Neutrosophic Multi-Criteria Method for Selecting Optimum Market

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Abstract

The Indonesian rolling stock maker's target market and business strategy are analyzed here—the study's planning, data, and technique. To achieve sustainable growth across the board in the power generating industry, we concentrate on understanding the critical variables driving sustainable development in a market context unlike before. To identify the most vital aspects to consider while dealing with ambiguous rules, a methodology using Multiple-Criteria Decision-Making (MCDM) was presented. To address ambiguity and bring the problem-solving process closer to reality, we created a unique method that integrates MCDM techniques. Analytical Hierarchy Process AHP was employed in this investigation. To zero in on our ideal clientele, we turned to the AHP technique. This strategy considers quantitative aspects such as market characteristics and degree of competition when making decisions. The results indicate that rolling stock manufacturers have good reason to invest in expanding their share of these markets. However, despite the many prospects available in this field, the rolling stock producer faces a significant obstacle: the inability to adequately fund the pursuit of a more considerable portion of the market

Keywords: Market selection; MCDM; Segmentation; AHP; Neutrosophic

1. Introduction

Trains are becoming more critical as the global transportation sector expands fast, especially the railway sector. The Association of the European Rail Industry (UNIFE), one of many research institutions that perform and publish these studies, reaches the same conclusion. All rolling stock producers are keen to compete for market size. However, if a business attempts to react reflexively to every change in the market, it would soon deplete its resources for little payoff. When choosing a market, a firm must carefully analyze its competitors and their strengths and weaknesses. In a highly competitive worldwide industry, it is difficult for any rolling stock manufacturer to increase their market share. To achieve market dominance, one must identify one's target market with great precision[1]–[3].

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Tosun, Unt, and Wadensjö argue that organizations still need to expand into new areas to grow and remain competitive in this age of globalization and technological change. A multi-criteria decision-making dilemma does not characterize the process of vetting potential overseas markets. Massive challenges and a shortage of reliable data on product quality attributes hamper accurate categorization. Market competition is increasing, and as a result, businesses must make wise marketing choices. Market selection and division are crucial [4]–[8].

Additionally, businesses need to put the data to use to fix the issue. Empirical causal link modeling is expensive and requires specialist knowledge, highlighting the significance of using market data for analytic target market selection. And since the high expense of the labor involved in this process means that businesses and organizations can't be sure it will be successful, they also can't rule out the chance that things could become worse[9]–[12].

Companies that place a higher value on these innovations are more likely to use them effectively, which results in a rise in the prevalence of these methods within international collective bargaining and, ultimately, the creation of multilateral cooperation and satisfactory contract terms for imports and exports. The choice of a target market is an example of an application of IT. Decisions on which markets to target and how they should be divided up are among the most important that any business's marketing managers will ever make. By dividing the market into distinct subsets, a company may better target its resources and efforts to meet the demands of its target audience. The ability to create objectives and factor loadings to the parameters and sub-criteria and familiarity with the item's features to be imported are necessary for successfully implementing the proposed approach[13]–[18].

This research provides a different strategy for deciding who to sell to. Every business that wants to expand internationally must choose the best course of action when exporting its products since various crucial obstacles, requirements, and institutional procedures may influence the export process. In this research, we propose a way for rolling stock manufacturers to customize their marketing plan better and pick their target market by combining the MCDM with the AHP. This research sifts through the literature on MCDM AHP applications to choose the best markets to focus on.

Choosing a specific demographic to sell to has generated much interest in recent decades. Different approaches have been suggested, implemented, and used to identify a target market using MCDM. The AHP is one such approach. Using an AHP study, analyzed how to best choose which market niches to target with Chinese textile and garment exports. AHP was used to rank the importance of the many variables affecting China's textile and garment industry. The AHP framework considers the following five factors: market buying power, capability, dominance, political situation, and required intensity. All five criteria were employed at a single tier in the framework. According to research, this technique can choose the best four options from six[19], [20]. They prioritize four worldwide market sectors for the aviation industry using AHP and PROMETHEE II.

