Customer adoption of Chat GPT for web development and programming assistance in the Zimbabwe tech industry

Alexander Sibanda[1]

[1]School of Economics and Business, Telkom University, Indonesia

Abstract

ChatGPT, an advanced conversational AI model by OpenAI, signifies a significant leap in human-computer interaction. Optimized for dialogue, ChatGPT has the potential to transform web development and programming support. In Zimbabwe, 60% of IT programmers express concerns about UI/UX design, while 70% face challenges in service quality due to software flaws and inadequate testing. This study investigates ChatGPT's application in Zimbabwe's tech industry for web development and programming support, and its impact on organizational performance. Employing an integrated Delone and McLean IS Success Model, the research examines adoption trends, barriers, and benefits of integrating ChatGPT into development workflows.A quantitative approach was utilized, employing survey data and statistical methods. A 5-point Likert Scale survey was distributed to 30 Zimbabwean ICT workers. Data analysis with SmartPLS 3.0 included descriptive and confirmatory factor analyses to assess reliability (Cronbach's alpha, composite reliability) and validity (factor loadings, AVE, HTMT ratio). Results indicate that ChatGPT significantly influences system, information, and service quality, enhancing user satisfaction and organizational benefits, with system quality exerting the strongest impact. Moreover, system quality positively affects organizational performance, though the moderating role of flexible organizational culture was insignificant. Recommendations include enhancing training data tailored to local technological needs, integrating real-time data sources, offering a paid version for updated data, ensuring robust error handling for service quality, providing educational resources, implementing feedback mechanisms, conducting developer training programs, and promoting cross-functional collaboration.

Keyword: chat gpt; conversational ai; web development; programming support; it programmers

1. Introduction

OpenAI's ChatGPT stands as a pioneering advancement in conversational AI. Designed as a counterpart to InstructGPT (AI C. O., 2023), which excels in following instructions, ChatGPT is specifically optimized for dialogue. This optimization is achieved through Reinforcement Learning with Human Feedback (RLHF), a sophisticated technique that incorporates human preferences and demonstrations to fine-tune the model's responses (AI C. O., 2023).

One of ChatGPT's key strengths is its capacity to automate a range of tasks, from simple to complex. Developers can utilize its capabilities to handle repetitive tasks such

as code generation, debugging, and documentation. This not only streamlines development workflows but also allows developers to focus on more innovative and strategic projects.

The rapid adoption of ChatGPT is noteworthy, distinguishing it from other popular apps and services. Achieving one million users in just five days, ChatGPT outpaced the growth trajectories of platforms like Instagram and Netflix, which took 2.5 months and 3.5 years, respectively. Several factors contribute to this swift adoption, highlighting ChatGPT's appeal and potential impact.

Foremost, ChatGPT's status as an innovative technology drives its rapid adoption. As the first large language model chatbot designed specifically for dialogue, ChatGPT represents a significant shift in human-computer interaction. The novelty of this approach attracts users interested in exploring new conversational experiences, contributing to its quick acceptance.

Additionally, ChatGPT's versatility is a major factor in its widespread adoption. Unlike applications with limited functions, ChatGPT offers a broad range of capabilities, from text generation and translation to answering questions and engaging in conversation. This versatility makes ChatGPT a valuable tool for a wide audience, catering to diverse user needs across various domains.

Zimbabwe's Information Technology Authority (ZIDA) found that 60% of local programmers are dissatisfied with the user interface (UI) and user experience (UX) of their software systems. Subpar UI/UX design leads to user confusion and reduced satisfaction, impacting web development efficiency.

The 2023 ICT Policy Framework in Zimbabwe identifies significant challenges, with 70% of the sector grappling with issues affecting service quality, largely stemming from software flaws and inadequate testing.

Globally, technologies like ChatGPT are rapidly gaining traction, exemplified by its one million users within five days. However, its specific adoption dynamics in Zimbabwe's tech sector, particularly in web development and programming, remain understudied. This raises questions about adoption drivers, challenges, and potential benefits in a sector projected to reach US$1.2 billion by 2025, despite a current adoption rate of only 10%.

Limited awareness and quality concerns are key barriers to ChatGPT's integration, despite its potential to reduce development time by 50%. Addressing these challenges is crucial to harnessing ChatGPT's capabilities effectively.

