues and augmenting customer satisfaction. In essence, the value of customers' feelings, as understood by the contact center, is highly significant. Employing a combination of topic modeling and sentiment analysis equips agents with the necessary tools to comprehend customer needs and concerns in real-time, thereby enhancing efficiency and amplifying customer satisfaction.

2.6. Brand Reputation and Customer Satisfaction

Brand reputation [31] is one of the most pivotal elements of any company and reflects the overall perception of the brand within the public sphere. This perception is shaped by a myriad pf factors, including direct customer experience, advertising, communication, and the company's image. Notably, a customer's experience with the company's contact center can significantly influence brand reputation, both positively and negatively [32].

A positive interaction with the contact center can enhance a customer's perception of the brand [33], whereas a negative experience can diminish it. For instance, if a customer encounters issues with a product and reaches the company's contact center for resolution, the inability of the agent to provide a satisfactory solution may lead to customer dissatisfaction and a negative view of the brand. This could erode trust in the brand and potentially result in negative word of mouth [34].

Furthermore, brand reputation can be influenced by the management of personal information. When a customer engages with a company's contact center, they anticipate the safeguarding of their personal information to resolve their issues [35]. Mishandling this information or inundation through unwanted advertising messages can negatively affect a brand's reputation.

To uphold brand reputation, companies must ensure that their agents are equipped to deliver high-quality customer services [36]. This entails providing agents with the necessary tools and resources to swiftly and effectively address customer concerns. In addition, companies can harness digitalization techniques such as topic modeling and sentiment analysis to monitor conversations between contact center agents and customers, identify issues, and enhance service delivery.

Finally, fostering transparency and open communication with customers is important. Clear and open communication policies related to data privacy and use of customers' personal information can cultivate greater trust in a brand and enhance a company's reputation. In summary, a customer's contact center experience has a substantial influence on brand reputation, and companies must take all feasible measures to ensure that they deliver high-quality customer service and handle customers' personal information appropriately [37].

2.7. Queue Management

Contact center queue management significantly influences customer satisfaction. Prolonged waiting times during phone or chat interactions can lead to frustration and diminished customer trust. Hence, it is crucial to efficiently handle queues and offer timely responses to customer inquiries.

The integration of topic modeling and sentiment analysis solutions can aid contact center agents in queue management. Analyzing customer–agent conversations helps identify the most frequent requests and critical issues that require immediate action. This enables agents to act promptly, reduce waiting times, and increase customer satisfaction [38]. However, effective queue management transcends waiting times for a response and requires timeliness and accuracy of the response. Agents need access to the information required to address customer queries quickly and precisely.

The amalgamation of topic modeling and sentiment analysis allows agents to swiftly comprehend the context of customer inquiries and deliver tailored responses. Moreover, these solutions can facilitate queue management by incorporating chatbots and virtual assistants, allowing immediate customer responses and reducing the agents' workload. Consequently, agents can focus on more intricate queries, thereby ensuring high-quality customer services.

Another crucial aspect of queue management is service availability. Customers anticipate access to customer support at all times, even beyond traditional business hours, leading many companies to implement 24/7 customer support solutions. Topic modeling and sentiment analysis solutions are instrumental in supporting this service, consistently ensuring timely and accurate responses [39].

Queue management is pivotal in contact center operations and has a significant impact on customer satisfaction. Topic modeling and sentiment analysis support agents in managing queues and delivering timely personalized services. However, it is imperative to emphasize that response timeliness is not the only crucial aspect of queue management; providing accurate and personalized responses is essential for maximum customer satisfaction.

2.8. Effectiveness of Response and Understanding of the Request

Ensuring the efficacy of a contact agent's response is vital to meeting customer expectations. According to a study conducted by PwC in 2018 [40], 69 percent of customers consider the effectiveness of the response to be one of the most pivotal factors in their contact center experience. This emphasizes customers' desire to understand and receive responses that address their specific needs.

