Postprint: An Empirical Study of User Satisfaction with Knowledge Service Quality on Government Websites Based on the MUSA Model

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Abstract

[Purpose/Significance] Through empirical research on evaluating knowledge service quality of municipal government websites, this study provides data support and reference for the improvement and optimization of government website knowledge services. [Method/Process] Evaluation criteria for government website knowledge service quality were established through literature collection and questionnaire surveys, and the MUSA model and benchmarking management method were applied to conduct an empirical analysis of user satisfaction with knowledge service quality of municipal government websites. [Results/Conclusion] The study obtained actual measurement results of user satisfaction with knowledge service quality for three municipal government websites, identifying each website's competitive advantages, disadvantages, weaknesses, and priority areas for improvement in the knowledge service process.

Full Text

Preamble

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An Empirical Study on User Satisfaction with Knowledge Service Quality of Government Websites Based on the MUSA Model

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Abstract

[**Purpose/Significance**] This study conducts an empirical evaluation of municipal government website knowledge service quality to provide data support and references for improving and optimizing these services. [**Method/Process**] Through literature review and questionnaire surveys, we established evaluation standards for government website knowledge service quality, then applied the MUSA model and benchmarking management method to empirically analyze satisfaction with municipal government website knowledge services. [**Result/Conclusion**] We obtained user satisfaction evaluation results for three municipal government website knowledge services, identifying each website's competitive advantages, disadvantages, weaknesses, and priority areas for improvement in their knowledge service delivery.

Keywords: Government website knowledge service; Knowledge service evaluation; MUSA model; Benchmarking management
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Introduction

By December 2017, China's internet user base had reached 772 million, with 40.74 million new users added throughout the year, representing an internet penetration rate of 55.8%—a 2.6 percentage point increase from the end of 2016 [**?**]. This widespread internet access enables users to obtain knowledge services from government websites anytime and anywhere. In the knowledge economy context, the fundamental purpose of government website development is to provide high-quality knowledge services that can quickly solve practical problems for users. Government website knowledge services are demand-oriented offerings that reorganize and refine various information resources according to specific problems and contexts, transforming them into ordered knowledge to address public practical application issues. Through government websites, citizens can more conveniently access solutions to real-world problems. For example, domestic government websites provide flood safety Q&A, "government terminology" explanations to help the public better understand administrative affairs, and knowledge about fire escape, self-rescue, and public health. The UK government website's "Public Health Skills and Knowledge Framework" offers systematic knowledge solutions for employee skills surveys, while Canada's "Polar Knowledge Canada" portal promotes understanding of the Arctic and disseminates knowledge about other polar regions including Antarctica.

Government website knowledge services differ fundamentally from information services. The former helps users acquire both explicit knowledge and innovative tacit knowledge, providing direct solutions to problems through proactive and personalized service methods. The latter merely provides data and information as explicit knowledge, generally without considering content relationships between user needs, and employs more passive service approaches. User satis-

faction with government website knowledge services represents a comprehensive evaluation of service quality. Therefore, based on user perceptions and through actual data collection and analysis, exploring general evaluation standards for government website knowledge service quality and applying these standards in empirical research will contribute to improving and optimizing government website knowledge services.

Literature Review

We conducted literature searches using keywords such as "Public Knowledge Service," "Government Knowledge Service," "Public Knowledge Service Evaluation," and "Public Knowledge Service Satisfaction" in foreign databases including the EBSCO platform and Emerald. In Chinese databases (CNKI, Wanfang, VIP), we used keywords including "知识服务" (knowledge service), "政府网站知识服务" (government website knowledge service), "知识服务质量评价" (knowledge service quality evaluation), and "知识服务用户满意度" (knowledge service user satisfaction). Our review reveals that current research in this field primarily focuses on three aspects: government website knowledge service studies, government website satisfaction studies, and knowledge service evaluation studies, with limited direct research on government website knowledge service evaluation and empirical studies.