This research explores factors influencing ChatGPT adoption in Zimbabwe's IT sector and its implications for organizational performance. It aims to uncover awareness barriers and quality concerns hindering integration, aiming to enhance system quality, information quality, user satisfaction, and overall service quality in Zimbabwe's growing tech industry.

2. Literature Review

D&M s Success Model

DeLone and McLean's extensive review of previous research led to the classification of Information Systems (IS) success (ISS) indicators into six key categories. This pioneering effort marked the first instance where IS researchers systematically prioritized the use of IS success metrics, significantly contributing to the field.

The six critical categories for assessing IS success include:

1. **System Quality**: This pertains to the hardware processing capabilities of the system.
2. **Information Quality**: This encompasses the timeliness and accuracy of the information provided.
3. **User Benefits** : This measures how frequently the IS is utilized.
4. **User Satisfaction**: This evaluates the intellectual responsiveness of IS personnel.
5. **Individual Impact**: This explores how Management Information Systems (MIS) influence user behavior.
6. **Organizational Effect**: This examines the broader impact of MIS on the entire organization.

DeLone and McLean's IS success model is a seminal framework in IS analysis, emphasizing the importance of system and information quality as primary success factors. This model provides a comprehensive view of IT investment evaluation by examining both individual and organizational performance through the quality of IS and the information it delivers, as well as user satisfaction and utilization.
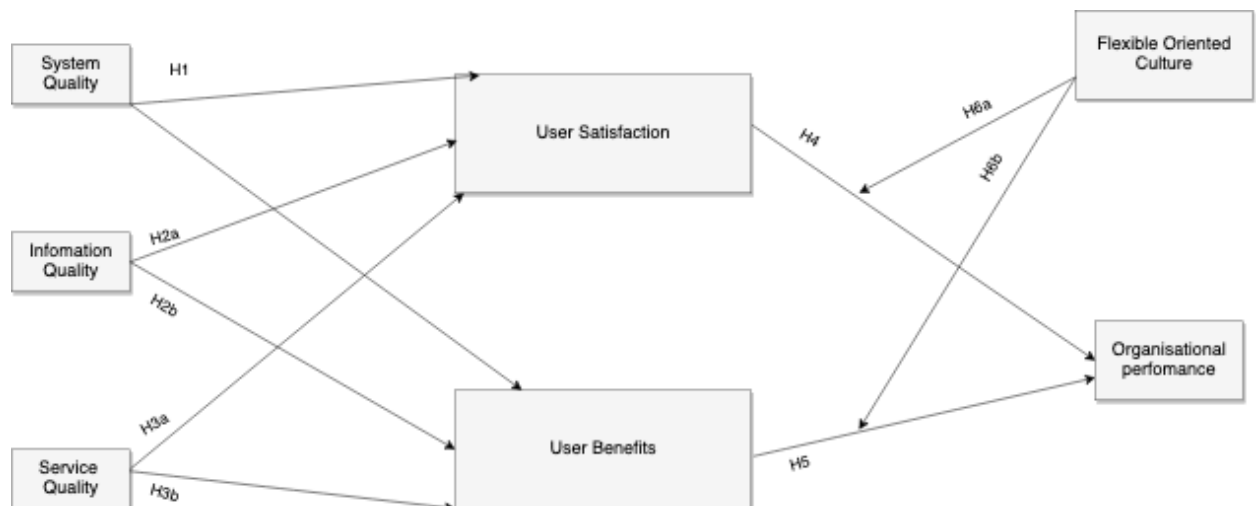
Research Framework and Hypothesis

Figure 1. Modified Research Framework

Hypothesis
1. **H1a**: System quality positively influences user satisfaction.
2. **H1b**: System quality positively influences user benefits.
3. **H2a**: Information quality positively influences user satisfaction.
4. **H2b**: Information quality positively influences user benefits.
5. **H3a**: Service quality positively influences user satisfaction.
6. **H3b**: Service quality positively influences user benefits.
7. **H4**: User satisfaction positively influences organizational performance.
8. **H5**: User benefits positively influence organizational performance.
9. **H6a**: Flexibility-oriented culture positively moderates the relationship between user satisfaction and organizational performance.
10. **H6b**: Flexibility-oriented culture positively moderates the relationship between user benefits and organizational performance.

