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Assessing Service Quality Performance in the Turkish Life Insurance Sector: An Integrated CRISUS-Centroidous-RAM Framework

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Abstract

This paper recommends an integrated multi-criteria decision-making framework that brings together the CRISUS, Centroidous, and RAM procedures to assess the service quality performance of companies operating in the Turkish life insurance industry. Criterion weights were determined through the integration of the CRISUS and Centroidous procedures via a linear aggregation operator, while company rankings were established by means of the RAM procedure. The application draws on an expert panel assessment covering eight leading companies in the sector in terms of premium production. The findings reveal that the digital policy ratio and the active agent ratio are the most influential determinants of service quality, whereas the geographic coverage rate occupies the lowest position in the weight ranking. According to the ranking results, Türkiye Hayat achieved the highest and Metlife the lowest service quality performance. Sensitivity analyses and comparisons with five alternative MCDM techniques confirmed the stability of the ranking order throughout. This study is distinguished by being the first to deploy the CRISUS and Centroidous procedures jointly within a single weighting scheme, and the first to apply the RAM procedure to the life insurance sector.

Keywords: Service Quality, Performance Assessment, Life Insurance, MCDM **JEL Codes:** C44, G22, L25, O33

Türk Hayat Sigortacılığı Sektöründe Hizmet Kalitesi Performansının Değerlendirilmesi: Bütünleşik CRISUS-Centroidous-RAM Çerçevesi

Öz

Bu çalışma, Türk hayat sigortacılığı sektöründe faaliyet gösteren şirketlerin hizmet kalitesi performansını değerlendirmek amacıyla CRISUS, Centroidous ve RAM prosedürlerini bütünleşik bir çok kriterli karar verme çerçevesi içinde bir araya getirmektedir. Kriter ağırlıkları CRISUS ve Centroidous prosedürlerinin doğrusal toplama operatörü aracılığıyla entegrasyonuyla belirlenmiş; şirket sıralamaları RAM prosedürü aracılığıyla elde edilmiştir. Uygulama, prim üretimi açısından sektörün önde gelen sekiz şirketini kapsayan bir uzman panel değerlendirmesine dayanmaktadır. Bulgular, dijital poliçe oranının ve aktif acente oranının hizmet kalitesinin en belirleyici kriterleri olduğunu ortaya koymakta; coğrafi kapsama oranının ise en düşük ağırlıklı kriter konumunda yer aldığını göstermektedir. Sıralama sonuçlarına göre Türkiye Hayat en yüksek, Metlife ise en düşük hizmet kalitesi performansını sergilemiştir. Duyarlılık analizleri ve alternatif ÇKKV teknikleriyle yapılan karşılaştırmalar sıralama kararlılığını doğrulamıştır. Bu çalışma, CRISUS ve Centroidous prosedürlerini ilk kez birlikte kullanan ve RAM prosedürünü hayat sigortacılığı sektörüne ilk kez uygulayan çalışma olma özelliği taşımaktadır.

Anahtar Kelimeler: Hizmet Kalitesi, Performans Değerlendirmesi, Hayat Sigortacılığı, ÇKKV **JEL Kodları:** C44, G22, L25, O33

Introduction

Service quality is a multidimensional construct that reflects the gap between customers' prior expectations of a service and the perceptions they form upon its actual delivery (Parasuraman et al., 1988; Rahmati & Darestani, 2022). Based on this conceptual perspective, the SERVQUAL scale was developed to assess service quality across five fundamental dimensions: reliability, responsiveness, assurance, empathy, and tangibles. Recent empirical findings indicate that the validity of this dimensional framework remains largely preserved in modern insurance markets (Özüdoğru and Uzun, 2024). The insurance sector ranks among those industries in which service quality exerts the most direct influence on competitive positioning, given the intangible nature of its products, the long-term relational structure that binds the customer to the firm, and the pivotal role that the claims experience plays in shaping overall service perceptions (Şentürk and Eker, 2017). Measuring and managing service quality in this sector is, however, structurally more demanding than in most other service domains (Büyükkakaç and Diker, 2025). At the heart of this difficulty lies the pronounced asymmetry of information that characterizes the relationship between the customer and the firm: while the customer possesses superior knowledge of their own risk profile, the firm holds considerably greater command over the technical substance of the service that it provides and the conditions of the market in which it operates (Rothschild and

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Stiglitz, 1976; Kutlu, 2025). Compounding this, service quality is something that cannot be directly experienced at the point of policy purchase; the sole moment at which the firm's promise is rendered tangible is the claims process — a juncture that is, more often than not, one of considerable emotional stress for the policyholder (Cummins and Tennyson, 1996; Skaf et al., 2024). Taken together, these structural features make service quality an inescapable determinant of both the customer trust and the corporate reputation that insurance companies seek to cultivate.

These sector-specific challenges, which render the measurement of service quality more demanding, simultaneously make it indispensable for a broad range of stakeholder groups. For company managers, service quality assessments provide an objective basis for identifying which dimensions perform well and which require improvement, feeding directly into decisions on resource allocation, human capital investment, and digital transformation priorities (Dwivedi et al., 2021). For regulatory authorities and policymakers, cross-company comparative evaluations serve a pivotal function in designing regulatory frameworks that are aimed at strengthening consumer protection across the sector (Işık and Adalar, 2025). For intermediaries and distribution channels, service quality indicators constitute one of the primary reference points that guide strategic decisions about which companies to partner with (Işık et al., 2025). From the consumer's perspective, the level of awareness and perception that policyholders hold regarding service quality directly shapes the purchasing decisions and long-term loyalty that they develop towards insurance products (Baştürk, 2019). Viewed across all these dimensions, the measurement and monitoring of service quality emerges as a multi-stakeholder research agenda that carries simultaneous strategic relevance for academics, practitioners, and regulators alike (Rahmati and Darestani, 2022).

It is precisely at this juncture that the assessment of service quality in the insurance sector has evolved beyond a straightforward measurement exercise into a genuinely complex, multi-dimensional decision problem. The root of this complexity lies in the fact that service quality simultaneously spans dimensions that are qualitatively distinct and at times mutually conflicting — encompassing claims effectiveness, agency network structure, digital service penetration, customer satisfaction, and geographic reach, among others. This structural complexity has made it increasingly apparent that perception-based instruments which rely solely on customer judgements — including well-established approaches such as SERVQUAL — are insufficient on their own to capture the full evaluative picture (Rahmati and Darestani, 2022; Ecer and Pamucar, 2021). At this point, MCDM approaches, which provide effective analytical tools for solving complex decision problems that require the simultaneous evaluation of criteria that differ in nature and may at times conflict with one another, come into play (Ecer et al., 2024). The literature on MCDM applications in the insurance sector has indeed expanded rapidly in response to this need, with an increasing number of studies that undertake systematic, comparative assessments of company performance across financial, sustainability, and service quality dimensions (Khodamoradi et al., 2014; Bilbao-Terol et al., 2022).

Against this backdrop, it is notable that the existing body of work remains heavily concentrated on non-life insurance companies, and that a service quality assessment which directly targets the life insurance sector — one that brings together a sector-specific, multi-dimensional criterion structure and an integrated set of MCDM procedures — has yet to appear in the literature. The present study addresses this gap by proposing an integrated MCDM framework for evaluating the service quality performance of companies that operate in the Turkish life insurance sector. The framework brings together the CRiterion Importance based on the SUm of Squares (CRISUS) and Centroidous procedures for criterion weighting, and the Root Assessment Method (RAM) for the ranking of alternatives. The validity and practical applicability of the proposed model are tested through a case study that covers eight leading companies in the Turkish life insurance sector in terms of premium production. Against this backdrop, the study seeks to answer the following research questions: i) What are the service quality dimensions and criteria that are specific to the Turkish life insurance sector? ii) Does the integrated CRISUS-Centroidous weighting procedure yield a more balanced and stable set of criterion weights compared with reliance on a single technique? iii) Does the RAM procedure produce applicable and valid results when deployed in the life insurance sector? iv) Which performance criteria are the primary determinants of service quality in the life insurance sector? v) Which insurance company demonstrates superior service quality performance relative to its peers in the life insurance sector? vi) Are the ranking outcomes that are yielded by the proposed integrated model consistent with those produced by alternative MCDM techniques?