2.1 Government Website Knowledge Service Research

Research on evaluation standards for knowledge services has been proposed by several scholars. Zhao Xuejin and Wu Yuhua [**?**] analyzed structural variables including tangibility, reliability, responsiveness, assurance, and empathy in knowledge-intensive service industries. Yu Hongguo et al. [**?**] applied five first-level indicators such as service personnel quality and service process standardization, along with 18 second-level indicators including system interface friendliness and innovation, to evaluate knowledge service customer satisfaction. Sun Xiao'ou [**?**] used five first-level indicators (resource selection, resource organization and retrieval, etc.), 15 second-level indicators (content quality, service content, service quality, etc.), and 28 third-level indicators (reliability, integrity, integration, responsiveness, security, etc.) to evaluate university library knowledge service performance user satisfaction. Yan Shan [**?**] proposed knowledge service resources, knowledge service personnel capabilities, and knowledge service outcomes as evaluation standards for university library knowledge service capabilities. Additionally, Xie Xinwen [**?**] and Wang Fang [**?**] suggested that knowledge services should possess adaptability, while Wen Wei [**?**] argued that public libraries should evolve from equal services to knowledge equity. Xue Diao [**?**] and Han Yongqing [**?**] conducted research on the visualization of knowledge services.

Domestic research on government website knowledge services primarily covers three areas: e-government knowledge management (represented by Xia Lixin et

al. [?] and Zhang Lisha et al. [?]), e-government information resource organization and integration (represented by Qian Zhu [?] and Hong Weida [?]), and government website knowledge fusion (represented by Chen Weidong [?] and Huang Xinping [?]). These studies provide a solid theoretical foundation for continuously improving government functions.

Foreign research on government website knowledge services also focuses primarily on e-government knowledge management. In this field, H. Behzadi et al. [?] used the "Knowledge Access, Creation, and Transfer" (K-ACT) model to study knowledge management mechanisms in 20 Iranian e-government portals providing citizen services. U. Heck et al. [?] argued that systematic knowledge management tools should be applied to e-government delivery.

2.2 Government Website Satisfaction Evaluation Research

Domestic scholars such as Han Jieping and Fan Wenyan [?], Xin Ling [?], and Yang Yafen [?] have researched evaluation methods and models for government website satisfaction, employing approaches including Structural Equation Modeling (SEM), Fuzzy Integral Comprehensive Evaluation, SERVQUAL model, Customer Satisfaction Index (CSI) model, and ACSI model.

Foreign scholars have also contributed to government website satisfaction evaluation methods and models. P. Verdegem et al. [?] applied SEM to measure data from five e-government websites. K. Fantazy et al. [?] used SEM to test theoretical models. A. Alawneh et al. [?] utilized SPSS and AMOS to analyze survey data reflecting public satisfaction with e-government. H. Nishimoto et al. [?] applied SERVQUAL, SERVPERF, and Importance-Performance Analysis (IPA) tools to evaluate citizen perceptions of e-government service performance.

2.3 Knowledge Service Evaluation Research

2.3.1 Domestic Research Domestic knowledge service evaluation research concentrates on libraries, archives, and scientific intelligence institutions, with representative scholars including Liu Hong [?], Zhao Danyang [?], and Yang Chunjing [?]. Research content includes evaluation standards, methods, and models.

Regarding evaluation standards, scholars have proposed various criteria. Zhao Xuejin and Wu Yuhua [?] used tangibility, reliability, responsiveness, assurance, and empathy as structural variables. Yu Hongguo et al. [?] applied five first-level indicators (service personnel quality, service process standardization, etc.) and 18 second-level indicators (system interface friendliness, innovation, etc.). Sun Xiao'ou [?] used five first-level indicators, 15 second-level indicators, and 28 third-level indicators. Yan Shan [?] evaluated knowledge service resources, personnel capabilities, and outcomes. Xie Xinwen [?] and Wang Fang [?] emphasized adaptability, while Wen Wei [?] advocated for knowledge equity in public libraries. Xue Diao [?] and Han Yongqing [?] researched knowledge service visualization.

For evaluation methods and models, domestic scholars generally employ SERVQUAL, SEM [?], ACSI, PZB model [?], and FAHP method [?].

2.3.2 Foreign Research Foreign research on public service and knowledge service evaluation includes standards, methods, and models. A. Alawneh et al. [?] identified five hypothetical factors (security and privacy, trust, accessibility, public service awareness, and quality) affecting Jordanian satisfaction with e-government portals. L. Ocampo et al. [?] used tangibility, reliability, responsiveness, assurance, and empathy as public service quality standards. S. S. Andaleeb et al. [?] applied reliability, responsiveness, and empathy to evaluate automobile service industry quality based on technical complexity and consumer knowledge.

For evaluation methods, foreign scholars typically use multiple linear regression, factor analysis [?], and SERVQUAL model [?].

