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The future of PROMETHEE in marketing

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ABSTRACT

This paper discusses how the PROMETHEE II method can be used to solve important marketing issues like product selection, customer segmentation, and brand preference analysis. By incorporating both qualitative and quantitative data with PROMETHEE II, marketers can provide clear, transparent, and actionable decision rankings. By relying on recent empirical studies and comparative research, this study emphasizes the method's versatility, decision transparency, and ease of communication with stakeholders. It acknowledges that there is room for improvement in weight sensitivities, scalability in complicated situations, and integration with real-time decision-making systems. The paper's conclusion suggests future research directions, highlighting the potential of combining PROMETHEE II with artificial intelligence, big data analytics, and hybrid decision models to make it more applicable in new digital marketing landscapes.

Keywords: *PROMETHEE II, MCDM, customer segmentation; brand preference, metaverse marketing*

Introduction

Decision-makers often encounter difficult tasks when evaluating multiple alternatives based on diverse criteria in the ever-evolving marketing landscape. When it comes to product selection, customer segmentation, and brand preference analysis, marketers need to take into account a range of factors that may not always align. In marketing, the PROMETHEE method, specifically its more advanced version PROMETHEE II, has become a powerful tool to address multi-criteria decision-making (MCDM) problems. Mareschal & Brans and (1988) developed the PROMETHEE II method that ranks and prioritizes alternatives by calculating preference flows using a set of weighted criteria. The application of this method in marketing has been extensive, with particular emphasis on analyzing consumer preferences, segmenting markets, and selecting products. The purpose of this paper is to deepen our understanding of PROMETHEE II's usage in marketing with a focus on its strengths, limitations, and potential enhancements for future use.

Theoretical background

The PROMETHEE I method can be extended to conduct pairwise comparisons between alternatives with the help of the PROMETHEE II method. PROMETHEE II overcame this limitation by introducing the net flow concept, despite PROMETHEE I generating a partial ranking. The net flow determines the distinction between the positive and negative flows for every alternative. A more precise and reliable decision-making tool is provided by this complete ranking, particularly in situations where marketers need to choose between competing alternatives. Pairwise comparisons are at the heart of the PROMETHEE II method. Decision-makers determine whether one alternative is better than the other based on several criteria for each pair of alternatives. The weight of each criterion is predefined and reflects its relative importance. The method translates these weights into an outranking relationship, which is a preference relationship that is determined by the criteria. The total outranking flows are calculated by PROMETHEE II to derive a net flow for each alternative (Brans & Mareschal,1992). Alternatives that have higher net flows are considered to be better choices. The PROMETHEE II method's capacity to handle both qualitative and quantitative data makes it particularly helpful for marketers who have complex decision-making processes (Brans & Mareschal, 2005). The PROMETHEE II method has become widely accepted for various marketing

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issues, particularly in product selection, customer segmentation, and brand preference analysis due to its versatility. In marketing, the PROMETHEE II method is frequently used for product selection and portfolio optimization. The task of selecting products that will perform well in the market for marketers often involves considering multiple criteria such as price, quality, innovation, and customer demand. In these circumstances, PROMETHEE II enables marketers to prioritize products based on their performance on different metrics. The application of PROMETHEE II to select green products for a company is highlighted in a prominent study by Liu et al. (2020). Alternatives were evaluated by the researchers based on criteria including environmental impact, customer preference, and profitability. The researchers ranked potential products and optimized the company's product portfolio using the method that assigns appropriate weights to each criterion. The research demonstrated that PROMETHEE II can incorporate multiple factors, resulting in marketers making well-informed decisions in complex product selection processes.

More recently in the PROMETHEE analysis, it was included the mechanism of:

- PROMETHEE III for ranking based on interval,
- PROMETHEE IV for complete or partial ranking of the alternatives when the set of solutions is continuous,
- PROMETHEE V for problems with segmentation constraints (Brans & Mareschal,1992),
- PROMETHEE VI for the human brain representation (Brans & Mareschal, 1995),
- PROMETHEE GDSS for group decision- making (Macharis et al., 1998), and the
- Visual interactive module GAIA (Geometrical Analysis for Interactive Aid) for graphical representation were developed to help in more complicated decision-making situations (Mareschal & Brans, 1988; Brans & Mareschal,1994; Brans & Mareschal, 2005).

