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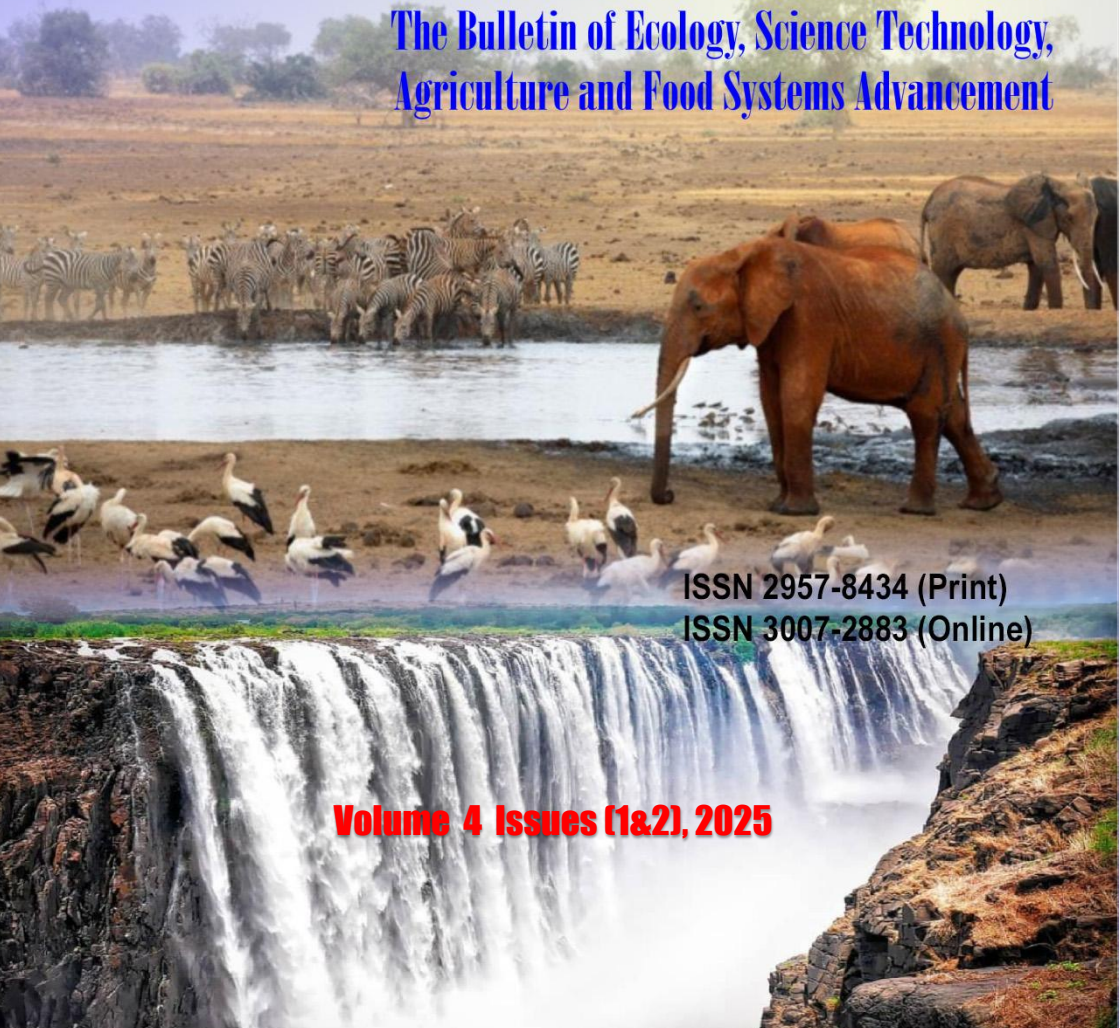

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THE IMPACT OF NATURAL LANGUAGE PROCESSING IN ENHANCING CUSTOMER EXPERIENCE IN THE BANKING INDUSTRY OF ZIMBABWE

TAPIWA TAKUNDWA[1], THANKS HONDOMA[2] AND AUDREY N. BOWORA[3]

Abstract

This study investigates the impact of Natural Language Processing (NLP) on enhancing customer experience within the Zimbabwean banking industry. Employing a mixed-methods approach with a survey of 385 customers and interviews with bank officials, the research assesses the adoption, effectiveness and challenges of NLP technologies like chatbots and virtual assistants. Quantitative results indicate that NLP users reported significantly higher customer satisfaction scores and a 30% improvement in response times, compared to non-users, demonstrating NLP's efficacy in streamlining service delivery. However, first-contact resolution rates remained similar between groups, suggesting complex issues still require human intervention. Qualitative findings reveal significant implementation barriers, including high costs, a shortage of skilled personnel and integration challenges with legacy systems. Despite these hurdles, the study concludes that NLP holds substantial