The remainder of the paper is organized as follows: Section 1 presents the literature review and theoretical background; Section 2 elaborates the methodological framework of the proposed model; Section 3 reports the case study findings; Section 4 presents the sensitivity and comparative analyses; Section 5 develops policy recommendations; and Section 6 offers concluding remarks and directions for future research.

1. Literature Review

The assessment of service quality and company performance in the insurance sector constitutes a multidimensional and methodologically demanding research area. This section reviews the current literature across two interrelated domains: studies

examining service quality in the insurance sector, and MCDM-based performance assessment applications in the insurance sector. Building on this review, the research gap and the positioning of the present paper are subsequently elaborated.

1.1. Studies on Service Quality in the Insurance Sector

A review of studies addressing service quality in the Turkish insurance sector reveals a strong concentration on survey-based measurement approaches and customer perception-oriented frameworks. Şentürk and Eker (2017) adopted a quantitative research design in their study of individuals holding comprehensive vehicle insurance policies in the Düzce province, collecting data through questionnaires to investigate the impact of perceived service quality on customer loyalty. Their findings indicated that the reliability, empathy, and responsiveness dimensions of service quality exert a positive and statistically significant influence on loyalty, whereas tangibility did not yield a meaningful effect. Dalkılıç and Kule (2022) employed the SERVQUAL instrument to measure service quality in digital insurance channels, conducting factor analyses on face-to-face survey data and identifying five core dimensions: tangibles, reliability, responsiveness, assurance, and empathy. Şener (2024) applied the SERVQUAL scale to customers of insurance agencies operating in the Antalya province, examining discrepancies between expected and perceived service quality and establishing that income level plays a determining role in shaping service quality perceptions. Büyükkakaç and Diker (2025) employed content analysis and the AHP method to evaluate qualitative data collected through face-to-face interviews with insurance agents. Their findings indicated that customer orientation was the most important service quality criterion, followed by reliability, transparency, and digitalization. Özüdoğru and Uzun (2024) integrated the AHP and TOPSIS algorithms to assess service quality in the insurance sector, comparatively ranking four insurance firms across criteria encompassing corporate reliability, tangibles, customer responsiveness, and service accessibility. Kutlu (2025) analyzed data from seven insurance companies operating in Türkiye over the 2018–2023 period using the CRITIC and MAIRCA methods, assessed service delivery performance, and found that companies with strong Bancassurance networks and extensive agency infrastructures maintained a consistent performance advantage throughout the observation window.

1.2. MCDM Applications in the Insurance Sector

A number of paper in the international literature stand out for their application of MCDM approaches to the assessment of insurance companies. Khodamoradi et al. (2014) integrated the DEMATEL and PROMETHEE II procedures to rank insurance companies in Iran, determining company standings by incorporating both financial and non-financial criteria within a unified framework. Mandić et al. (2017), who assessed the efficiency of Serbian insurance firms over the 2007–2014 period, relied on F-AHP and TOPSIS techniques based on five key financial indicators, demonstrating that the combined approach can be effectively deployed in complex financial decision problems. Gharizadeh Beiragh et al. (2020) offered a hybrid model that combines AHP, PCA, and DEA to assess the ESG performance of Iranian insurance firms, conducting a comparative analysis of fourteen firms across fourteen criteria spanning economic, environmental, and social dimensions. Dwivedi et al. (2021) employed an integrated BSC and BWM procedure to evaluate the multidimensional performance of an insurance firm, encompassing both financial and non-financial indicators, thereby demonstrating the applicability of the approach in complex decision-making contexts. Mimović et al. (2021) combined the TOPSIS technique with interval-valued fuzzy rough sets in the Serbian insurance sector, benchmarking company performances against nine financial criteria over the 2006–2016 period. Ecer and Pamucar (2021) applied an IF-MARCOS model to assess the pandemic performance of insurance firms in terms of healthcare services, demonstrating the technique's stability and consistency under conditions of uncertainty. Bilbao-Terol et al. (2022) united the EBW and MRP procedures to rank non-life insurance firms in Spain, deriving criterion weights through interval-valued pairwise comparisons and computing overall performance scores via the MRP component. Rahmati and Darestani (2022) integrated a balanced scorecard framework with the BWM and TOPSIS techniques in the Iranian insurance sector, concluding that enhancing service quality constitutes the most pressing strategic priority. Zhang et al. (2023) combined the TODIM technique with a balanced scorecard in a neutrosophic environment to assess the managerial performance of private insurance companies under conditions of deep uncertainty. Akgül (2025) developed a hybrid RANCOM-SIWEC-MAIRCA framework to evaluate the corporate financial performance of Turkish insurance companies, finding that the current ratio constitutes the most decisive criterion and that Türkiye Sigorta achieved the highest performance score across the analysis period.

Turning to MCDM applications with a specific focus on the Turkish insurance sector, a noteworthy body of work has also accumulated in this area. Kula et al. (2016), who examined the financial performance of insurance and private pension companies listed on BIST, employed the GRA approach to rank firms across a set of financial indicators drawn from the 2010–2014 period, producing one of the earliest MCDM-based performance assessments conducted within the Turkish insurance sector. Işık et al. (2023) investigated the nexus between financial performance and premium generation in the Turkish non-life insurance market through a hybrid LOPCOW-SWARA II-MARCOS model covering eight companies over the 2011–2019 period, revealing that the two constructs mutually reinforce one another. Işık et al. (2025) evaluated five BIST-listed non-life insurance companies over the 2015–2019 period using a hybrid Pythagorean F-AHP and MAIRCA model, identifying service network as the most decisive performance dimension and Halk Sigorta as the top-performing company. Işık and Adalar (2025) developed the IF-CRADIS approach by

integrating the CRADIS procedure with intuitionistic fuzzy sets to assess the ESG-based sustainability performance of Turkish non-life insurers, finding that Türkiye Sigorta achieved the highest and Eureko Sigorta the lowest performance rating. Taşcı (2024) assessed seven Turkish non-life insurers across financial and service network dimensions for the 2018–2022 period, deploying an integrated Entropy-MEREC-MACONT decision framework

1.3. Research Gap Analysis

A comprehensive reading of the literature surveyed above makes clear that MCDM research in the insurance sector has been drawn predominantly towards financial performance indicators, efficiency measurement, and sustainability assessments, largely privileging non-life insurance companies and leaving the life insurance segment without adequate scholarly attention. Within the Turkish insurance literature, service quality research has meanwhile remained anchored to customer perception measurement, with company-level comparative evaluations built around integrated MCDM frameworks remaining conspicuously rare. This broader picture brings four distinct research gaps into sharp relief.

The first gap concerns the absence of an objective framework for operationalizing service quality dimensions specific to the life insurance sector. Prevailing studies rely predominantly on perception-based instruments such as SERVQUAL, and no work has jointly examined sector-specific dimensions — encompassing claims effectiveness, agency network structure, geographic reach, digital service penetration, and customer satisfaction — within a single analytical structure. The present study closes this gap by constructing a multi-dimensional criterion set derived from expert panel deliberations.

The second gap pertains to the inadequate coverage of the life insurance sector from an MCDM standpoint. The vast majority of existing MCDM applications in the Turkish insurance market have been confined to non-life firms or BIST-listed companies; an application directly targeting life insurance companies and centered on service quality remains absent from the literature.

The third gap concerns the fact that neither CRISUS nor Centroidous has previously been applied within the insurance domain. No study has yet deployed these procedures jointly through a linear aggregation operator. By doing so for the first time, the present study mitigates dependence on any single weighting technique and broadens the methodological repertoire available to researchers.

