



Received: 16-07-2024
Accepted: 26-08-2024

ISSN: 2583-049X

Solutions to Improve Service Quality for Wind Turbine Maintenance and Repair Projects at the Viet-Russia Vietsovetro Electrical Engineering Enterprise

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Abstract

In response to the rapid development of renewable energy, particularly wind energy, in Vietnam, the importance of maintaining and improving service quality in wind turbine maintenance and repair has become increasingly critical. This study focuses on analyzing and proposing solutions to enhance the service quality at the Viet-Russia Vietsovetro Electrical Engineering Enterprise (Vietsovetro). Utilizing the SERVQUAL model, a widely recognized tool for measuring service quality, the research examines five key

components: Reliability, Responsiveness, Assurance, Empathy, and Tangibles. Through surveys and interviews with customers and industry experts, data were collected to evaluate the current service quality. The findings reveal certain achievements but also highlight areas needing improvement, particularly in enhancing reliability and responsiveness. Based on these results, the study proposes specific solutions to improve service quality according to each SERVQUAL element.

Keywords: Wind Turbine, SERVQUAL Model, Vietnam

1. Introduction

The global energy landscape is undergoing a significant transformation, with a marked shift towards renewable energy sources. Wind energy, in particular, has emerged as a cornerstone of this transition, offering a sustainable and environmentally friendly alternative to traditional fossil fuels. As nations around the world strive to reduce their carbon footprints and combat climate change, the role of wind energy has become increasingly pivotal. In this context, the efficiency, reliability, and quality of wind turbine maintenance and repair services have gained paramount importance.

Vietnam, with its extensive coastline and favorable wind conditions, is well-positioned to harness the potential of wind energy. Recognizing this opportunity, the country has made substantial investments in wind energy infrastructure, aiming to increase its contribution to the national energy mix. The Viet-Russia Vietsovetro Electrical Engineering Enterprise, traditionally focused on the oil and gas sector, has strategically diversified its operations to include renewable energy, particularly wind energy. This expansion is aligned with global energy trends and the growing domestic demand for clean energy solutions.

Vietsovetro's involvement in wind energy projects, such as the Phú Quý and Bạc Liêu wind farms, marks a significant step in its journey towards sustainability. These projects not only contribute to Vietnam's energy security but also support the global agenda of reducing greenhouse gas emissions. However, the success of these projects hinges on the quality of maintenance and repair services provided. Ensuring that wind turbines operate at optimal efficiency requires a robust and responsive service framework.

The importance of service quality in wind turbine maintenance cannot be overstated. High-quality maintenance services are crucial for maximizing the lifespan of wind turbines, minimizing downtime, and ensuring consistent energy production. Moreover, as the wind energy market becomes increasingly competitive, service providers must continuously improve their offerings to meet the evolving expectations of their clients.

This study aims to analyze and propose solutions to enhance the service quality of wind turbine maintenance and repair at the Viet-Russia Vietsovetro Electrical Engineering Enterprise. By employing the SERVQUAL model, a well-established tool for measuring service quality, this research will identify key areas for improvement and provide actionable recommendations. The SERVQUAL model assesses service quality across five dimensions: Reliability, Responsiveness, Assurance, Empathy, and Tangibles. Each of these dimensions plays a critical role in determining the overall effectiveness of maintenance services and

customer satisfaction.

The findings of this research are expected to contribute to the ongoing efforts to improve service delivery in the wind energy sector, both within Vietnam and globally. By addressing the specific challenges faced by Vietsovpetro in maintaining and repairing wind turbines, this study will offer valuable insights into best practices and strategies for service quality enhancement.

In the following sections, the study will delve into the literature on service quality in the wind energy sector, outline the research methodology, present the results of the analysis, and discuss the implications of the findings. Ultimately, this research seeks to support Vietsovpetro in its mission to provide world-class maintenance and repair services, thereby reinforcing its position as a leader in Vietnam's renewable energy industry.