In this context, the incorporation of digitalization techniques such as topic modeling and sentiment analysis is highly advantageous for contact center agents. These techniques enable agents to discern customer requests and craft responses accordingly [41]. Text analysis aids agents in identifying conversation topics and gauging customer satisfaction. Furthermore, sentiment analysis reveals the emotional tone of customers, thereby enabling personalized responses.

For instance, if a customer contacts the contact center to report a technical issue, topic modeling helps the agent identify the subject of the conversation, whereas sentiment analysis reveals whether the customer is upset or frustrated [42]. This enables the agent to deliver a personalized response that considers the customer's emotions, fostering a sense of being understood.

In addition, sentiment analysis [43] helps agents gain a more precise understanding of customer requests. For instance, when a customer inquires about a product return policy, topic modeling identifies the subject of the conversation, and sentiment analysis distinguishes whether the customer seeks to return the product or simply seeks information about the procedure. This allows the agent to provide a more accurate response that effectively satisfies customer requests.

In summary, the effectiveness of responses is paramount for ensuring customer satisfaction, and the integration of digitalization techniques such as topic modeling and sentiment analysis is a valuable tool for contact center agents. It equips customers with a better understanding of customer requests, enabling them to deliver personalized and accurate responses that meet their needs and expectations.

2.9. Data Quality and Its Value

The incorporation of topic modeling and sentiment analysis into the analysis of customer–agent conversations presents a substantial information resource for businesses. These tools facilitate the extraction of concealed meanings and insights from conversation data, which may otherwise remain obscure [44]. Notably, topic modeling automates the identification of prevalent conversation topics, offering immediate visibility of customer issues and concerns. Conversely, sentiment analysis detects the emotional tenor of discussions, encompassing both customers and agents (without encroaching on controlling an agent's work [45]). This information serves as a foundation for companies to enhance service quality and foster a superior customer experience.

For instance, data analysis helps businesses identify recurrent customer-reported issues and empower them to refine their products and services. Furthermore, it enables a better understanding of customer needs, allowing tailored service provisions that closely align with these needs [46]. Ultimately, data analytics assess the efficacy of companies' marketing and communication strategies by offering insights into customer preferences and expectations. Essentially, the integration of topic modeling and sentiment analysis into the analysis of customer–agent conversations signifies substantial economic value for businesses. This integration not only enables service quality enhancements [47] but also leads to a superior customer experience, contributing to a competitive edge in the market.

2.10. Data Usage and GDPR Ethics in Europe

Recording conversations within contact centers can serve as a valuable source of data for enterprises. Nonetheless, it is imperative to consider the requirements of the European General Data Protection Regulation (GDPR), which mandates explicit customer consent for conversation recording and data utilization for marketing purposes. Therefore, companies must implement appropriate safeguards to protect the collected data and ensure that their utilization aligns with their intended purposes. Furthermore, sharing successful instances of data utilization can help enterprises comprehend the economic value of the collected data and refine their data management strategies [48].

For instance, some enterprises harness collected data to identify customer needs and enhance their products and services. Others leverage data to optimize the management of internal resources and processes, resulting in reduced operating costs and increased overall operational efficiency [49]. In all cases, the ethical use of collected data is paramount, respecting customer privacy to uphold trust in the enterprise and guarantee compliance with privacy regulations.

2.11. Framework for Real-Time Operations of Agents

In response to the evolving landscape of contact center operations and the imperative to elevate agent performance and well-being, foster customer trust, and personalize customer interactions, we introduce a holistic framework designed to address these crucial facets. Our proposed framework, illustrated in Figure 3, builds on a foundation of the implementation of topic modeling/sentiment analysis for real-time assistance. The structure encompasses key components such as customer relationship management (CRM), user identification, problem identification, and chatbot integration.

