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Weighting Strategic Plan Goals and Evaluating Annual University Performance Using FUCOM and MARCOS: The Case of a State University

FUCOM ve MARCOS Yöntemleri ile Üniversite Stratejik Planındaki Amaç ve Hedeflerin Ağırlıklarının Belirlenmesi ve Yıllara Göre Üniversite Performansının Ölçümü: Bir Devlet Üniversitesi Örneği

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Abstract

University strategic plans serve as roadmaps that guide universities in line with their mission and vision during the planning period. Within this framework, goals and their related objectives are defined, and the success of achieving these objectives is measured using performance indicators. However, the contribution of each goal to the overall strategy, and each objective to its goal, may vary. To assess the university's progress over time and compare annual performance, it is necessary to determine the contribution (weight) of goals, objectives, and performance indicators. This study employed the FUCOM (Full Consistency Method), a subjective multi-criteria decision-making approach, to calculate the contribution weights of goals to the overall plan and objectives to their respective goals. At Pamukkale University, these weights were determined through a linear model based on pairwise comparisons conducted by strategic planning experts. Once the weights were identified, they were multiplied by the performance indicator values. To compare strategic performance across years, the MARCOS (Measurement of Alternatives and Ranking according to Compromise Solution) method was applied. By transforming previously qualitative elements such as goals and objectives into weighted numerical values, the study enabled the measurable and comparable evaluation of strategic implementation. The results indicate that changes in performance indicators were significantly influenced by external factors such as the COVID-19 pandemic, administrative decisions, and the realism of targets. These findings highlight the importance of adopting more scientific and applicable methods for the monitoring and evaluation of strategic objectives.

Keywords: University Strategic Plan, Multi-Criteria Decision Making, FUCOM, MARCOS, Regression

Özet

Üniversite stratejik planları, üniversitenin misyon ve vizyonu doğrultusunda, planın konulduğu yıllarda üniversitenin çizeceği yol haritasıdır. Belirlenen plan doğrultusunda amaçlar ve bu amaçlara bağlı hedefler belirlenir. Belirlenen hedeflerin uygulanmasındaki başarı o hedefleri gerçekleştirmede ölçüm aracı olan göstergelerdir. Stratejik planda her amacın plana katkısı ve her hedefin amaca katkısı aynı olmak zorunda değildir. Üniversitenin yıllar içinde planı ne oranda gerçekleştirdiği ve yıllara göre planı uygulama başarısını sıralamak için bu amaç ve hedeflerin katkı oranlarını ve hedefi açıklayan göstergelerin katkı oranlarını bilmek gerekir. Subjektif bir değerlendirme yöntemi olan FUCOM yöntemi ile üniversite stratejik planı oluşturan amaçların plana ve hedeflerin amaçlara katkı oranları (ağırlıkları) belirlenebilir. Pamukkale Üniversitesinde, strateji geliştirme uzmanlarının kıyaslamaları ile kurulan doğrusal model sayesinde bu ağırlıklar FUCOM yöntemi ile belirlenmiştir. Üniversite stratejik planındaki ağırlıklar belirlendikten sonra bu ağırlıklar stratejik planın gösterge değerleri ile çarpılarak incelenen yıllardaki planları gerçekleştirme oranlarına göre yıllar kıyaslanmıştır. Kıyaslama yapmak için Çok Kriterli Karar Verme tekniklerinden olan MARCOS yöntemi kullanılmıştır. Bu çalışmada daha önce nitel olarak ifade edilen amaç ve hedef gibi değerler ağırlıklandırılarak sayısal büyüklüklere dönüştürülmüş ve birbiri ile kıyaslanabilir ve ölçülebilir hale gelmiştir. Yılların kıyaslanabilmesi ve planların gerçekleşme sıralamalarının ölçülebilmesi mümkün olmuştur. Bu çalışmanın bulguları, performans göstergelerindeki dalgalanmaların büyük ölçüde COVID-19 pandemisi, idari kararlar ve hedef değerlerin gerçekçilik düzeyi gibi dışsal faktörlerden etkilendiğini ve stratejik hedeflerin izlenmesinde daha bilimsel ve uygulanabilir yöntemlerin gerektiğini ortaya koymaktadır.

Anahtar Kelimeler: Üniversite Stratejik Plan, Çok Kriterli Karar Verme, FUCOM, MARCOS, Regresyon

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In alignment with the university's mission, strategic plans are developed under the leadership of the university rector and a designated team. Strategic planning plays a vital role in the success of an educational institution. It enables the institution to analyze and predict future developments while also aiding in the establishment and maintenance of a competitive organization (Mahardhika & Raharja, 2023). Within the scope of strategic plans, specific goals are defined, accompanied by objectives that aim to achieve these goals. Performance indicators are identified to measure these objectives, but the contribution of each performance indicator to its associated objective is not uniform. These contributions are determined by the team responsible for formulating the strategic plan.

In the strategic plan of the university under study, while the contributions of performance indicators to objectives have been determined, the contributions of objectives to goals and goals to the overall plan remain undefined. To evaluate the decision-making criteria forming the plan, multi-criteria decision-making (MCDM) methods can be employed.

This study has two main aims. The first aim is to determine the weights of the goals and objectives influencing the plan using FUCOM (Full Consistency Method), a subjective evaluation technique. This will enable the identification of the weights of goals and objectives in the plans of universities with similar goals. The second aim is to assess the implementation of strategic plans during specific periods and monitor the university's performance over the years by applying the MARCOS (Measurement of Alternatives and Ranking according to Compromise Solution) method, one of the MCDM techniques, based on the determined weights.