1 Midlands State University Department of Information and Marketing Sciences, Zimbabwe, https://orcid.org/0009-0007-5716-9287 , takundwat@staff.msu.ac.zw,
2 Midlands State University Department of Information and Marketing Sciences, Zimbabwe https://orcid.org/0009-0000-4543-1742 hondomat@staff.msu.ac.zw
3 Zimbabwe Ezekiel Guti University Department of Economics Business Intelligence and Entrepreneurship, Zimbabwe, https://orcid.org/0009-0008-1740-9976 audreybowora@gmail.com

potential for improving operational efficiency and customer engagement in Zimbabwe. It recommends strategic investments in localized NLP solutions, capacity building and supportive policy frameworks to overcome existing challenges and fully leverage NLP for financial inclusion and competitive advantage in an evolving digital landscape.

Keywords: Customer Satisfaction, Digital Transformation, Financial Inclusion, Service Delivery, Operational Efficiency, Technology Adoption.

Introduction

The banking sector in Zimbabwe has been undergoing significant transformation, particularly in the context of digitalisation, amid economic challenges and evolving customer expectations. Despite the adoption of various technological innovations, customer experience in Zimbabwean banks remains suboptimal, marked by delays, inefficiencies and limited access to personalised services (Mhuriro, 2020). These challenges are exacerbated by infrastructure limitations and inconsistent service delivery across urban and rural settings. As banks strive to remain competitive and responsive, leveraging digital solutions, particularly in customer service, becomes essential for long-term sustainability and customer loyalty.

Globally, Natural Language Processing (NLP) has emerged as a revolutionary tool in the banking industry, facilitating customer interactions through chatbots, virtual assistants and automated customer support systems. NLP enables real-time communication between customers and banks, enhancing response times, improving service personalisation and reducing operational costs (Makudza, Jaravaza and Makandwa, 2024). For instance, international banks utilise NLP-driven chatbots for query resolution, fraud detection through language pattern analysis and sentiment analysis to gauge customer satisfaction levels. The integration of such intelligent systems has been linked to higher customer engagement and loyalty.

Customer satisfaction is a crucial determinant of success in the financial services industry, where trust and reliability form the foundation of

customer relationships. As such, ensuring seamless and efficient service delivery directly influences customer retention and profitability (Chingwaro, Muchowe and Njaya, 2024). The ability of banks to meet customer needs promptly and effectively through innovative technologies such as NLP, can significantly enhance the overall service experience. Particularly in emerging markets, where physical access to banking services may be limited, digital tools serve as vital alternatives to traditional banking models.

Objectives

1. To assess the current level of NLP adoption in Zimbabwean banks.
2. To evaluate the impact of NLP technologies on customer satisfaction.
3. To explore challenges and opportunities in implementing NLP solutions.
4. To recommend strategies for enhancing customer experience using NLP.

Hypotheses

- **H1:** NLP significantly improves customer service efficiency in Zimbabwean banks.
- **H2:** Customers show higher satisfaction with NLP-enabled banking solutions.
- **H3:** The adoption of NLP in banking faces major technological and infrastructural challenges in Zimbabwe.

Literature Review

Barriers to NLP Adoption in the Banking Sector

One of the most significant barriers to the adoption of NLP in banking, particularly in emerging markets, is the high initial cost of implementation. Developing, customising and deploying NLP systems require substantial investment in both software and hardware

infrastructure. This includes expenses related to acquiring advanced AI models, data storage systems and integrating these technologies with existing banking platforms (Kshetri, 2021). For many banks, especially in developing economies, these upfront costs are prohibitive, limiting their ability to invest in such innovations despite the potential long-term benefits. Furthermore, ongoing costs related to system maintenance, updates and customer support add to the financial burden, making NLP adoption a considerable strategic decision rather than a simple technological upgrade.

Closely related to financial barriers is the issue of technological readiness and the availability of skilled labor. Effective deployment of NLP requires not only robust IT infrastructure, but also access to specialised skills in AI, machine learning and data science (Ofori-Atta and Mensah, 2021). In many countries, particularly in Africa and parts of Asia, there is a shortage of professionals with the expertise needed to develop, manage and optimise NLP systems. This skills gap forces banks to either invest heavily in training existing staff or to outsource these functions, which can further increase operational costs. Moreover, limited access to reliable internet and digital infrastructure hampers the ability of banks in less developed regions to fully exploit the potential of NLP technologies.

