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Service Quality Analysis of Business Licensing Information System (BLIS) at the Provincial Industry Department Using Decision Tree

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ABSTRACT

In the digital era, government services, particularly business licensing, are expected to be efficient, reliable, and user- friendly to meet public demands. The South Sumatra Provincial Industry Department has adopted a web-based Business Licensing Information System to facilitate the licensing process. However, the system's effectiveness in delivering quality service and ensuring process efficiency remains underexplored. This study aims to evaluate the service quality of the system, focusing on factors such as reliability, responsiveness, assurance, empathy, and usability. Using decision tree analysis, the study identifies the key variables impacting user satisfaction and process efficiency. The research objectivesinclude assessing the overall quality of the service, analysing factors influencing efficiency, and providing recommendations for system improvement. Data will be gathered from business users who have utilized the system withinthe past year. The study scope encompasses service quality dimensions, process efficiency indicators, and user satisfaction metrics. Decision tree analysis will be employed to analyse these variables, highlighting the most influentialfactors on system performance. This research is expected to provide insights for enhancing the system's reliability and usability, offering data-driven recommendations for decision-makers at the Industry Department. By improving the system, users can experience a more streamlined and satisfying licensing process, ultimately increasing their likelihood to recommend and reuse the service. The findings will also contribute to public information systems literature, serving asa valuable reference for similar service evaluations and optimizations in other government sectors.

1. INTRODUCTION

In the contemporary digital era, information technology has emerged as a pivotal catalyst for enhancing the efficiency and quality of public services. The rapid advancement of digital transformation presentsunprecedented opportunities for societal engagement, particularly concerning accessibility and the promptness of services [1]. Consequently, local governments, including the South Sumatra Provincial Industry Department, must adapt to these technological advancements to deliver superior services, especially within business licensing. The integration of technology hasfacilitated the transition from cumbersome and time-consuming processes to more streamlined and efficient operations. Business licensing is a crucial component of local economic development, conferring legal legitimacy upon entrepreneurs and fostering a conducive business environment. However, before the implementation of digital systems, the process was predominantly manual [2]. Entrepreneurs were required to physically visit the department office, complete paper-based forms, and navigate a lengthy series of procedural requirements. This approach presented significant challenges, particularly for those constrained by limited time and resources, often leading to administrative errors, delays, and dissatisfaction that undermined confidence in public services.

To address these issues, the South Sumatra Provincial Industry Department implemented a web-based Business Licensing Information System. This system empowers entrepreneurs to submit applications online, making the process faster, more user-friendly, and more transparent. Entrepreneurs can now access licensing services remotely at their convenience, eliminating the need for physical visits. This shift has optimized both time and cost efficiency while significantly enhancing the overall effectiveness of the licensing process. The system includes features such as simplified form completion, the ability to upload documentation, and real-time tracking of application status. These improvements have enhanced accessibility, enabling entrepreneurs to proactively manage their applications. By streamlining the process, the system has accelerated investment and industrial development in the region, although a comprehensive evaluation of its service quality remains imperative.

This study aims to evaluate the service quality of the system, focusing on dimensions like reliability, responsiveness, assurance, empathy, and usability. Using decision tree analysis, the research will identify key factors influencing user satisfaction and process efficiency. This methodological approach will enable the department to understand system performance better and pinpoint areas for improvement.

The findings are anticipated to provide actionable recommendations to enhance service quality and efficiency. By improving the system, the South Sumatra Provincial Industry Department can strengthen public trust and foster an improved business environment. This research not only supports the advancement of e-government services but also promotes sustainable economic growth for the broader community.

2. LITERATURE REVIEW

In recent years, e-government systems have increasingly prioritized enhancing public service delivery through digitization, aiming to improve efficiency, accessibility, and user satisfaction. Business licensing, as a fundamental aspect of public administration, has reaped significant benefits from this shift. Online platforms such as the Business Licensing Information System (BLIS) automate labour-intensive and resource-heavy manual processes, enabling faster and more streamlined service delivery [3]. This transition not only alleviates administrative burdens but also fosters greater transparency and accessibility, establishing a foundation for more effective and citizen-centric public services. The digitization of public services through e-government platforms has notably improved accessibility and operational transparency. Specifically, in the domain of business licensing, these platforms enable businesses to apply for, monitor, and receive licenses digitally. This innovation has significantly reduced processing times and operational costs while improving service delivery efficiency [4]. Empirical research highlights that the quality of e-government services is strongly influenced by factors such as usability, reliability, and responsiveness, all of which are critical to user satisfaction [5]. These findings underscore the necessity of designing systems that are not only functional but also responsive to the nuanced requirements of users.