Variables
1. **System Quality**: Reflects responsiveness, availability, simplicity, and reliability of ChatGPT systems, crucial for organizational knowledge growth and performance enhancement.
2. **Service Quality**: Includes dependability, assurance, responsiveness, and an excellent user interface, enabling users to interact effectively with information systems and enhancing overall satisfaction.
3. **Information Quality**: Evaluated based on timeliness, completeness, correctness, and relevance, influencing goal achievement and user satisfaction by providing accurate, timely, and reliable information.
4. **User Satisfaction**: Influenced by system, service, and information quality, it reflects the overall contentment of users with the ChatGPT system, impacting work performance and organizational outcomes.
5. **User Benefits**: The advantages users gain from using ChatGPT, such as rapid responses and intuitive interfaces that facilitate task completion and foster positive experiences.
6. **Organizational Performance**: The impact of user satisfaction and benefits on the overall performance of the organization, including productivity, project success rates, and profitability.
7. **Flexibility-Oriented Culture**: An organizational culture that promotes innovation, facilitates change, and enhances performance by leveraging internal and external resources, encouraging creativity, and fostering an environment conducive to novel approaches.

3. Materials and Method

The study developed an integrated model incorporating factors from both TAM and the Delroy Success Modle framework, akin to (Shetty & Panda, 2022, 2020) proposal. Hypotheses were formulated from this model for empirical testing. Empirical validation was carried out using confirmatory factor analysis(CFA) and structural equation modeling (SEM). Following sections provide a comprehensive overview of the data collection and analysis methodologies employed.

Data Collection

1. The research adopted a positivist philosophy, prioritizing empirical evidence to reveal truths about the subject (Asiaei & Nor, 2019). A quantitative methodology was employed, with data collected online using Google Docs forms distributed through social media platforms. To ensure accuracy, the questionnaire used a five-point Likert scale and included layman's definitions of constructs for clarity (Asiaei & Nor, 2019). Expert validation ensured face validity, and a pilot study with 20 participants validated the instrument's reliability and validity.

2. The survey gathered data from 30 Zimbabwean tech professionals who used ChatGPT for web development or programming assistance. Data collection was facilitated through LinkedIn and WhatsApp to reach accessible participants (H. Hassan et al., 2017), supplemented by snowball sampling to extend reach beyond immediate connections (Cohen et al., 2014). This comprehensive approach ensured thorough data collection from the targetnnnnn population.

Data Analysis Techniques

1. For data analysis, the study utilized robust statistical tools, namely the International Business Machines Corporation (IBM) Statistical Package for the Social Sciences (SPSS) 27 and Smart PLS 4.0. These software packages were chosen for their advanced capabilities in handling quantitative data and conducting sophisticated analyses.

2. To ensure the validity and reliability of the statistical methods employed, several fundamental prerequisites were rigorously met. Cronbach's alpha reliability test was conducted to assess the internal consistency of the measurement scales used in the study. Additionally, normality tests were performed to verify that the data adhered to a normal distribution, a crucial assumption for many statistical techniques. Multicollinearity tests were also carried out to identify and mitigate any issues arising from high correlations among predictor variables. Furthermore, a common method bias assessment was undertaken to detect and control for potential biases introduced by shared method variance.

4. Results

Respondents Characteristic

This study explores ChatGPT adoption among Zimbabwean tech professionals in web programming and assistance roles. Data was collected via a February 2024 Google questionnaire, yielding 35 responses after excluding those unfamiliar with ChatGPT. Analysis using Smart PLS 4.0 focused on demographic profiles like gender, age, occupation, education, and awareness of ChatGPT among 30 participants. Results indicate a male majority (68%), consistent with prior research showing higher male engagement in ChatGPT usage. The largest age group was 25-34 years (55%), mirroring global trends. IT professionals dominated (46.18%), underscoring their significant role in adopting ChatGPT. Educational backgrounds were predominantly IT Bachelor's degrees (55%), followed by Master's degrees (36%) and IT certifications (9%), highlighting a strong academic foundation in IT among respondents.