This study is organized as follows:

Under the Literature Review section, academic studies on university strategic plans, both domestic and international, will be examined, along with studies focusing on FUCOM and MARCOS methods. In the University Strategic Plans section, the goals, objectives, and performance indicators of a state university for the years 2019–2023 will be discussed. Subsequent sections will provide a detailed explanation of FUCOM and MARCOS methods. In the Application section, the methods will be utilized to analyze and evaluate the university's strategic plan.

Literature Review

Under this section, studies related to university strategic planning are presented. Moreno-Carmona et al. (2020) demonstrated how open government principles (transparency, openness, participation, and collaboration) can be implemented in the strategic planning processes of universities. They proposed a model that uses an online platform designed to engage both primary stakeholders (students, faculty, researchers, and administrative staff) and secondary stakeholders (companies, institutions). This platform was utilized to identify, monitor, and control the university's strategic objectives. Participants submitted and voted on their proposals, and a year later, the platform was reused to evaluate performance indicators. It was noted that this approach could serve as a significant tool for sustainable strategic management and for aligning stakeholders with institutional objectives.

Makki et al. (2023) aimed to evaluate the educational quality of university faculties and rank them. For this purpose, standard criteria from international university ranking systems and other criteria derived from the university's Balanced Scorecard (BSC) perspective within its strategic plan were utilized. The study was conducted in three stages: identifying criteria, determining their weights, and ranking faculties using RATMI, a novel MCDM method.

Bantilan et al. (2023) reviewed 15 articles on strategic planning in education, 10 of which focused on higher education institutions, published between 2020 and 2022. Their analysis generated themes regarding the challenges, processes, and impacts of strategic planning. For challenges, three themes emerged: lack of knowledge and skills in strategic planning, improper implementation, and low stakeholder engagement. For processes, the themes included considering organizational vision, mission, goals, and objectives, involving stakeholders in planning, and assessing internal and external environments. Regarding impacts, two themes were identified: achieving a competitive advantage and determining the institution's current and future direction. These findings underscore the importance of strategic planning in overcoming challenges and enhancing educational institutions for future success.

Özakıncı and Sadioğlu (2022) examined the transparency and accountability of strategic plans in Türkiye state universities. The study assessed the extent to which performance indicators related to these concepts were included and the degree to which transparency and accountability were achieved. Of 128 state universities, 117 were evaluated, and their compliance with transparency and accountability was analyzed in relation to their URAP (University Ranking by Academic Performance) rankings and year of establishment.

Önen and Uysal (2021) analyzed the vision, mission, and core values sections of strategic plans from 15 universities in Türkiye's Eastern Anatolia Region using a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis. By employing content analysis, qualitative data in the strategic plans were transformed into quantitative data. This enabled classification of vision, mission, core values, and SWOT data, allowing comparisons and clustering of the universities.

Engin (2021) analyzed the mission, vision, and core values of 116 state universities in Türkiye. The study presented frequency tables of mission statements, vision statements, and core values across three different strategic planning periods.

Dağlar (2019) conducted a qualitative analysis of the objectives in the strategic plans of both state and private universities in Türkiye. The study tabulated the frequency of terms used in the objectives and compared private and state universities.

Yılmaz (2016) examined the strategic plans of 90 state universities in Türkiye using text analysis. The study reported the frequency of terms related to internationalization in these plans and identified themes. These themes were ranked based on their recurrence, and common themes were identified.

Taş et al. (2019) conducted a thematic analysis of the mission, vision, and objectives in three different strategic plans of a single state university. They identified the frequency of recurring terms and compared the strategic plans.

Çatı et al. (2016) similarly conducted a thematic study, evaluating the strategic plans of 36 universities within the framework of entrepreneurial universities. In this context, they used terms related to scientific publications, R&D, and innovation-supported project numbers as performance indicators. The frequency of these terms and the number of universities incorporating them were presented in tabular format.

Kocaoğlu et al. (2020) compared the most recent two strategic plans of three state universities. The study investigated whether the plans had improved in terms of structure and quality and concluded that the latest plans, prepared using the guidelines provided by the Ministry of Development, were more systematic and comprehensive.

Yiyit (2014) examines the relationship between the effectiveness of strategic plans mandated for many state institutions and organizational learning. Conducted as an exploratory qualitative case study at a state university, the research analyzes strategic plans prepared by academic departments. A total of 32 semi-structured interviews were carried out across eight faculties, one vocational school, and the rectorate. The study is structured around three main themes: organizational openness to change, efforts to access, share, and utilize information, and the contribution of the strategic plan to organizational effectiveness. Findings reveal that without double-loop learning, planned organizational change is difficult to achieve effectively.

Fürüzan (2009) examines the adoption of strategic planning and the Balanced Scorecard (BSC) in higher education institutions following the inadequacy of traditional planning methods. By analyzing examples from the UK, Australia, Canada, the United States, and Turkey, the study proposes a model for strategic planning and BSC implementation tailored to the Turkish higher education system.

Çetin and Taş (2012) focused on eight state universities located in the Mediterranean region of Turkey, examining the extent to which their strategic plans align with the guidelines set forth by the Turkish State Planning Organization. Utilizing the document analysis method, the research identified various deficiencies within the strategic plans of these institutions.

Alev and Öztop (2022) examined the strategic plans of four universities located in the Western Mediterranean region, focusing on key components such as the preparation process, situation analysis, future perspective, differentiation, strategy development, costing, and monitoring and evaluation. The document analysis method was employed to conduct this investigation. Although the strategic plans addressed similar thematic areas across the universities, the study highlighted a lack of standardization in both the form and content of the documents.