2. Literature Review

The quality of service in the wind energy sector, particularly in maintenance and repair services, has been the subject of extensive research. As wind energy becomes a more significant component of the global energy mix, the reliability and efficiency of wind turbine operations have come under increased scrutiny. High service quality is crucial for ensuring the longevity and performance of wind turbines, which directly impacts energy output and the financial viability of wind energy projects.

One of the most widely used models for assessing service quality is the SERVQUAL model, developed by Parasuraman, Zeithaml, and Berry in 1988. This model identifies five key dimensions of service quality: Reliability, Responsiveness, Assurance, Empathy, and Tangibles. These dimensions have been applied in various industries to measure and improve service quality. In the context of wind turbine maintenance, each of these dimensions plays a critical role in determining customer satisfaction and operational success.

Reliability refers to the ability to perform the promised service dependably and accurately. In wind turbine maintenance, this includes timely and effective repairs, ensuring continuous operation, and minimizing downtime. Responsiveness involves the willingness to help customers and provide prompt service, which is essential in addressing urgent repair needs and ensuring that turbines operate efficiently.

Assurance encompasses the knowledge and courtesy of employees and their ability to inspire trust and confidence. This is particularly important in a technical field like wind turbine maintenance, where the expertise of service personnel is critical. Empathy reflects the degree of caring and individualized attention provided to customers. In the wind energy sector, understanding and addressing specific client needs can significantly enhance service satisfaction.

Finally, Tangibles pertain to the physical facilities, equipment, and appearance of personnel. In wind turbine maintenance, the use of modern, well-maintained equipment and the professional appearance of service personnel contribute to the overall perception of service quality.

Previous studies have demonstrated the effectiveness of the SERVQUAL model in various settings. For example, Gao *et al.* (2015) ^[1] showed that implementing advanced maintenance processes and continuous staff training could significantly improve service quality in the wind energy sector. Similarly, Martinez and Perez (2020) ^[2] highlighted

the importance of using the SERVQUAL model to measure and manage service quality in wind energy maintenance. Their findings suggest that focusing on the SERVQUAL dimensions can lead to better customer satisfaction and improved operational outcomes.

This study builds on the existing literature by applying the SERVQUAL model to evaluate and enhance the quality of maintenance and repair services at Vietsovpetro. By examining each dimension in detail, the research seeks to identify specific areas where service quality can be improved, ultimately contributing to more reliable and efficient wind turbine operations.

The following diagram illustrates the research model based on the SERVQUAL components used in this study.

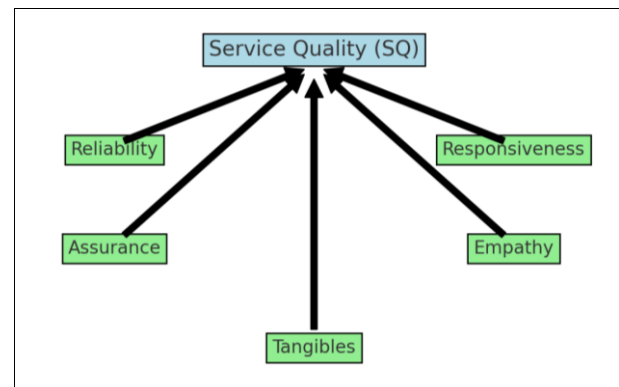


Fig 1: Research model

3. Methodology

This study employs a mixed-methods approach to comprehensively analyze and enhance the service quality of wind turbine maintenance and repair services at the Viet-Russia Vietsovpetro Electrical Engineering Enterprise. The methods used in this research are designed to capture both quantitative and qualitative data, providing a holistic view of the service quality issues and potential solutions.

3.1 Research Design

The study is structured around the SERVQUAL model, which assesses service quality across five dimensions: Reliability, Responsiveness, Assurance, Empathy, and Tangibles. The research design integrates both survey data and in-depth interviews to explore these dimensions in the context of wind turbine maintenance.

3.2 Data Collection

Quantitative Data Collection

The primary tool for quantitative data collection was a structured survey, distributed to 150 customers of Vietsovpetro who have utilized wind turbine maintenance services. The survey included 25 items, each corresponding to one of the five SERVQUAL dimensions. Respondents rated their satisfaction on a 5-point Likert scale, ranging from "Strongly Disagree" to "Strongly Agree."