The framework begins with the identification and categorization of user problems, directing them to agents for major issues without automated solutions and utilizing chatbots for minor problems with available automated solutions. We emphasize value to the customer by guiding interactions between agents and users and the judicious integration of automated solutions. Real-time sentiment analysis (SA) and topic modeling (TM) continuously inform the process, allowing agents to adapt to user sentiments and requests on the fly. Simultaneously, the framework prioritizes brand reputation and customer satisfaction, with the understanding that positive interactions contribute to long-term success. Efficient queue management ensures optimal resource allocation and timely responses, contributing to the overall effectiveness of the response and the understanding of user requests.
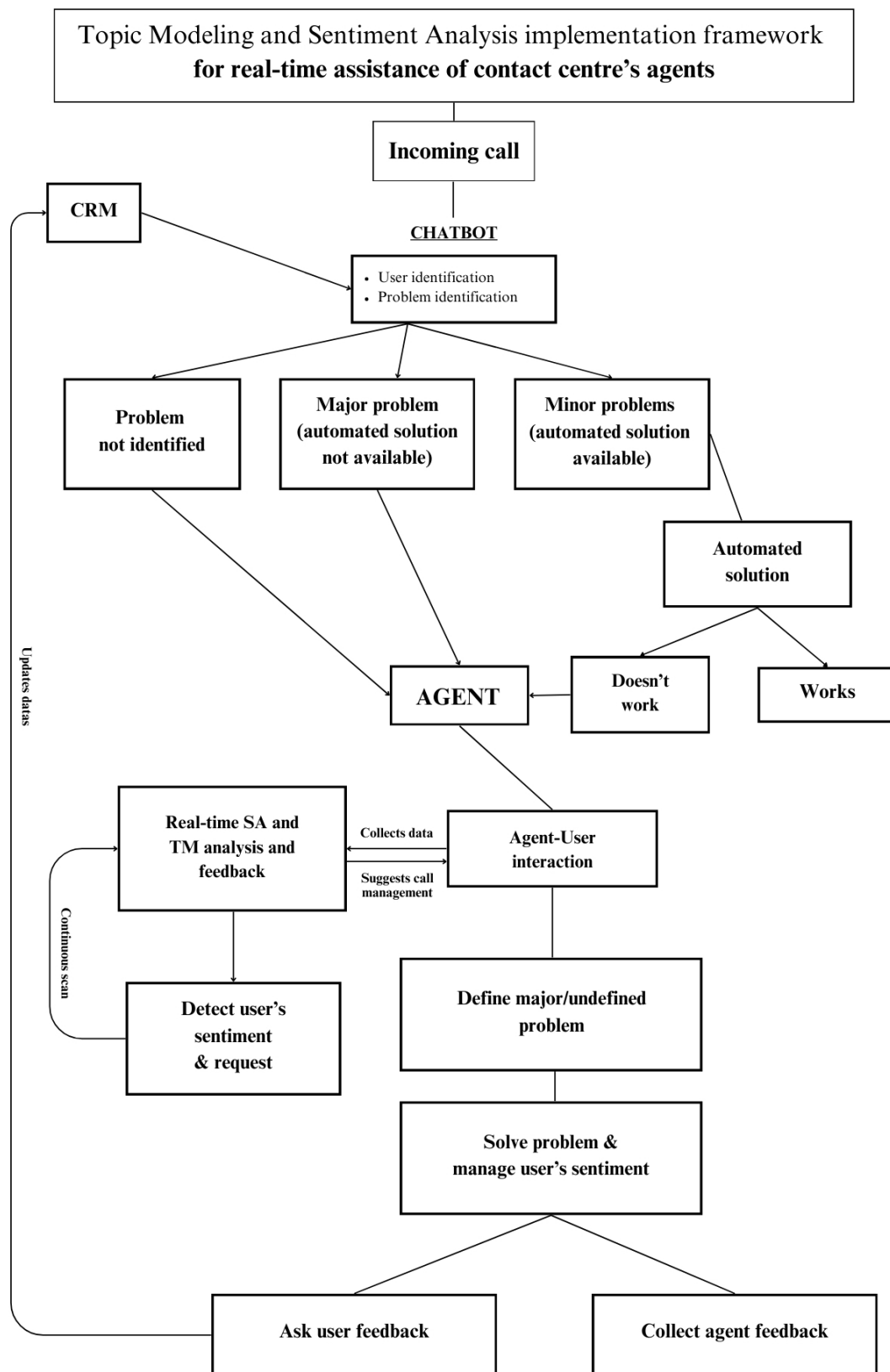
Figure 3. Framework for the implementation of topic modeling and sentiment analysis in customer care agent's support systems. Our elaboration.