Table 1. Average Variance Extracted (AVE)

Variable	Average Variance Extracted (AVE)
Flexible oriented culture	0.876
Information Quality	0.714
Organisation Performance	0.894
Service Quality	0.873
System Quality	0.937
User Benefits	0.733
User Satisfaction	0.886

Source: Processed Data (2024)

Table 2. HTMT Values

	BNT	FCU	INQ	OGP	SAT	SEQ	SYQ	FCUxBNT	FCUxSAT
BNT									
FCU	**0.827**								
INQ	0.809	**0.706**							
OGP	0.836	0.635	**0.723**						
SAT	0.795	0.804	0.787	**0.733**					
SEQ	0.819	0.703	0.721	0.791	**0.701**				
SYQ	0.715	0.600	0.786	0.573	0.805	**0.580**			
FCUxBNT	0.142	0.146	0.080	0.030	0.039	0.028	**0.106**		
FCUxSAT	0.066	0.082	0.104	0.054	0.024	0.028	0.091	**0.799**	

Table 3. Cronbach's Alpha and Composite Reliability

Variable	Cronbach's Alpha	Composite Reliability
Flexible oriented culture	0.860	0.934
Information Quality	0.920	0.937
Organisation Performance	0.881	0.944
Service Quality	0.854	0.932
System Quality	0.933	0.968
User Benefits	0.879	0.917
User Satisfaction	0.871	0.939

Source: Processed Data (2024)

Discussion of Hypothesis Results

Table 4. Path Coefficient and t-value

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P value	Conclusion
SEQ-> BNT	0.385	0.374	0.085	4.544	0.000	Accepted
SYQ -> SAT	0.423	0.418	0.086	4.946	0.000	Accepted
BNT-> OGP	0.640	0.626	0.112	5.696	0.000	Accepted
INQ -> BNT	0.336	0.353	0.121	2.780	0.003	Accepted
INQ-> SAT	0.265	0.264	0.096	2.745	0.003	Accepted
SEQ-> SAT	0.215	0.225	0.084	2.575	0.005	Accepted
SAT -> OGP	0.231	0.234	0.109	2.126	0.018	Accepted
SYQ -> BNT	0.210	0.206	0.115	1.832	0.034	Accepted
FCU x BNT -> OGP	0.168	0.150	0.101	1.663	0.049	Accepted
FCU x SAT -> OGP	-0.127	-0.115	0.094	1.354	0.089	Rejected

Source: Processed Data (2024)

System Quality

The research highlights a strong relationship between system quality and user satisfaction, supported by previous studies (Delone, 2021; Bharati & Chaudhury, 2004; Bauer et al., 2006). In fields like web development and programming, accurate and prompt responses are crucial (Zheng et al., 2013). Systems that consistently deliver precise information enhance user experience, fostering trust and satisfaction (Xu et al., 2013).

Furthermore, the findings reveal a significant positive correlation between system quality and user benefits ($\beta = 0.210$, $p = 0.034$, $p < 0.05$), consistent with prior research (Delone, 2021; Bharati & Chaudhury, 2004; Palmer, 2002). Palmer (2002) underscores the impact of system quality on user performance, particularly in ChatGPT's role in providing reliable programming assistance. Users rely on ChatGPT for dependable results and efficient problem-solving (Lin, 2023; Donna & Novak, 2020).

Information Quality

The findings highlight a strong positive correlation between information quality and user satisfaction, supported by research (Delone, 2021; Van Riel et al., 2020; Petter et al., 2013) ($\beta = 0.265$, $p = 0.000$, $p < 0.05$). Information quality significantly influences user satisfaction, particularly through its impact on the user interface (Delone & McLean, 2020; Van Riel et al., 2024). ChatGPT is recognized for providing comprehensive, current data (Filieri et al., 2015; Masri et al., 2019; Ponte et al., 2015), assessed by attributes like accuracy, timeliness, completeness, and relevance (Teo et al., 2008).

Access to precise information enhances user satisfaction and job performance (Veeramootoo et al., 2018). ChatGPT's accurate and timely information supports expedited decision-making and problem-solving (Gao et al., 2015), fostering achievement and satisfaction (Delone & McLean, 2003).

The research confirms a significant positive link between information quality and user benefits (Delone, 2021; Van Riel et al., 2020; Ponte et al., 2015) ($\beta = 0.036$, $p = 0.003$, $p < 0.05$). Higher-quality information supports programmers by improving efficiency, productivity, and decision-making (Veeramootoo et al., 2018), contributing to their skill development and professional growth.

Service Quality

The findings reveal a significant positive correlation between service quality and user satisfaction ($\beta = 0.215$, $p = 0.005$, $p < 0.05$), supported by prior studies (Ashfaq et al., 2020; Ofori et al., 2017). Service quality, which focuses on meeting user needs and enhancing productivity (Gao & Waechter, 2017; Zheng et al., 2013), aligns with positive outcomes observed in Marketing and Consumer Behavior Research (Delone & McLean, 2019).