In summary, satisfaction evaluation research generally employs regression analysis, factor analysis, and structural equation modeling, with models such as ACSI, SERVQUAL, and PZB. Few scholars have combined the MUSA model with benchmarking to study user satisfaction with government website knowledge service quality. The MUSA model aggregates different preferences in satisfaction functions, minimizing error probability through aggregation and disaggregation processes. Its primary advantage is fully considering the qualitative nature of user judgments and preferences expressed in satisfaction surveys, aiming to maximize consistency between functions and user judgments. Combined with benchmarking and presented graphically, MUSA results enable clear, intuitive comparison of government website knowledge service quality, offering high practical value. Therefore, we apply MUSA model and benchmarking to empirically study government website knowledge service quality satisfaction, exploring their role in evaluation.

Research Methods: MUSA Model and Benchmarking Management

3.1 MUSA Model

MUSA (Multicriteria Satisfaction Analysis) [?] is a preference disaggregation model that aggregates individual judgments into a collective value function. It is a multicriteria satisfaction analysis method—specifically, a preference disaggregation approach. The model assumes that overall user satisfaction can be explained through criteria representing service characteristic dimensions, treating user satisfaction measurement as a multicriteria evaluation problem where overall satisfaction depends on a set of evaluation criteria (X_1, X_2, ..., X). Each surveyed user provides judgments—partial satisfaction scores for each specific criterion [?].

Since both overall and partial satisfaction are based on qualitative criteria, the

model derives an overall value function y* and a series of partial value functions x*, with the primary objective of maximizing consistency between value functions and user satisfaction. Based on the preference disaggregation approach, the ordinal regression equation is:

$y^* = \Sigma(b\ x^*) - \sigma^+ + \sigma^-$, Formula (1)

where y* represents the user's overall satisfaction judgment with the organization, x *represents the partial satisfaction judgment function, b are weights, n is the number of criteria, and* σ^+ *and* σ^- *are errors. Overall satisfaction judgment y* and partial satisfaction judgments x* are normalized monotonic functions within the interval [0,100]. To avoid monotonicity issues, the following equations are used:

$z = y_1 - y$ where m = 1, 2, ..., α-1
$w = b\ x_1 - b\ x$ where k = 1, 2, ..., α -1 and i = 1, 2, ..., n

The optimization model can be written as:

[Minimize] $F = \Sigma(\sigma^+ + \sigma^-)$
Subject to:
$\Sigma w - \Sigma z - \sigma^+ + \sigma^- = 0$ where i = 1, 2, ..., M and t = 1, 2, ..., T, Formula (3)
$\Sigma z = 100$, $\Sigma w = 100$, z , w , σ^+ , σ^- ≥ 0 m, i, j, k, t

where q represents the user's overall satisfaction judgment with organization t, and q represents satisfaction judgments with organization t's criteria. M is the number of users, and T is the number of competing organizations. The objective is to reduce satisfaction judgment errors to negligible levels.

For evaluated organizations, overall and partial satisfaction judgments S and S serve as basic performance indicators, assessed through:

$S = \Sigma(p\ y)$ *where t = 1, 2, ..., T, Formula (4)*
$S = \Sigma(p\ x)$ where i = 1, 2, ..., n and t = 1, 2, ..., T

where p represents the frequency of users at overall satisfaction level m, and p represents the frequency at partial satisfaction level k.

Combining Formula (1) and Formula (4), assuming overall average satisfaction index is the weighted sum of partial satisfaction indices, these indicators take the form:

$S = \Sigma(b\ S)$ where t = 1, 2, ..., T. Formula (5)

Satisfaction analysis should include: (1) Overall satisfaction index: ranging from 0 to 100%, representing the basic performance indicator; (2) Criterion satisfaction indices: showing partial satisfaction levels for specific criteria, also ranging 0-100%; (3) Criterion weights: showing relative importance among selected criteria.

Perceptual maps can be drawn based on user satisfaction for benchmarking and identifying improvement measures. Combining criterion average satisfaction indices and weights produces a "performance/importance" diagram—an action diagram divided into four quadrants based on criterion performance and importance levels, guiding organizational action: "Maintain Status Quo" (low performance/unimportant), "Leverage Opportunities" (high performance/important), "Transfer Resources" (high performance/unimportant), and "Action Opportunities" (low performance/important). [Figure 1: see original paper] illustrates this framework.

3.2 Benchmarking Management

Benchmarking management originated in enterprise management practice, also translated as benchmark management or best practice comparison. Keehley et al., in *Benchmarking in the Public Sector*, define it as "a process of recognizing and introducing best practices to improve performance" [**?**]. The core idea is to continuously improve and enhance competitiveness by comparing with advanced organizations and learning from excellent benchmarks. We applied this concept to empirically study user satisfaction with knowledge service quality across three municipal government websites, comparing them to identify optimal knowledge service quality and establish benchmarks for improvement.

