Closing the Insurance Gap in Turkey: Prioritizing Key Factors and Strategies

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Abstract: Turkey presents a unique opportunity for improving insurance coverage, thanks to its dynamic economy, high working-age population, and strategic geopolitical location. Despite its significant economic potential, insurance penetration in Turkey is relatively low compared to other emerging nations. This study aims to identify the primary indicators and prioritize investment areas to improve Turkey's insurance penetration. The study employs the AHP method to weight selected criteria based on a literature review, relying on expert opinions. Subsequently, the TOPSIS method is used to rank the alternative results. The findings indicate that probability and level of competition are the most critical factors determining insurance coverage in Turkey. Additionally, technological transformation and intellectual capital are the most important investment areas to increase penetration in the country, while innovation is the least essential alternative. The results of our study can serve as a valuable reference point for industry stakeholders and policymakers, especially in economies struggling with low insurance penetration. This study presents a roadmap to narrow the insurance coverage gap by identifying and prioritizing strategic investment opportunities while optimizing investment returns. [Key words: Insurance coverage gap, insurance penetration, the Turkish insurance industry, investment prioritization.]

INTRODUCTION

The insurance industry has become increasingly important in many countries, particularly in developed economies, where insurers have larger assets than banks (Davies et al., 2003). In addition to generating

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funds for economies, the insurance industry is vital in mitigating the financial risks of unexpected events, including catastrophes such as earthquakes, floods, and epidemics (Yazıcı, 2023). As a risk transfer mechanism, insurance facilitates the transfer of risks from the private sector and households to insurers who are risk management experts (Trichet, 2005). Risk pools mitigate the adverse effects of risk-induced stress, reducing the capital required to compensate for potential losses. This surplus capital, in turn, facilitates an increase in innovation, production, investment, and competition, which are the key drivers of economic growth (Feyen et al., 2011).

The importance of the insurance industry varies according to nations' economic development level. Emerging economies benefit from the insurance industry's ability to mobilize low-cost funds that can be directed towards investments. Therefore, a comprehensive insurance market can meet resource needs that are strategically vital for these economies. Insurance penetration is a specific measure of the insurance market's development within a country. It is a powerful tool for cross-national comparisons (IAIS, 2017). This metric, which can be computed for life, non-life, or all insurance branches, represents the proportion of total premiums the insurance industry generates in GDP. A higher ratio indicates greater insurance market development (Ngoima, 2013; Bah and Abila, 2022). Furthermore, insurance penetration is linked to insurance demand, which is a crucial factor in determining a nation's level of economic development (Olayungbo and Akinlo, 2016).

Globally, insurance penetration rates have experienced a decline, falling from 8.1% in 2000 to 6.7% in 2022, with emerging economies demonstrating a positive differentiation from advanced economies (Swiss Re, 2023). As a dynamic emerging economy with a high working-age population and strategic geopolitical location, Turkey has relatively low insurance penetration rates compared to other emerging economies. It is more evident when Turkey is compared with economies in the same class regarding economic activity and demographic structure. Among these countries, the BRICS (Brazil, Russia, India, China, and South Africa) economies, with which Turkey's financial performance is often evaluated, stand out (Ersoy and Uçkun, 2022). While Turkey's insurance penetration rate stood at 1.3% in 2021, the average penetration rate in BRICS economies was 5.1% (Statista, 2023). Despite such a significant gap, projections for the future of the Turkish insurance industry are promising. According to the Insurance Association of Turkey (IAT, 2020), adequate public support and the repositioning of the industry investment would lead to high performance in insurance penetration rates in Turkey.

   Enhancing insurance coverage in Turkey is crucial in promoting sustainable economic development and ensuring financial stability. Due to its geographical location, Turkey is vulnerable to many natural disasters and environmental risks, especially earthquakes (Gurenko et al., 2006). In February 2023, two of the most significant earthquakes in the country's history occurred in Pazarcik and Elbistan. According to preliminary assessments, these disasters resulted in an estimated economic loss of USD 103.6 billion. Earthquake insurance coverage only accounts for USD 1.9 billion of the total USD 54.7 billion structural damage incurred by residential buildings (SBB, 2023). This implies a wide coverage gap of 97%, leading to a significant wealth loss of USD 52.8 billion for households. Furthermore, Turkey's rapid economic growth and urbanization over the past few decades have led to increasing property, health, and liability risks, along with natural catastrophe risks. Although there has been significant premium growth in relevant insurance branches, insurance penetration rates in Turkey remain low (OECD, 2023). Closing the insurance gaps for individual and commercial risks will help in the recovery from economic losses more efficiently and contribute to the country's socioeconomic stability.