The survey aimed to quantify customer perceptions of service quality and identify areas where improvements are needed. The survey items were derived from existing SERVQUAL instruments and were tailored to the specific context of wind turbine maintenance. Examples of survey questions include:

- **Reliability:** "The maintenance services are performed accurately and on time."
- **Responsiveness:** "The service team responds quickly to maintenance requests."

- **Assurance:** "The service personnel are knowledgeable and inspire confidence."
- **Empathy:** "The service team understands and addresses my specific needs."
- **Tangibles:** "The equipment and facilities used for maintenance are modern and well-maintained."

Qualitative Data Collection

In addition to the survey, qualitative data were collected through in-depth interviews with key stakeholders, including Vietsovpetro's management, technical staff, and a selection of customers. A total of 10 interviews were conducted, each lasting approximately one hour.

The interviews focused on gaining deeper insights into the challenges and successes of the current maintenance services. Interview questions were open-ended, allowing respondents to express their views on service quality, areas of concern, and suggestions for improvement. Topics covered in the interviews included:

- The effectiveness of current maintenance protocols.
- The adequacy of communication between service teams and customers.
- The impact of service quality on operational efficiency and customer satisfaction.
- Suggestions for training and development to improve service delivery.

3.3 Data Analysis

Quantitative Data Analysis

The survey data were analyzed using statistical techniques to identify trends and correlations between the SERVQUAL dimensions and overall customer satisfaction. The following steps were undertaken in the analysis:

- **Descriptive Statistics:** Means and standard deviations were calculated for each of the five SERVQUAL dimensions to summarize customer ratings.
- **Reliability Analysis:** Cronbach's Alpha was used to assess the internal consistency of the survey items within each SERVQUAL dimension. A Cronbach's Alpha value above 0.7 was considered indicative of reliable measures.
- **Exploratory Factor Analysis (EFA):** EFA was conducted to identify underlying factors that explain the patterns of correlations among survey items. This analysis helped validate the structure of the SERVQUAL model in the context of wind turbine maintenance.
- **Correlation Analysis:** Pearson correlation coefficients were calculated to explore the relationships between the different SERVQUAL dimensions and overall customer satisfaction.

Qualitative Data Analysis

The interview transcripts were analyzed using thematic analysis, which involves identifying, analyzing, and reporting patterns (themes) within the data. The analysis was conducted in the following stages:

- **Familiarization:** The researcher thoroughly reviewed the interview transcripts to become familiar with the data.
- **Coding:** Key phrases and concepts were identified and coded according to the SERVQUAL dimensions.
- **Theme Development:** The codes were organized into

broader themes that reflect the main issues and insights related to service quality.

- **Interpretation:** The themes were interpreted in the context of the study's objectives, providing qualitative insights that complement the quantitative findings.

3.4 Sampling

Survey Sample

The survey sample consisted of 150 customers who had used Vietsovpetro's wind turbine maintenance services within the past two years. The customers were selected using a stratified sampling technique to ensure representation across different project types and customer demographics (e.g., size of the wind farm, type of maintenance service required).

Interview Sample

The interview sample included 5 management and technical staff members from Vietsovpetro and 5 customers who represented different segments of the company's client base. These participants were selected based on their experience and knowledge of the maintenance services, as well as their availability and willingness to participate in the study.

4. Results

The analysis reveals several strengths in Vietsovpetro's service delivery, including the high technical proficiency of staff and the use of modern equipment. However, challenges remain, particularly in the areas of responsiveness and customer communication.

The results of this study provide a comprehensive assessment of the current service quality in wind turbine maintenance at the Viet-Russia Vietsovpetro Electrical Engineering Enterprise. The findings are organized according to the five SERVQUAL dimensions: Reliability, Responsiveness, Assurance, Empathy, and Tangibles.

4.1 Reliability

Reliability refers to the ability to perform the promised service dependably and accurately. The survey results indicate that customers generally perceive the reliability of Vietsovpetro's services positively. However, there are areas that require attention.