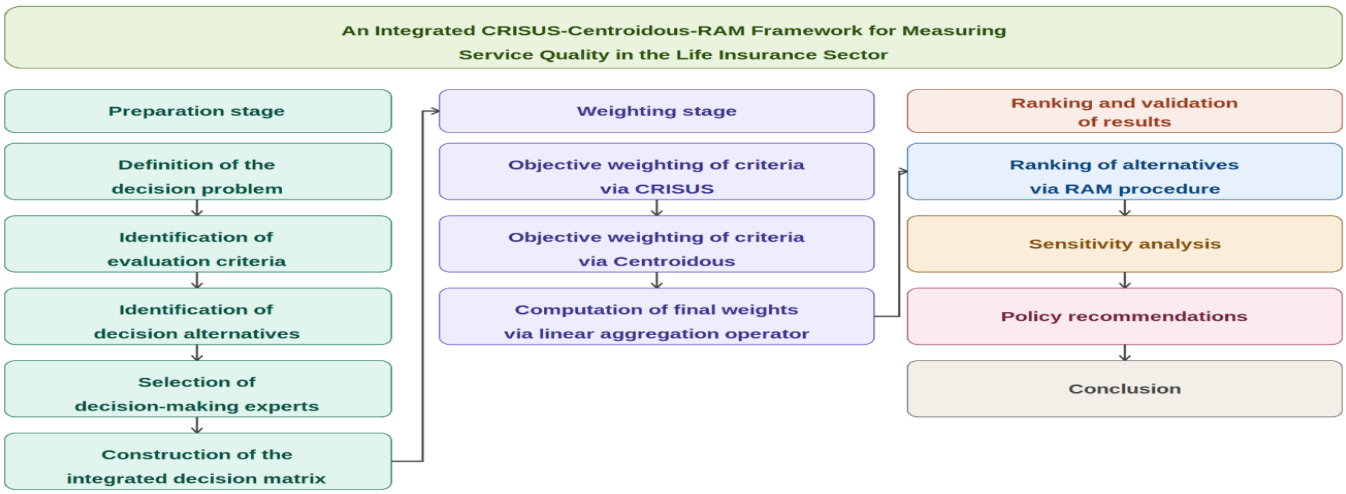
The fourth gap involves the complete absence of RAM from the life insurance literature. Although successfully tested across energy, banking, and sustainability contexts, RAM has not been employed in the insurance sector. By adapting it to life insurance for the first time, this study establishes its practical viability in this domain.

Drawing on these four gaps, the present study proposes an integrated CRISUS-Centroidous-RAM decision framework that delivers methodological pluralism in objective weighting, a multi-dimensional criterion structure tailored to the sector, and robust stability as confirmed through sensitivity analyses — making an original and replicable contribution to both the MCDM literature and Turkish life insurance research.

2. Methodology

This manuscript suggests an integrated MCDM model for evaluating the service quality performance of life insurance companies. The model employs the CRISUS and Centroidous methods for the objective identification of criterion weights, and the RAM procedure for the ranking of alternatives. The methodological flow of the study is illustrated in Figure 1, while the theoretical framework underlying each method is elaborated in the subsections that follow.

Figure 1. Methodological Framework of the Proposed Integrated Model



2.1. CRISUS Procedure

The determination of criterion weights in decision-making problems is of critical importance for the reliability of the assessment process. In this regard, Adalar and Işık (2025) introduced the CRISUS procedure into the literature as an objective weighting method that derives importance coefficients directly from the distributional properties of the decision matrix. Although the theoretical foundations of the method draw upon the Statistical Variance (Rao and Patel, 2010) and the Entropy method (Shannon, 1948), CRISUS presents a distinct mathematical structure specifically designed to overcome the inherent limitations of both. The Entropy method simplifies uncertainty measurement by applying a fixed constant $\mathrm{k} = 1/\ln(\mathrm{m})$ uniformly across all criteria, while the SV approach exhibits instability as the number of alternatives increases. CRISUS addresses both shortcomings through a two-stage normalization procedure in which a sum-of-squares operator is combined with standard deviations, yielding a weighting mechanism that more accurately reflects the dispersion characteristics of individual criteria. The approach further distinguishes itself through the simplicity of its computational steps and its independence from the expert-induced inconsistencies that are inherent to subjective weighting approaches. The procedural steps of CRISUS are outlined below.

Step 1. The initial decision matrix is constructed via Eq. (1), incorporating all decision alternatives and assessment criteria.

$$Z = [z_{ij}]_{m\times n} = \begin{bmatrix} z_{11} & z_{12} & \cdots & z_{1n} \\ z_{21} & z_{22} & \cdots & z_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ z_{m1} & z_{m2} & \cdots & z_{mn} \end{bmatrix} \quad (1)$$

Step 2. Vector normalization is applied to the initial decision matrix. Beneficial and non-beneficial criteria are handled separately through Eqs. (2) and (3), yielding the first normalized matrix.

$$b_{ij} = \frac{z_{ij}}{\sqrt{\sum_{i=1}^{m} {z_{ij}}^2}} \quad (2)$$

$$b_{ij} = 1 - \frac{z_{ij}}{\sqrt{\sum_{i=1}^{m} {z_{ij}}^2}} \quad (3)$$

Step 3. The second normalized matrix is derived by applying Eq. (4) to all elements of the first normalized matrix.

$$t_{ij} = \frac{b_{ij}}{\sum_{i=1}^{m} b_{ij}} \quad (4)$$

Step 4. The sum-of-squares value for each criterion is computed from the second normalized matrix via Eq. (5).

$$\rho_j = \sum_{i=1}^{m} t_{ij}^2 \quad (5)$$

Step 5. The standard deviation $(\sigma_j,\ j = 1,2,\ldots,n)$ of each metric is derived from the first normalized matrix.

Step 6. The objective importance weights of the metrics are determined through Eq. (6).

$$w_j = \frac{\sigma_j \rho_j}{\sum_{j=1}^{n} \sigma_j \rho_j} \quad (6)$$

2.2. Centroidous Procedure

The Centroidous procedure is an objective criterion weighting method introduced into the decision-making literature by Vinogradova-Zinkevič (2024). The approach draws upon the concept of the centroid in cluster analysis, determining the weight of each criterion according to its distance from the centre of the group in the space of normalized values. The underlying assumption is that criteria positioned closer to the group centre more consistently reflect the overall structure of the assessment group and therefore possess a higher degree of representativeness. Accordingly, as the distance of a criterion from the centroid decreases, its relative importance in the decision-making process increases. This property renders the method more robust to extreme values and yields a more balanced distribution of weights across criteria (Mao et al., 2025; Rasoanaivo, 2025; Öztaş, 2025). Furthermore, the approach offers notable methodological advantages in terms of computational simplicity, applicability to datasets containing negative values and zeros, and the ability to produce stable results across different distance measures, including Euclidean, Manhattan, and Chebyshev distances (Vinogradova-Zinkevič, 2024). The procedural steps of the Centroidous method are outlined below.

Step 1. The decision matrix is structured in accordance with Eq. (1).

Step 2. The values in the initial matrix are normalized by Eq. (7) to eliminate discrepancies arising from differences in measurement scales. In the original procedure, this normalization is applied identically to beneficial and non-beneficial criteria, without any prior transformation. The reason is that the Centroidous procedure derives criterion importance not from the direction of preference but from the representativeness of the criterion, as measured by its distance from the centre of the group. Accordingly, the values

yielded by Eq. (7) should be interpreted not as performance scores but as the share of each alternative within the total of the criterion concerned.

$$y_{ij} = \frac{z_{ij}}{\sum_{i=1}^{m} z_{ij}} \tag{7}$$

Step 3. The centroid vector of the criterion group is determined from the normalized matrix via Eq. (8). Each element of this vector corresponds to an alternative ($i = 1, \dots, m$) and equals the mean of the normalized values of that alternative across all criteria ($j = 1, \dots, n$).

$$c_i = \frac{1}{n} \sum_{j=1}^{n} y_{ij} \tag{8}$$

Step 4. The Euclidean distance of each criterion from the centroid vector is calculated with Eq. (9).

$$d_j = \sqrt{\sum_{i=1}^{m} (y_{ij} - c_i)^2} \tag{9}$$

Step 5. In the Centroidous procedure, the representativeness of each criterion is assessed through its distance from the centroid. As this distance decreases, the relative weight of the criterion increases. This relationship is expressed in Eq. (10).

$$s_j = \frac{\min(d_j)}{d_j} \tag{10}$$

Step 6. The weight coefficients of all criteria are computed by means of Eq. (11).

$$w_j = \frac{s_j}{\sum_{j=1}^{n} s_j} \tag{11}$$

2.3. Final Weighting Procedure

Since each objective weighting technique measures criterion importance from a different mathematical perspective, no single procedure can be universally considered superior for all decision problems. The resulting weight values are naturally influenced by the assumptions, normalization procedures, and knowledge extraction mechanisms inherent in the chosen weighting method. For this reason, the integration of different objective weighting approaches has become an increasingly adopted strategy in the multi-criteria decision-making (MCDM) literature to mitigate methodological bias, leverage complementary methodological strengths, and obtain more stable and reliable criterion weights. This integrated perspective increases the trustworthiness of the weighting process and contributes to more robust decision-making outcomes (Tekgün et al., 2026).