   This research aims to identify the principal factors to enhance insurance penetration in Turkey and define the most crucial investment areas to achieve this. The main contributions of the study are as follows:

i.   There are numerous studies in the literature on the factors that affect insurance industry performance and demand. Despite identifying related factors, these studies fail to address the issue of how to enhance insurance coverage in a country. The study initially determines the primary factors that impact insurance penetration. It then identifies the crucial areas of investment that can raise insurance penetration significantly. The paper explains the causes of low insurance coverage in Turkey, one of the leading emerging economies, and proposes policy solutions to address the problem.

ii.   Over the past two decades, Turkey has faced difficulties in increasing its insurance penetration beyond 2%. However, expanding insurance coverage can play a crucial role in boosting the insurance industry's contribution to the economy, leading to sustainable growth and long-term economic resources for the country. Closing the financial protection gaps will promote social and economic justice while increasing the country's resilience to catastrophic events that have been rising in recent years.

iii. By identifying the priority areas required to increase insurance penetration in Turkey, the insurance industry will be able to optimize the returns on its investments by using its limited resources more

efficiently. Therefore, the findings from the priority analysis in this study will be instructive for the Turkish insurance industry.

iv. Analyzing the coverage gap in Turkey is essential in two respects. First, Turkey has a lower insurance coverage rate than other countries with similar economic and demographic factors. This indicates significant room for the insurance industry to expand in Turkey. However, the lack of demand for insurance makes it challenging to achieve this potential and requires additional investigation in this field. Second, despite the low insurance penetration rate in the country, the Turkish insurance market is one of the most developed markets in the region in terms of indicators such as the size of written premiums, market depth, and technological infrastructure. Therefore, the findings obtained in this country will be an essential reference point for other emerging markets in the region.

In this context, the study will start with a comprehensive literature review of the various determinants of insurance penetration. Later, the AHP-TOPSIS methodology will be employed to identify the most important factors and prioritize the investment areas to increase the penetration of the Turkish insurance industry. Lastly, the research will propose policy recommendations based on the outcomes obtained and end with a discussion of the implications of the research.

LITERATURE REVIEW

The insurance industry plays a crucial role in the economic growth and development of countries (Jahromi and Goudarzi, 2014). While its direct impact on the economy is often cited, its support of the financial system is also significant (Abdelzaher and Born, 2022). Insurance industry performance and penetration rates are commonly used metrics to assess the level of development of global insurance markets and have been the subject of many academic studies. Studies have particularly focused on countries with high insurance coverage gaps, highlighting the importance of this issue and offering detailed analyses and recommendations (Ulbinaitė and Kučinskienė, 2013; Chakrabarti and Shankar, 2015; Radhika and Satuluri, 2019; Brokešová et al., 2014; Outreville, 1996).

Literature on insurance penetration

Among macroeconomic variables, economic growth (Cristea et al., 2014; Pradhan et al., 2016; Olayungbo and Akinlo, 2016), inflation rate (Alhassan and Biekpe, 2016; Zerriaa and Noubbigh, 2016; Lee et al., 2018;

Olarewaju and Msomi, 2021a; Browne and Kim, 1993), and foreign direct investment (Carson et al., 2021) were the most studied. Furthermore, researchers also examined the impact of certain socioeconomic variables, such as household economic status, average age (Chakrabarti and Shankar, 2015; Chui and Kwok, 2008; Beck and Webb, 2003), and the legal system of the country (Hussels et al., 2005), on insurance penetration.

Burca and Batrinca (2014) considered the return on assets (ROA) as a financial performance metric. Based on their panel data analysis, Kramaric et al. (2017) concluded that ROA had a positive impact on company performance. Derbali (2014) found in his study on eight insurance companies in Tunisia that ROA positively influenced company performance. Kaya (2015) found that factors such as company size and premium growth rate were positively correlated with profitability, while age, loss ratio, and current ratio were negatively correlated in non-life insurance companies in Turkey. Camino-Mogro and Bermúdez-Barrezueta (2019) conducted an analysis of key financial metrics for insurance companies, including ROA, investment income, and profit after tax. Their findings highlighted the potential negative impact of regulations requiring higher capital on insurance companies' profitability, as these regulations may lead to increased investment and reserves.

The loss ratio was also a significant explanatory variable among other financial criteria. Kočović et al. (2014) found that high loss ratios hurt the profitability of non-life insurance companies. Chen and Wong (2004) argued that maintaining a well-structured insurance system in Asian economies required considering loss ratios as a crucial factor. Another performance criterion is operational efficiency. Chi-Ai et al. (2017) suggested that achieving long-term reserves is critical for life insurance companies, and operational efficiency is necessary for accomplishing this goal. Similarly, studies conducted in different countries and using various methods emphasized the importance of operational efficiency for insurance industry performance (Eling and Jia, 2019; Kader et al., 2010; Erhemjamts and Leverty, 2010).

Non-financial criteria, such as customer satisfaction and the level of competition, were commonly employed in empirical studies. For instance, a study conducted by Pooser and Browne (2018) investigated the satisfaction levels of car insurance owners in the US. The findings revealed that policyholders with higher satisfaction levels experienced lower costs and higher profitability. Siddiqui and Sharma (2010) maintained that companies should design strategies to enhance customer satisfaction by providing high-quality service. Similarly, Camarero (2007) argued that insurance firms should prioritize providing superior service to increase their economic and market performance. Furthermore, numerous studies have

examined the impact of competition level or market structure on the insurance industry performance (Hussels and Ward, 2006; Alhassan et al., 2015; Choi and Weiss, 2005; Pope and Ma, 2008). According to Alhassan et al. (2015), competition level improves customer satisfaction and increases profitability. Additionally, Zeytinoğlu et al. (2012) discovered that market-based ratios can explain changes in stock returns for Turkish non-life insurance companies.