The prerequisite for applying MUSA model and benchmarking to evaluate government website knowledge service quality is establishing evaluation standards, requiring in-depth analysis of these criteria.

Establishing Government Website Knowledge Service Evaluation Standards

4.1 Preset Evaluation Standards

Government website knowledge services target a broad, massive user base. Therefore, evaluation indicators are based on the classic SERVQUAL model, which offers rich connotations, appropriate quantity, reduced cognitive burden, and high practicality. SERVQUAL's five indicators have been widely applied across service quality evaluation domains, demonstrating strong applicability and explanatory power across contexts. Based on literature review and government website knowledge service contexts, we added six indicators to the original five: security, convenience, integration, adaptability, equity, and visualization. Government-provided knowledge services require security as a foundation; convenience and integration reflect people-centered, citizen-friendly philosophies; adaptability to unpredictable complex situations represents value-added services; equity is essential; and visualization simplifies complex professional knowledge through graphics, images, and videos for better user understanding. Therefore, these 11 indicators are necessary for evaluating government website knowledge service quality, as shown in .

4.2 Evaluation Standard Validation

We validated the preset evaluation standards through questionnaire surveys to determine final criteria. Based on , we designed a questionnaire collecting data on preset standards. The questionnaire included two parts: (1) basic respondent information; (2) importance assessment of government website knowledge service quality standards based on user perception. Using a 5-point Likert scale (1 = very unimportant to 5 = very important), we distributed the questionnaire online via Wenjuanxing, collecting 210 responses with 175 valid (83.3% validity rate), meeting predetermined sample size requirements.

4.2.1 Sample Characteristics Analysis of the 175 valid questionnaires shows respondent characteristics in [Figure 3: see original paper]. Basic information covered gender, age, education, and occupation. Gender distribution was balanced (47.43% male, 52.57% female). Age distribution concentrated in 18-30 and 31-40 years (91.43% combined). Education was predominantly undergraduate and graduate (81.71% combined). Occupations included students, enterprise staff, public institution workers, researchers, farmers, and others, demonstrating comprehensive coverage. The sample aligns with internet user demographics (primarily ages 10-39), showing good representativeness and high reference value.

4.2.2 Descriptive Analysis of Evaluation Standards Statistical analysis calculated means and standard deviations for each standard, shown in . Means indicate user recognition of importance; standard deviations indicate consistency (smaller values show greater consensus). All 11 standards had means above 3.766 (average 4.2996), with standard deviations below 1 (average 0.7597), indicating high and consistent recognition. Therefore, these 11 standards are important for evaluating government website knowledge service quality. Using SPSS 22.0 factor analysis, we calculated criterion weights, shown in .

Empirical Research

5.1 Data Collection

After validating the 11 evaluation standards, we conducted empirical research on three municipal government websites: Shanghai, Beijing (Capital Window), and Tianjin, using MUSA model and benchmarking. Data collection again employed Wenjuanxing online questionnaires with the same demographic coverage for comprehensiveness. Before accessing websites and completing questionnaires, respondents received explanations distinguishing knowledge services from information services to ensure authentic evaluations. We collected 377 questionnaires with 339 valid (89.92% validity rate).

Users rated each website against the 11 criteria using qualitative scales: very satisfied [80-100], satisfied [60-80), neutral [40-60), dissatisfied [20-40), very dissatisfied [0-20). Results appear in .

5.2 Data Analysis

User satisfaction analysis distinguishes attitudes and preferences, including criterion average satisfaction and weights, shown in . Based on user perceptions, "reliability," "tangibility," "adaptability," and "assurance" carry relatively high weights, indicating their importance in government website knowledge services. Conversely, "empathy," "convenience," and "visualization" have lower weights, suggesting users pay less attention to these features.

Performance analysis reveals each website's competitive advantages, disadvantages, and improvement needs. Capital Window (Beijing) achieved the highest overall satisfaction index, though not exceptionally high, with relatively low scores for "convenience," "empathy," "responsiveness," and "adaptability." Shanghai and Tianjin showed similar, moderate overall satisfaction. Shanghai had relatively low scores for "integration" and "empathy," while Tianjin showed low scores for "integration," "responsiveness," and "adaptability" (all below 70%).