Oskaloğlu and Çatı (2022) aim to analyze the strategic plans of research and candidate research universities in Türkiye within the framework of the Research Universities Performance Monitoring Index. Employing a qualitative research methodology, the study utilized document analysis to examine the strategic plans of 11 research universities and 5 candidate research universities. The analysis focused on three key dimensions: Research Capacity, Interaction and Collaboration, and Research Quality. The findings reveal that nearly all indicators associated with the "Research Capacity" dimension of the Performance Monitoring Index are addressed in the strategic plans of both research and candidate research universities.

Halilov (2024), the study offers theoretical frameworks, competitive analyses, and practical methodological recommendations aimed at enhancing the quality of strategic management processes in higher education institutions. In this context, the structure of the educational services market, forms of institutional competition, and quality components of strategic planning are addressed in a comprehensive manner.

Bumin Süzen et al. (2025) employed document analysis to examine the goals, objectives, and performance indicators related to institutionalization as outlined in the strategic plans of state universities. Within this scope, a total of 26 goals, 94 objectives, and 379 performance indicators associated with the theme of institutionalization were identified across 26 state universities. The findings indicate that the universities' institutionalization-related goals predominantly focus on strengthening institutional capacity and enhancing relationships with stakeholders. Furthermore, the objectives were generally found to align with themes such as stakeholder engagement, institutional capacity, governance systems, and quality assurance mechanisms.

Despite being a relatively new subjective evaluation method, the FUCOM (Full Consistency Method) proposed by Pamucar et al. (2018) has been widely used. For instance, Ecer (2021) applied FUCOM to calculate the weights of criteria for wind farm location selection; Genç et al. (2022) used it to evaluate alternatives for automobile engine oils; Akbari et al. (2021) applied it to determine potential groundwater recharge zones; Bozanic et al. (2021) utilized it to select a group of construction machines for mobility; and Stevic and Brokovic (2020) developed a model for human resource evaluation in a transportation company. Ekin and Usta (2024) also used FUCOM method to determine the importance ranking and weights of CNC machine selection criteria.

The MARCOS (Measurement of Alternatives and Ranking according to Compromise Solution) method, also used in this study, was applied for the first time in combination with FUCOM. Introduced by Stevic (2020), MARCOS was used to evaluate 21 criteria for ranking eight alternatives in the selection of sustainable suppliers in the healthcare sector. In subsequent studies, Deveci et al. (2021) evaluated four alternatives for wind farm locations in Türkiye's Aegean coastal region using MARCOS. This study introduced a hybrid model with MARCOS and compared its results with other MCDM methods for validation. Similarly, Ecer (2021b) ranked 10 electric vehicle alternatives based on technical features (e.g., acceleration, price, battery life, range) using MARCOS and other MCDM techniques.

Some studies conducted with FUCOM and MARCOS methods are given in Table 1.

University Strategic Plans

Strategic planning helps an institution design its future and enables it to be successful in preserving its identity, image, and reputation. Planning in educational institutions helps them adapt to the education system of the 21st century by aligning with modern educational trends, fostering educational innovation, and promoting academic renewal. Strategic planning is also essential for addressing the educational trends of the 21st century, allowing institutions to manage future conditions effectively (Mahardhika & Raharja, 2023). The benefits of strategic planning in higher education are outlined in seven points (Nataraja & Bright, 2018):

1. It provides a framework for setting a direction to help the university achieve its desired future.
2. It offers a framework for gaining a competitive advantage.
3. It enables the participation and collaboration of all university stakeholders.
4. By enhancing the vision of all key participants, it encourages them to think creatively about the university's strategic direction.
5. It improves dialogue among participants, leading to a better understanding of the organization's vision and fostering a sense of ownership and affiliation with the institution's strategic plan.
6. It aims for alignment with the university's environment.
7. It allows the university to determine its priorities.

According to the Turkish Language Association, a university is defined as "an educational institution consisting of faculties, institutes, vocational schools, and similar units, which possess scientific autonomy and public legal personality, and engage in higher-level education, teaching, scientific research, and publishing" (TDK, 2024). Universities generally share similar missions. The missions of state universities are listed on the Presidency of the Republic of Türkiye's Strategy and Budget Directorate website. In this study, the mission of Pamukkale University (PAU) is stated as: "To be a leading university with a strong institutional identity that raises individuals who fulfill their professional and social responsibilities successfully, and conduct education, research, and community contribution activities in line with universal and national values and the requirements of the era" (TCSBB. 2024a). In line with this mission, a strategic plan is developed by a team consisting of the Rector, Vice Rectors, the University's senior management, the General Secretary, the Strategy Development Department Head, and university sub-unit spending authorities (PAU, 2024). Strategic goals, objectives related to these goals, and performance indicators for measuring the achievement of these objectives are determined in this plan. The goals set for PAÜ for the 2019-2023 period are presented in Table 2, the objectives to achieve these goals are shown in Table 3, and the performance indicators measuring the achievement of these objectives are given in Table 4 (PAU, 2024). In its 2019–2023 Strategic Plan (PAU, 2024), the university positions itself as 45% research-oriented, 40% education-oriented, and 15% entrepreneurship-oriented. However, these proportions appear to be based on the subjective judgments of the plan's preparers. The extent to which the stated goals and objectives correspond to these proportions or how the goals and objectives are distributed across these categories is not explicitly articulated in the plan. One dimension of this study is to determine the relative weight of the university's goals and objectives within the framework of its self-defined institutional positioning.

Objectives have been set in order to realise the goals in Table 2. The determined objectives and the related goals are given in Table 3.

Performance indicators and percentage contribution of each objective have been defined for achieving each objective. These percentage contributions are determined by a team of strategy development experts, with expert opinion and approval from senior management. The identified performance indicators and percentage contributions are presented in Table 4.