This holistic approach ensures a dynamic, adaptive, and customer-centric strategy for real-time assistance in contact center operations, leveraging topic modeling/sentiment

analysis to not only streamline agent performance but also enhance customer satisfaction and fortify brand reputation. The framework's cyclical nature, incorporating user and agent feedback, facilitates continuous improvement in the quality of the service provided.

3. Agent Well-Being

Agent well-being is a vital element [50] that is essential for the optimal functioning of the contact center and the delivery of high-quality services to customers. As advanced technology and automation continue to transform the operation of contact centers, it is becoming increasingly common for employees to experience technostress and technoanxiety. These phenomena arise from the rapid pace of technological advancement [51] and utilization of highly sophisticated tools and devices [52], which often require high technical proficiency and cognitive abilities. These factors can produce stress and anxiety in contact center workers, who are under constant pressure to meet customer expectations and resolve their issues promptly and effectively.

Several issues characterize the phenomena of technostress and technoanxiety.

(i)   Complexity of technology. As technology advances and becomes more sophisticated, it can be challenging for employees to keep up with the new tools and systems. This can lead to feelings of stress and anxiety, especially if they are unfamiliar with the technology, or if there are frequent updates and changes.

(ii) Job security. With the increase in automation, some employees may worry that their jobs are at risk. This can lead to feelings of insecurity and anxiety regarding future employment prospects.

(iii) Pressure to perform. With advanced technology and automation, there are high expectations of productivity and efficiency. This can pressure employees to perform at high levels, leading to stress and anxiety.

(iv) Loss of control. As technology takes over more tasks, employees may feel less control over work. This can lead to feelings of frustration and anxiety, especially if they are unable to easily adapt to new systems.

(v)   Need for ongoing training. As technology evolves, employees may need to receive ongoing training to keep up with the latest tools and systems. This can be time-consuming and stressful, particularly if they feel as if they do not retain information quickly enough.

By being aware of these issues and taking proactive actions to address them, organizations can contribute to creating a more supportive work environment for their employees.

In this context, self-efficacy can be a key factor in the well-being of contact center agents. Self-efficacy is defined as a person's belief that he or she can successfully achieve a specific goal; that is, the confidence an individual has in his or her ability to perform a specific task. A study conducted by Compeau and Higgins [53] showed that contact center agents who exhibit a high level of self-efficacy can handle stress and anxiety situations more effectively than those who exhibit a low level of self-efficacy.

Therefore, the utilization of topic modeling and sentiment analysis techniques within contact centers can provide significant advantages to businesses, enhance the quality of service provided to customers, and enable companies to extract valuable information from interactions. Additionally, the use of advanced tools such as AI-powered chatbots can help reduce the workload of agents, allowing them to focus on more complex and challenging requests. However, it is also crucial to consider the welfare of contact center agents and their capacity to manage the stress and anxiety associated with their work [54]. Adopting advanced text analytics techniques can serve as an effective remedy to boost agent self-efficacy and foster a healthier and more productive work environment.

3.1. New Technologies: Advantages and Opportunities

In the context of contact centers, the introduction of new technologies represents a double-edged sword that profoundly influences the well-being of agents.

The implementation of advanced technology offers several advantages. Workload reduction due to the use of digital technologies relieves agents from repetitive tasks, allowing them to focus on more complex requests. Automation also streamlines the customer journey, improving response times and overall customer experience. In addition, access to detailed workforce information facilitates training and development decisions, providing leadership with an in-depth overview of staff needs and skills [55].