Furthermore, the results from both approaches were the same. Market size, growth, share, political clout, price competitiveness, quality, and familiarity with the product were all considered. Despite the success achieved by the Judgment process's criteria, the results of this study imply that any future work in this area should focus on the four crucial "Ps" (Product, Place, Price, Promotion). The marketing mix's four components, or "Ps," were popularized. In addition, Al-shabeeb claims that AHP often contributes excellent findings, suggests and evaluates options, and offers a potent stages model to conceptualize the issue[21]–[24].

Accordingly, this study will employ the 4-Ps criteria in identifying the target market through the MCDM method utilizing AHP. Product (P) will be limited to conventional automobiles without autonomous driving technology. The second P, "Place," will be limited to an easily accessible service model; the third P, "Price," will serve as a component of the criteria; and the fourth P, "Marketing," will be an afterthought whose explanation is grounded in the findings of this article.

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With such a large market to exploit and so much stiff competition from other firms, rolling stock producers must have a solid basis on which to base their marketing and product development efforts[25]–[27].

More than a hundred large and small European companies are engaged in the design, production, repair, and refurbishing of rail transit systems, subsystems, and associated equipment, forming UNIFE as the representatives of the European rail industrial sector. To foresee the future expansion of the global rail market, UNIFE commissioned research. According to a study by UNIFE, the global rail market will expand by 2.7% annually between 2021 and 2023. Among the regions, Africa/the Middle East and Latin America have the fastest growth rates (5.2% and 4.8%, respectively), followed by NAFTA (3.1%). Development in Western Europe is at 2.2%, and it has been helped by the replacement and expansion of rolling stock in countries like Denmark, Germany, the United Kingdom, and France.

Since everyone is fully aware of how significant the potential profit is in the roll stock market, the rivalry is cutthroat. As much as home in the country of origin as it is in the international market where the manufacturer has its roots. The incredible thing is that there is no one winner that controls 100% of the market. In addition, the sector as a whole is quite free of monopolization, and the bulk of the market shows only modest allegiance to any supplier. As a result, this is a perfect chance to plot out future rail expansion plans. We can pinpoint the marketplaces' locations and get a sense of how they typically function.

New rolling stock purchases are prompted by market activity. There are essentially three types of motorists, and they are as follows: To fulfill the needs of capacity expansion, fleet revitalization, and new railway line rolling equipment. In addition, to track and locomotives, the new rail corridor project will need rolling stock in order to function. The Whole Market Potential is a geographical representation of all rolling stock projects in the railway industry.

2. Strategies for Research Methodology and Layout

Thomas Saaty proposed the AHP in 1970. The strategy relies on deconstructing a problem into its components to arrive at a solution. A ranked list of the components is provided. The features also include quantification and comparison of judgment factors. Numerous choice issues have benefited from the AHP approach, which involves breaking down criteria and options into a hierarchy and then using a decision model to contrast and contrast aspects.

For example, selecting a textile and clothing supplier may be difficult because of the variety of subjective variables that must be considered. AHP helps management overcome these difficulties. To implement AHP, one must first break down complex issues into manageable chunks. It combines all the solutions to individual problems into a single, comprehensive solution. Through pairwise comparisons, experts' judgments are used to generate priority scales that reveal the relative importance of different criteria when evaluating a set of options. Using a layered architecture framework of the planning and tracking launched by top management, the judge may zero in on relevant criteria and sub-criteria. The objectives are drawn from many vantage points, from the intermediate to the fundamental, usually a collection of answers. Figure 1 depicts a straightforward AHP model.