In this research, criterion weight values are obtained through objective weighting algorithms such as CRISUS and Centroidous, and the resulting weight vectors are then combined via an aggregating procedure. This combination reduces dependence on a single objective weighting mechanism by leveraging the complementary characteristics of both methodologies, thereby providing more robust and reliable criterion weights for the subsequent ranking process. Thus, the final criterion weights are derived by combining the weights obtained from both methods with equal contribution, as expressed in Eq. (12).

$$w_j^* = \alpha \times w_j^{CRISUS} + (1 - \alpha) \times w_j^{\text{Centroidous}} \tag{12}$$

In Eq. (12), w_j^* refers to the composite weight assigned to the j-th criterion, whereas w_j^{CRISUS} and $w_j^{\text{Centroidous}}$ denote the weights produced by the respective procedures. Setting $\alpha = 0.5$ ensures that both procedures contribute equally to the final weighting outcome

2.4. RAM Procedure

The RAM procedure is an innovative MCDM method introduced into the decision-making literature by Sotoudeh-Anvari (2023) for the purpose of determining the performance ranking of alternatives in decision problems. The method builds on a distinctive aggregation structure in which the weighted normalized sums of beneficial criteria serve as the radicand, while those of non-beneficial criteria function as the index. The core philosophy of RAM rests on a partially compensatory structure that prioritizes the integrated performance of alternatives under beneficial criteria, such that weak performance under beneficial criteria cannot be directly offset by strong performance under non-beneficial criteria (Trung et al., 2024). This characteristic constitutes the principal methodological distinction that sets RAM apart from existing MCDM methods. Beyond this, the procedure offers a range of further methodological strengths, including independence from additional parameters, the capacity to handle both beneficial and non-beneficial criteria within a unified computational structure, eliminating the need for any prior transformation, the absence of negative performance scores, and a well-established resistance to the rank reversal paradox (Hezam et al., 2024; Mai, 2025). The procedural steps of the RAM method are outlined below.

Step 1. The decision matrix is constructed as specified in Eq. (1)

Step 2. The decision matrix is normalized via Eq. (7).

Step 3. The normalized scores are weighted using the final weight coefficients through Eq. (13) to obtain the weighted normalized matrix.

$$n_{ij} = y_{ij} \times w_j^* \tag{13}$$

Step 4. For each alternative, the aggregate weighted normalized values are calculated separately for beneficial and non-beneficial criteria through Eqs. (14) and (15). In these equations, B denotes the index set of the beneficial criteria and C the index set of the non-beneficial criteria. Accordingly, U_i aggregates the weighted normalized values of the beneficial criteria only, whereas L_i aggregates those of the non-beneficial criteria only. The direction of preference of the criteria is incorporated into the model at this stage.

$$U_i = \sum_{j \in B} n_{ij} \tag{14}$$

$$L_i = \sum_{j \in C} n_{ij} \tag{15}$$

Step 5. The performance score of alternatives is obtained through Eq. (16). The alternative yielding the highest P_i value is identified as the best-performing option.

$$P_i = \sqrt[2+L_i]{2 + U_i} \tag{16}$$

3. Case Study

The integrated model developed in this case study has been tested on the Turkish life insurance sector, and the application process is elaborated in detail across the following subsections.

3.1. Composition of the Expert Panel

Five experts were included in the assessment process of the study. The first expert (E_1) has 22 years of experience in the insurance sector, holds a bachelor's degree, and serves as deputy general manager at a life insurance company. The second expert (E_2) has 17 years of professional experience, holds a master's degree, and works as an insurance auditor within the Ministry of Treasury and Finance. The third expert (E_3) has 15 years of experience, holds a doctoral degree, and serves as an associate professor in the field of insurance and risk management at a university. The fourth expert (E_4) has 19 years of industry experience, holds a master's degree, and works as a senior manager in a bancassurance channel. The fifth expert (E_5) has 12 years of experience, holds a doctoral degree, and serves as a research assistant in the field of finance and insurance at a university. Although the experts differ in terms of academic qualifications, professional positions, and years of experience, all panel members possess substantial expertise in the fields of life insurance, insurance regulation, or insurance research. Since the primary objective of the expert panel was to establish a collective consensus regarding the assessment criteria and the performance of the alternatives, each expert's judgement was assigned equal importance throughout the evaluation process. Accordingly, equal weighting was adopted when aggregating the expert assessments, ensuring that the final results reflect the collective expertise of the panel rather than the influence of individual professional status or academic title.

3.2. Identification of the Assessment Criteria

During the criteria identification process, the expert panel was asked the following question: "Which criteria should be taken into consideration when measuring service quality in the Turkish life insurance industry?" In line with the consensus reached among the experts, both the dimensions and the criteria were jointly determined, resulting in a total of 20 criteria organized under 6 distinct dimensions. These metrics are displayed in Table 1.

Table 1. Assessment Criteria Identified Through Expert Consensus

Dimension	Criterion	Code	Optimization
Geographic Coverage	Total Number of Branches/Regional Directorates	K_1	Max.
	Geographic Coverage Rate	K_2	Max.
	Regional Representation Balance	K_3	Max.
Agency Network	Total Number of Agents	K_4	Max.
	Active Agent Ratio	K_5	Max.
	Bancassurance Channel Share	K_6	Max.
	Agent Satisfaction Index	K_7	Max.
Claims Effectiveness	Average Claims File Settlement Duration	K_8	Min.
	Claims Payment Duration	K_9	Min.
	Outstanding Claims File Ratio	K_{10}	Min.
	Claims Settlement Ratio	K_{11}	Max.
Digital Services	Digital Policy Ratio	K_{12}	Max.
	Online Claims Notification Ratio	K_{13}	Max.

	Mobile Application Service Score	K_{14}	Max.
	Chatbot/AI-Assisted Service Usage	K_{15}	Max.
	Customer Complaint Ratio	K_{16}	Min.
Customer Satisfaction	Complaint Resolution Duration	K_{17}	Min.
	Customer Satisfaction Index	K_{18}	Max.
Human Resources	Number of Claims Department Personnel	K_{19}	Max.
	Number of Claims Files per Personnel	K_{20}	Min.

Including all 20 criteria in the final assessment process could undermine the effectiveness and discriminatory power of the model. Accordingly, a screening approach was utilized to reduce the number of criteria. To this end, the same experts were asked to rate the 20 criteria using the [1–9] scale proposed by Krstić et al. (2024), where 1 denotes the lowest level of importance and 9 denotes the highest. The scores assigned by each expert to each criterion were aggregated, and the mean score for each criterion was computed. For instance, the mean score for K_1 was computed as 4.2. Subsequently, the arithmetic mean of the twenty criterion averages was calculated, yielding a grand mean value of 6.21. This grand mean was adopted as the screening threshold because it represents the overall average importance level assigned by the expert panel across all candidate criteria. Accordingly, only those criteria with mean scores exceeding the grand mean were retained for the final assessment, as they reflect above-average importance according to the collective judgement of the experts. Employing the grand mean as a benchmark provides a transparent and data-driven criterion screening mechanism, avoiding the use of arbitrary cut-off values while ensuring that the final criterion set consists of the most relevant and informative criteria for the subsequent MCDM analysis. It should nonetheless be acknowledged that a threshold computed from the scores of five experts is exposed to sampling error and may render the classification of criteria lying close to the cut-off sensitive. The discriminatory power of the threshold was therefore examined through two additional checks. First, no criterion average falls between 5.00 and 7.00, which means that setting the threshold at any value within this interval yields exactly the same criterion set. Second, the same ten criteria are selected in the five sub-panels obtained by excluding each expert in turn, as well as when the median is used in place of the arithmetic mean as the threshold. As regards the excluded criteria, a conceptual overlap arises in the case of K_{11} (Claims Settlement Ratio), which belongs to the claims effectiveness dimension. Since this criterion measures the same phenomenon as K_{10} (Outstanding Claims File Ratio) from the opposite direction, the retention of K_{10} limits the loss of information in the claims effectiveness dimension. The expert assessment scores and criterion averages are presented in Table 2.