Regulatory and compliance concerns also present significant obstacles to NLP adoption in financial services. Banks operate in highly regulated environments where customer data protection, risk management and service transparency are strictly monitored (Deloitte, 2020). NLP systems, particularly those involving automated decision-making, must comply with various legal frameworks such as data protection laws and AI ethics guidelines. In many jurisdictions, there is still a lack of clear regulations regarding the use of AI in financial services, leading to uncertainty and hesitation among banks (Gonzalez and Kingsbury, 2022). Institutions fear potential legal repercussions if AI systems, including NLP tools, make errors that affect customers, especially in contexts where regulatory bodies are still catching up with technological advancements.

Finally, data privacy and security issues are critical concerns in the adoption of AI and NLP technologies in banking. NLP systems rely heavily on vast amounts of customer data to function effectively, which raises significant risks regarding data breaches and unauthorised access (Sharma and Chen, 2021). Banks must ensure that NLP tools comply with stringent data protection standards, such as the General Data Protection Regulation (GDPR) in Europe or equivalent laws in other regions. Additionally, the use of cloud-based NLP services introduces third-party risks, as banks must trust external providers with sensitive information. Ensuring end-to-end encryption, secure data storage and transparent data handling policies is essential, yet often complex and costly, further complicating the decision to implement NLP solutions.

The Zimbabwean Banking Context

Zimbabwe's Information and Communication Technology (ICT) infrastructure has experienced gradual development over the past decade, with significant investments made to enhance connectivity and digital access. However, despite progress, the country still faces considerable challenges in achieving widespread, reliable internet access, especially in rural areas (Chigora and Guzura, 2020). According to the Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ), internet penetration stood at approximately 61% by 2023, reflecting steady growth but still lagging behind other African nations such as Kenya and South Africa (POTRAZ, 2023). This limited infrastructure affects the scalability of advanced digital technologies like NLP, which require stable and fast connections for real-time processing and interaction.

Mobile banking and digital finance have emerged as vital components of Zimbabwe's financial ecosystem, driven largely by mobile money platforms such as EcoCash. Due to cash shortages and economic instability, the use of mobile financial services has surged, with over 80% of the population relying on mobile platforms for every-day transactions (Munyoro and Munyoro, 2021). Banks have increasingly integrated mobile banking solutions, offering basic services such as fund transfers, bill payments and account management. However, the integration of sophisticated AI technologies, including NLP, remains

limited, as most institutions prioritise foundational digital services. The growing demand for more responsive and personalised digital experiences presents a significant opportunity for banks to explore NLP-driven innovations to enhance customer engagement and service efficiency.

The regulatory environment in Zimbabwe is evolving, with government initiatives aimed at promoting digital transformation in financial services. The Reserve Bank of Zimbabwe (RBZ) has introduced guidelines to support the adoption of fintech, encouraging innovation, while emphasising the need for security and consumer protection (RBZ, 2021). However, there remains a lack of specific regulatory frameworks governing the use of AI and NLP, creating uncertainty for banks considering these technologies (Chitimira and Ncube, 2021). Moreover, compliance with global standards, such as data privacy and cybersecurity, is still developing, which further complicates the adoption of NLP. Policymakers have acknowledged the potential of AI in economic growth and have included ICT development in national strategic plans, though more targeted policies are needed to accelerate AI adoption in banking.

Zimbabwean banks face unique challenges and opportunities in adopting NLP technologies. Among the key challenges are limited financial resources, inadequate technical expertise and inconsistent ICT infrastructure (Dube and Gumbo, 2022). Yet, the country's high mobile penetration rate and the population's growing familiarity with digital financial services create a promising landscape for innovation. Banks have the chance to leverage mobile-based NLP solutions tailored to local languages and contexts, potentially overcoming some infrastructural barriers. Furthermore, partnerships with local tech firms and international fintech providers could enable cost-effective NLP implementations. As customer expectations for efficient and personalised services continue to rise, Zimbabwean banks that invest strategically in NLP, may gain a competitive edge in the region's rapidly evolving financial landscape

In the Zimbabwean context, several issues pose barriers to optimal customer service. These include limited internet penetration in rural areas, low digital literacy and a lack of robust ICT infrastructure to support advanced technologies like NLP (Ncube, Chinakidzwa and Mushayavanhu, 2025). Moreover, economic instability often restricts banks from investing heavily in innovative solutions, thereby affecting service delivery. However, with the increasing adoption of mobile banking and digital platforms, there is a growing need to explore NLP's potential in bridging these service gaps and democratising access to banking services.