The contributions presented in Table 4 represent the percentage impact of each performance indicator on achieving the respective objectives. However, while these contributions are known, the contributions of the objectives to their corresponding goals, as well as the goals contributions to the strategic plan as a whole, remain unclear (PAU, 2024). One aim of this study is to determine these contribution ratios. Another aim is to analyze the realization rates of the plans over the years and, based on this analysis, evaluate the overall realization rates of the strategic plans during the examined period.

FUCOM Method

The steps and formulas of the FUCOM method, a subjective approach proposed for solving the criteria weighting problem, which is a fundamental issue in multi-criteria decision-making (MCDM) problems, are presented below (Pamucar et al., 2018):

Step 1: First, the criteria are ranked from the most important to the least important.

$$C_{j(1)} > C_{j(2)} > \ldots > C_{j(k)} \tag{1}$$

Step 2: In the second step, a comparison of the ranked criteria is made. This allows the determination of the vector of the comparative priorities of the evaluation criteria, as shown in Equation 2:

$$\Phi = \left(\varphi_{1/2},\ \varphi_{2/3},\ \varphi_{3/4}, \ldots,\ \varphi_{k/(k+1)}\right) \tag{2}$$

Here $\varphi_{k/(k+1)}$ represents the importance level of criterion $C_{j(k)}$ relative to criterion $C_{j(k+1)}$.

Step 3: The weight coefficients of the evaluation criteria are calculated based on two conditions:

$$\frac{w_k}{w_{k+1}} = \varphi_{k/(k+1)} \tag{3}$$

$$\frac{w_k}{w_{k+2}} = \varphi_{k/(k+1)} \otimes \varphi_{(k+1)/(k+2)} \tag{4}$$

Using Equations 3 and 4, the weights are calculated with the expectation of minimizing the deviation from perfect consistency (χ). In order to minimize the inconsistency, a model as in Equation 5 is established and solved. The weights that minimize the inconsistency are determined.

$$\begin{cases} \min \chi \\ \left|\frac{w_{j(k)}}{w_{j(k+1)}} - \varphi_{\frac{k}{k+1}}\right| \le \chi, \forall_j \\ \left|\frac{w_{j(k)}}{w_{j(k+2)}} - \varphi_{k/(k+1)} \otimes \varphi_{(k+1)/(k+2)}\right| \le \chi, \forall_j \\ \sum_{j=1}^{n} w_j = 1, \quad w_j \ge 0, \forall_j \end{cases} \tag{5}$$

To explain the working of the Fucom Method, the Example 2 in (Pamucar et al., 2018) are given here. In the example there are 5 criteria. Decision makers performed criteria ranking in equation 6 and the priorities of criteria given in Table 5.

$$C_2 > C_1 > C_4 > C_3 > C_5 \tag{6}$$

Comparative priorities calculated by the obtained priorities as $\varphi C_2/C_1$ = 2,1/1=2,1, $\varphi C_1/C_4$ = 3/2,1=1,43, $\varphi C_4/C_3$ = 3/3=1, $\varphi C_3/C_5$ = 7/3=2,33. The final values of the weight coefficients should meet the conditions $\frac{w_2}{w_1}$=2,1, $\frac{w_1}{w_4}$=1,43, $\frac{w_4}{w_3}$=1, $\frac{w_3}{w_5}$=2,33, also the final values of the weight coefficients should meet the condition of mathematical transitivity that $\frac{w_2}{w_4}$=2,1*1,43=3.00, $\frac{w_1}{w_3}$=1,43*1=1,43, $\frac{w_4}{w_5}$=1*2,33=2,33 by these conditions the final model can be defined as;

$$\begin{cases} \min \chi \\ \left|\frac{w_2}{w_1} - 2.1\right| \le \chi, \quad \left|\frac{w_1}{w_4} - 1.43\right| \le \chi, \quad \left|\frac{w_4}{w_3} - 1\right| \le \chi, \quad \left|\frac{w_3}{w_5} - 2.33\right| \le \chi, \\ \left|\frac{w_2}{w_4} - 3.00\right| \le \chi, \left|\frac{w_1}{w_3} - 1.43\right| \le \chi, \left|\frac{w_4}{w_5} - 2.33\right| \le \chi, \\ \sum_{j=1}^{5} w_j = 1, \quad w_j \ge 0, \forall_j \end{cases} \tag{7}$$

By solving model in equation 7 the weight coefficients (0,437, 0,208, 0,146, 0,063) obtained.

MARCOS Method

The MARCOS method aims to consider the relationship between reference values (ideal and anti-ideal alternatives) for ranking alternatives in multi-criteria decision-making (MCDM) problems. The utility functions of the alternatives are defined, and the distance of an alternative from the ideal solutions is determined by these utility functions. The best alternative is the one that is closest to the ideal solution and, at the same time, farthest from the anti-ideal reference point. The steps and formulas of the MARCOS method are outlined below (Stevic et al., 2020).

Step 1: First, a decision matrix is constructed with *n* criteria and *m* alternatives.

Step 2: The decision matrix is expanded. The expanded decision matrix includes the defined ideal and anti-ideal solutions.

$$X = \begin{array}{c} \\ AAI \\ A_1 \\ A_2 \\ \ldots \\ A_m \\ AI \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \cdots & C_n \end{array} \\ \begin{bmatrix} x_{aa1} & x_{aa2} & \cdots & x_{aan} \\ x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \\ x_{ai1} & x_{ai2} & \cdots & x_{ain} \end{bmatrix} \end{array}$$

The best alternative solution, AI, and the worst alternative, AAI, are calculated according to Equations 8 and 9.

$$AAI = \min_i x_{ij} \quad \text{if } j \in B \quad \text{and} \quad \max_i x_{ij} \quad \text{if } j \in C \tag{8}$$

$$AI = \max_i x_{ij} \quad \text{if } j \in B \quad \text{and} \quad \min_i x_{ij} \quad \text{if } j \in C \tag{9}$$

Here, *B* represents the group of benefit criteria and *C* represents the group of cost criteria.