Table 2. Expert Assessment Scores and Criterion Averages

Code	E_1	E_2	E_3	E_4	E_5	Avg.	Code	E_1	E_2	E_3	E_4	E_5	Avg.
K_1	3	5	6	3	4	4.2	K_{11}	5	6	5	2	4	4.4
K_2	9	8	8	7	8	8.0	K_{12}	9	8	8	7	9	8.2
K_3	9	7	9	8	9	8.4	K_{13}	7	9	7	8	8	7.8
K_4	6	9	6	8	9	7.6	K_{14}	5	6	4	5	4	4.8
K_5	7	8	6	7	7	7.0	K_{15}	4	6	5	7	3	5.0
K_6	6	4	5	6	4	5.0	K_{16}	8	9	7	9	9	8.4
K_7	3	5	4	5	6	4.6	K_{17}	5	3	4	6	5	4.6
K_8	5	4	5	3	5	4.4	K_{18}	9	8	7	7	8	7.8
K_9	8	9	7	7	7	7.6	K_{19}	3	2	5	4	6	4.0
K_{10}	8	7	8	7	9	7.8	K_{20}	5	4	7	3	4	4.6
Grand Mean									6.21				

An examination of the expert assessment scores presented in Table 2 reveals that the criteria whose averages exceed the grand mean of 6.21 are K_2, K_3, K_4, K_5, K_9, K_{10}, K_{12}, K_{13}, K_{16}, and K_{18}. These 10 criteria are considered to represent the assessment dimensions with the highest degree of expert consensus and the greatest informational value for measuring service quality performance. The criteria were subsequently recoded and are presented in Table 3 for use in the final calculation process.

Table 3. Final Assessment Criteria

Dimension	Criterion	Code	Optimization
Claims Effectiveness	Claims Payment Duration	K_1	Min.
	Outstanding Claims File Ratio	K_2	Min.
Agency Network	Total Number of Agents	K_3	Max.
	Active Agent Ratio	K_4	Max.
Geographic Coverage	Geographic Coverage Rate	K_5	Max.
	Regional Representation Balance	K_6	Max.
Digital Services	Digital Policy Ratio	K_7	Max.
	Online Claims Notification Ratio	K_8	Max.

Customer Satisfaction	Customer Complaint Ratio	K_9	Min.
	Customer Satisfaction Index	K_{10}	Max.

3.3. Decision Alternatives

The eight companies included in the case study were chosen from among the leading firms in the Turkish life insurance industry in terms of premium production as of December 2025. These companies are AgeSA Hayat ve Emeklilik (A_1, 13.46%), Allianz Yaşam ve Emeklilik (A_2, 9.55%), Anadolu Hayat (A_3, 11.56%), Garanti BBVA Emeklilik (A_4, 11.18%), Metlife Emeklilik (A_5, 8.04%), QNB Sağlık Hayat ve Emeklilik (A_6, 8.18%), Türkiye Hayat ve Emeklilik (A_7, 16.40%), and Viennalife Emeklilik (A_8, 12.04%), with a combined market share of 90.41%. These companies were selected on two grounds: their collective market share ensures the generalizability of the evaluation outcomes, and their diversity in terms of corporate structure and capital origin provides a robust testing ground for the proposed model.

3.4. Application of the Proposed Model

This section presents the results yielded by applying the proposed integrated framework to the Turkish life insurance sector.

3.4.1. Findings of the CRISUS Procedure

To implement the introduced combined methodology, the construction of a decision matrix is first required. Unlike the [1–9] scale employed for determining criterion weights, a five-point Likert-type scale [1–5] was adopted for assessing the performance of the decision alternatives. The use of different rating scales reflects the distinct objectives of these two assessment stages. The [1–9] scale was preferred during the criterion screening phase because its broader range provides greater discrimination among the importance levels assigned to the candidate criteria, thereby facilitating a more sensitive identification of the most relevant criteria. In contrast, the [1–5] scale reduces the cognitive burden on experts when making concrete performance judgements across multiple alternatives while remaining a widely accepted rating standard for performance assessment in the MCDM literature. Accordingly, the expert panel assessed the performance of the eight insurer alternatives with respect to the ten final criteria with the [1–5] scale. The arithmetic mean of the scores assigned by the experts was then calculated to construct the integrated decision matrix. For instance, the mean score assigned to K_1 for AgeSA (A_1) was 3.40. The resulting integrated decision matrix is presented in Table 4. Subsequently, the first normalized matrix was obtained by applying Eqs. (2) and (3) to the decision matrix, and the corresponding results are reported in Table 5. The second normalized matrix was then derived using Eq. (4), and the results are presented in Table 6. Finally, the sum-of-squares values obtained from the second normalized matrix, the standard deviation values calculated from the first normalized matrix, and the final objective criterion weights were determined using Eqs. (5) and (6), respectively, with the results reported in Table 7.

Table 4. Integrated Decision Matrix

	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}
A_1	3.40	3.80	4.20	4.40	3.80	4.20	3.60	3.60	3.80	4.00
A_2	1.60	1.80	1.40	2.80	3.20	3.20	2.60	2.80	3.00	2.80
A_3	3.80	3.20	3.40	3.60	2.60	4.20	3.60	3.60	2.60	3.00
A_4	2.80	3.40	3.20	3.60	3.80	4.00	3.60	3.00	3.00	3.40
A_5	1.20	1.00	1.20	1.40	2.60	2.40	1.80	1.80	1.20	2.60
A_6	1.60	1.80	2.20	2.00	2.20	2.20	2.20	2.00	2.20	2.00
A_7	4.80	4.80	4.80	4.80	4.60	4.60	4.60	4.60	4.80	4.80
A_8	3.80	4.60	3.80	3.80	3.80	4.60	4.00	4.00	3.40	4.40

Table 5. First Normalized Matrix

	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}
A_1	0.6147	0.5947	0.4551	0.4478	0.3939	0.3926	0.3776	0.3856	0.5754	0.4050
A_2	0.8187	0.8080	0.1517	0.2849	0.3317	0.2991	0.2727	0.2999	0.6648	0.2835
A_3	0.5694	0.6587	0.3684	0.3664	0.2695	0.3926	0.3776	0.3856	0.7095	0.3037
A_4	0.6827	0.6374	0.3468	0.3664	0.3939	0.3739	0.3776	0.3213	0.6648	0.3442
A_5	0.8640	0.8934	0.1300	0.1425	0.2695	0.2243	0.1888	0.1928	0.8659	0.2632
A_6	0.8187	0.8080	0.2384	0.2035	0.2280	0.2057	0.2308	0.2142	0.7542	0.2025
A_7	0.4561	0.4881	0.5201	0.4885	0.4768	0.4300	0.4825	0.4927	0.4636	0.4860
A_8	0.5694	0.5094	0.4118	0.3867	0.3939	0.4300	0.4196	0.4285	0.6201	0.4455

Table 6. Second Normalized Matrix

	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}
A_1	0.1140	0.1102	0.1736	0.1667	0.1429	0.1429	0.1385	0.1417	0.1082	0.1481
A_2	0.1518	0.1497	0.0579	0.1061	0.1203	0.1088	0.1000	0.1102	0.1250	0.1037
A_3	0.1056	0.1220	0.1405	0.1364	0.0977	0.1429	0.1385	0.1417	0.1334	0.1111
A_4	0.1266	0.1181	0.1322	0.1364	0.1429	0.1361	0.1385	0.1181	0.1250	0.1259
A_5	0.1602	0.1655	0.0496	0.0530	0.0977	0.0816	0.0692	0.0709	0.1628	0.0963
A_6	0.1518	0.1497	0.0909	0.0758	0.0827	0.0748	0.0846	0.0787	0.1418	0.0741
A_7	0.0846	0.0904	0.1983	0.1818	0.1729	0.1565	0.1769	0.1811	0.0872	0.1778
A_8	0.1056	0.0944	0.1570	0.1439	0.1429	0.1565	0.1538	0.1575	0.1166	0.1630