The visual PROMETHEE in marketing research

Decision-makers can use the software to rank, sort, and analyze complex decision problems with multiple, often conflicting criteria using the PROMETHEE method and graphical visualization tools (GAIA plane analysis). Marketing managers are given a structured, transparent, and interactive approach by visual PROMETHEE to address complex marketing decisions that involve multiple conflicting criteria (Mareschal, 1984; Mareschal & De Smet, 2009; Mareschal, 2020; Tarnanidis et al., 2023). Mareschal recommended that marketing managers use the visual PROMETHEE software to make the best alternative decisions. The necessary steps are:

1. Define the problem in marketing (e.g. choosing a market segment and prioritizing the product lines.
2. Identify what needs to be considered when making a decision (e.g. **e**nsure that stakeholders are involved in the selection of relevant qualitative and quantitative criteria.
3. Collect data and assess its performance (e.g. analyze each alternative against each criteria using scales, expert judgment, or market data)
4. Establish the weights of the criteria based on their significance using stakeholder input or an analytical hierarchy process (AHP).
5. Execute a PROMETHEE evaluation (e.g. calculating preference flows and visualizing results using the GAIA)
6. Examine the reliability of rankings and decision recommendations by adjusting criteria weights while interpreting and testing results.

Researchers and practitioners can consult the visual PROMETHEE manual in the official Mareschal website (for firther info see Appendix and the following link: https://bertrand.mareschal.web.ulb.be/promethee.html) for more information on using the PROMETHEE method. Some scholarly articles and references that discuss or use visual PROMETHEE or PROMETHEE methods in marketing or related business decision contexts are the design of operational synergies in multicriteria analysis (Durán et all., 2020; Macharis et al., 2004) and a broad review including marketing, supplier selection, and service quality assessment (Behzadian et al., 2010; Kumar, 2025).

Application of PROMETHEE II in Marketing

PROMETHEE II has been a great help in customer segmentation. The act of segmenting a market involves grouping consumers who have similar needs, preferences, or behaviors. However, it should be mentioned that traditional segmentation techniques often fail to take into account the complexity of consumer decision-making, which is influenced by multiple factors. In these cases marketers can use the PROMETHEE II method to evaluate customers using various criteria, such as loyalty, purchasing behavior, demographic characteristics, and engagement. Casas-Rosal et al. (2023) applied PROMETHEE II to segment customers in a food market environment. They assessed consumer behavior and preferences, including frequency of purchase, product categories, and price sensitivity. By applying the PROMETHEE II method, they were able to categorize customers more effectively than traditional segmentation methods, providing valuable insights for targeted marketing campaigns. Furthermore, PROMETHEE II can be utilized in brand preference analysis to identify the brands that consumers prefer based on factors such as product quality, price, customer loyalty, and brand reputation. Companies can refine their branding strategies by using the method to rank competing brands. Maidinsah & Aziz (2020) demonstrated the utility of PROMETHEE II for analyzing brand preferences. The researchers derived a ranking that highlighted the most favored brands by comparing multiple brands based on criteria such as customer satisfaction, product quality, and social perception. By doing so, companies were able to adjust their marketing and branding strategies to align more closely with consumer preferences. Structured MCDM tools were utilized by Tarnanidis and colleagues in marketing, particularly with PROMETHEE

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(see table 1). Their investigation fills significant methodological holes in marketing decision-making. By expanding these tools into new areas (metaverse, digital marketing), innovation is possible. Based on their research, they found limitations in empirical validation, integration with data-driven AI systems, and scalability to dynamic, real-time environments.