Step 3: The expanded decision matrix is obtained using Equations 10 and 11.

$$n_{ij} = \frac{x_{ai}}{x_{ij}} \quad \text{if } j \in C \tag{10}$$

$$n_{ij} = \frac{x_{ij}}{x_{ai}} \quad \text{if } j \in B \tag{11}$$

Here, x_{ij} ve x_{ai} represent the elements of the expanded decision matrix *X*.

Step 4: The weighted decision matrix is calculated using Equation 12.

$$v_{ij} = n_{ij} \times w_j \tag{12}$$

Step 5: The benefit degrees of the alternatives (K_i) relative to the ideal and anti-ideal solutions are calculated using Equations 13 and 14.

$$K_i^- = \frac{S_i}{S_{aai}} \tag{13}$$

$$K_i^+ = \frac{S_i}{S_{ai}} \tag{14}$$

Here, S_i (i=1, 2, …, m) represents the sum of the elements of the weighted *V* matrix, and it is calculated using Equation 15.

$$S_i = \sum_{i=1}^{n} v_{ij} \tag{15}$$

Step 6: The utility function of the alternatives is determined as $f(K_i)$. The utility function represents the compromise of the observed alternative with respect to the ideal and anti-ideal solutions. The utility function of the alternatives is defined by Equation 16.

$$f(K_i) = \frac{K_i^+ + K_i^-}{1 + \frac{1 - f(K_i^+)}{f(K_i^+)} + \frac{1 - f(K_i^-)}{f(K_i^-)}} \tag{16}$$

Here, $f(K_i^-)$ represents the utility function for the anti-ideal solution, while $f(K_i^+)$ represents the utility function for the ideal solution. The utility functions are defined by Equations 17 and 18.

Step 7: The alternative with the highest possible value for the utility function is considered the best alternative.

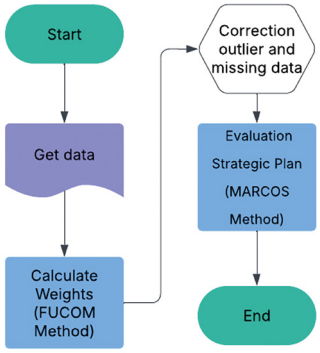
$$f(K_i^-) = \frac{K_i^+}{K_i^+ + K_i^-} \tag{17}$$

$$f(K_i^+) = \frac{K_i^-}{K_i^+ + K_i^-} \tag{18}$$

Application

Figure 1 shows the steps in the evaluation of the university strategic plan.

Figure 1
Flowchart of Application



First, the weights of the goals, objectives and performance indicators were determined by FUCOM method. In the next step, outliers and missing data were obtained. In the last step, the implementation of the strategic plan by year was evaluated with the MARCOS method.

Calculation of the Weights of Goals, Objectives, and Performance Indicators in the Strategic Plan

In this section, the weights of the goals and objectives in the strategic plan were first determined based on the opinions of strategic planning experts (Strategy Development Department Head, five experts and two lecturers) (PAU, 2024). Initially, the weights of the goals in the strategic plan were calculated using the FUCOM (Fuzzy Multi-Criteria Decision-Making) method.

Step 1: The goals have been ranked in order of importance.

G1=G2>G4>G3>G5

Step 2: The importance levels of the criteria have been determined and given in Table 6.

Step 3: $\Phi = (\varphi_{1/2}, \varphi_{2/3}, \varphi_{3/4}, \ldots, \varphi_{k/(k+1)})$ is calculated. $\varphi_{A1/A2}$=1, $\varphi_{A2/A4}$=1,2, $\varphi_{A1/A4}$=1,2, $\varphi_{A4/A3}$= 1,08, $\varphi_{A3/A5}$= 1,53, $\varphi_{A5/A4}$= 1,08 was obtained.

Step 4:

$$\begin{gathered} min\chi \\ \left|\frac{w_{j(A1)}}{w_{j(A2)}}-1\right|\le\chi,\left|\frac{w_{j(A2)}}{w_{j(A4)}}-1{,}2\right|\le\chi,\left|\frac{w_{j(A4)}}{w_{j(A3)}}-1{,}08\right|\le\chi \\ \left|\frac{w_{j(A3)}}{w_{j(A5)}}-1{,}53\right|\le\chi,\left|\frac{w_{j(A1)}}{w_{j(A4)}}-1{,}2\right|\le\chi,\left|\frac{w_{j(A2)}}{w_{j(A3)}}-1{,}3\right|\le\chi,\left|\frac{w_{j(A4)}}{w_{j(A5)}}-1{,}66\right|\le\chi \\ \Sigma_{j=1}^{5}w_j=1,\ w_j\ge 0,\forall_j \end{gathered} \quad (19)$$

Step 5: The model presented in Equation 19 was solved using the MS Excel Solver add-in, and the weight values provided in Table 7 were obtained.

After determining the weights of the goals in the strategic plan, the contributions of the objectives under each goal to the plan were analyzed using the FUCOM method. The FUCOM method was applied to the objectives under each specific goal, and the global weights of the objectives in the strategic plan were calculated by multiplying the weights of the objectives, as shown in Table 8, by the weights of their respective goals.

The weights of the performance indicators under the same objective have been presented as percentages in the strategic plan and are detailed in Table 4. The global weights of the performance indicators were calculated by multiplying their respective weights by the weights of the associated objectives, and the results are provided in Table 9.