Table 7. Results of the CRISUS Procedure

	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}
ρ_j	0.1302	0.1303	0.1454	0.1385	0.1316	0.1324	0.1344	0.1351	0.1286	0.1338
σ_j	0.1468	0.1481	0.1416	0.1182	0.0843	0.0893	0.1001	0.1033	0.1201	0.0971
$\rho_j \times \sigma_j$	0.0191	0.0193	0.0206	0.0164	0.0111	0.0118	0.0135	0.0140	0.0154	0.0130
w_j	0.1240	0.1252	0.1336	0.1062	0.0720	0.0767	0.0873	0.0906	0.1001	0.0843
Rank	3	2	1	4	10	9	7	6	5	8

3.4.2. Findings Regarding the Centroidous Procedure

In this subsection, the objective weights of the assessment criteria are determined by means of the Centroidous procedure. To this end, the decision matrix presented in Table 4 was normalized through Eq. (7) without any distinction between beneficial and non-beneficial criteria, in line with the original implementation of the method, and the resulting outputs are furnished in Table 8. Higher values in the K_1, K_2 and K_9 columns indicate a higher level of the indicator concerned and therefore cannot be interpreted in favour of performance. In the subsequent stages, the centroid for each criterion was computed via Eq. (8), the Euclidean distance of each criterion from its centroid was established through Eq. (9), the representativeness levels of the criteria were derived using Eq. (10), and the final weight values were obtained by means of Eq. (11). The findings pertaining to all computational stages are compiled in Table 9.

Table 8. Matrix Obtained through Sum Normalization (Centroidous and RAM)

	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}
A_1	0.1478	0.1557	0.1736	0.1667	0.1429	0.1429	0.1385	0.1417	0.1583	0.1481
A_2	0.0696	0.0738	0.0579	0.1061	0.1203	0.1088	0.1000	0.1102	0.1250	0.1037
A_3	0.1652	0.1311	0.1405	0.1364	0.0977	0.1429	0.1385	0.1417	0.1083	0.1111
A_4	0.1217	0.1393	0.1322	0.1364	0.1429	0.1361	0.1385	0.1181	0.1250	0.1259
A_5	0.0522	0.0410	0.0496	0.0530	0.0977	0.0816	0.0692	0.0709	0.0500	0.0963
A_6	0.0696	0.0738	0.0909	0.0758	0.0827	0.0748	0.0846	0.0787	0.0917	0.0741
A_7	0.2087	0.1967	0.1983	0.1818	0.1729	0.1565	0.1769	0.1811	0.2000	0.1778
A_8	0.1652	0.1885	0.1570	0.1439	0.1429	0.1565	0.1538	0.1575	0.1417	0.1630

Table 9. Findings of Centroidous Procedure

	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}
d_j	0.0544	0.0494	0.0521	0.0268	0.0566	0.0379	0.0197	0.0243	0.0473	0.0390
s_j	0.3614	0.3984	0.3775	0.7355	0.3475	0.5187	1.0000	0.8113	0.4162	0.5046
w_j	0.0661	0.0728	0.0690	0.1344	0.0635	0.0948	0.1828	0.1483	0.0761	0.0922
Rank	9	7	8	3	10	4	1	2	6	5

3.4.3. Findings Concerning the Final Weighted Procedure

This section combines the criterion weights produced by the CRISUS and Centroidous procedures via the linear aggregation operator in Eq. (12), with the consolidated final weights reported in Table 10. A closer examination of the findings reported in Table 10 reveals that K_7 carries the highest weight, followed by K_4, K_8, K_3, K_2, K_1, K_{10}, K_9, K_6 and K_5, in descending order of importance.

Table 10. Final Criteria Weighting Results

	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}
w_j^{CRISUS}	0.1240	0.1252	0.1336	0.1062	0.0720	0.0767	0.0873	0.0906	0.1001	0.0843
$w_j^{Centroidous}$	0.0661	0.0728	0.0690	0.1344	0.0635	0.0948	0.1828	0.1483	0.0761	0.0922
w_j^*	0.0950	0.0990	0.1013	0.1203	0.0678	0.0858	0.1351	0.1194	0.0881	0.0883
Rank	6	5	4	2	10	9	1	3	8	7

3.4.4. Findings Related to the RAM Procedure

In the concluding stage, the derived criterion weights were fed into the RAM procedure to generate the service quality performance rankings of the companies under evaluation. To this end, decision matrix reported in Table 4 was normalized through Eq. (7), and the resulting normalized values are provided in Table 8. The weighted matrix was subsequently derived by applying Eq. (13), and the corresponding outputs are detailed in Table 11. In the concluding step, the weighted aggregate values for both beneficial and non-beneficial criteria, along with the final ranking scores for each alternative, were computed through Eqs. (14-16), respectively, and the consolidated findings are compiled in Table 12. In this computation, the beneficial criteria K_3, K_4, K_5, K_6, K_7, K_8 and K_{10} were included in the U_i aggregate, whereas the non-beneficial criteria K_1, K_2 and K_9 were included in the L_i aggregate. An examination of the results reported in Table 12 indicates that A_7 attains the highest performance score, followed by A_1, A_8, A_4, A_3, A_2, A_6, and A_5.The ranking yielded by the RAM procedure is broadly consistent with the premium production standings of the companies under evaluation. While this correspondence points to a relationship between service quality and market share, it also carries the possibility that expert perceptions are not entirely independent of company size, given that the assessment rests on expert judgement. The correspondence is therefore not interpreted as an external validation of the proposed model.

Table 11. Weighted Normalized Matrix

	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}
A_1	0.0140	0.0154	0.0176	0.0201	0.0097	0.0123	0.0187	0.0169	0.0139	0.0131
A_2	0.0066	0.0073	0.0059	0.0128	0.0082	0.0093	0.0135	0.0132	0.0110	0.0092
A_3	0.0157	0.0130	0.0142	0.0164	0.0066	0.0123	0.0187	0.0169	0.0095	0.0098
A_4	0.0116	0.0138	0.0134	0.0164	0.0097	0.0117	0.0187	0.0141	0.0110	0.0111
A_5	0.0050	0.0041	0.0050	0.0064	0.0066	0.0070	0.0094	0.0085	0.0044	0.0085
A_6	0.0066	0.0073	0.0092	0.0091	0.0056	0.0064	0.0114	0.0094	0.0081	0.0065
A_7	0.0198	0.0195	0.0201	0.0219	0.0117	0.0134	0.0239	0.0216	0.0176	0.0157
A_8	0.0157	0.0187	0.0159	0.0173	0.0097	0.0134	0.0208	0.0188	0.0125	0.0144

Table 12. Results of the RAM Procedure

		U_i	L_i	P_i	Rank
A_1	AgeSA	0.1083	0.0434	1.4405	2
A_2	Allianz	0.0719	0.0249	1.4330	6
A_3	Anadolu Hayat	0.0949	0.0382	1.4374	5
A_4	Garanti BBVA	0.0951	0.0364	1.4379	4
A_5	Metlife	0.0513	0.0134	1.4288	8
A_6	QNB	0.0577	0.0220	1.4289	7
A_7	Türkiye Hayat	0.1283	0.0569	1.4437	1
A_8	Viennalife	0.1103	0.0468	1.4403	3

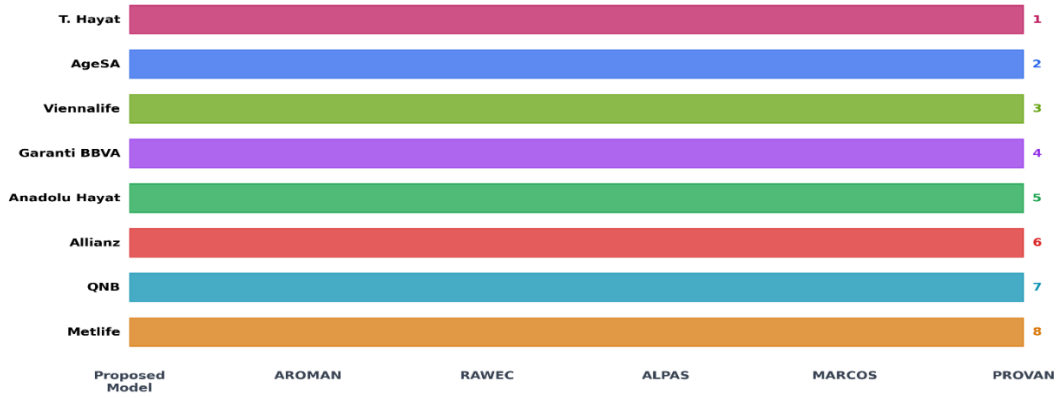
4. Sensitivity Analyses

This section subjects the proposed hybrid model to a set of sensitivity and comparative analyses aimed at verifying its reliability and stability