The performance and penetration of the insurance industry may be explained by various alternative criteria, which can be classified as corporate governance, sociopolitical environment, financial literacy, technological transformation, intellectual capital, and innovation. Wang et al.'s (2007) panel data analysis conducted in Taiwan demonstrates that corporate governance significantly impacts the efficiency of the insurance industry. Additionally, Abdoush et al. (2022) argued that corporate governance significantly affects insurance companies' financial performance, especially during crises. Key corporate governance factors, such as the director's independence, positively impact non-life insurance firms (Hsu and Petchsakulwong, 2010) and financially benefit shareholders (Tornyeva and Wereko, 2012). While insurance penetration partly can be explained by income level, cultural variables and sociopolitical environment play a part in an individual's perception of risk and their approach to uncertainty (Outreville, 2018). Financial literacy levels are also a significant determinant of insurance industry performance, with prior studies predominantly indicating that insurance demand tends to rise as financial literacy levels increase (Lin et al., 2017; Mare et al., 2019; Weedige et al., 2019).

Technological advancements, such as artificial intelligence, have accelerated the insurance industry's transformation, resulting in significant impacts on customer satisfaction, insurance penetration (Ravi and Vedapradha, 2023) and increased efficiency of insurance companies (Neirotti and Paolucci, 2007). By leveraging sophisticated analytical models, the risks associated with natural disasters can now be assessed with greater accuracy, and risks can be priced more precisely (Chang et al., 2020). Information technology investments have been demonstrated to enhance business performance (Bharadwaj et al., 1999; Harris and Katz, 1991). Intellectual capital is another critical variable affecting insurance companies' performance, positively impacting financial performance (Alipour, 2012) and productivity (Lu et al., 2014). Innovative products, including microinsurance, can enhance insurance penetration (Inyang and Okonkwo, 2022). Innovation strategies contributed to insurance penetration in the Kenyan insurance industry (Mutegi, 2018; Kiragu, 2016), and innovation competence supported business performance in the Sri Lankan insurance market (Rajapathirana and Hui, 2018). Recent studies have also

shown that innovation performance and research and development (R&D) positively impact insurance company profitability and market competitiveness (Chen et al., 2021; Kamenjarska et al., 2022).

Literature on MCDM Models

Multi-criteria decision-making (MCDM) is a methodology used to select at least two options from a countable or infinite number of alternatives (Kumar et al., 2017). MCDM methods are utilized predominantly in studies that evaluate insurance industry performance, with the Analytic Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods being the most employed. Both methods have been employed independently or in combination.

For example, Rani (2021) proposed a personalized life insurance policy selection using the TOPSIS method. Ersoy et al. (2019) evaluated the financial performance of life and non-life insurance companies operating in takaful insurance in Turkey. Similarly, Meral (2021) analyzed the performance of the life and non-life insurance industry in Turkey during the COVID-19 pandemic using the TOPSIS method. The insurance markets are characterized by numerous domestic and foreign insurance companies, leading to product diversity and complex policy details, making buying insurance more challenging. MCDM can be utilized to address this issue. Pattnaik et al. (2021) recommended using the TOPSIS method to select India's most appropriate life insurance company.

Researchers employed various performance criteria when applying the MCDM models. For instance, in their evaluation of the performance of Chinese insurance companies, Lu and Zhu (2018) integrated financial and non-financial criteria into their study using the AHP method, which allowed for the inclusion of a diverse set of factors that affect company performance in the model. Furthermore, Pahwa and Gupta (2019) examined the factors that influence the demand for health insurance. Their survey-based study, which utilized the AHP method, found that internal factors, such as the company, product, and marketing, and external factors, such as demography and psychology, impact the demand for health insurance. Additionally, some studies explored alternative insurance models aiming to increase insurance penetration using the AHP method. Ansari et al. (2020) utilized the fuzzy AHP method to investigate alternative business models for individuals lacking insurance coverage, such as private and social insurance.

Rationale of the Study

After a thorough review of the relevant literature, the following conclusions have been drawn:

i.   The factors affecting the performance of the insurance industry and the demand for insurance have been a popular area of interest among researchers in recent years.

ii. MCDMs are widely preferred for analyzing endogenous and exogenous factors related to insurance industry performance.

iii. Although these studies have identified the relevant factors, they have found little evidence on how to improve the insurance penetration level in a country.

iv. Therefore, it is crucial to identify the priority investment areas that can help increase insurance penetration.

Based on these results, the study aims to determine the key factors affecting insurance penetration in Turkey and to identify the most prioritized investment alternatives to increase insurance coverage. In this context, the study employed a hybrid AHP-TOPSIS methodology, frequently preferred among the MCDM methods.

Methodology

The model estimation employed a hybrid approach of AHP and TOPSIS. A comprehensive consistency analysis was conducted to ensure the reliability of expert opinions, and criteria weighting was performed using the AHP method. Subsequently, the TOPSIS method was employed to select the optimal alternative based on the predefined criteria.

The study utilized AHP as the central component of the decision-making methodology. AHP was chosen due to its ability to handle decision hierarchies effectively and prioritize criteria. AHP provides a robust framework for pairwise comparisons, enabling stakeholders or decision-makers to express their subjective judgments. The hierarchical structure of AHP can break down complex decisions into manageable components, making it ideal for analyzing multilevel decision problems. Additionally, AHP includes consistency checks to validate the quality of pairwise comparisons, thereby increasing the reliability of the results. Furthermore, AHP was enhanced by the TOPSIS, which evaluates alternatives based on their proximity to the ideal solution. TOPSIS was preferred due to its ability to provide a concrete preference ranking based on positive and negative criteria. The method enables clear ranking and comprehensive evaluation of alternatives (Thakkar, 2021).