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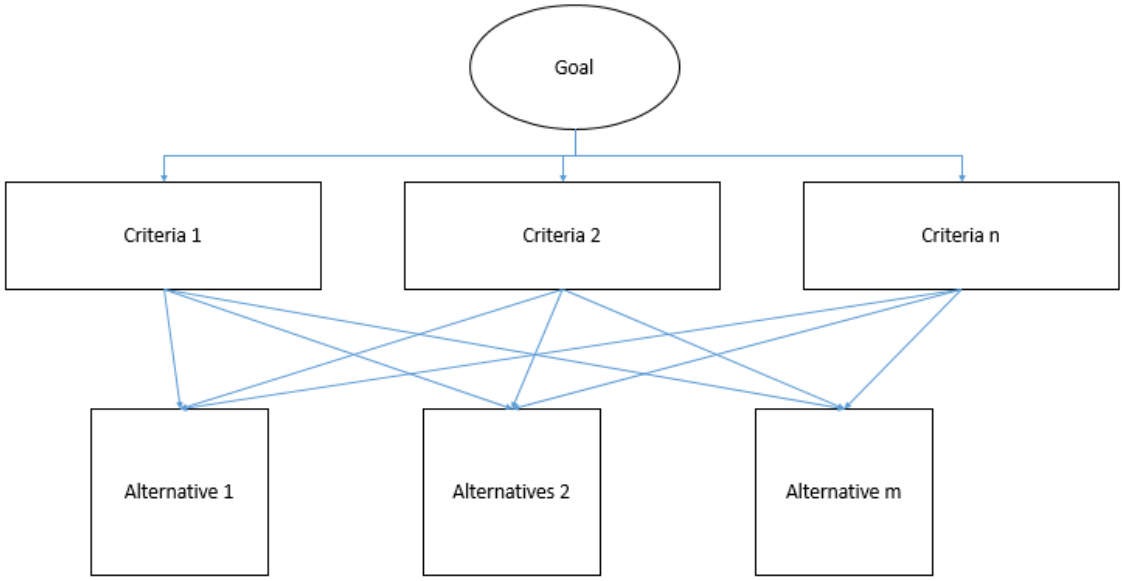

Figure 1: The hierarchy tree of the problem.

Advantages, possibilities, costs, and dangers are all examples of either tangible or intangible factors that may be arranged in a hierarchical decision model. To choose the best option from a set of possibilities, this strategy considers both concrete and abstract criteria while also considering the plausibility and intuitiveness of the choices on the table. For instance, the AHP has been put to use in numerous contexts. These regions have already implemented AHP with the following caveats: (1) Selecting a preferred option from a set of feasible alternatives when many choice factors are in play. The second method, called "ranking," consists of placing options in order from best to worst. The third strategy is prioritization, which is picking the best possible answers. Allocating resources among several options is called resource allocation. (5) Benchmarking entails evaluating an organization's business transformation methods against other successful firms. Sixth, "quality management" refers to the work to address the many contributors to quality and quality growth. (7) Resolving disputes involves bringing together persons with apparently incompatible goals or professions and finding common ground.

The available market will be ranked and prioritized using AHP in this article. After segments have been created, the next step is targeting.

To make a call, the AHP approach entails the following stages:

Creation of a model: breaking down the issues into parts (goals, characteristics, and choices).

Establish priorities by comparing predicted goals pairwise to determine criterion significance.

Get a list of options with your priorities: Get your choices for each criterion.

To summarise the model, keep in mind that the weight of every criterion is taken into account when formulating the overall choices of the alternatives and that all preferences are expressed as a weighted sum. The best solution is the one that receives the most votes.

Make a final decision based on the analyses and outcomes.

Following those guidelines, the first step is to decide what needs to be accomplished. This article aims to narrow down the potential customer base within the constraints of the rolling stock producer.

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Quantitative parameters will be investigated once a corporate objective has been established; they will be used to identify the criteria required for AHP modeling. Information culled from leading rolling stock publications over the past 5 years, including Railway Pro, World Railway Journal, and Railroad Gazette International. Euler-Hermes, a leading credit risk consultant, obtained nonpayment risk information for each nation. In addition, various macro-parameters of a nation tend to track statistics from the World Bank. All of the collected data is shown in a single, easy-to-navigate table in the appendix, which has been cleaned of any traces of noise and organized to facilitate screening and short selling.

To make an intelligent decision on the criteria, you use to define your target market, keep in mind that you can't make a sale without first satisfying consumer demand. Once demand is present, observing the capacity of the possible customer needs to be watched; in contrast to this, the less the probability of nonpayment would make the prospective investor more appealing if the judicial index in that nation is strong enough. Despite meeting all of these requirements, the firm still has to convince prospective customers to stick with it because of its superior competitive positioning in the rolling stock manufacturing industry. A distinct set of criteria, including market purchasing power, give clear market dominance, good governance, and the degree of need. Boeing's usage of AHP in their Strategic Market Decision. In this instance, it splits the eligibility requirements into two important criteria: Aesthetic And functional and Competitive Strength. In this article, we'll try to combine the criteria from the two articles and examine how they might be utilized to choose a target audience for rolling stock producers. Figure 2 shows the AHP structure.