The application of NLP in Zimbabwe's banking sector holds immense potential in improving efficiency, enabling personalised customer interactions and expanding service reach. By automating routine inquiries, analysing customer feedback in real-time and providing 24/7 service availability, NLP could transform the customer service landscape in Zimbabwean banks. As the global banking industry continues to evolve, the successful integration of NLP technologies may be pivotal in repositioning Zimbabwe's financial institutions to meet modern customer expectations effectively.

The Oretical Framework

This study is underpinned by an integrated theoretical framework that combines the Technology-Organisation-Environment (TOE) Framework and the Technology Acceptance Model (TAM). This combined lens provides a holistic structure for understanding the adoption, implementation and impact of Natural Language Processing (NLP) technologies in the Zimbabwean banking sector.

Technology-Organisation-Environment Framework

The Technology-Organisation-Environment Framework, as established by Tornatzky and Fleischer (1990), provides a foundational structure for analysing technological innovation adoption by positing that the process is influenced by three interconnected contexts: technological, organisational and environmental. This framework is highly applicable for understanding the drivers and barriers of NLP adoption in Zimbabwean banks. The technological context, which encompasses

relevant internal and external technologies, is examined through the perceived benefits of NLP, such as improved service efficiency and higher customer satisfaction—hypotheses that represent the innovation's relative advantage. This context also incorporates technological challenges, including high implementation costs, inadequate technical infrastructure and integration complexities with legacy systems, which align with the framework's constructs of compatibility and complexity. The organisational context, involving firm characteristics and resources like size and human capital, is directly investigated through qualitative interviews with bank officials focusing on strategic motivations and internal barriers. The environmental context, which includes industry structure, regulatory frameworks and supporting infrastructure, is analysed through the explicit examination of the Zimbabwe's regulatory environment.

Technology Acceptance Model

While the TOE framework explains adoption at the organisational level, the Technology Acceptance Model (Davis, 1989) is used to understand the impact at the individual (customer) level. TAM suggests that two key beliefs — Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) — determine an individual's intention to use a system, which leads to actual usage.

The study employs the Technology Acceptance Model (TAM) construct of PU, defined as the degree to which a person believes that using a system would enhance their performance, to understand customer adoption. This is directly measured through the hypothesis that NLP improves customer service efficiency and leads to higher customer satisfaction. The quantitative metrics of response time improvement and satisfaction scores are direct operationalisations of these perceived benefits, which drive customer acceptance and use of NLP-enabled services. Furthermore, the construct of PEOU, which refers to the belief that using a system would be free of effort, is indirectly addressed. The study touches upon PEOU through external variables like challenges in digital literacy and infrastructure that can hinder this perception. The concept of first-contact resolution also indirectly relates to PEOU. An

NLP tool's inability to resolve an issue easily would be perceived as difficult to use, requiring additional customer effort.

The TOE framework explains why and how Zimbabwean banks decide to adopt (or not adopt) NLP technologies, addressing the third hypothesis (H3). The quantitative findings on customer satisfaction and response times then feed back into the TOE's technological context as evidence of the innovation's relative advantage, potentially influencing future organisational decisions.

Simultaneously, TAM explains why customers respond positively to this technology (as confirmed by supporting H1 and H2), based on their perception of its usefulness in delivering faster, more satisfactory service.

Methodology

Research Design

This study employs a mixed-methods research design, combining quantitative surveys and qualitative interviews to gain comprehensive insights into the impact of Natural Language Processing on customer experience in Zimbabwean banks. Mixed methods provide a robust framework for triangulating data, enhancing the validity and reliability of findings (Creswell and Plano Clark, 2018). Quantitative data collected through structured surveys allowed for statistical analysis of customer satisfaction levels, response times and perceptions of NLP tools, while qualitative interviews with bank employees provided depth and context regarding the strategic implementation and challenges of NLP in banking. The integration of both approaches ensured a holistic understanding of the research problem. The research targeted both banking institutions and customers, recognising that effective NLP adoption and its impact on customer experience could be assessed only through perspectives from both sides. While customer surveys focused on service interaction, satisfaction and preferences, interviews with bank staff — particularly in IT, customer service and managerial roles — explored institutional readiness, technology use and operational insights (Bryman, 2017). This dual focus aligned with contemporary

research in financial services, where customer-centricity and technological capability were analysed in tandem to assess service innovation (Venkatesh *et al*., 2022).