Table 1: Comparative analysis

Study	Focus	Key Contributions	Implications
Multiple-Criteria Decision-Making (MCDM) Techniques and Statistics in Marketing (Tarnanidis et al., 2025a)	Marketing decisions using MCDM techniques	Linking MCDM with real marketing problems and integrating qualitative and quantitative methods.	MCDM in marketing that incorporates AI, big data, and multiple channels
Marketing in the Metaverse Through MCDM Methods and Statistics (Tarnanidis et al., 2025b)	Using MCDM to make metaverse marketing decisions.	Introducing PROMETHEE and AHP to virtual/immersive markets.	Studying metaverse data in real life; integrating AI analytics
MCDM Review in Marketing and Managerial Decisions: Practical Implications and Future Research (Tarnanidis et al., 2025c)	Taking a systematic approach to MCDM in marketing and management	An extensive overview; both practical and managerial insights	Combine AI, sustainability, and real-time marketing decisions in a way that is effective
Digital marketing and AI integration with robotics for the fight against racism in football (Tarnanidis, 2025)	Using AI, robotics, and digital marketing to address racism in football across different cultures	Attempts to merge digital campaigns with AI and robotics to enhance social responsibility marketing and cultural sensibility	Implement PROMETHEE II for judging multi-criteria digital campaigns that take into account social impact, engagement, cultural relevance, and technology adoption.
Exploring the Impact of Mobile Marketing Strategies on Consumer Behavior (Tarnanidis, 2024a)	Consumer decision-making is influenced by mobile marketing strategies	Defines the key factors, such as personalization, timing, privacy, and conversion, that shape mobile consumer behavior	Using PROMETHEE II, rank mobile marketing tactics by multi-criteria including personalization, conversion rate, cost, and privacy concerns.
What Lies Ahead for Marketing in Wholesale and Retailing (Tarnanidis , 2024b)	What's to come in retail and wholesale marketing in the future?	Examines new retail models, digital integration, and operational shifts to meet the demands of consumers	Ensure efficiency, customer experience, digital presence, and costs are balanced by choosing a multi-channel strategy using PROMETHEE II.
Leveraging Marketing Strategies to Help Consumers Make Decisions Using Metaverse Technologies (Tarnanidis & Gkiouzepas, 2024)	Consumers are assisted with decision-making through the use of metaverse technologies.	Discusses the enhancement of decision support by immersive, personalized virtual environments	PROMETHEE II has the option to prioritize various metaverse tools and strategies based on their effectiveness in engagement, personalization, and decision-assistance
New Trends in Marketing and Consumer Science Tarnanidis & Sklavounos, 2024)	An in-depth examination of new developments in marketing and consumer research.	Points out the importance of integrating AI, big data, and new decision models to adapt to rapidly changing market environments	Create marketing decision-making frameworks that are dynamic and live in real time with PROMETHEE II's integration of AI and big data analytics
Research Notes on the Future of Marketing and Consumer Insights (Tarnanidis & Manaf, 2024)	Information on marketing research priorities and methodologies for the future	Emphasizes the growing complexity of consumer insights, necessitating decision models that are more flexible and adaptive	Integrate AI-generated insights and real-time data to manage complex multi-dimensional marketing problems with the use of PROMETHEE II.
Review and the Use of PROMETHEE Methods in Marketing Problems (Tarnanidis et al., 2023)	Using metrics to make marketing decisions.	Highlights the strengths and applications of PROMETHEE	Integrate social media analytics and a hybrid decision system into PROMETHEE.

Source: The author

The research conducted by Tarnanidis and his team has made a significant contribution to integrating Multiple-Criteria Decision-Making (MCDM) methods in marketing research and practice, particularly with the PROMETHEE method. More

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analytically, the edited volume provides a comprehensive and comprehensible introduction to how MCDM techniques like PROMETHEE, AHP, and TOPSIS can be utilized in marketing decision-making, but it occasionally lacks methodological rigor (Tarnanidis et al., 2025a). Their research demonstrates how models like PROMETHEE, AHP, and TOPSIS can improve decision quality in scenarios with multiple competing criteria, such as pricing, service quality, brand image, and customer satisfaction. The book's practical value lies in integrating qualitative and quantitative assessments, with case studies that can be applied to market segmentation, supplier selection, and service evaluation. The accessibility and practical orientation of this work make it easier for marketing managers to understand complex decision models. Despite its broad coverage, it lacks methodological depth in some sections, and relies predominantly on case studies from Europe, which limits generalizability. Hence, future research should focus on expanding MCDM applications to AI-driven, omnichannel, and big data contexts

The chapter about metaverse marketing is innovative and shows how structured decision methods can be utilized by businesses to make decisions in emerging, uncertain environments like the metaverse. The authors are studying the potential of MCDM techniques to aid in the strategic marketing decision-making process in metaverse environments. Virtual branding, avatar engagement, and immersive service offerings are evaluated using PROMETHEE and other MCDM tools in the chapter. The challenges of decision-making in uncertain, fast-evolving digital spaces where historical data is scarce are addressed by this highly innovative study (Tarnanidis et al., 2025b). This work contributes to the emerging field of virtual marketing in a unique manner.