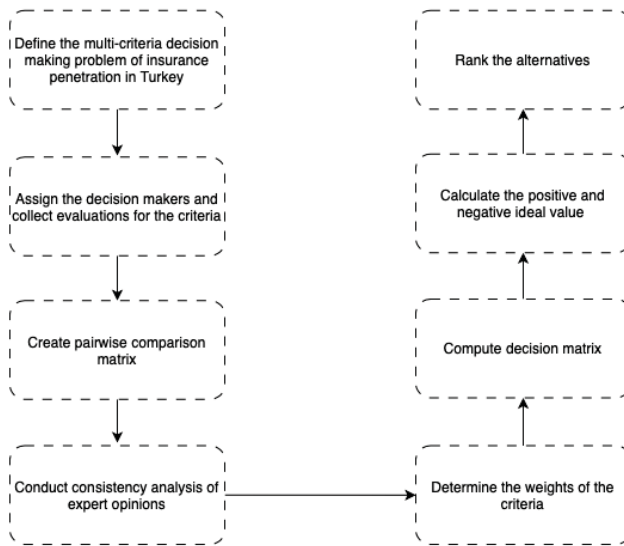Figure 1 presents a detailed description of the proposed model.

Fig. 1. The flowchart of the proposed model.

Stage 1. Pre-Analysis

> Step 1. Define the multi-criteria decision-making problem of insurance penetration in Turkey

> Step 2. Assign the decision makers and collect evaluations for the criteria

> Step 3. Create pairwise comparison matrix

Stage 2. AHP Procedure

> Step 4. Conduct consistency analysis of expert opinions

> Step 5. Determine the weights of the criteria

Stage 3. TOPSIS Procedure

> Step 6. Compute decision matrix

> Step 7. Calculate the positive and negative ideal value

> Step 8. Rank the alternatives

Data and Variables

The model was developed using relevant literature to identify criteria and alternatives. Definitions for the criteria and alternatives are provided in Tables 1 and 2, respectively.

Table 1. Determinants of Insurance Penetration

Dimension	Criterion	Reference
Financial	Operational efficiency (C1)	(Chi-Ai et al., 2017; Eling and Jia, 2019; Kader et al., 2010; Erhemjamts and Leverty, 2010)
	Loss ratio (C2)	(Chen and Wong, 2004; Kočović et al., 2014)
	Return on assets (C3)	(Olarewaju and Msomi, 2021b; Kramaric et al., 2017; Derbali, 2014; Kočović et al., 2014)
Non-financial	Customer satisfaction (C4)	(Nebo and Okolo, 2016; Siddiqui and Sharma, 2010; Pooser and Browne, 2018)
	Level of competition (C5)	(Alhassan et al., 2015; Choi and Weiss, 2005; Hussels and Ward, 2006)

As shown in Table 1, three financial and two non-financial criteria for insurance penetration were identified. Regarding the financial criteria, operational efficiency represents how efficient the process is based on the operational costs of the insurance industry relative to premium production. The loss ratio is calculated as the ratio of claims incurred in a period to total premium production. An excessively high loss ratio can pressure the long-term profitability of insurance companies, while an extremely low ratio may result in diminished perceived benefits for customers. The third financial criterion, the return on assets, reflects the insurance industry's profits ratio to its total assets. Ensuring a sustainable level of profitability in the industry can support capital accumulation and foster new investments.

Among non-financial criteria, customer satisfaction is one of the most important determinants of consumers' demand for insurance. It can support customer loyalty and promote interest in insurance products. The level of competition, the last criterion addressed in the study, describes the competitive environment required for well-structured insurance market functioning. While competition is vital for a healthy insurance market, excessive competition in specific domains may interrupt differentiation and prompt customers to base their decisions solely on price. On the other hand, imperfect competition can lead to various efficiency issues and suboptimal practices among insurance companies.

Table 2 presents five potential investment areas for enhancing insurance penetration. Firstly, investment in corporate governance could foster

Table 2. Investment Alternatives for Turkish Insurance Industry

Alternative	Reference
Corporate governance (A1)	(Wang et al., 2007; Hsu and Petchsakulwong, 2010; Tornyeva and Wereko, 2012; Abdoush et al., 2022; Ullah et al., 2019)
Financial literacy (A2)	(Lin et al., 2017; Mare et al., 2019; Weedige et al., 2019)
Innovation (A3)	(Rajapathirana and Hui, 2018; Mutegi, 2018; Inyang and Okonkwo, 2022; Kiragu, 2016)
Intellectual capital (A4)	(Lu et al., 2014; Alipour, 2012; Asare et al., 2017; Olarewaju and Msomi, 2021a)
Technologic transformation (A5)	(Idris et al., 2013; Ravi and Vedapradha, 2023)

transparency and equitable practices within the insurance industry, thereby consolidating institutional structures and promoting sustainable growth in the market. Secondly, insurers could invest in financial literacy to overcome the low level of financial awareness in some societies, which can limit demand for insurance. Improving financial literacy is a vital prerequisite for the wider diffusion of insurance amongst the general population. Thirdly, insurers could attract customers by innovating and adapting to the changing technological landscape. It requires developing new insurance products and services in line with emerging consumer trends. Fourthly, investing in intellectual capital is crucial for ensuring the successful development and implementation of innovative, sustainable policies. The quality of people and the industry's expertise capacity would be decisive in this regard. Finally, investment in advanced technologies is necessary to catch the 21st-century wave of digital transformation.