Conversely, job insecurity can arise due to fear that automation renders some tasks obsolete, generating anxiety among workers. Increased monitoring, if excessive, can exert additional psychological pressure on agents. The use of outdated technology may lead to frustration and stress, thereby hindering its operational effectiveness [56].

From a broader perspective, the meaning and satisfaction derived from work can be compromised if automation reduces the perceived utility of agents' skills. Finally, a high-stress environment exacerbated by the implementation of new technologies can contribute to physical and emotional fatigue among agents [57]. Careful management of these factors is crucial for ensuring the successful integration of new technologies into contact centers and maximizing operational benefits without compromising the well-being of agents.

Table 1 provides a detailed overview of how these dynamics manifest and can be managed to create healthy and productive work environments [58]. The table highlights the dual impact of introducing new technologies into contact centers. From a positive perspective, this reveals the transformation of how agents handle daily tasks with a reduction in workload, increased efficiency, and new training opportunities. However, this technological revolution brings about significant challenges including job insecurity, excessive monitoring, the presence of outdated technologies, and a potential impact on the perception of the meaningfulness of work. Prudent management of these aspects is crucial to maximize the benefits of new technologies and mitigate the drawbacks of agent well-being.

Table 1. An overview of the advantages and challenges of integrating digital technologies into contact centers and their relationship with the well-being of agents.

Aspects	Advantages	Challenges
Reducing Workload	- AI chatbots simplify repetitive tasks, reducing agent workload. - Automation guides customers to the right agent, improving request resolution, and reducing wait times.	- Job insecurity may arise as automated tasks can make agent roles obsolete. - Increased monitoring might lead to excessive pressure and anxiety, undermining agents' well-being.
Improving Efficiency	- Internal chat options facilitate real-time communication, increasing operational efficiency.	- The use of outdated technologies may hinder agent effectiveness, generating frustration and stress. - Increased cognitive load associated with learning new tools can lead to burnout if not managed carefully.
Training and Development	- Innovative tools offer detailed insights into workforce needs, facilitating informed decisions. - Continuous training is emphasized as crucial to keep agents aligned with new technologies and industry trends.	- Reduction in job meaning may arise if automation undermines the agents' perceptions of usefulness.
Stress Management	- Stress management techniques enhance concentration, productivity, and agent well-being. - Intelligently empowering agents use AI to filter medical information and empower customers on their health.	- High-stress environments intensified by new technologies may contribute to physical and emotional fatigue.

3.2. The Real Value of Supporting the Contact Center's Agents

It is crucial to address the challenges and strategies related to implementing structures in order to enhance the productivity of contact-center agents in knowledge-based tasks. As highlighted in Thomas H. Davenport's article, "Rethinking knowledge work: A strategic approach" [59], states that two significant challenges arise: the risk of alienating knowledge workers and the potential drawbacks of automation. To mitigate these challenges, it is essential to grant knowledge workers the ability to override automated decisions, which can foster better decision making and reduce resistance. The integration of familiar and easily accessible tools into structured systems can enhance customer acceptance and efficiency. Knowledge workers and executives must understand the functioning of the structured system, enabling them to identify discrepancies and make informed decisions on when to rely on human judgment.

4. A Real Case Study

A case study was conducted to evaluate the performance of 25 telephone agents in a real-world contact center by introducing the support of a topic modeling/sentiment analysis tool to analyze real-time conversations with customers. The study was conducted throughout the entire month of April 2023, and the results were analyzed to determine improvements in personal average handling time (AHT) compared to the first quarter of 2023. This study included low-, medium-, and high-performing agents. The experimental dataset for the case study is summarized in Table 2. The results of the case study are visually represented in Figure 4, wherein panel (a) displays the box plot of the AHT performance prior to and following the use of topic modeling/sentiment analysis and panel (b) shows the output of a paired Student's *t* test with a 90% confidence level. The findings of the case study demonstrate the significance of the reduction in the AHT parameters owing to the use of the topic modeling/sentiment analysis tool. As a result, the participating agents demonstrated superior performance, surpassing previous achievements.