Tarnanidis' 'Digital Marketing and AI Integration with Robotics for the Fight against Racism in Football' (2025)' presents an AI-driven approach to tackle social issues via marketing strategies across multiple cultures. Ethical, cultural, and technological criteria need to be incorporated into decision-making, and this research highlights the complexity of doing so. PROMETHEE II, which is renowned for managing multiple conflicting criteria, can be expanded to assess digital marketing campaigns based on factors such as social impact, audience engagement, cultural sensitivity, and technological integration. The 2024 study by Tarnanidis on mobile marketing strategies examines how different mobile-based tactics affect consumer behavior. This area is suitable for PROMETHEE II applications due to its comprehensive and multi-dimensional nature of consumer response. It is possible to consider variables such as personalization, timing, relevance of content, privacy concerns, and conversion rates simultaneously (Tarnanidis, 2024a). In addition, Tarnanidis and her co-authors Sklavounos and Manaf's work in "New Trends in Marketing and Consumer Science" (2024) investigate the potential of marketing insights and decision-making in the years yet to come. These studies indicate that decision models that can handle big data, real-time analytics, and AI-generated insights are becoming more necessary. With PROMETHEE II, marketers can use its transparent and flexible structure to incorporate AI-driven metrics and consumer insights, providing them with a sturdy framework for multi-criteria decision-making in rapidly evolving markets (Tarnanidis & Sklavounos, 2024; Tarnanidis & Manaf, 2024).

Inasmuch, the systematic MCDM review provides a methodological overview of how MCDM techniques can enhance managerial decision-making by offering structured, transparent, and justifiable prioritization of complex options. However, it is noted that there is a gap in research that pertains to integrating MCDM methods with emerging technologies such as AI and big data analytics. (Tarnanidis et al., 2025c). Also, it is found that few studies exclusively concentrating on this method in marketing (Tarnanidis et al., 2023). Their research shows that PROMETHEE can prioritize marketing alternatives using multiple criteria, with applications spanning from product selection and service evaluation to market entry decisions. Additionally, it outlines advantages such as decision transparency and adaptability, but also tackles shortcomings such as subjectivity in preference weighting, scaling challenges, and challenges in integrating qualitative consumer insights.

The PROMETHEE II method is particularly well-suited for marketing decisions in the context of marketing due to its many key advantages. Marketing managers, marketing education, and academic research in marketing have many important implications. PROMETHEE II enables simultaneous evaluation of products using multiple criteria, which is a significant advantage (Mareschal & Tsaples, 2021; Mareschal, 2020). Both quantitative data (such as price) and qualitative data (such as consumer opinions and preferences) can be incorporated using PROMETHEE II. It is particularly useful when evaluating consumer-facing products, as subjective factors such as design and user experience are just as significant as technical specifications (Krouska et al., 2022). Using the PROMETHEE II method, rankings are generated that offer straightforward and actionable insights that are easy to share with stakeholders. Marketing decisions require transparency because decision-makers often need to justify their decisions to management or investors (Zhang, 2019). Although the PROMETHEE II method has its advantages, it still has its shortcomings. One of the significant drawbacks of the PROMETHEE II method is its inability to assign weights to criteria. The final rankings are highly dependent on the accuracy of the weights assigned (Saaty & Ergu, 2015), and small changes in the weights can significantly alter the final ranking. Marketing decisions are particularly challenging due to the fact that criteria's importance can vary depending on consumer behavior. Despite PROMETHEE II's effectiveness in moderately complex problems, it may struggle to handle highly complex problems that involve a large number of alternatives and criteria. As the size of the problem increases, the computational complexity also rises, which may lead to difficulties in obtaining reliable results (Deng, 2022).

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Conclusion and future directions

Complex marketing problems, especially those related to product selection, customer segmentation, and brand preference analysis, can be tackled effectively through the PROMETHEE II method. Modern marketers find it highly valuable because it can handle multiple criteria, integrate subjective preferences, and provide clear decision rankings. Future research should address its limitations in terms of weight sensitivity and scalability. The application of PROMETHEE II in real-time marketing decision-making can be significantly improved by integrating it with machine learning, big data, and hybrid models. The PROMETHEE II method will continue to be a crucial tool for making informed, data-driven marketing decisions as the marketing landscape evolves. In the future, it is possible to explore hybrid models that combine PROMETHEE II with other decision-making methods, like machine learning or fuzzy logic. The robustness of decision-making could be enhanced by marketers by using hybrid approaches to account for uncertainties in consumer preferences and market conditions. With the speed of innovation in the smart consumer product sector speeding up, there is a growing need for real-time decision-making. Marketing can respond swiftly to changes in consumer behavior or market conditions by incorporating real-time data streams, such as dynamic consumer feedback and competitive analysis, into the PROMETHEE II method.