The proficiency level of experts, who contribute their expertise to determine the criteria and alternatives, is a crucial factor affecting the performance of decision-making systems. Within the scope of the study, five decision-makers, each possessing a minimum of 11 years of expertise in the insurance field, were appointed to provide their linguistic evaluations for both the criteria and the alternatives. Table 3 presents the competencies of the experts.

AHP Model

The criteria weights were acquired through the employment of expert opinions utilizing the AHP. AHP is a mathematical method that integrates qualitative and/or quantitative variables to evaluate priorities in decision-making processes. At the top level of the hierarchical structure is the outcome that is expected to be achieved according to the set objective. At

Table 3. The Details of Decision Makers

Decision maker	Level of education	Experience	Occupation
DM1	Ph.D.	23	Academic in Insurance
DM2	Ph.D.	17	Managing Partner at Insurance Assistance Company
DM3	M.Sc.	25	Deputy Secretary General, Insurance Association
DM4	M.A.	11	Marketing Director, Insurance Company
DM5	B.A.	13	Reinsurance Manager, Reinsurance Company

the middle level, criteria are positioned, and at the bottom level, alternatives are identified (Saaty, 2008). The graphical representation of this framework is illustrated in Figure 2.

The AHP method requires the identification of the objective before starting the process. Following this, literature analyses or surveys are conducted as appropriate to the purpose, and criteria for alternatives are identified. All factors must be thoroughly evaluated since this stage directly impacts the results. Once the objective, criteria, and alternatives have been identified, pairwise comparison matrices are created using a predetermined scale. Saaty (1986) proposed an importance scale ranging from 1 to 9, although other scales may be utilized. The Likert scale (Likert,
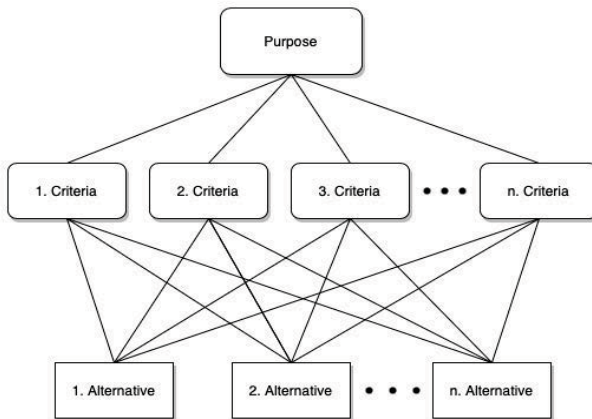

Fig. 2. Analytic hierarchy process.

Table 4. Binary Comparison Matrix

Value	Importance	Definition
1	Equal	Two elements contribute equally to the objective
2	Moderate importance	Experience and judgment moderately favor one element over another
3	Strong importance	Experience and judgment strongly favor one element over another
4	Very strong importance	One element is favored very strongly over another; its dominance is demonstrated in practice
5	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation

1932) was used in this study, and the relevant importance scale values and their interpretations are listed in Table 4.

The AHP method was implemented through a series of steps, which are as follows:

i.   Once the purpose of the study was established, the criteria and alternatives were identified. Subsequently, a pairwise comparison matrix was created to ascertain the relative importance of each criterion. An example arrangement is presented in Equation 1.

$$\begin{matrix} 1 & a_{12} & a_{13} \\ 1/a_{12} & 1 & a_{23} \\ 1/a_{13} & 1/a_{23} & 1 \end{matrix} \tag{1}$$

ii.   The determination of eigenvectors relied on the entries within the square matrix, which was prepared during the initial phase of criteria weighting. The calculation formula utilized for this purpose is specified in Equation 2.

where i = 1, 2, 3,...n and j = 1, 2, 3,...n;

$$b_{ij} = \frac{a_{ij}}{\Sigma_{i=1}^{n} a_{ij}}$$

$$w_{ij} = \frac{\Sigma_{i=1}^{n} b_{ij}}{n} \tag{2}$$

iii. To ensure accuracy in determining the eigenvector, it was imperative to perform a consistency calculation. This calculation involved the computation of the consistency index (CI) as specified in Equation 3.

$$\lambda_{maks} = \frac{1}{n} \sum_{i=1}^{n} \frac{a_{ij} \cdot w_j}{w_i}$$

$$CI = \frac{\lambda_{maks} - n}{n - 1} \tag{3}$$

iv. To determine the consistency, it is essential to know about the Random Index (RI) value. Table 5 contains the RI values for a comparison matrix of n entries.

Table 5. Random Index Values for Comparison Matrix

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Source: Piantanakulchai and Saengkhao, 2003

After calculating the consistency index and stochastic index, the next step was calculating the consistency ratio value utilizing Equation 4.

$$CR = \frac{CI}{RI} \tag{4}$$

The value of the consistency ratio should be at most 0.10 since any value above this threshold indicates that the decision maker's judgments are not consistent. When the ratio exceeds 0.10, it is imperative to improve the quality of judgments (Saaty, 1990).

v. The pairwise comparison matrix for the alternatives was formulated using expert opinions (see Table 1A of the Appendix for detailed calculation).