In addition, the study evaluated and quantified two additional performance indicators for the entire operation: first call resolution (FCR), which showed enhancements that, if applied to the entire team of operators, were projected to increase by 5% and customer satisfaction (CSAT), which also increased by 3% if projected onto the entire team.

The results of this case study clearly indicate that the implementation of the topic modeling/sentiment analysis tool led to substantial and noticeable enhancements in various aspects of business performance, including streamlining operational processes and improving overall services provided to customers. These positive outcomes can be attributed to the increased efficiency of operators and elevated intrinsic value of the services offered.
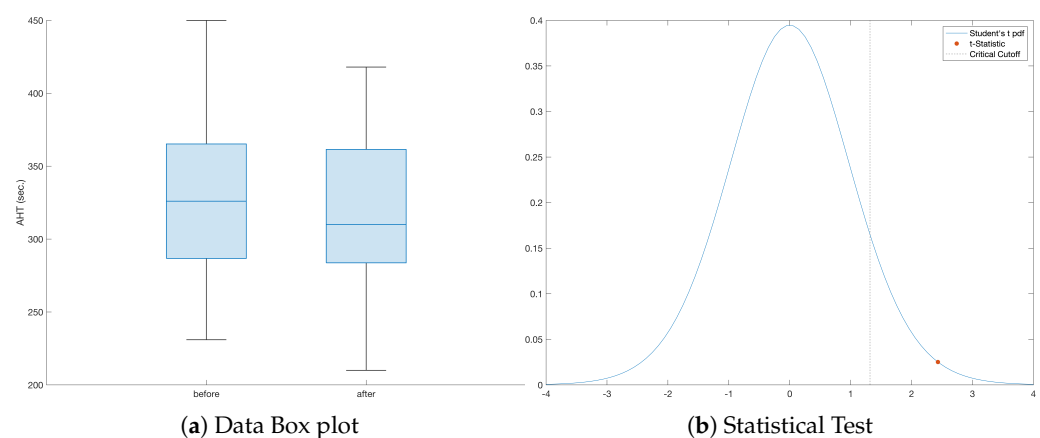

(**a**) Data Box plot

(**b**) Statistical Test

Figure 4. Results of the case study: (**a**) Box plot of the experimental data before and after application of topic modeling/sentiment analysis tool. (**b**) Paired Student's *t* test at the 90% confidence level.

Table 2. Average handling time (AHT) in seconds and percentage variation in AHT.

Agent	AHT before	AHT after	Variation
1	231	210	−9.1%
2	239	220	−7.9%
3	244	242	−0.8%
4	255	250	−2.0%
5	283	277	−2.1%
6	286	280	−2.1%
7	287	293	2.1%
8	288	285	−1.0%
9	293	293	0.0%
10	307	310	1.0%
11	310	307	−1.0%
12	321	324	0.9%
13	326	293	−10.1%
14	327	296	−9.5%
15	330	327	−0.9%
16	335	332	−0.9%
17	338	345	2.1%
18	347	354	2.0%
19	365	369	1.1%
20	366	359	−1.9%
21	393	393	0.0%
22	410	418	2.0%
23	412	416	1.0%
24	432	393	−9.0%
25	450	404	−10.2%

5. Conclusions

Customer experience within the contact center is a pivotal facet influencing brand reputation and overall business success. The adoption of advanced techniques, including topic modeling and sentiment analysis, aids agents in comprehending customer needs and offers timely and effective responses [60]. Moreover, the question of analyzing contact center agents' conversations in real-time creates pertinent considerations, such as implementing real-time support tools and effectively managing queues, which are pivotal for enhancing customer experience within the contact center, consequently benefiting the company [61].