Opulation

The target population for this study included bank employees involved in key operational and strategic functions, specifically those in IT, customer service and management roles. These individuals were directly engaged with the adoption, use and oversight of NLP tools within their respective institutions. IT personnel managed the technical aspects of NLP systems, ensuring functionality and integration with existing platforms. Customer service staff offered insights into how these tools affected client interactions, while managers provided strategic viewpoints on cost-effectiveness, customer satisfaction and long-term goals (Ofori-Atta and Mensah, 2021). Including a range of employees from banks of various sizes and technological capacities allowed for a well-rounded understanding of how internal factors shaped the deployment and impact of NLP in Zimbabwe's banking sector (Dube and Gumbo, 2022). In parallel, bank customers from both urban and rural areas formed a crucial part of the study population, offering diverse perspectives on service delivery and digital interaction. Urban customers, typically more exposed to digital banking and AI-driven services, provided valuable feedback on the efficiency, accessibility and personalisation offered by NLP tools. Conversely, rural customers faced different challenges, including limited access to ICT infrastructure, which influenced their experiences and satisfaction with such technologies (Chikandiwa, 2021). By capturing feedback from a demographically and geographically varied customer base, the research evaluates whether NLP solutions effectively met the needs of all customer segments and contributed to improving financial inclusion in Zimbabwe (Munyoro and Munyoro, 2021).

Data Collection Instruments

To gather quantitative data, the study employed structured questionnaires, designed using a Likert scale to measure key dimensions of customer experience, including satisfaction, responsiveness and interactions with NLP tools. Likert scales were

particularly effective in capturing the intensity of respondents' attitudes and perceptions, providing a standardised method for assessing customer views across different service dimensions (Joshi *et al*., 2015). The questionnaire included items such as customer satisfaction with chatbot responsiveness, perceived personalisation of services and overall ease of using AI-driven platforms. These structured instruments enabled the collection of numerical data that could be statistically analysed to identify trends, correlations and differences, among various customer groups, particularly between urban and rural populations. For the qualitative component, semi-structured interview guides were used to collect insights from bank officials, focusing on their experiences with the implementation and management of NLP technologies. These guides included open-ended questions on topics such as technological readiness, strategic objectives for adopting NLP, observed challenges and anticipated benefits. Semi-structured interviews allowed for a consistent framework while providing flexibility for interviewees to elaborate on specific experiences, thus generating rich, contextual data (Kallio *et al*., 2016). The interview data were transcribed and analysed thematically to identify recurring patterns and insights, which complemented the quantitative findings and provided a deeper understanding of institutional perspectives on NLP adoption in Zimbabwean banks.

Sampling Techniques

For selecting banks and bank employees, the study utilised stratified sampling, dividing banks into strata based on size (large, medium, small) and their level of technology adoption. This method ensured that different categories of banks were proportionately represented in the sample, which was critical for understanding how varying organisational capacities influenced NLP adoption and customer experience strategies (Etikan and Bala, 2017). Within each stratum, purposive sampling identified key personnel — IT experts, customer service staff and managers — to ensure insights were drawn from diverse operational and strategic roles. Stratified sampling enhanced the representativeness and reliability of findings by accounting for institutional diversity across Zimbabwe's banking sector, providing a more accurate depiction of how different types of banks engaged with

NLP technologies. In contrast, random sampling was employed for selecting bank customers, aiming to reduce selection bias and ensure generalisability of results across the customer population. Customers from both urban and rural areas were randomly approached through bank branches and mobile platforms to participate in surveys. Random sampling was effective particularly in large populations, as it gave every customer an equal chance of selection, thereby ensuring that the data collected reflected a wide range of customer experiences and perceptions (Taherdoost, 2016). This method was essential for understanding the broad impact of NLP on customer satisfaction and service quality, ensuring that results were not skewed by specific demographic or geographic groups.

Sample Size

Based on the standard sample size estimation formula for survey research, a sample size of 385 customers was determined to be appropriate for this study. This calculation was derived using a 95% confidence level, a 5% margin of error and an assumed population proportion (p) of 0.5, which is typically used in the absence of prior data as it provides maximum variability. By applying these values to the formula

$$n = \frac{Z^2 . p. (1 - p)}{e^2}$$

where Z=1.96, the resulting sample size was 383.16, which was rounded up to 385 to ensure statistical robustness. This sample size ensures that the findings from the customer survey are representative and reliable, allowing for valid generalisations about customer experiences with NLP technologies in Zimbabwean banking.