The methodology applied in this research involves the direct derivation of the criteria weights, while the rank average is considered for evaluating the alternatives. In contrast, the ranking obtained from the AHP method alone requires multiplying the mean rank values by the weights determined in the second step and then ranking the alternatives according to the resulting scores.
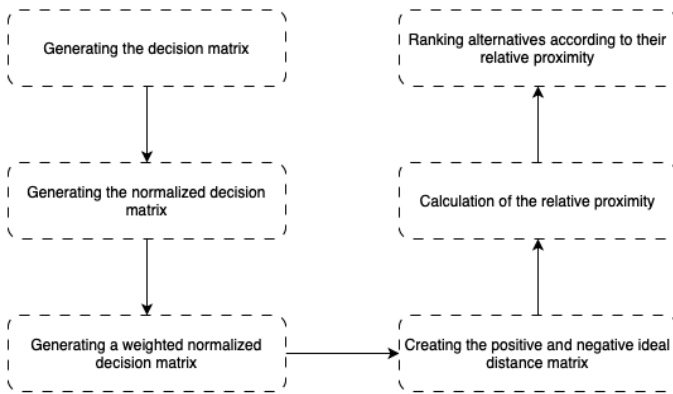
Fig. 3. TOPSIS algorithm.

TOPSIS Model

The methodology's final step involves using criteria weighted according to the information collected to rank the alternatives using the TOPSIS. The TOPSIS method, developed by Hwang and Yoon (1981), is a multi-criteria decision-making approach used to determine the most appropriate alternative from a limited number of options by minimizing the distance to the ideal point and maximizing the distance to the non-ideal point. Figure 3 shows the sequential stages of this process.

The steps of the TOPSIS model are shared below.

i.   Following the set objective, the alternatives and criteria were determined, and the weights of the criteria and the evaluation scores of the alternatives based on the criteria were collected. The decision matrix (D) scores the criteria against the alternatives. The inputs for this step were prepared utilizing the AHP method, as described in the previous section of our study. Equation 5 presents an example decision matrix (see Table 2A of the Appendix for detailed calculation).

$$D = \begin{matrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{matrix} \tag{5}$$

ii. The normalized decision matrix (R) was created by normalizing the scores in the D matrix. This normalization process was performed by applying Equations 6 and 7.

where i = 1, 2, 3,...n and j = 1, 2, 3,...k;

$$r_{ij} = \frac{y_{ij}}{\sqrt{\Sigma_{i=1}^{n} y_{ij}^2}} \tag{6}$$

$$r = \begin{matrix} r_{11} & r_{12} & r_{13} \\ r_{21} & r_{22} & r_{23} \\ r_{31} & r_{32} & r_{33} \end{matrix} \tag{7}$$

iii.   The weighted standard decision matrix (V) was created by multiplying the normalized criteria ratings by the criteria weights collected from the expert opinions. The criteria weights used in the TOPSIS model were obtained from the outputs of the AHP method.

iv.   The TOPSIS technique requires creating positive and negative ideal solutions while ranking alternatives. The maximum and minimum values of the column values in the standard weighted matrix were determined, and V^+ and V^− were calculated, respectively. Then, the ideal discrimination criteria (S^+ and S^−) were calculated using the square root of the sum of the squares of the row values in the V matrix and the differences of V^+ and V^− values. Equations 8 and 9 were used to calculate the separation measures.

$$S_i^+ = \sqrt{\Sigma_{j=1}^{n} (v_{ij} - v_j^+)^2} \tag{8}$$

$$S_i^- = \sqrt{\Sigma_{j=1}^{n} (v_{ij} - v_j^-)^2} \tag{9}$$

v.   The final stage of TOPSIS is the calculation of the relative closeness to the ideal solution (C_i^+). Equation 10 was used for this calculation, which allows the determination of the ideal solution by considering the selected criteria and evaluating the alternatives according to them.

$$C_i^+ = \frac{s_i^-}{s_i^- + s_i^+} \tag{10}$$

Table 6 illustrates the distance values calculated for each decision maker on the positive/negative ideal solution, utilizing Equations 8 and 9.

Table 7 presents the rankings of alternatives as determined by the AHP and AHP-TOPSIS methodologies. While the results obtained from both approaches are similar, it is observed that the hybrid model yields more precise measurements.

Table 6. Relative Closeness to the Ideal Solution

Ideal solution	Decision maker	A1	A2	A3	A4	A5
Positive ideal solution	DM1	0.37	0.16	0.35	0.27	0.22
	DM2	0.04	0.25	0.35	0.10	0.31
	DM3	0.20	0.10	0.24	0.16	0.18
	DM4	0.41	0.35	0.27	0.41	0.05
	DM5	0.24	0.34	0.23	0.18	0.03
Negative ideal solution	DM1	0.03	0.34	0.07	0.13	0.19
	DM2	0.34	0.11	0.01	0.26	0.08
	DM3	0.11	0.25	0.08	0.15	0.13
	DM4	0.04	0.08	0.16	0.04	0.42
	DM5	0.17	0.00	0.11	0.22	0.34

Table 7. Comparative Ranking Results

Alternatives	AHP-TOPSIS	AHP
Corporate governance (A1)	36.73%	18.31%
Financial literacy (A2)	37.63%	16.49%
Innovation (A3)	22.45%	15.00%
Intellectual capital (A4)	43.33%	21.73%
Technological transformation (A5)	57.76%	28.46%

The study reveals that return on assets (ROA) stands out as the most critical factor affecting insurance penetration, while operational efficiency is identified as having the weakest influence. The assigned weights of the criteria are ranked in the following order: ROA (C3), level of competition (C5), customer satisfaction (C4), loss ratio (C2), and operational efficiency (C1). (Table 1A of the Appendix reports the weights determined by the decision makers for each criterion.)