Business licensing information systems are inherently designed to streamline the licensing process; however, evaluating their effectiveness requires a thorough examination of service quality dimensions, including reliability, responsiveness, assurance, and usability [6]. Established frameworks such as SERVQUAL have been adapted for digital service evaluations to measure critical parameters such as response times and system uptime. These metrics are indispensable for identifying performance gaps and enhancing the effectiveness of digital platforms [7]. Incorporating these evaluations allows policymakers and system developers to align service delivery mechanisms with user expectations and system performance standards.

Attributes within service quality dimensions, such as processing speed and the availability of technical support, play a decisive role in shaping user satisfaction. The C4.5 decision tree algorithm, an advancement of the ID3 algorithm, has been extensively utilised in assessing service quality due to its robust classification and predictive capabilities [8]. This algorithm's strengths lie in its ability to handle continuous data, address missing values effectively, and incorporate pruning techniques to mitigate overfitting. By computing information gain for each attribute, C4.5 identifies the most influential variables, constructs decision tree structures with the highest-gain attributes as root nodes, and recursively partitions data to achieve optimal classifications [9]. In the context of service quality analysis, the C4.5 algorithm provides an empirically grounded methodology for categorising user feedback and system performance data. Metrics such as "processing time," "accuracy," and "user satisfaction rate" serve as pivotal nodes within decision tree structures, with branches delineating satisfaction levels. This analytical approach offers nuanced insights into user interactions and highlights areas for improvement, enabling a data-driven enhancement of service delivery mechanisms [8]. For policymakers and administrators, such analyses are instrumental in refining e-government services to meet evolving user demands and ensure sustainable, high-quality digital public services.

3. RESEARCH METHODS

This study analyses the service quality of the Business Licensing Information System (BLIS) at the South Sumatra Provincial Industry Department using the C4.5 decision tree algorithm. The primary objective is to identify and evaluate the factors influencing user satisfaction, which include reliability, responsiveness, assurance, and usability. By utilising the C4.5 model, this research explores the relationships between these independent variables and the dependent variable, user satisfaction. The C4.5 algorithm is particularly suited for this analysis as it partitions data into multiple classes based on the most relevant attributes, leveraging information gain to prioritize critical factors impacting satisfaction [10]. The visualization illustrates the implementation of the C4.5 algorithm to analyse user satisfaction within the Business Licensing Information System (BLIS). The decision tree effectively categorizes satisfaction levels into "Satisfied" and "Not Satisfied," demonstrating the application of data-driven classification techniques. This model highlights the critical role of the C4.5 algorithm in identifying key attributes that influence satisfaction, providing valuable insights for improving service quality. The steps involved are as follows:

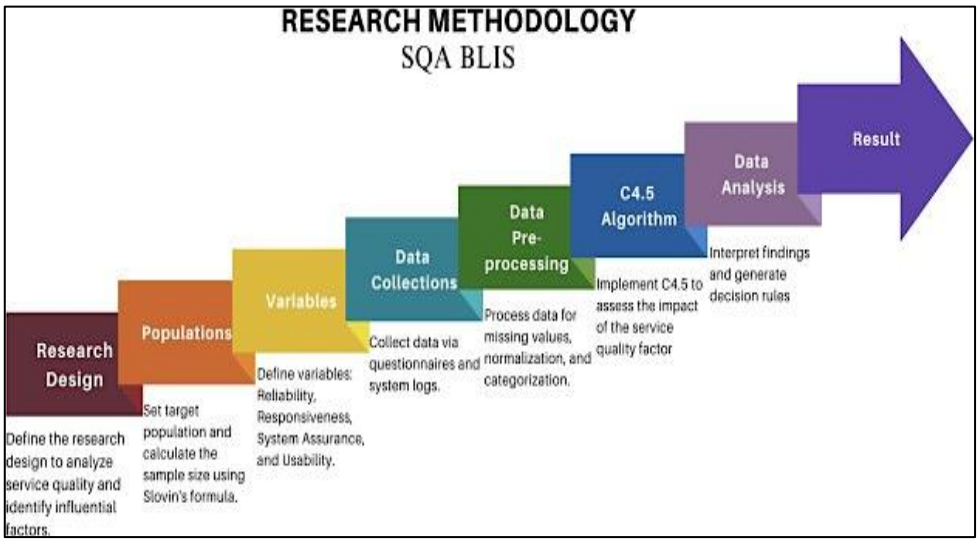

Figure 1. Research Methodology

The research methodology shown in Figure 1 adopts a structured and comprehensive approach, combining descriptive and analytical research designs. Descriptive research enables the identification and documentation of current service quality conditions, while analytical research delves into the impact of these factors on user satisfaction. According to [11], integrating these two approaches is highly effective for public service analysis, as it highlights key attributes and provides deeper insights into user behaviour and satisfaction levels. This dual approach ensures a robust framework for evaluating service quality within e-government systems. The target population of this study comprises users of BLIS at the Provincial Industry Department. Slovin's formula is employed to ensure the sample is representative while maintaining manageable data for analysis. This widely used formula accounts for the total population size (N) and a specified margin of error (e), ensuring statistical validity and reducing biases in the findings [12]. By applying this method, the research provides a reliable basis for generalizing results to the broader population, thereby enhancing the credibility and reliability of the study's outcomes [13]. This research focuses on specific variables—reliability, responsiveness, system assurance, and usability—as key dimensions for assessing service quality. These variables align with established e-service quality models, creating a comprehensive framework for evaluating user satisfaction in digital government services [14]. Data collection is conducted through system logs and usage data, providing both quantitative insights into system performance and qualitative feedback from users. This dual-source approach ensures a holistic evaluation of the system, combining objective metrics with subjective experiences [15].

Data preprocessing is a critical phase in the research, aimed at ensuring the collected data is accurate, consistent, and ready for analysis. Missing values are addressed using imputation techniques, and continuous variables are normalized to maintain a balanced analysis. Additionally, data is categorized into clear and meaningful classes, facilitating the effective application of the C4.5 algorithm. This preprocessing step is vital to improving the performance and reliability of the machine learning model, minimizing errors and biases in the results [16], [17]. The C4.5 decision tree algorithm is a powerful tool for constructing classification models, offering high accuracy and interpretability [18]. The algorithm calculates information gain to identify the most significant attributes, placing these at the root and subsequent nodes of the decision tree. Its ability to handle both numeric and categorical data, as well as its pruning mechanism to prevent overfitting, makes it an ideal choice for evaluating diverse service quality variables, such as reliability and responsiveness [9],[19]. These features ensure that the resulting model is both robust and generalizable.

The data analysis phase focuses on interpreting the decision tree model to derive actionable insights. The C4.5 algorithm identifies patterns in how variables such as responsiveness and usability influence user satisfaction, generating clear decision rules. For instance, rules such as "if processing time is low and system assurance is high, then user satisfaction is likely to be high" provide a data-driven basis for improvement strategies. This systematic analysis highlights specific areas requiring attention, enabling targeted enhancements in service quality [2],[20]. The findings of this research highlight the critical drivers and barriers to user satisfaction with BLIS. For example, if system assurance emerges as a significant factor, it underscores the need for strengthened security measures to enhance user confidence. These results offer practical guidance for policymakers and administrators, enabling them to focus on improving specific attributes of the system. Prior studies corroborate the value of such data-driven approaches in guiding e-government improvements and enhancing service delivery efficiency [21],[22]. This study not only advances the understanding of service quality evaluation but also provides actionable recommendations for enhancing digital public services effectively.

4. DISCUSSION AND RESULT

Table 1 below provides a comprehensive overview of the service quality metrics for the Business Licensing Information System (BLIS), organized into four primary service quality variables: Reliability, Responsiveness, Assurance, and Usability. Each variable consists of specific metrics that are categorized into performance levels (High, Moderate, Low) with values on a scale from 0 to 1. These values represent BLIS's performance in each area, offering a foundation for analysis using the C4.5 decision tree algorithm

Table 1. Service Quality of the Business LicensingInformation System

Variable	Metric	Category	Value
Reliability	Accuracy	High	0.92
	TPR	Moderate	0.78
	Availability	High	0.95
	Consistency	Moderate	0.80
Responsiveness	Precision	Moderate	0.85
	Processing Time	Low	0.70
	Technical Support	High	0.90
	Update Frequency	Moderate	0.75
Assurance	User Trust Accuracy	High	0.88
	FPR	Low	0.15
	Data Security	High	0.92
	Staff Competency	High	0.90
Usability	User Satisfaction Rate	Moderate	0.80
	Task Completion Rate	High	0.85
	Accessibility	High	0.90
	Interface Design	Moderate	0.75

The variable Reliability in Table 1 above includes metrics like Accuracy (0.92), True Positive Rate (TPR) (0.78), Availability (0.95), and Consistency (0.80). High values in Accuracy and Availability indicate that the system is precise and accessible, which is essential for reliability. Responsiveness comprises metrics such as Precision (0.85), Processing Time (0.70), Technical Support (0.90), and Update Frequency (0.75). Responsiveness reflects the system's ability to process and respond to user actions quickly and effectively. While high scores in Precision and Technical Support suggest that users are receiving accurate and efficient support, the lower score in Processing Time (0.70) indicates that the system might be slow in certain areas. Improving response speed could positively impact user satisfaction in this dimension. The Assurance variable includes User Trust Accuracy (0.88), False Positive Rate (FPR) (0.15), Data Security (0.92), and Staff Competency (0.90). These metrics reflect the security and trustworthiness of BLIS. High scores in User Trust Accuracy, Data Security, and Staff Competency imply strong user confidence in the system's operations, while the low FPR suggests minimal false alerts, which enhances trust. Usability consists of metrics such as User Satisfaction Rate (0.80), Task Completion Rate (0.85), Accessibility (0.90), and Interface Design (0.75). Usability is concerned with how easily users interact with BLIS. High scores in Accessibility and Task Completion Rate indicate that users can efficiently access the system and complete tasks, but a moderate score in Interface Design suggests room for improvement in user interface to enhance user experience.