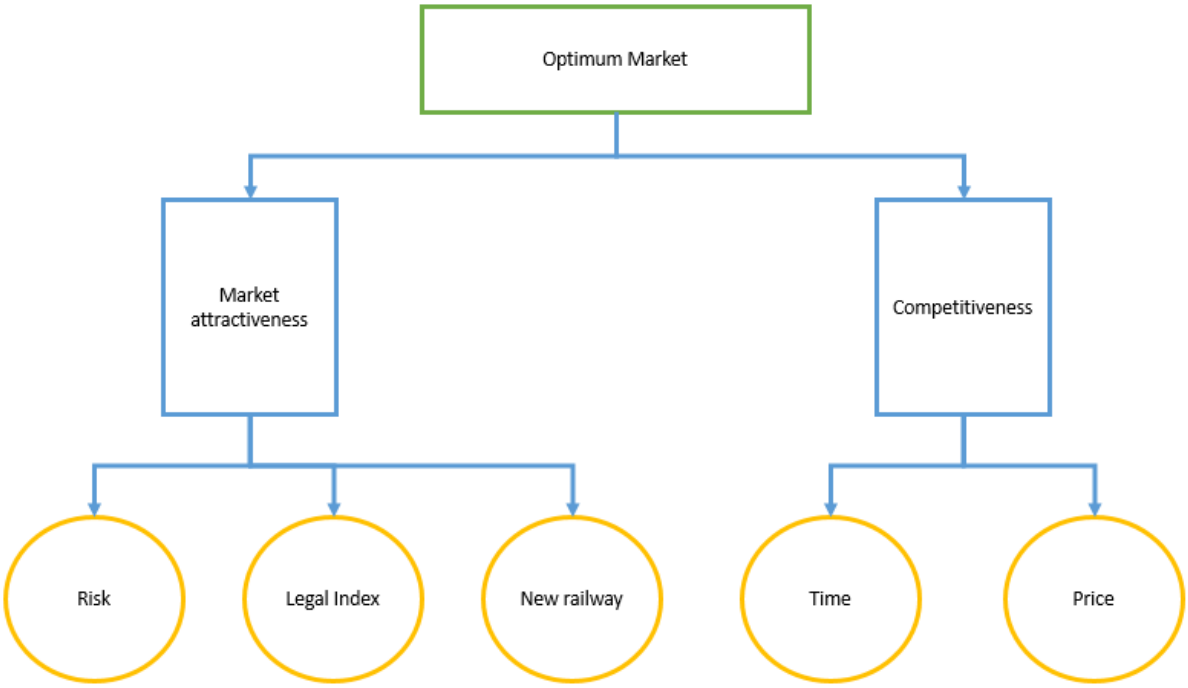

Figure 2: The structure of the AHP.

3. Results and analysis

By dividing the five criteria given by Zhao into the two fundamental criteria of Industry Attractiveness and Competition Strength, this structure is a hybrid of the two-level architecture of AHP employed in the Boeing case, as mentioned in the secure choice device's example. The requirements may be summed up in a simple formula known as the "4-Ps," proposed.

After settling on a framework, the business must next identify which criteria are most important by comparing them head-to-head to establish how much weight each should be given to get the desired

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end result. The first comparison will be between market attractiveness and the Strength of the competition. From this vantage point, the allure of the market is roughly equivalent to the threat posed by the competition. In any case, with a bias toward the competitive edge.

The criteria for commercial viability. The number of metro rail, the risk of nonpayment, the legal power index, and brand loyalty are the four parameters used in a head-to-head comparison. For example, Table 1 displays a comparison matrix for all possible combinations of the abovementioned factors. Where MSC is market selection criteria1

Table 1: The comparison matrix.