Our findings in Table 7 show that technological transformation is the most prioritized investment area to increase penetration in the insurance industry, while innovation is the least essential alternative. The ranking results of alternatives are listed as technological transformation (A5), intellectual capital (A4), financial literacy (A2), corporate governance (A1), and innovation (A3).

DISCUSSION

Over the past two decades, the insurance industry has seen remarkable growth on a global scale, largely driven by emerging markets. At the start of the century, emerging markets accounted for just 4.9% of the industry, which has risen to 18.9%. Although nominal premium growth has been achieved during this time, the share of insurance production in the economy has decreased from 8.1% to 6.7%. However, there has been a positive trend of diversification in emerging markets, with insurance penetration increasing from 1.9% to 3% (Swiss Re, 2023). It is important to note that development performance can vary among emerging markets. For example, Mexico's penetration rates increased from 1.7% to 2.5%, while Turkey's increase was less significant, from 1.2% to 1.4% (OECD, 2023). Despite Turkey's economic size, it ranks only 42nd in premium production, whereas countries like Hong Kong, Taiwan, and the Netherlands have a higher share of the insurance market relative to their economic size. This demonstrates that factors beyond just economic growth influence the development of insurance industries.

Turkey presents a unique case study to examine the reasons behind the remaining insurance coverage gaps despite economic growth. Our study aimed to determine the primary indicators and prioritize investment areas for increasing insurance penetration in Turkey. To achieve this, we weighted the selected criteria based on the literature review using AHP, relying on expert opinions. Subsequently, we ranked the alternative results obtained through the TOPSIS method. According to the study's findings, it is apparent that investment in technological transformation should be a top priority for the insurance industry to increase insurance penetration in Turkey.

The technological transformation of insurance represents the employment of digital channels in sales and after-sales services, policy management and claims process automation, and optimal utilization of data analytics, artificial intelligence, mobile, and cloud technologies. Such technological advancements enable insurers to analyze risks more accurately, price their products more precisely, develop innovative products, and offer them to customers through optimal channels. Moreover, technological transformation facilitates the insurance industry's ability to adapt to consumers' evolving demands and expectations in the 21st century. The opportunities presented by adapting to new technologies would extend competition in the insurance market beyond pricing, resulting in a more robust competitive landscape and profitable business prospects for companies.

A considerable number of studies in the existing literature claimed that technological transformation has the potential to contribute significantly

to the insurance industry across a broad spectrum of domains. One of the primary rationales for this argument is that technological transformation can revolutionize the insurance business model beyond providing benefits such as business efficiency, profitability, and transparency. To illustrate, Cohn et al. (2017) maintained that insurance products based on smart contracts, unlike their traditional counterparts, enable compensation based on a straightforward "if–then" relationship as soon as the risk is realized. This novel approach allows insurers to cover various unexplored domains, ranging from agriculture to energy investments. Furthermore, Bian et al. (2018) demonstrated that usage-based insurance products that rely on in-vehicle telematics data and machine learning algorithms offer a more accurate measure of accident risk, enable more precise pricing, and support technical profitability.

Despite their remarkable progress in digital transformation over the last two decades, insurers have been criticized for their limited adoption of new technologies (Naylor, 2017). Specifically, insurers have faced criticism for their understanding of digitalization as only introducing digital technology to traditional insurance processes (Cappiello, 2018). In contrast, insurtech are leveraging the benefits of emerging technologies to develop innovative applications that are revolutionizing the insurance value chain. This lack of comprehension by traditional insurance companies has resulted in the rapid expansion and success of insurtech startups (McKinsey, 2021). It highlights the certainty of technological transformation in the insurance industry, whether produced by internal or external factors.

Improving intellectual capital constitutes a critical domain of investment for augmenting insurance penetration. Intellectual capital refers to intangible assets such as the institutions' knowledge, experience, and intellectual property rights. Given the standardized character of insurance products, insurers require intellectual capital to establish a competitive advantage in the marketplace. By improving their corporate business processes, boosting their research and development efforts, and enriching their human capital, corporations can maintain a superior market position vis-à-vis competitors. It leads to a better competitive environment in the market, resulting in a range of benefits such as improved service quality, enhanced risk analysis, and the development of innovative products. Several studies have reported on the positive impact of intellectual capital on organizational performance. For instance, Lu et al. (2014) demonstrated that intellectual capital positively influences the operational efficiency of life insurance firms. Moreover, Alipour (2012) and Asare et al. (2017) established a statistically significant positive relationship between intellectual capital with corporate profitability. Likewise, Oppong et al. (2019)

revealed that intellectual capital significantly affects the efficiency of insurance companies.

The findings indicate that prioritizing investments in technological transformation and intellectual capital is imperative for enhancing insurance penetration. Following these, the focus should be given to financial literacy and corporate governance. The study highlights that the Turkish insurance industry should leverage technology to improve its overall performance, thereby increasing the penetration rate within the country. Furthermore, the industry should enhance its intellectual capital by strengthening its human capital and implementing policies for continuous business improvement.