The global weights of the identified indicators will be utilized in the MARCOS method to calculate and rank the realization of the strategic plan and the success of its implementation across the analyzed years.

Correction of Outliers and Calculation of Missing Data

Numerous methodologies have been proposed for the estimation and substitution of missing values and outliers. Techniques such as mean and median imputation, the utilization of the largest order statistic, and the application of time series model-based forecast values are employed to address and rectify these data anomalies (Appaia & Palraj, 2023). For outlier data, strategy development department personnel were consulted, and outlier data were corrected. In addition, for missing data, linear regression equations for each performance indicator were derived, and new data were obtained in place of the missing data. For example, for the performance indicator "G4O3I5" has a 4-year value (2018 to 2021), the 2018 value is the initial value. 2022 and 2023 year values are missing data. A regression equation was obtained using the data from 2018 to 2021 in Figure 2.

For the performance indicator "G4O1I3", the missing value of 2023 was also obtained from the regression analysis in Figure 3.

Figure 2
For the years 2022 and 2023, the values of performance indicator G4O3I5, 1060 and 1063 were obtained from the regression analysis

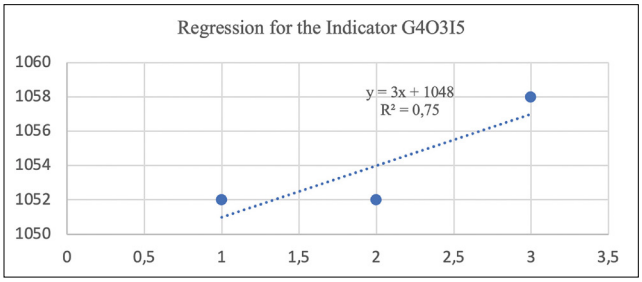
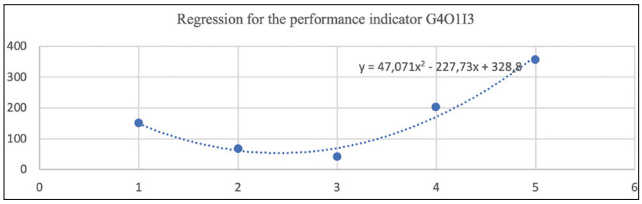


Figure 3
For the year 2023, the values of Indicator G4O1I3, 657 were obtained from the regression analysis



In a strategic plan, for some indicator mean value of years is used for estimating missing data. For example, G5O1I5 has values (102,155,21,35,110) for the years 2018 to 2022. This indicator was affected by the COVID-19 pandemic and took low values in 2020 and 2021. According to expert opinion, for the missing year 2023, the average of the years 2018, 2019 and 2022, when there was no pandemic, can be used for 2023. In this way, the missing data for 2023 was obtained as "122".

Evaluation of the University by Years in Terms of Strategic Plan Implementation

To effectively conduct monitoring and evaluation, the performance of the indicators in the strategic plan must be measured. For measuring, we need actual data during the monitoring period. The actual data were obtained from the report on the "Reports-Strategic Plan>Strategic Plan" web page under the "Strategic Management Information System" software (PAUSYBS, 2024), which is the University's information system software, with the permission of the institution under document number E.540731.

This performance measurement (PM) is calculated using Equation 20, which includes the initial value at the start of the plan period (A), the targeted year-end value during the monitoring period (B), and the actual value during the monitoring period (C) (TCSBB, 2024b). For the strategic plan, the initial values are the values of the year 2018. Because the plan was designed for the next 5 years at the end of 2018.

For example, the first indicator coded as G1O1I1, representing " Average number of students per academic staff member," has the Initial Value (A), Target Value (B), Actual Value (C), and Performance ratio for the examined years, as shown in Table 10.

The performance measurement (PM) for all indicators associated with the strategic plan has been calculated and is presented in Table 11.

The data in Table 11 form the decision matrix in the MARCOS method. The indicators represent the criteria, and the years represent the alternatives. Out of the indicators in the strategic plan, 75 are benefit criteria. There are 5 cost criteria in the plan, which are the indicators coded G1O1I1, G3O6I3, G5O1I1, G5O1I3, and G5O1I4. The goal of the plan is to maximize the benefit criteria and minimize the cost criteria. The weights of the indicators that form the criteria, determined using the FUCOM method, are multiplied by the decision matrix to obtain the weighted decision matrix.

The steps of the MARCOS method have been applied to the weighted decision matrix, and the performance of the years has been measured based on their achievement of the goals. The ranking of the years according to the goals is provided in Table 12. Additionally, in the last column of the table, all objectives have been evaluated together, and the rankings based on the overall achievement rates of the strategic plan are presented.

Upon examining Table 12, it can be stated that 2019 was the most successful year in achieving the strategic plan's goals during the observed period. In contrast, 2023 cannot be considered a highly successful year in reaching the goals, either for the entire 2018–2019 period or on an annual basis. Variations have been observed in the achievement of certain goals across different years.

Results and Discussion

The performance indicators evaluated to achieve strategic objectives may have been influenced by external factors. One such factor is the COVID-19 pandemic during the years 2020 and 2021. For instance, the performance indicator G3O1I3, "Number of community health awareness activities," recorded a value of 78 in 2019, whereas it surged to 1008 in 2020, a year significantly impacted by the pandemic. Similarly, the effect of the pandemic can be observed in the indicator G3O2I5, "Number of educational, conference, and other events open to the public." The number of events, which was 1130 in 2019, dropped drastically to 155 in 2020 due to the pandemic. The decline in the performance indicator G3O4I3, "Number of students participating in sports activities," can also be associated with the pandemic.