4.1. Comparison of the Proposed Model with Alternative MCDM Procedures

The validity of the ranking outcomes derived from the RAM procedure was examined through a systematic comparison with five well-established MCDM approaches drawn from the recent literature. To this end, AROMAN (Bošković et al., 2023), RAWEC (Puška et al., 2024), ALPAS (Ulutaş et al., 2025), MARCOS (Stević et al., 2020), and PROVAN (Biswas et al., 2025) were selected as benchmarking tools. All five approaches were implemented on the basis of the identical decision matrix and final criterion weights. As evidenced by the comparative results illustrated in Figure 2, every procedure yields an identical ranking order. To further verify the consistency of the ranking results, Spearman's rank correlation coefficient (ρ) and Kendall's rank correlation coefficient (τ) were calculated between the proposed RAM model and each benchmark MCDM procedure. Both coefficients were found to be 1.000 ($\rho = 1.000; \tau = 1.000$) for all pairwise comparisons, indicating perfect rank agreement. These findings quantitatively confirm that the rankings produced by the proposed hybrid model are fully consistent with those generated by the benchmark approaches, thereby providing additional evidence for the robustness and reliability of the proposed framework.

Figure 2. Comparison of Ranking Results across MCDM Procedures



4.2. Examination of the Rank Reversal Phenomenon

Ranking reversal testing is one of the most commonly utilized validation approaches to determine the stability and resilience of newly designed MCDM methodologies (Işık et al., 2026).In the second phase of the sensitivity analysis, the rank reversal phenomenon is investigated through two groups of scenarios. The first group consists of eight scenarios in which the alternative carrying the lowest performance score is successively removed from the decision set. The second group covers seven scenarios in which the alternative carrying the highest performance score is successively removed. In both groups the analyses were re-run at every step, and the criterion weights obtained from the complete decision set were kept fixed. The results illustrated in Figure 3 show that the ranking order remains unchanged across all scenarios in which the lowest-performing alternative is removed. The findings relating to the scenarios in which the best-performing alternative is removed are presented in Figure 4. In these scenarios the relative positions of the alternatives are largely preserved, and only the order of A_5 and A_6, the two lowest-performing alternatives, changes across scenarios. As can be seen in Table 12, the performance scores of these two alternatives are extremely close to one another. This change in order is therefore interpreted not as a structural breakdown of the ranking but as a sensitivity between alternatives whose scores are indistinguishable. Accordingly, the proposed model is largely resilient to the rank reversal phenomenon, and the only change observed is confined to two alternatives with almost identical scores.

Figure 3. Findings of the Rank Reversal Scenario

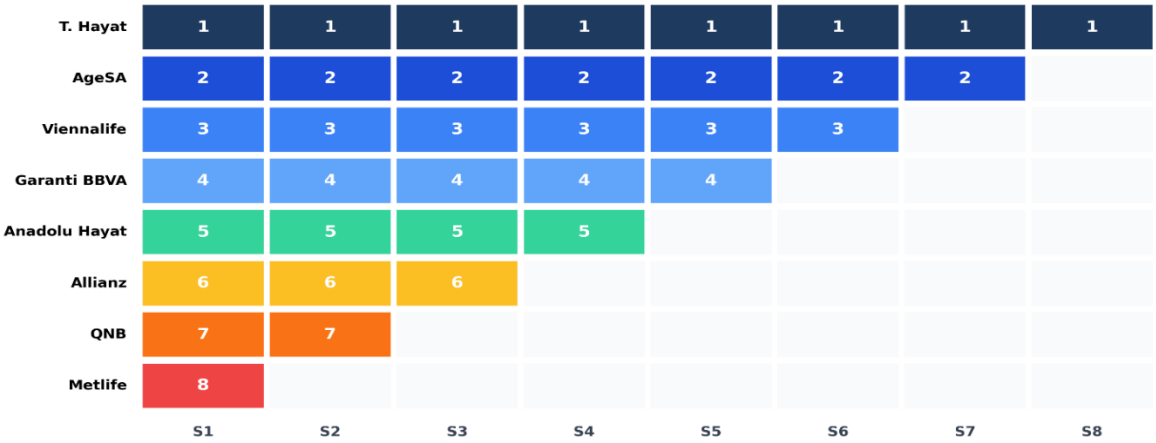
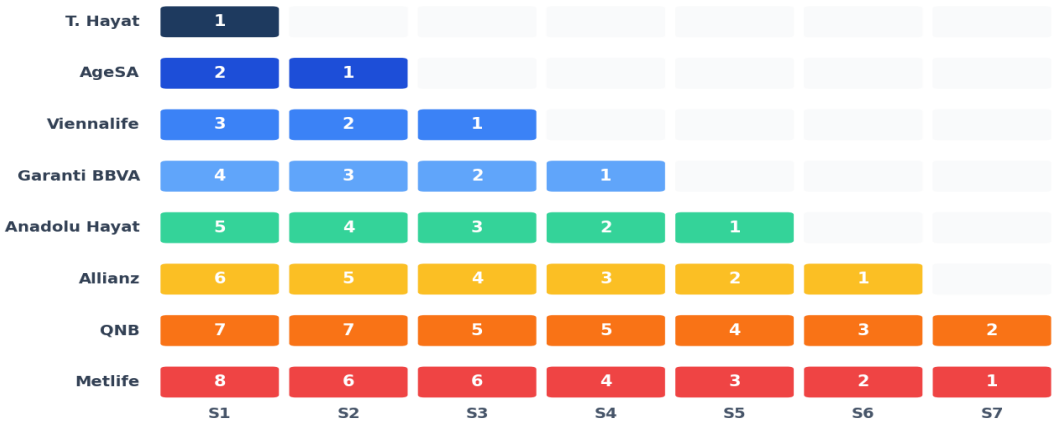


Figure 4. Findings of the Rank Reversal Scenarios Based on the Successive Removal of the Best-Performing Alternative



5. Policy Recommendations

Drawing on the findings obtained through the application of the proposed model to the Turkish life insurance industry, this section puts forward a set of recommendations across three interrelated dimensions: theoretical and methodological, managerial and practical, and regulatory and sectoral.

5.1. Theoretical and Methodological Contributions

The final criterion weights derived from the integrated CRISUS-Centroidous procedure carry theoretically meaningful implications for understanding how service quality is constituted in the life insurance sector. The placement of Digital Policy Ratio in first position and Online Claims Notification Ratio in third signals that digital transformation has become the most decisive strategic axis of service quality in life insurance. Equally noteworthy is the composition of the lower tier of the weight ranking. The lowest weights are assigned to the geographic coverage criteria, with the Geographic Coverage Rate and Regional Representation Balance ranking tenth and ninth, respectively — suggesting that, as service delivery increasingly migrates to digital channels, physical reach is losing its capacity to differentiate service quality among life insurers. These are followed by the customer satisfaction criteria: the Customer Satisfaction Index and the Customer Complaint Ratio rank seventh and eighth, below all claims-related, agency-related, and digital criteria — a finding that challenges the long-standing primacy of perception-based measurement in the service quality literature and provides empirical support for moving beyond the SERVQUAL paradigm towards multi-dimensional assessment frameworks that incorporate sector-specific performance dimensions.