ChatGPT's prompt and accurate solutions enhance satisfaction, especially among programmers (Lien et al., 2017). Swift responses and user-friendly interfaces

are crucial for meeting user expectations. Reliable service ensures timely assistance and access to dependable information, boosting user satisfaction (Lien et al., 2017).

The research confirms a significant positive association between service quality and user benefits ($\beta = 0.385$, p = 0.00, p < 0.05), echoing previous findings (Rust & Oliver, 2015; Ashfaq et al., 2020; Ofori et al., 2017). This highlights the critical role of service quality in enhancing user benefits. High-quality service supports programmers with increased productivity, improved problem-solving, higher code quality, and learning opportunities (Lien et al., 2017). Responsive and reliable service contributes to satisfaction by providing timely assistance and accurate information. Clear communication and user-friendly interfaces further enhance interaction, maximizing the service's value (Lien et al., 2017).

User Benefits

The findings highlight a strong positive correlation between user benefits and organizational performance ($\beta = 0.640$, p = 0.000, p < 0.05), underscoring their critical role in organizational success (Rust & Oliver, 2015). While direct research on ChatGPT's impact is limited, high satisfaction with AI software is noted (H. Bell & N. K. H. Tang, 2019). Swift AI responses correlate with positive outcomes, indicating how customer satisfaction affects sales rates (D. M. Szymanski & R. T. Hise, 2020).

User benefits from ChatGPT, such as increased productivity and better code quality, significantly enhance organizational performance. Improved processes and outputs can expedite project delivery and boost customer satisfaction, thereby enhancing overall organizational effectiveness (Nodari et al., 2016; Pandey et al., 2018; Payal et al., 2016).

User Satisfaction

The researcher identified a significant positive link between user satisfaction and organizational performance ($\beta = 0.231$, p = 0.018, p < 0.05), highlighting the pivotal role of user satisfaction in driving organizational success (Rust & Oliver, 2015). While direct examination of ChatGPT's impact on organizational performance is limited, evidence suggests high user benefits with AI software offerings (H. Bell & N. K. H. Tang, 2019). Performance across sectors like telecommunications, marketing, and service sales is closely tied to customer and stakeholder benefits.

Integration of ChatGPT in workplaces supports knowledge accumulation and application, indicating its benefits enhance organizational performance (S. C. Pandey et al., 2018; R. Payal et al., 2016). Importantly, both user benefits and satisfaction positively influence organizational performance.

Flexible Oriented Culture

The study found no significant positive relationship between a flexibility-oriented culture and its moderating effect on satisfaction and organizational performance ($\beta = -0.127$, p = 0.089, p < 0.05). Previous research suggested that companies fostering flexibility might gain competitive advantage by enhancing service

quality and operational efficiency through ChatGPT integration (Stock et al., 2007; White et al., 2003). However, the direct impact of such a culture on satisfaction and performance may vary depending on organizational dynamics or contexts.

Nevertheless, there is a positive correlation between a flexibility-oriented culture and moderating the relationship between user benefits and organizational performance (β = -0.127). Such a culture typically fosters adaptability and innovation, potentially enhancing service quality and operational efficiency through ChatGPT integration (Stock et al., 2007; White et al., 2003). The significant impact of system quality on benefits within a flexibility-valued culture underscores the pivotal role of benefits in organizational performance.

5. Recommendations

- System Quality: Enhancing system quality for ChatGPT among Zimbabwean tech programmers is key. This includes optimizing training data for local tech industry nuances and refining pre-trained models with Zimbabwe-specific domain data.
- Information Quality: Improving information quality for ChatGPT among tech programmers involves integrating real-time data sources and considering upgrading to extend data updates beyond April 2023.
- Service Quality: To enhance service quality, robust error handling mechanisms are needed for ChatGPT. These should manage ambiguous queries and provide informative guidance.
- User Satisfaction: Improving user satisfaction includes providing educational resources for effective query formulation and response understanding
- User Benefits: Strategies to enhance user benefits include integrating feedback mechanisms into training modules for personalized guidance.
- Organizational Performance: Enhancing organizational performance involves tailored training programs to elevate proficiency in using ChatGPT for effective outcomes.
- Flexible-Oriented Culture: Promoting a flexible-oriented culture includes fostering cross-functional collaboration to leverage diverse perspectives and solutions.
- Implementing these strategies can effectively improve ChatGPT's utility for Zimbabwean tech developers, ensuring better satisfaction and meeting specific user needs.

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