In addition to the pandemic, administrative decisions and government policies may have contributed to variations in performance indicator values. For example, the performance indicator G3O3I3, "Ratio of accredited laboratories to total research laboratories," recorded a performance measurement of zero in 2022 and 2023 due to the suspension of accreditation for accredited laboratories. Similarly, the cancellation of agreements related to the indicator G2O4I2, "Number of national joint graduate programs," resulted in a performance measurement of zero in 2023.

Some performance indicators were also affected by the target values set. For example, the target values for the indicator G3O2I1, "Stakeholder satisfaction rate (%)," were determined as 83, 85, 87, 90, and 93 for the years 2019 to 2023, respectively. Although setting a high satisfaction level may seem favorable, achieving a 93% satisfaction rate may not be a realistic target. Similarly, when examining the target values and actual realization rates of the performance indicator G4O1I5, "Satisfaction level with Management Information Systems software and applications", the target values for the years 2019-2023 were set at 70, 71, 72, 73, and 74, while the actual realization values were 69, 75,74, 76,72, 78,32, and 77,6. The indicator G4O1I5 had a performance measurement (PM) of 3,37 in 2020 with a satisfaction rate of 75,74, while in 2022, a satisfaction rate of 78,32 was recorded with a PM of 2,33 (Table 11).

These findings highlight the importance of setting appropriate targets to ensure accurate performance measurement and goal achievement. This study differs from other strategic studies conducted in Türkiye by not only qualitatively analyzing strategic plans but also emphasizing goals and objectives. Furthermore, it is a unique study in terms of assessing the performance of a state university in Türkiye over the years.

The results obtained in this study aim to determine university rankings over the years based on the realization of strategic plan performance indicators. Strategic plan developers should carefully determine the performance indicator values assigned to objectives and select achievable goals. This method can be applied to many universities, and a comparison can be made between universities. A comparison between universities can be made by giving weight to the aims and objectives of universities that are seen to be in a similar position (research-oriented, education-oriented, etc.). The monitoring and evaluation reports prepared subjectively by the strategy development teams of the strategy development department for the years 2019-2023 did not include a scientific method. This study aims to show that these evaluations can be made with MCDM methods in the future.

Note: Permission was obtained from the institution for the use of the data with document number E.540731.

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Appendix: Tables

Table 1
Studies Related to Methods

Reference	Year	Method(s)	Summary
Badi & Abdulshahed (2018)	2018	FUCOM	Used FUCOM for evaluating decision-making criteria weights.
Pamucar et al. (2018)	2018	FUCOM	Introduced FUCOM for determining weight coefficients in MCDM.
Bozanic et al. (2019)	2019	FUCOM	Applied FUCOM-MAIRCA for evaluating railway crossings.
Stevic & Brokovic (2020)	2020	FUCOM	Human resource evaluation in a transportation company.
Stevic et al. (2020)	2020	MARCOS	Ranked eight alternatives for sustainable supplier selection in healthcare.
Akbari et al. (2021)	2021	FUCOM	Identified potential zones for groundwater recharge.
Bozanic et al. (2021)	2021	FUCOM	Selected construction machines for mobility.
Deveci et al. (2021)	2021	MARCOS	Evaluated wind farm location alternatives on Türkiye's Aegean coast.
Ecer (2021)	2021	FUCOM	Calculated the weights of criteria for wind farm location selection.
Ecer (2021b)	2021b	MARCOS + other MCDM	Ranked electric vehicle alternatives based on technical features.
Duc Trung (2022)	2022	MARCOS	Evaluated machining methods using MARCOS with various weighting techniques.
Genç et al. (2022)	2022	FUCOM	Evaluated alternatives for selecting automobile engine oils.
Vu et al. (2023)	2023	MARCOS	Optimized process variables in EDM using graphite electrodes.
Ekin & Usta (2024)	2024	FUCOM	Ranked CNC machine selection criteria.
Xie & Zou (2025)	2025	MARCOS	Compared MARCOS with other MCDM methods in engineering.

Table 2
Goals of Paü Strategic Plan for the years 2019-2023

Goal Code	Goal
G1	To ensure the continuous development of education and training activities with innovative approaches
G2	To improve the identity of being a research-oriented university by increasing the quality of scientific activities
G3	Improving the University's Relations with its Stakeholders by Increasing its Fields of Activity
G4	Structuring Corporate Management Processes by Assuring Quality and Continuously Improving Institutionalisation
G5	To promote entrepreneurship culture within the university, to increase competitiveness by ensuring differentiation

Table 3
Strategic Objectives

Goal Code	Objective Code	Objective
G1	G1O1	Ensure 60% of academic programs meet national and international relevant standards by 2023.
G1	G1O2	Develop and improve educational infrastructure.
G2	G2O1	Increase publications in indexed scientific journals by 20% annually.
G2	G2O2	Raise the number of externally funded national and international research projects by 10% annually.
G2	G2O3	Expand the number of research projects supported by the Internal Scientific Research Projects (BAP) Coordination Unit by 80% by 2023
G2	G2O4	Establish and enhance research infrastructures and collaborative environments for multidisciplinary studies.
G2	G2O5	Create environments for translating research results into applications and increase the number of patents threefold by the end of 2023
G3	G3O1	Conduct research addressing major regional health issues and maintain satisfaction levels in existing diagnostic and treatment services above 90% by 2023.
G3	G3O2	Increase stakeholder satisfaction with university-provided services by 3% annually.
G3	G3O3	Strengthen university-industry collaboration.
G3	G3O4	Enhance partnerships between the university and sports clubs or federations.
G3	G3O5	Increase the number of artistic and cultural activities by 20% annually.
G3	G3O6	Improve energy efficiency, promote environmentally friendly practices and technologies.
G3	G3O7	Complete accessible campus infrastructure and occupational safety measures by 2023.
G4	G4O1	Enhance process efficiency to improve quality.
G4	G4O2	Establish quality assurance systems in all academic and administrative units by 2023.
G4	G4O3	Strengthen institutional identity and improve interactions with stakeholders.
G5	G5O1	Achieve a top-20 position in the "Entrepreneurial and Innovative University" rankings by 2023.
G5	G5O2	Increase the number of entrepreneurship-themed activities and projects by 10% annually.