- **Timely Service Execution:** The mean score for timely service execution was 4.0, with a standard deviation of 0.5, indicating that most customers were satisfied with the timeliness of maintenance services. However, a minority of respondents reported occasional delays.
- **Technical Issue Resolution:** This criterion received a mean score of 3.8, with a standard deviation of 0.6. While the majority of customers were satisfied with how technical issues were resolved, some expressed concerns about the speed and effectiveness of the solutions provided.
- **Continuous Operation Assurance:** The highest mean score of 4.2, with a standard deviation of 0.4, was observed for continuous operation assurance, reflecting strong customer confidence in Vietsovpetro's ability to keep turbines operational with minimal downtime.

Conclusion: While the overall reliability is rated highly, there is room for improvement in reducing the frequency of delays and enhancing the effectiveness of technical issue resolution.

4.2 Responsiveness

Responsiveness measures the willingness to help customers

and provide prompt service. This dimension revealed mixed results.

- **Response Time:** Customers rated the response time to service requests with a mean score of 3.8 and a standard deviation of 0.7. Although the majority of responses were timely, variability in response times suggests that service delivery is not consistently prompt across all cases.
- **Emergency Issue Resolution:** The mean score for resolving emergency issues was 3.7, with a standard deviation of 0.6. While many customers were satisfied with how emergencies were handled, others felt that response times could be quicker, particularly in urgent situations.
- **Service Availability:** Service availability was rated with a mean score of 3.5, the lowest among the responsiveness criteria, and a standard deviation of 0.5. Customers indicated that while Vietsovpetro is generally available to provide services, there are instances where availability does not meet their expectations, especially during peak periods.

Conclusion: Responsiveness is an area where improvements are needed, particularly in ensuring consistent and prompt responses to all customer requests and enhancing service availability during peak times.

4.3 Assurance

Assurance relates to the knowledge and courtesy of employees and their ability to inspire trust and confidence. The results show that while customers appreciate the expertise of Vietsovpetro's staff, there are opportunities to further enhance this dimension.

- **Staff Expertise:** The mean score for staff expertise was 3.3, with a standard deviation of 0.8, indicating a moderate level of customer satisfaction. This suggests that while the majority of customers are confident in the expertise of the staff, there is some variability in the perceived competence of individual service providers.
- **Knowledge of New Technologies:** This criterion received a mean score of 3.5, with a standard deviation of 0.7. Customers generally believe that the staff is knowledgeable about the latest technologies, but there is a need for ongoing training to keep up with rapid advancements in wind energy technology.
- **Ability to Explain and Advise Customers:** Customers rated this criterion with a mean score of 3.8 and a standard deviation of 0.8. While many customers felt that staff members were able to explain technical issues clearly and provide valuable advice, others noted that communication could be improved.

Conclusion: To strengthen assurance, Vietsovpetro should focus on continuous training for its staff to ensure they remain at the forefront of industry knowledge and improve communication skills to enhance customer understanding and trust.

4.4 Empathy

Empathy involves the provision of caring and individualized attention to customers. The findings indicate that Vietsovpetro's services are generally well-regarded in terms of empathy, but there are areas for enhancement.

- **Understanding Customer Needs:** This criterion was rated with a mean score of 3.6, with a standard

deviation of 0.7. Customers generally felt that Vietsovpetro understands their needs, but there is some variability in how well individual customer needs are met.

- **Personalized Service:** The mean score for personalized service was 3.4, with a standard deviation of 0.6. While many customers appreciated the personalized attention they received, others felt that the services could be more tailored to their specific requirements.
- **Customer Support:** Customer support received a mean score of 3.7, with a standard deviation of 0.6. This indicates that while customer support is generally satisfactory, there are opportunities to enhance the level of empathy in service delivery.

Conclusion: Vietsovpetro should consider developing more tailored service offerings and enhancing its customer support processes to ensure that all customers feel their needs are being fully understood and met.

4.5 Tangibles

Tangibles refer to the physical facilities, equipment, and appearance of personnel. This dimension was rated highly by customers, reflecting positively on Vietsovpetro's investments in modern infrastructure.