However, the significance of the well-being of contact center agents cannot be understood when determining enterprise success. Technostress and technoanxiety substantially affect the agents' self-efficacy, thereby influencing their ability to navigate stressful situations. Therefore, while evaluating agents' performance, enterprises must prioritize agents' well-being by mitigating friction points in customer–agent relationships, addressing technological stress, and integrating psychological support and training programs to foster a positive work environment [62].

Moreover, recording and analyzing conversations can provide valuable insights into enhancing service quality and optimizing internal processes. Compliance with data privacy regulations, such as GDPR, and ensuring data utilization solely to enhance the customer experience are essential considerations.

Ultimately, the customer's experience within the contact center is inextricably linked to brand reputation. Positive experiences lead to increased customer loyalty and brand advocacy, whereas negative experiences erode trust and negatively impact reputation. Therefore, companies must invest in agent training, advanced tools, and a positive work environment to provide exceptional customer experience, as highlighted by Kumar et al. [63].

In summary, customer experience within the contact center significantly shapes enterprise success and necessitates continual attention. Embracing advanced techniques, prioritizing agent well-being, leveraging collected data to refine internal processes and ser-

vice quality, and vigilantly monitoring brand reputation are vital components to ensuring a positive and successful customer experience [64] for the enterprise.

Implications for Future Research

In the evolving landscape of technological advancement, there is a growing need to enhance real-time support systems to comprehend customers' social priorities and behaviors [65]. Future advancements in this domain could focus on integrating the perceived synchrony of customer interactions with newly acquired psychological characteristics [66] to significantly increase the efficacy of real-time support tools.

Analyzing customers' psychological characteristics enables support agents to gain deeper insights into the social situations in which customers navigate, thereby facilitating the delivery of more personalized support. For instance, when a customer experiences heightened stress levels, an agent armed with the suggested lexicon can employ strategies to alleviate stress, thereby enhancing the overall customer experience. Furthermore, the integration of perceived synchrony holds the potential to further optimize real-time support tools. Perceived synchrony gauges the extent to which customers feel that the support aligns with their expectations and needs. By factoring in perceived synchrony, support agents can ensure the delivery of highly effective support and foster greater customer satisfaction and loyalty.

However, seamless integration of psychological characteristics and perceived synchrony into real-time support systems requires addressing several challenges. A major challenge is the collection of accurate and meaningful data on customer psychological characteristics. This requires the development of innovative data collection methods and tools along with a profound understanding of the factors influencing customer behaviors and decision-making processes [67].

Another critical challenge is to uphold ethical and responsible data practices. This involves the implementation of stringent data privacy regulations and a commitment to employ data solely to enhance the customer experience, refraining from illicit purposes.

Notwithstanding these challenges, the potential advantages of incorporating psychological characteristics and perceived synchrony into real-time support systems are significant. By comprehending customers' social priorities and behaviors, support agents can provide more effective and personalized assistance [68], thereby fostering greater customer satisfaction and loyalty. Furthermore, aligning support with customer expectations and needs can bolster brand reputation, and ultimately drive business success.

Future research in this domain will likely focus on the development of innovative methods for collecting and analyzing data on customers' psychological characteristics, along with exploring novel approaches for integrating perceived synchrony into real-time support systems. Additionally, there will be increased emphasis on ensuring that support agents are well prepared to navigate the challenges of real-time support and receive adequate training and resources to excel [69].

The integration of psychological characteristics and perceived synchrony into real-time support systems has the potential to significantly amplify the efficacy of support tools and enhance the overall customer experience [70]. As organizations continue to invest in these technologies, it is crucial to prioritize ethical and responsible data usage while equipping support agents to meet customer needs in real-time.

Lastly, it would be beneficial to explore the concept of universal ethics by evaluating agent–user conversations in a manner that goes beyond mere adherence to regulations. By conducting such an analysis, we can expand the discussion on ethical practices in the utilization of chatbot technologies, offering perspectives that extend beyond the current emphasis on GDPR in both Italian and European contexts. Examining the ethical implications of these interactions through a more inclusive lens may provide valuable insights that can contribute to the establishment of global ethical guidelines.

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