	MSC1	MSC2	MSC3	MSC4
MSC1	1	5	7	3
MSC2	0.2	1	5	5
MSC3	0.14285714	0.2	1	7
MSC4	0.33333333	0.2	0.14285714	1

The numbers used for administration inside the table are actual figures. We have to have a scale to evaluate the relative importance of the various factors.

However, in terms of competitive power, both price and turnaround time are equally important. A pairwise matrix may be computed using the parameters listed in table 3 for each choice after the firm has conducted its pairwise comparisons. To make a fair comparison among each pair, we divide the numerical information presented in the parameters of the various options by their respective numbers. The table's criteria for the alternatives are based on data collected from various reliable sources. In rolling share price research, the first step is to compile a list of upcoming projects from reliable sources. Second, reliable rating firms like Euler Hermes are consulted to determine the default rate. Third, information from the World Bank is used to compile the legal strength index.

Using AHP and PROMETHEE II, Haddad ranked the four areas as Boeing's target markets, and both methods yielded the same conclusion. More so, the key elements that affect China's textile and clothing trade have been effectively evaluated by Zhao. Utilizing the AHP framework introduced, the aforementioned relevant criteria serve as the foundation for choosing market segments for the sector in Asia. This research combines the two concepts up front to show that the technique correctly ranks the market segments of a railway supplier across various nations with known quantitative data.

Future research based on this publication shouldn't only concentrate on the evaluation phase. However, the GE-McKinsey Matrix is also used to rank all known projects by placing them into one of four quadrants according to market characteristics and the company's current degree of competition.

The nine-box matrix provides the decentralized organization with a methodical means of determining where to allocate resources. Companies don't need to depend on individual divisions' projections of their future performance if they consider the desirability of the associated sector and the division's competitive power within that sector (Quarterly, 2008).

As there are many different kinds of rolling stock, every market may be considered a different kind of business. Consequently, market attractiveness may also be called the attractiveness of a specific sector. In addition, the work put into breaking into a new market might be considered an investment in and of itself. For this reason, prioritizing and rating the target audience is not a done deal; in the latter, it may be worthwhile to include the already-established market into the GE-McKinsey 9 matrix. This means that after the market is defined and assessed, the firm will have many viable possibilities from which to choose. One may either invest, earn, or sell off assets.

4. Conclusion

The findings of this article support the use of AHP with the 4-P criterion for choosing target markets in the rolling stock industry. Australia, Kenya, Tanzania, New Zealand, and India have been shown to be the top five markets out of twenty-four options. The theoretical foundation for making an

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informed decision about a rolling stock company's target market is provided in this study. Therefore, the AHP technique necessitates taking into account the opinions of specialists from each organization during implementation, particularly regarding comparing the criteria in pairs.

In line with the study's goals, its findings may be utilized by the rolling stock industry as a benchmark for deciding which markets to focus on. Both the criteria used and the specifications of the alternatives may be modified according to the available resources and constraints, as well as the professional judgment of the company's specialists.

References

[1] L. Kogan, S. A. Ross, J. Wang, and M. M. Westerfield, "Market selection," *Journal of Economic Theory*, vol. 168, pp. 209–236, 2017.

[2] W. H. Davidson, "Market similarity and market selection: Implications for international marketing strategy," *Journal of Business Research*, vol. 11, no. 4, pp. 439–456, 1983.

[3] Noura Metawa , Amany Ahmed Elshimy, Parameter Tuned Machine Learning based Decision Support System for Bank Telemarketing, American Journal of Business and Operations Research, Vol. 4 , No. 1 , (2021) : 28-38

[4] N. Papadopoulos and O. M. Martín, "International market selection and segmentation: perspectives and challenges," *International Marketing Review*, 2011.

[5] G. Dosi, O. Marsili, L. Orsenigo, and R. Salvatore, "Learning, market selection and the evolution of industrial structures," *Small business economics*, vol. 7, no. 6, pp. 411–436, 1995.

[6] N. Alexander, M. Rhodes, and H. Myers, "International market selection: measuring actions instead of intentions," *Journal of services marketing*, 2007.

[7] O. Andersen and A. Buvik, "Firms' internationalization and alternative approaches to the international customer/market selection," *International business review*, vol. 11, no. 3, pp. 347–363, 2002.