5.2.1 Action Diagram Analysis Based on this data, we constructed action diagrams for the three websites, shown in [Figure 4: see original paper]. All three share similarities: "empathy" and "visualization" fall in the "maintain status quo" quadrant (low satisfaction but low importance), while "tangibility" and "security" appear in the "leverage opportunities" quadrant (high satisfaction and importance).

Each website also has criteria in the "action opportunities" quadrant. For Shanghai, these are "adaptability," "assurance," "responsiveness," and "integration"—requiring resource investment to improve overall satisfaction and competitiveness. For Beijing, "assurance," "adaptability," and "responsiveness" need attention. For Tianjin, "reliability," "adaptability," "integration," and "responsiveness" require improvement.

5.2.2 Relative Performance Diagram Analysis Benchmarking analysis focuses on competitive performance assessment and advantage identification through relative performance diagrams, shown in [Figure 5: see original paper]. These maps help websites position themselves against competitors and identify improvement opportunities.

For Shanghai, "reliability" is a competitive advantage (high satisfaction and relative performance). "Visualization," "adaptability," and "responsiveness" are in the "wait" quadrant—relatively high performance versus competitors but low absolute satisfaction, requiring monitoring for potential future conversion to key advantages. "Tangibility" is in the "strive" quadrant: high satisfaction but still below competitors, and with high importance, requiring further investment.

For Beijing, "tangibility," "reliability," "equity," and "security" are competitive advantages with high satisfaction and relative performance. "Empathy" and "convenience" are competitive disadvantages (low satisfaction and relative

performance), but their low importance means limited attention is needed. However, “assurance” and “adaptability” are important and should be prioritized for investment to convert into competitive advantages.

For Tianjin, “assurance” and “equity” are competitive advantages. “Convenience” and “empathy” are in the “wait” quadrant—moderate satisfaction but outperforming competitors, with low importance requiring minimal attention. “Reliability” and “responsiveness” are competitive disadvantages with low satisfaction and relative performance, but their high importance (especially “reliability”) demands significant resource investment to enhance competitiveness.

Discussion and Summary

Using the MUSA model and benchmarking, we measured user satisfaction with knowledge service quality across three municipal government websites, identifying each site’s competitive advantages, disadvantages, weaknesses, and priority improvement areas. Results are summarized in .

Key findings: 1. **Competitive advantages:** Shanghai’s are “reliability” and “convenience”; Beijing’s are “reliability,” “integration,” and “tangibility”; Tianjin’s are “assurance,” “convenience,” and “equity.” These criteria show satisfaction indices significantly above average. 2. **Competitive disadvantages:** Shanghai’s are “tangibility,” “assurance,” “integration,” and “equity”; Beijing’s are “assurance,” “convenience,” and “adaptability”; Tianjin’s are “reliability,” “responsiveness,” and “integration.” These show satisfaction indices well below average. 3. **Weaknesses:** Shanghai’s are “adaptability,” “assurance,” “responsiveness,” and “integration”; Beijing’s are “assurance,” “adaptability,” and “responsiveness”; Tianjin’s are “reliability,” “adaptability,” and “integration.” These criteria show relatively low performance across all three websites but high importance. 4. **Priority improvements:** Shanghai should prioritize “tangibility,” “assurance,” “integration,” and “responsiveness”; Beijing should focus on “assurance,” “adaptability,” and “responsiveness”; Tianjin should address “reliability,” “adaptability,” “integration,” and “responsiveness.” Notably, all three websites need to prioritize “responsiveness.”

Specific recommendations: - **Shanghai:** Maintain reliability and convenience advantages while strengthening network security, real-time information updates, compatibility upgrades, and stable links. Improve webpage design rationality and aesthetics, enhance professional skills, achieve one-stop services, and increase system response speed. - **Beijing:** Maintain reliability, integration, and tangibility advantages while continuously integrating latest information resources, designing open, advanced, high-performance, practical, and secure systems with reasonable, clear, and aesthetically pleasing layouts. Enhance professional skills, improve knowledge service capabilities, and increase response speed. - **Tianjin:** Maintain assurance, convenience, and equity advantages while continuously improving knowledge and technical capabilities, enhancing compatibility, and unconditionally opening e-government knowledge content.

Strengthen network security, real-time information updates, one-stop service construction, and system response speed.

As representative Chinese government websites, Shanghai, Beijing, and Tianjin portals should serve as models for all government websites to learn from, strengthening tangibility, assurance, integration, responsiveness, reliability, and adaptability to provide high-quality knowledge services and advance e-government knowledge services toward an innovative, applied, and efficient digital service stage.

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