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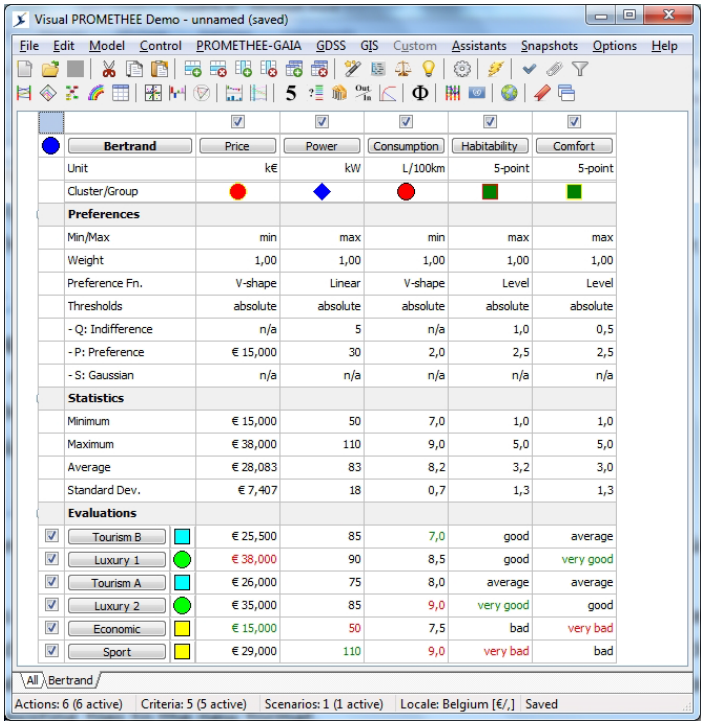
Appendix

The visual PROMETHEE software created by Mareschal offers a more effective way to screen decision-making problems and study results, such as outranking flows, partial and complete rankings, GAIA Plane, and sensitivity analysis. Figures 1 and 2 show data visualization, along with tutorials and examples that cover a range of decision-making issues As stated in the visual PROMETHEE manual, the main window of a demo dataset example about buying a new car is shown as follows.



Bertrand	Price	Power	Consumption	Habitability	Comfort
Unit	k€	kW	L/100km	5-point	5-point
Cluster/Group					
Preferences					
Min/Max	min	max	min	max	max
Weight	1,00	1,00	1,00	1,00	1,00
Preference Fn.	V-shape	Linear	V-shape	Level	Level
Thresholds	absolute	absolute	absolute	absolute	absolute
- Q: Indifference	n/a	5	n/a	1,0	0,5
- P: Preference	€ 15,000	30	2,0	2,5	2,5
- S: Gaussian	n/a	n/a	n/a	n/a	n/a
Statistics					
Minimum	€ 15,000	50	7,0	1,0	1,0
Maximum	€ 38,000	110	9,0	5,0	5,0
Average	€ 28,083	83	8,2	3,2	3,0
Standard Dev.	€ 7,407	18	0,7	1,3	1,3
Evaluations					
Tourism B	€ 25,500	85	7,0	good	average
Luxury 1	€ 38,000	90	8,5	good	very good
Tourism A	€ 26,000	75	8,0	average	average
Luxury 2	€ 35,000	85	9,0	very good	good
Economic	€ 15,000	50	7,5	bad	very bad
Sport	€ 29,000	110	9,0	very bad	bad

Figure 1: Example of Visual PROMETHEE-The purchase of a new car

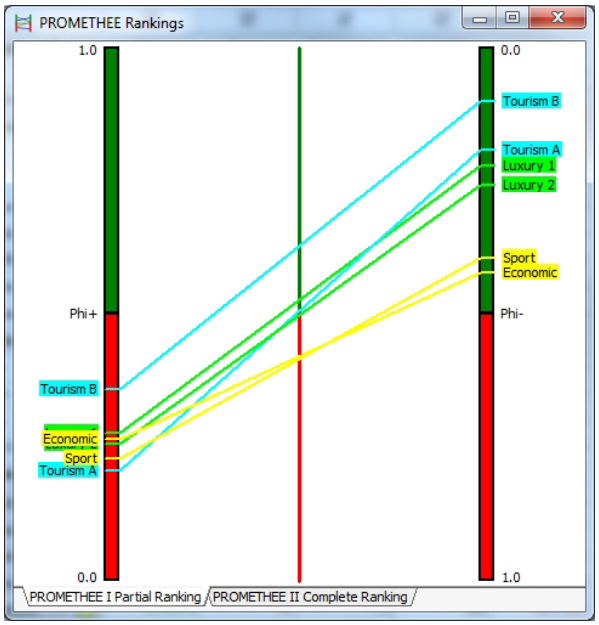


Figure 2: PROMETHEE rankings