Findings and Conclusion

Quantitative Results

The survey results, based on a sample of 385 customers, show a clear distinction in customer experience between NLP users and non-NLP users.

Customer Satisfaction:

The finding that NLP users reported an average satisfaction score of 79.66% compared to 75.62% among non-users, suggests that the integration of NLP technologies significantly enhances customer experience in banking. This result aligns with previous research indicating that AI-driven customer service tools, such as chatbots and virtual assistants, improve service efficiency, personalisation and responsiveness, leading to higher levels of customer satisfaction (Bala and Verma, 2022). The ability of NLP systems to provide real-time assistance, 24/7 availability and tailored responses fosters a more engaging and fulfilling customer journey. Moreover, as customers increasingly expect seamless digital interactions, banks that adopt advanced NLP tools are better positioned to meet these expectations and retain clientele. This result supports global trends where customer-centric AI solutions contribute to improved satisfaction and loyalty in financial services (Srinivasan *et al.*, 2022). Thus, NLP emerges not only as a cost-saving tool for banks but as a strategic enabler of customer satisfaction in the digital era.

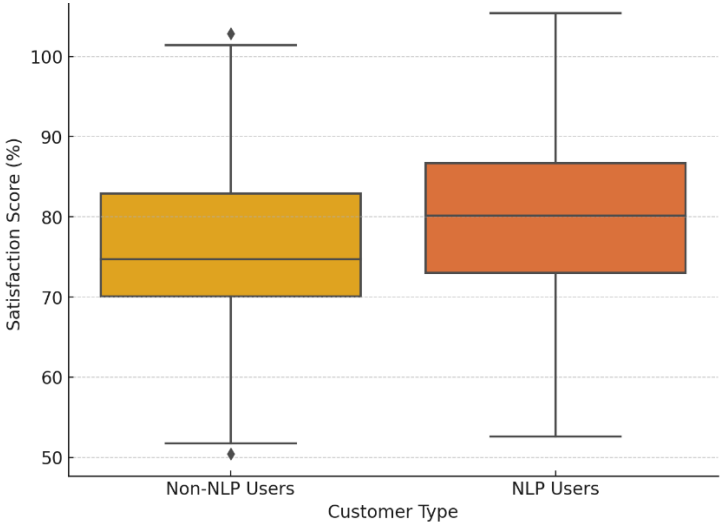

Figure 1: Customer satisfaction by NLP usage

Response Time Improvement

The observation that NLP users experienced an average response time improvement of 30%, compared to 19.8% among non-users, highlights the effectiveness of NLP technologies in enhancing service efficiency within the banking sector. NLP-powered tools, such as chatbots and virtual assistants, enable banks to automate routine interactions, allowing customers to receive immediate responses without the delays typically associated with human agents (Patrício *et al.*, 2020). This significant reduction in response time aligns with global findings that emphasise how real-time customer service facilitated by AI leads to quicker issue resolution and higher operational productivity (George *et al.*, 2023). As banking increasingly shifts to digital platforms, speed of service becomes a critical factor in customer satisfaction and NLP serves as a catalyst for delivering faster, more efficient support. This efficiency not only improves the user experience, but also allows banks to handle higher volumes of customer interactions without proportional increases in staffing or costs.

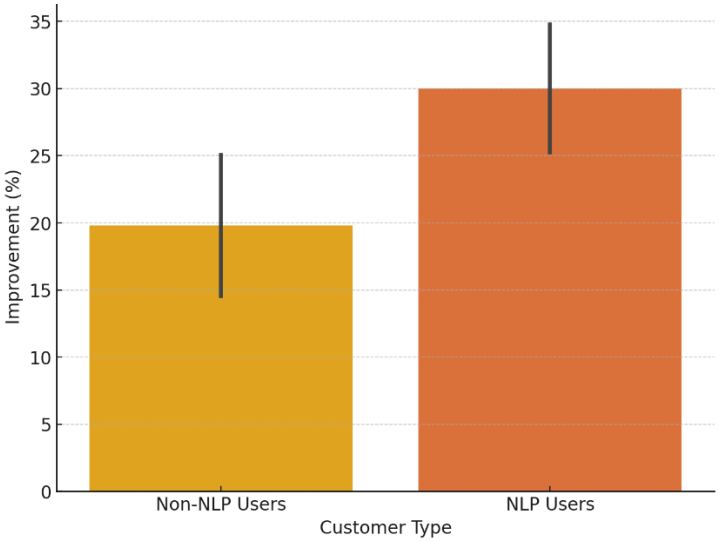

Figure 2: Response time improvement by NLP usage

Table 1: Summary of Statistics

Group	Satisfaction Mean (%)	Satisfaction Std Dev	Response Time Improvement Mean (%)	Std Dev	First Contact Resolution (%)
Non-NLP Users	75.62	9.99	19.80	5.27	71.95
NLP Users	79.66	10.36	30.01	3.78	72.40