[8] S. Malhotra, K. Sivakumar, and P. Zhu, "Distance factors and target market selection: the moderating effect of market potential," *International marketing review*, 2009.

[9] D. Dow, "A note on psychological distance and export market selection," *Journal of international marketing*, vol. 8, no. 1, pp. 51–64, 2000.

[10] N. Papadopoulos, H. Chen, and D. R. Thomas, "Toward a tradeoff model for international market selection," *International business review*, vol. 11, no. 2, pp. 165–192, 2002.

[11] P. Brewer, "International market selection: developing a model from Australian case studies," *International Business Review*, vol. 10, no. 2, pp. 155–174, 2001.

[12] L. Foster, J. Haltiwanger, and C. J. Krizan, "Market selection, reallocation, and restructuring in the US retail trade sector in the 1990s," *The Review of Economics and Statistics*, vol. 88, no. 4, pp. 748–758, 2006.

[13] Alaa Elsayed Elsayaad, A new way of Reaching consumers: the Role of Marketing Related Mobile Factors on the Consumers' Acceptance of Multichannel Mobile Marketing, American Journal of Business and Operations Research, Vol. 3 , No. 2 , (2021) : 94-106

[14] L. E. Brouthers and G. Nakos, "The role of systematic international market selection on small firms' export performance," *Journal of Small Business Management*, vol. 43, no. 4, pp. 363–381, 2005.

[15] C. Gaston-Breton and O. M. Martín, "International market selection and segmentation: A two-stage model," *International Marketing Review*, 2011.

[16] P. Westhead, M. Wright, and D. Ucbasaran, "International market selection strategies selected by 'micro- and 'small firms," *Omega*, vol. 30, no. 1, pp. 51–68, 2002.

[17] Ahmed N. Al-Masri , Manal Nasir, A Novel Fuzzy Clustering with Metaheuristic based Resource Provisioning Technique in Cloud Environment, Fusion: Practice and Applications, Vol. 6 , No. 1 , (2021) : 08-16

[18] Ø. Moen, M. Gavlen, and I. Endresen, "Internationalization of small, computer software firms: Entry forms and market selection," *European Journal of Marketing*, 2004.

[19] D.-Y. Chang, "Applications of the extent analysis method on fuzzy AHP," *European journal of operational research*, vol. 95, no. 3, pp. 649–655, 1996.

[20] T. L. Saaty, "Decision-making with the AHP: Why is the principal eigenvector necessary," *European Journal of operational research*, vol. 145, no. 1, pp. 85–91, 2003.

[21] R. de FSM Russo and R. Camanho, "Criteria in AHP: a systematic review of literature," *Procedia Computer Science*, vol. 55, pp. 1123–1132, 2015.

[22] M. B. Ayhan, "A fuzzy AHP approach for supplier selection problem: A case study in a Gear motor company," *arXiv preprint arXiv:1311.2886*, 2013.

[23] V. S. Lai, B. K. Wong, and W. Cheung, "Group decision making in a multiple criteria environment: A

Doi: https://doi.org/10.54216/IJNS.190126

Received: March 23, 2022 Accepted: September 20, 2022

case using the AHP in software selection," *European Journal of Operational Research*, vol. 137, no. 1, pp. 134–144, 2002.
[24] T. L. Saaty, "Decision making—the analytic hierarchy and network processes (AHP/ANP)," *Journal of systems science and systems engineering*, vol. 13, no. 1, pp. 1–35, 2004.
[25] Y. Liu, C. M. Eckert, and C. Earl, "A review of fuzzy AHP methods for decision-making with subjective judgments," *Expert Systems with Applications*, p. 113738, 2020.
[26] M. C. Y. Tam and V. M. R. Tummala, "An application of the AHP in vendor selection of a telecommunications system," *Omega*, vol. 29, no. 2, pp. 171–182, 2001.
[27] K. M. A.-S. Al-Harbi, "Application of the AHP in project management," *International Journal of project management*, vol. 19, no. 1, pp. 19–27, 2001.

Doi: https://doi.org/10.54216/IJNS.190126

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