CONCLUSION AND FUTURE RESEARCH

The Turkish insurance industry has faced significant challenges in recent years due to economic instability. This instability has negatively impacted the industry's technical profitability. In 2021, the monetary policy decision to reduce interest rates deepened the existing inflation problem, resulting in the Turkish lira losing nearly 70% of its value against the dollar in the last two years. These price and exchange rate shocks had a major impact on the insurance industry, leading to a decline in return on assets from 3.1% in 2020 to 2.4% in 2022. The car liability branch experienced a technical loss of around 20%. The health branch also suffered a decrease in technical profitability due to rising medical inflation, dropping from 20% to 4%. The concentration of premium production in the car and health branches, which account for 65% of the total, makes the Turkish insurance industry vulnerable to economic volatility (IAT, 2023).

Moreover, the country faces unique risks that highlight the pressing issue of existing gaps in insurance coverage. Over the last two decades, natural disasters have caused significant loss of life and property. Although compulsory insurance schemes are in place to cover these risks, application failures have resulted in coverage gaps, particularly in less developed areas. Furthermore, the country's life insurance industry faces a significant deficit, accounting for only 13.1% of total premium production, well below the OECD average of 49.1% (OECD, 2023). This issue is especially crucial as Turkey faces an ageing crisis due to declining birth rates and increasing life expectancy. Unfortunately, the industry is not investing enough intellectual capital and innovation resources to reach new customers. Evidence of this is seen in the distribution of operating expenses, where 62% is allocated to production expenses, while personnel, marketing, and R&D expenses receive only 21%, 2%, and 0.01%, respectively (IAT, 2023).

Drawing on our empirical findings, we recommend that the Turkish insurance industry invest in technological transformation and intellectual capacity building to boost penetration. These areas have significant resource requirements due to their long-term return on investment. Moreover, the high fragility of the insurance market and the economic volatility of Turkey make implementing these strategies more challenging. Turkey should implement policies to increase its insurance base to improve insurance penetration, which has remained at around 1.5% for the past two decades. The industry can enhance the efficiency of its investments by directing resources towards the most productive investment areas.

In order to effectively implement these strategies, policymakers and the insurance industry should work together collaboratively. Given the economic volatility of the Turkish economy, supervisory authorities should enhance the supervision of companies' financial stability and adopt measures to minimize the impact of financial shocks on the insurance market. Moreover, national and local governments should collaborate with the industry to implement effective mechanisms to expand insurance coverage, particularly in areas with low insurance penetration rates. Regulatory bodies can provide incentives or regulatory adjustments to promote the adoption of advanced technologies and strengthen intellectual capital. By doing so, policymakers can support creating a more comprehensive and inclusive insurance environment in Turkey.

Our study has produced valuable insights for industry stakeholders and policymakers, but it is essential to recognize its limitations. The main limitation of this study is its narrow focus on Turkey. While some of the findings may have relevance for insurance markets with similar characteristics, conducting analyses in different countries could lead to different outcomes. Additionally, while research focused on specific countries can improve understanding of conditions within those countries, it cannot provide a comprehensive view of the global landscape. It is important to note that this study did not consider some industry-specific measures, such as the combined ratio, due to methodological constraints. To gain a more comprehensive understanding, future research could explore the impact of these measures in a wider context. Additionally, researchers may examine other emerging insurance markets with significant insurance gaps.

COMPETING INTERESTS

The authors declare that they have no competing interests.

APPENDIX

Table 1A. Calculation of Criteria Weights for Decision Makers

Decision Maker	C1	C2	C3	C4	C5
DM1	0.09	0.09	0.48	0.19	0.15
DM2	0.06	0.13	0.50	0.20	0.12
DM3	0.11	0.15	0.27	0.05	0.42
DM4	0.13	0.07	0.49	0.19	0.11
DM5	0.05	0.13	0.37	0.09	0.37

Table 2A. Decision Matrix

Decision maker	Alternative	C1	C2	C3	C4	C5
DM1	A1	0.09	0.12	0.07	0.10	0.21
	A2	0.10	0.07	0.46	0.05	0.12
	A3	0.19	0.25	0.08	0.19	0.19
	A4	0.29	0.36	0.16	0.23	0.34
	A5	0.34	0.19	0.22	0.43	0.14
DM2	A1	0.34	0.33	0.40	0.33	0.18
	A2	0.05	0.09	0.16	0.19	0.07
	A3	0.10	0.07	0.06	0.08	0.10
	A4	0.25	0.23	0.30	0.32	0.36
	A5	0.26	0.28	0.09	0.08	0.28
DM3	A1	0.09	0.32	0.10	0.17	0.18
	A2	0.09	0.07	0.32	0.06	0.35
	A3	0.28	0.11	0.21	0.34	0.09
	A4	0.12	0.32	0.11	0.16	0.24
	A5	0.41	0.18	0.26	0.26	0.14
DM4	A1	0.18	0.13	0.06	0.10	0.14
	A2	0.06	0.07	0.16	0.05	0.11
	A3	0.14	0.21	0.21	0.29	0.38
	A4	0.14	0.10	0.06	0.11	0.22
	A5	0.48	0.50	0.51	0.45	0.15
DM5	A1	0.23	0.28	0.26	0.12	0.11
	A2	0.07	0.05	0.05	0.06	0.05
	A3	0.10	0.10	0.13	0.12	0.18
	A4	0.39	0.34	0.28	0.20	0.20
	A5	0.23	0.23	0.28	0.50	0.46

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