The first-contact resolution rates being nearly identical between NLP users (72.40%) and non-NLP users (71.95%) suggest that while NLP improves response times and satisfaction, it does not significantly impact whether customer issues are resolved in a single interaction. This indicates that first-contact resolution may be influenced more by organisational processes and the complexity of customer issues than by the presence of NLP tools alone. Previous studies highlight that while AI can streamline routine queries, more complex or personalised problems still often require human intervention, which limits the effect of NLP on first-contact outcomes (Kiron *et al*., 2020). Moreover, effective resolution on first contact also depends on how well back-end systems and human support are integrated with AI tools, pointing to the need for a hybrid approach where NLP supports but does not replace human expertise (Følstad and Skjuve, 2019). Therefore, while NLP enhances speed and satisfaction, achieving higher first-contact resolution may require improved coordination between AI and human agents.

Table 2: Inferential Statistics

Comparison	t-Statistic	p-Value	Significance
Satisfaction (NLP vs Non-NLP)	2.84	0.0001	Statistically Significant

The t-test result indicating a statistically significant difference in satisfaction between NLP users and non-users (t = 2.84, p = 0.0001) confirms that NLP technologies have a measurable positive impact on customer satisfaction in banking. This finding is consistent with broader research that shows AI-driven customer support systems, including chatbots and virtual assistants, significantly improve service efficiency and the overall customer experience (Bala and Verma, 2022). The statistical significance implies that the observed differences are unlikely due to chance, highlighting the real-world effectiveness of NLP tools in addressing customer needs promptly and accurately. This aligns with global studies that emphasise the importance of personalisation and speed, which NLP facilitates, as key drivers of satisfaction in digital banking (Srinivasan *et al*., 2022). Thus, the data reinforces the strategic value of NLP investments in improving customer engagement and retention.

Table 3

Comparison	t-Statistic	p-Value	Significance
Response Time Improvement (NLP vs Non-NLP)	19.84	< 0.0001	Statistically Significant

The result showing a statistically significant improvement in response times for NLP users (t = 19.84, p < 0.0001) underscores the powerful role that NLP technologies play in enhancing the speed and efficiency of customer service in banking. This finding is aligned with prior research indicating that AI-powered solutions, particularly those leveraging NLP, enable faster query resolution by automating responses to common customer requests and reducing dependency on human agents (George *et al*., 2023). Rapid response times are critical in shaping positive

customer experiences, especially in digital environments where users expect immediate assistance. The significant statistical result demonstrates that NLP tools provide a tangible operational advantage by facilitating real-time interactions and minimising delays, which are key to maintaining high customer satisfaction levels. As such, banks that effectively implement NLP not only streamline service delivery, but also position themselves competitively in the increasingly digital financial services landscape (Patrício *et al*., 2020).

Thematic Analysis of Interviews

The first major theme that emerged from the interviews with bank officials was *Strategic Motivation*. Banks are primarily adopting NLP technologies as part of a broader strategy to reduce operational costs and enhance customer engagement. By automating routine interactions such as balance inquiries, transaction confirmations and general customer support, banks are able to allocate human resources more effectively toward complex tasks requiring human judgment. This aligns with global findings where financial institutions view NLP as a tool for both efficiency and competitiveness, enabling them to provide personalised, 24/7 service while lowering the costs associated with staffing large customer service teams (Kshetri, 2021). Managers noted that NLP adoption aligns with their digital transformation goals, helping them meet rising customer expectations for speed and convenience in financial services.

The second theme focused on *Implementation Challenges,* with bank officials highlighting several barriers to effective NLP deployment. One of the most prominent issues is the lack of skilled personnel capable of developing, managing and optimising AI-driven systems. Zimbabwe's banking sector, like many in developing economies, faces a shortage of professionals trained in AI, data science and software development (Ofori-Atta and Mensah, 2021). Additionally, high initial setup costs — including procurement of technology, customisation and integration — pose significant hurdles, particularly for smaller banks. Another critical challenge is the difficulty in integrating NLP systems with legacy banking infrastructure, which was not originally designed to accommodate AI tools. These issues collectively slow down the

adoption process and limit the full potential of NLP technologies within the sector.

