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EDITOR'S NOTE

It is with great pleasure that we present the proceedings of the Research Exhibition in Mathematics and Computer Sciences (REMACS 8.0). This book is a collection of research work in the fields of Computer Science and Mathematics, contributed by the final year students from Universiti Teknologi MARA, Perlis Branch. The aim of this book is to showcase the diversity and depth of research in these two interrelated fields.

Mathematics and Computer Science are the two fields that have seen tremendous growth and advancement in recent years. With the rise of new technologies and the increasing demand for data-driven solutions, researchers in these fields have been working hard to develop new theories, algorithms, and models that can help solve some of the most pressing problems of our time. This book is a testament to their hard work and dedication.

The articles in this book cover a wide range of topics, including algebra, analysis, logic, computer architecture, algorithms, artificial intelligence, machine learning, computer network, netcentric computing and many more. The work presented here is both theoretical and practical and has the potential to impact on many areas of society, from finance and healthcare to education and security.

We hope that this book will serve as a valuable resource for future students in the fields of Mathematics and Computer Science. We also hope that it will inspire more students to pursue innovative and groundbreaking research in these two fields. Finally, we would like to express our gratitude to all the contributors for their hard work and dedication, without which this book would not have been possible.

THE EDITORS

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RANKING FACTORS INFLUENCING CONSUMER PREFERENCE IN CHOOSING A PETROL STATION USING FUZZY AHP

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Abstract

Many petrol station operators lack a structured approach to prioritising consumer preferences, especially in local areas like Perlis. This study applies the Fuzzy Analytical Hierarchy Process (F-AHP) to identify and rank factors influencing petrol station choices. A structured questionnaire was distributed to five selected experts, comprising UiTM Perlis lecturers, staff, and a petrol station worker. Pairwise comparisons and fuzzy AHP technique were employed to evaluate four main factors: fuel quality, service quality, location, and brand reputation, with each comprising three sub-factors. Results show fuel quality was the most significant factor (normalised weight = 0.4458), followed by brand reputation (normalised weight = 0.3207), location (normalised weight = 0.1327), and service quality (normalised weight = 0.1008). Sub-factors like loyalty programs and octane rating were highly ranked. Fuzzy AHP effectively highlighted priority areas for consumer decision-making, offering valuable insights for station operators and planners.

Keywords: *fuzzy AHP, petrol station, fuel quality, brand reputation, service quality, location*

1. Introduction

The main objective of this study is to rank the factors that influence consumer preference when choosing a petrol station using fuzzy AHP. Petrol station operators often rely on intuition or incomplete data for service improvements or station placement (Fowler, 2016). Without a structured approach, it is challenging to identify the factors that most significantly influence consumer preferences. This often leads to poor use of resources and limits opportunities for growth. There were four main factors, including fuel quality, service quality, location, and brand reputation, with each comprising three sub-factors. The respondents in the study were five experts, including lecturers and staff of the UiTM Perlis Branch, as well as petrol station workers in Arau, Perlis. The findings may not apply to other regions. Variations in local infrastructure, population density, economic conditions and regulatory environments could have led to different selections for petrol station dynamics in other areas.

2. Methodology

This study used the Fuzzy AHP method to rank factors that influence consumer preferences in petrol station selection. The process involved identifying the factors, designing a pairwise comparison questionnaire, converting linguistic terms into triangular fuzzy numbers, aggregating expert judgments, checking for consistency, calculating fuzzy weights, defuzzifying them into crisp values, normalising the results, and ranking the factors. Four main factors were considered: fuel quality, service quality, location, and brand reputation, with each comprising three sub-factors. Experts were selected based on their experience in petrol station operations or consumer behaviour research. The questionnaire was distributed manually to petrol station workers through face-to-face sessions, and online to UiTM Perlis staff and lecturers using the Smart Survey platform. All experts were guided to use the AHP one-to-nine scale. The questionnaire included twenty-six pairwise comparisons and took around thirty minutes to complete.

3. Results / Findings

The Fuzzy AHP analysis identified fuel quality as the most influential factor in consumer preference in choosing a petrol station, with a normalized weight of 0.4458, followed by brand reputation (normalized weight = 0.3207), location (normalized weight = 0.1327), and service quality (normalized weight = 0.1008). This result indicates that technical fuel aspects such as efficiency and engine performance are key priorities for consumers when selecting a petrol station. This result is consistent with the findings of Xavier et al. (2022), who emphasized that fuel quality plays a significant role in shaping customer satisfaction within petrol station services. Among the sub-factors, promotion and loyalty programs (normalized weight = 0.2488) were ranked as the most important sub-factor, followed closely by octane rating (normalized weight = 0.2295) and additive packages (normalized weight = 0.1986). These findings indicate that consumers simultaneously value economic incentives, such as loyalty programs, and technical reliability in fuel performance. This shows that consumers choose petrol stations based on both reasonable prices and good service quality in line with the findings of Sundjaja et al. (2022).

4. Novelty of Research

This study uses the Fuzzy AHP method to rank factors that influence consumer preferences when choosing a petrol station. It goes beyond previous research by combining product quality with consumer incentives in one framework. The Buckley approach is applied to capture expert judgment more accurately in uncertain conditions (Ayhan, 2013). This study focuses on Perlis to provide more location-specific insights. It also compares judgments from lecturers and staff of the UiTM Perlis Branch, as well as petrol station workers in Arau, Perlis. This gives a clearer picture of what consumers value. The results show that fuel quality influences consumers more than brand reputation, location and service quality in choosing a petrol station. This helps station operators understand where to improve. The novelty lies in applying fuzzy logic to a local context to support better decisions in the petrol retail industry.

5. Conclusion or Future Work

This study shows that fuel quality and brand reputation are the main factors for consumers in choosing a petrol station. Future research could apply this method to other states or compare urban and rural preferences. These findings can help petrol station operators focus on what matters most to attract and retain consumers.

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