From a sectoral perspective, this pattern can be explained by the distinctive characteristics of the life insurance sector. The limited discriminatory power of the geographic coverage criteria reflects the distribution structure of the Turkish life insurance market, in which the leading companies deliver their services predominantly through nationwide bancassurance networks and rapidly expanding digital channels. Physical reach is therefore largely comparable across the leading firms, exhibits limited variation, and consequently contributes little to differentiating service quality. The relatively weak position of the customer satisfaction criteria, in turn, stems from the nature of the service itself. Unlike service sectors characterized by frequent customer interactions, life insurance is inherently a long-term and relatively low-touch financial service, where customer engagement after policy issuance is generally limited. As a result, perception-based indicators such as the Customer Satisfaction Index tend to exhibit comparatively low variability across firms, thereby reducing their discriminatory power in objective weighting approaches based on data dispersion. In contrast, operational and structural indicators such as the Digital Policy Ratio, Online Claims Notification Ratio, and Total Number of Agents demonstrate greater variation among insurance firms and therefore contribute more substantially to distinguishing organizational performance. This suggests that, within the life insurance sector, operational capabilities and digital service infrastructure play a more decisive role in differentiating service quality than either physical geographic reach or perception-based customer satisfaction measures.

From a methodological perspective, the CRISUS procedure assigned the highest weight to Total Number of Agents, whereas the Centroidous procedure prioritized Digital Policy Ratio. Their integration via a linear aggregation operator reconciled this divergence, producing a more balanced weight set that captures informational content that either method alone would have partially obscured — offering concrete evidence for the theoretical necessity of methodological plurality in objective weighting processes. The RAM procedure, applied to the life insurance sector for the first time, produced consistent and valid results throughout, with the ranking order preserved across eight sensitivity scenarios and confirmed by five alternative MCDM comparisons. Taken as a whole, the proposed framework is positioned as a replicable methodological infrastructure adaptable to other service sectors with similarly complex evaluation needs.

5.2. Managerial and Practical Recommendations

The placement of Digital Policy Ratio and Online Claims Notification Ratio among the highest-weighted criteria makes clear that digital transformation constitutes the most critical strategic axis of service quality in life insurance. Companies that have yet to develop adequate digital infrastructure — a pattern that corresponds closely with the lower-performing group — are advised to direct investment towards these areas as an immediate priority, as expanding digital channels is likely to affect not only service quality scores but also customer retention and premium production potential.

The second-highest weight assigned to Active Agent Ratio points to the quality of the agency network, rather than its scale, as the more decisive determinant of service quality. Companies are therefore recommended to shift strategic focus from expanding the agent base towards improving agent activity levels, developing performance-based incentive mechanisms, and investing in structured training programmes.

Claims-related criteria — Claims Payment Duration and Outstanding Claims File Ratio — while falling behind the digital dimensions in weight, remain strategically significant given the direct bearing of claims processing on customer trust and should be retained among strategic priorities.

The ranking results reveal a pronounced performance divergence. The positioning of Türkiye Hayat in first place, followed by AgeSA and Viennalife, confirms a strong upper performance cluster, while the placement of Metlife and QNB at the lower end indicates that a comprehensive service quality review is warranted for these companies. Benchmarking against top-ranked peers offers a practical starting point for closing the performance gap.

5.3. Regulatory and Sectoral Policy Recommendations

The prominence of Digital Policy Ratio and Online Claims Notification Ratio among the highest-weighted criteria suggests that regulatory authorities should consider establishing minimum performance standards for digital service delivery in the life insurance sector. Sector-wide application of such standards would narrow the digital service quality gap between companies and ensure equal consumer access to essential digital services. In this regard, it is recommended that the relevant regulatory authorities strengthen reporting obligations related to digital service delivery and develop a corresponding regulatory framework.

The transparent publication of ranking outcomes carries considerable potential for reshaping competitive dynamics in the sector. Regular disclosure of company-level service quality performance scores would enable consumers to make more informed choices while simultaneously generating market-based pressure on lower-performing companies to improve — a policy instrument grounded in transparency rather than direct regulatory intervention whose effectiveness has been demonstrated across a range of international contexts.

The position of Türkiye Hayat at the top of the ranking, as a company operating within a publicly owned structure, suggests that the relationship between service quality performance and ownership structure is a subject worth examining. Whether this performance originates from the institutional structure or from sustained investment in service quality is not a question that can be disentangled with the data of the present study. Addressing this relationship with broader data sets would be of value both for understanding the competitive conditions of the sector and for placing policy design on an empirical footing.

Finally, the comparatively low performance scores obtained for Metlife and QNB suggest that the regular monitoring of service quality indicators would be of benefit across the sector as a whole. Given that the findings rest on expert assessments relating to a single period, a framework based on monitoring minimum service quality standards sector-wide and on companies developing their own improvement plans appears more appropriate than an approach involving company-level enforcement.

Conclusion

This manuscript developed an integrated decision framework combining the CRISUS, Centroidous, and RAM procedures to assess the service quality performance of eight Turkish life insurance companies. To this end, six research questions were addressed through a structured analytical process spanning criterion identification, weighting, ranking, and validation.

The final criterion weights paint a theoretically significant picture of how service quality is constituted in the life insurance sector. The placement of Digital Policy Ratio in first position, Active Agent Ratio in second, and Online Claims Notification Ratio in third establishes that digital transformation and agency network effectiveness have emerged as the primary determinants of service quality in this sector. Equally telling is the composition of the lower end of the weight ranking, where the geographic coverage criteria receive the lowest weights and the customer satisfaction criteria likewise fall below all claims-related, agency-related, and digital criteria — a finding that calls into question the sufficiency of perception-based measures as standalone proxies for service quality, pointing to the greater explanatory power of behavioral and structural indicators and providing empirical support for moving beyond the SERVQUAL paradigm towards multi-dimensional assessment frameworks.

The ranking outcomes reveal a pronounced performance divergence across companies. Türkiye Hayat achieved the highest score, reflecting the contribution of its comprehensive digital channels, strong bancassurance network, and extensive agency infrastructure. AgeSA and Viennalife followed in second and third place, while Metlife and QNB occupied the lower end of the ranking, indicating a structural need for improvement in digital service channels and agency network effectiveness. The correspondence between the ranking outcomes and the premium production standings is in line with the expectation that service quality and market share move together. This correspondence is nevertheless not regarded as an independent confirmation of the validity of the model.

From a methodological standpoint, this study makes three mutually reinforcing contributions. First, the integration of the CRISUS and Centroidous procedures through a linear aggregation operator produced a more balanced weight set by consolidating the informational content that each procedure extracts from distinct statistical properties of the decision matrix, thereby mitigating the vulnerability arising from dependence on a single weighting technique. Second, the RAM procedure was applied to the life insurance sector for the first time and produced valid and consistent results. Third, sensitivity analyses across eight scenarios and comparisons with five alternative MCDM techniques confirmed the full preservation of the ranking order, establishing the robustness and replicability of the proposed framework.

Despite its methodological contributions, this manuscript is subject to some limitations that should be considered when interpreting its findings. First, although the expert panel was deliberately composed of individuals with substantial professional and academic expertise in the life insurance industry, the evaluation process inevitably relies on expert judgement. Consequently, different expert panels or alternative expert-weighting strategies could lead to slight variations in the criterion screening and performance assessment results. A further consequence of this expert-based design is that the scores assigned may be influenced by the size and the visibility of the companies within the sector. The composition of the panel, whose members are drawn from different institutions and positions, and the equal weighting of expert judgements limit this influence without eliminating it altogether. A design in which indicators such as claims payment duration or the digital policy ratio are compiled directly from the publicly disclosed operational data of the companies is the most direct way of overcoming this limitation. Moreover, as the criterion screening threshold is derived from the mean scores of five experts, the inclusion or exclusion of criteria whose averages lie close to the threshold is sensitive to panel size. Broader expert panels would reduce this sensitivity. Second, the proposed framework was validated using data from the Turkish life insurance sector and eight insurance companies; therefore, the findings should not be generalized to different institutional, regulatory, or market environments without further empirical verification. Third, the objective weighting procedures employed in this case study are based on deterministic data and do not explicitly account for uncertainty or ambiguity in the assessment process. Future research may therefore extend the proposed model by integrating uncertainty modelling methods, such as fuzzy set theory, grey system theory, interval-valued approaches, or hybrid combinations thereof, to assess the robustness and stability of the proposed framework under uncertain decision environments. Finally, the cross-sectional research design captures organizational performance at a single point in time and therefore cannot reflect temporal changes in competitive dynamics or service quality. Longitudinal analyses using multi-period data, together with applications to different countries and service sectors such as banking, healthcare, and energy, would provide a more comprehensive evaluation of the proposed framework's generalizability and practical applicability.

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