Figure 2 below illustrates the application of the C4.5 algorithm to construct a decision tree for analysing user satisfaction within the Business Licensing Information System (BLIS). This decision tree classifies satisfaction levels into two categories, "Satisfied" and "Not Satisfied," based on the attribute Accessibility. The root node evaluates whether Accessibility to split the dataset into two branches. The tree's structure is guided by the principle of information gain, ensuring that the most significant attribute is selected to optimize classification accuracy. Figure 2 above evaluates the attribute Accessibility with the condition Accessibility <= 0.89. This condition splits the data into two branches: cases where Accessibility is less than or equal to 0.89 and cases where it is greater than 0.89. At the root node, the entropy is 1.0, indicating maximum uncertainty because the samples are evenly distributed between the two classes (value = [2, 2]). The C4.5 algorithm uses information gain to identify Accessibility as the most significant attribute for classification, ensuring an optimal split. The two branches lead to leaf nodes, which represent the final classifications. For the left branch (Accessibility <= 0.89), all samples are classified as "Not Satisfied," resulting in an entropy of 0.0, meaning there is no uncertainty (value = [2, 0]). For the right branch (Accessibility > 0.89), all samples are classified as "Satisfied," also with an entropy of 0.0 and no uncertainty (value = [0, 2]). The decision tree analysis using the C4.5 algorithm identifies Accessibility as the most significant factor influencing user satisfaction with the Business Licensing Information System (BLIS). This research shows improvement of Accessibility scores beyond this threshold that significantly enhances user satisfaction. By leveraging information gain, the decision tree highlights the most impactful attributes,

providing a clear and actionable framework for system optimisation and reinforcing Accessibility as a key metric for improving the service quality.

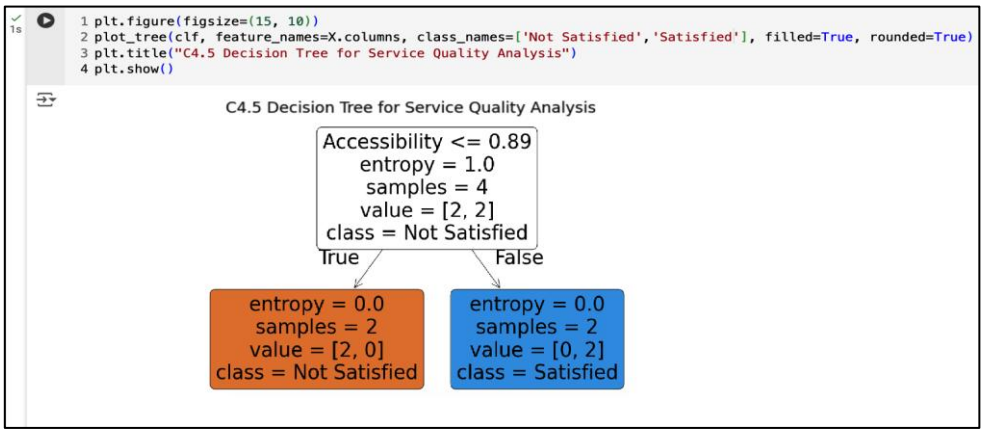

Figure 2. C4.5 Algorithm using Python

5. CONCLUSION

The service Quality Analysis of the Business Licensing Information System (BLIS) using the C4.5 decision tree algorithm has provided valuable insights into the factors influencing user satisfaction and system efficiency at the Provincial Industry Department. The analysis identified critical service quality dimensions and quantified their impact on user experience. The findings show that high reliability and usability scores, particularly in aspects like system availability, accuracy, and accessibility, contribute significantly to positive user satisfaction. However, lower scores in processing time and interface design indicate areas where the system could improve to better meet user needs.

The results from the decision tree model offer actionable recommendations for enhancing service quality in BLIS. By prioritizing improvements in metrics such as response speed and interface usability, the Industry Department can address specific user concerns and enhance the overall functionality of the licensing system. This data-driven approach not only supports decision-making but also aligns with the broader objective of digital transformation in public services, providing a foundation for continuous improvement in e-government systems. Ultimately, this study contributes to a more efficient and user-cantered licensing process, fostering trust and satisfaction among users and encouraging greater engagement with the system.

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