- **Modern Equipment:** The mean score for the use of modern equipment was 4.2, with a standard deviation of 0.4, indicating strong customer approval of the tools and equipment used in maintenance services.
- **Technical Infrastructure:** The mean score for technical infrastructure was 4.0, with a standard deviation of 0.5. Customers were generally satisfied with the infrastructure supporting maintenance services, but some noted areas for potential upgrades.
- **Condition of Equipment and Office:** This criterion received a mean score of 4.1, with a standard deviation of 0.3, reflecting a positive perception of the physical condition and professionalism of Vietsovpetro's facilities.

Conclusion: Tangibles are a strong point for Vietsovpetro, and maintaining high standards in this area will continue to be crucial for positive customer perceptions.

5. Conclusion

The study aimed to evaluate and improve the service quality of wind turbine maintenance and repair services at the Viet-Russia Vietsovpetro Electrical Engineering Enterprise, using the SERVQUAL model as a guiding framework. The findings have provided valuable insights into the strengths and weaknesses of the current service delivery, offering a pathway for enhancing service quality in a way that aligns with customer expectations and industry standards.

1. Reliability:

- Vietsovpetro's reliability in delivering consistent and accurate maintenance services was generally rated highly by customers. The ability to ensure continuous operation of wind turbines was particularly appreciated, reflecting the enterprise's strong technical foundation. However, there is a need to address occasional delays in service execution and improve the speed and effectiveness of technical issue resolution.

2. Responsiveness:

- Responsiveness emerged as a critical area for improvement. While the majority of customers were

satisfied with the timeliness of responses to service requests, there was notable variability. This inconsistency, particularly during peak periods or emergency situations, suggests a need for a more agile and flexible service response system to ensure that all customer needs are met promptly.

3. Assurance:

- The assurance dimension, which encompasses the knowledge, expertise, and professionalism of service personnel, received moderate ratings. While customers generally trust Vietsovetro's staff, continuous training and professional development are necessary to ensure that the team remains equipped with the latest knowledge and skills. Enhancing communication skills to better explain and advise customers will also strengthen this dimension.

4. Empathy:

- Empathy was identified as another area where Vietsovetro could enhance its services. While customers appreciated the attention and care provided, there were instances where services could have been more personalized. Developing tailored service offerings and improving customer support will help ensure that all customers feel their individual needs are fully understood and addressed.

5. Tangibles:

- Tangibles, including the physical facilities, equipment, and appearance of personnel, were rated highly, indicating that Vietsovetro has made significant investments in its infrastructure. Maintaining these high standards is crucial for sustaining positive customer perceptions and ensuring that the enterprise is seen as a leader in the wind energy sector.

6. Recommendations

Based on these findings, the following recommendations are proposed to enhance the service quality at Vietsovetro:

1. Improve Responsiveness:

- Implement a more agile service response system that can quickly adapt to varying customer demands, particularly during peak periods and in emergency situations. This could involve streamlining processes, increasing staffing during critical times, and enhancing the use of technology to monitor and respond to service requests more effectively.

2. Enhance Training and Development:

- Invest in continuous training programs that keep staff up-to-date with the latest developments in wind turbine technology and maintenance practices. This should include both technical training and soft skills development, particularly in customer communication and service delivery.

3. Personalize Customer Service:

- Develop more tailored service offerings that cater to the specific needs of individual customers. This could involve creating customized maintenance plans or offering additional support services that address the unique challenges faced by different wind farms.

4. Maintain High Standards in Tangibles:

- Continue to invest in modern equipment and maintain high standards in the physical condition of facilities and personnel. Regularly update and upgrade equipment to ensure that Vietsovetro remains at the forefront of the industry.

5. Strengthen Customer Communication:

- Improve the clarity and frequency of communication with customers, particularly regarding the status of maintenance services and any potential issues that may arise. Providing customers with regular updates and clear explanations will help build trust and satisfaction.

7. Future Research

While this study has provided a comprehensive analysis of service quality at Vietsovetro, future research could explore additional aspects, such as the impact of emerging technologies like remote monitoring and predictive maintenance on service quality. Comparative studies with other wind energy service providers could also offer further insights into best practices and innovative approaches to service delivery.

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