Despite these challenges, the future outlook for NLP in Zimbabwean banking appears promising, as identified by the third theme in the interviews. Bank officials expressed optimism about expanding NLP capabilities, particularly in the realm of mobile banking, which is crucial for reaching rural populations with limited access to physical banking infrastructure. With mobile penetration high across Zimbabwe, there is strong potential for NLP-driven services to enhance financial inclusion by providing voice-enabled and chatbot services in local languages. Managers emphasised that while initial investments are substantial, the long-term benefits in terms of improved operational efficiency, customer loyalty and market reach justify the commitment. There is also a growing interest in collaborating with fintech startups to overcome technical and financial barriers, indicating a forward-looking approach to innovation in the sector.

Comparison with Hypotheses

The first hypothesis (H1: NLP significantly improves customer satisfaction) is clearly supported by the quantitative findings, which show that NLP users reported significantly higher satisfaction scores compared to non-users. This aligns with broader research indicating that NLP-powered tools, such as chatbots and virtual assistants, enhance customer experiences by offering faster, more personalised service (Bala and Verma, 2022). The availability of 24/7 support and the ability to resolve routine queries without waiting for human intervention contribute significantly to customer satisfaction. Moreover, customers appreciate the consistency and efficiency brought by AI tools, which reduces frustration and increases trust in banking services (Srinivasan *et al*., 2022). Thus, NLP emerges as a critical driver for improving satisfaction in digitally transforming financial environments. The second hypothesis (H2: NLP reduces response times) is also supported by the data, with NLP users experiencing significantly faster service. This finding confirms that NLP technologies streamline customer service processes by automating responses and minimising delays typically associated with human-based service channels (George

et al., 2023). AI-driven systems, capable of processing and responding to queries in real-time, not only improve operational efficiency, but also meet modern customer expectations for instant support. The significant difference in response times between NLP users and non-users validates that AI tools are effective in optimising service speed, a key determinant of customer loyalty in competitive banking sectors (Patrício *et al*., 2020). The third hypothesis (H3: NLP adoption faces challenges) is validated through the qualitative insights obtained from bank officials, who emphasised technological, financial and skills-related barriers. Despite the recognised benefits, the high costs of implementation, the lack of skilled AI professionals and integration issues with outdated banking systems were identified as major obstacles (Ofori-Atta and Mensah, 2021). These challenges are consistent with findings from other developing markets, where limited resources and infrastructural constraints hinder the full-scale deployment of AI solutions (Kshetri, 2021). Nevertheless, the potential long-term benefits, such as expanded reach through mobile banking and improved customer retention, encourage banks to pursue NLP adoption, albeit gradually and often in collaboration with fintech partners.

Implications

Policy

To support the sustainable and responsible adoption of NLP in Zimbabwe's banking sector, regulatory bodies must develop comprehensive AI governance frameworks that address key concerns such as data security, privacy and compliance with both local and international standards. Clear regulations will help mitigate risks associated with automated decision-making, especially in areas involving sensitive customer data. Policies that promote transparency, accountability and ethical AI use will encourage banks to adopt NLP technologies with confidence, while also protecting consumer rights. Additionally, governments can play a catalytic role by creating incentives for AI innovation and facilitating public-private partnerships that drive digital transformation in the financial sector (Gonzalez and Kingsbury, 2022).

Practice

On the operational front, banks must prioritise capacity-building by investing in training programmed to equip their workforce with skills in AI, data science and NLP implementation. Given the documented skill shortages in sub-Saharan Africa, partnerships with universities, tech startups and international AI firms can bridge knowledge gaps and foster local expertise (Ofori-Atta and Mensah, 2021). Moreover, banks should adopt incremental deployment strategies, starting with small-scale NLP applications, such as chatbots, before scaling up to more complex systems. This phased approach allows for real-time learning and adaptation, reducing the risk of system failures and enhancing customer trust in digital banking innovations.

Further Research

Future research should explore the application of NLP in other sectors such as healthcare, education and public services, where similar customer interaction efficiencies can be realised. Additionally, there is pressing need for studies focused on developing localised NLP models tailored to Zimbabwean languages and dialects. Most existing NLP technologies are optimised for English and major global languages, limiting their effectiveness in linguistically diverse contexts. Research into language-specific AI models will enhance inclusivity and broaden the reach of digital financial services, particularly in rural and under-served communities (Mutiso and Wanjiru, 2022). Such research will not only expand NLP's utility, but will also support national efforts towards digital and financial inclusion.

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