Table 4
Performance Indicators of the Strategic Plan

Objective Code	Performance Indicator Code	Performance Indicator	Percentage contribution
G1O1	G1O1I1	Average number of students per academic staff member.	20
G1O1	G1O1I2	Number of students participating in international learning and/or internship mobility programs.	20
G1O1	G1O1I3	Number of departments offering double major and/or minor programs.	15
G1O1	G1O1I4	Number of programs aligned with educational accreditation standards.	30
G1O1	G1O1I5	Number of programs offering distance education.	15
G1O2	G1O2I1	Number of classrooms supported by technology-based systems.	30
G1O2	G1O2I2	Student independent study areas established in academic units (in square meters).	15
G1O2	G1O2I3	Total area of spaces designated for educational purposes (total classroom area, in square meters).	20
G1O2	G1O2I4	Total area of spaces designated for education and research purposes (total laboratory count).	20

G1O2	G1O2I5	Number of printed publications available in the library.	15
G2O1	G2O1I1	Number of publications in indexed journals (SCI, SCI-Expanded, SSCI, AHCI, ESCI).	35
G2O1	G2O1I2	Number of publications in journals indexed by other field-specific databases.	25
G2O1	G2O1I3	Number of publications in national journals indexed by ULAKBİM TR Directory.	20
G2O1	G2O1I4	Average number of citations per academic staff member in indexed journals.	20
G2O2	G2O2I1	Number of nationally funded external research projects.	40
G2O2	G2O2I2	Number of internationally funded external research projects.	40
G2O2	G2O2I3	Number of educational and informative meetings related to research project implementation processes.	20
G2O3	G2O3I1	Number of supported undergraduate and graduate theses.	40
G2O3	G2O3I2	Number of supported institutional infrastructure projects.	20
G2O3	G2O3I3	Number of supported research projects (introductory-level and rapid support projects).	40
G2O4	G2O4I1	Number of graduate programs established in multidisciplinary fields.	25
G2O4	G2O4I2	Number of national joint graduate programs.	20
G2O4	G2O4I3	Number of completed projects by application and research centers.	25
G2O4	G2O4I4	Number of research laboratories.	20
G2O4	G2O4I5	Number of databases subscribed through the library.	10
G2O5	G2O5I1	Total number of patents obtained.	50
G2O5	G2O5I2	Number of collaborative projects conducted with external partners.	50
G3O1	G3O1I1	Satisfaction rate of healthcare service recipients (%).	35
G3O1	G3O1I2	Number of projects conducted in public health.	25
G3O1	G3O1I3	Number of community health awareness activities.	20
G3O1	G3O1I4	Number of awareness activities organized in occupational health and safety.	20
G3O2	G3O2I1	Stakeholder satisfaction rate (%).	30
G3O2	G3O2I2	Number of participants in training programs organized by the Continuing Education Center.	15
G3O2	G3O2I3	Number of activities organized by student clubs.	15
G3O2	G3O2I4	Number of joint activities conducted with external stakeholders.	20
G3O2	G3O2I5	Number of educational, conference, and other events open to the public.	20
G3O3	G3O3I1	Number of advisory board meetings conducted with the participation of industry representatives.	20
G3O3	G3O3I2	Number of academic staff supporting Technopark projects.	20
G3O3	G3O3I3	Ratio of accredited laboratories to total research laboratories.	20
G3O3	G3O3I4	Number of external services provided by laboratories.	20
G3O3	G3O3I5	Number of collaborative projects conducted with industry (including graduate thesis projects).	20
G3O4	G3O4I1	Number of agreements established with sports clubs and federations.	20
G3O4	G3O4I2	Number of collaborative sports activities organized with stakeholders.	20
G3O4	G3O4I3	Number of students participating in sports activities.	20
G3O4	G3O4I4	Number of events organized for promoting sports activities and raising public awareness.	20
G3O4	G3O4I5	Proportion of areas allocated for sports activities within the total campus area (%).	20

G3O5	G3O5I1	Number of projects conducted in artistic and cultural fields.	40
G3O5	G3O5I2	Number of artistic and cultural events.	60
G3O6	G3O6I1	Number of projects implemented to increase energy efficiency and resource use.	20
G3O6	G3O6I2	Number of activities conducted on energy efficiency.	20
G3O6	G3O6I3	Amount of energy consumed per square meter in indoor areas (kW/m²).	15
G3O6	G3O6I4	Amount of green space per person on university campuses (m²).	15
G3O6	G3O6I5	Number of events organized to raise environmental awareness.	30
G3O7	G3O7I1	Ratio of accessible buildings to total buildings (%).	50
G3O7	G3O7I2	Completion rate of occupational safety risk analyses and infrastructure alignment studies (%).	50
G4O1	G4O1I1	Rate of process definitions established in academic and administrative units.	30
G4O1	G4O1I2	Total hours of in-service training provided to administrative staff on regulations.	20
G4O1	G4O1I3	Total hours of training provided on personal development and communication skills.	20
G4O1	G4O1I4	Completion rate of activities aimed at structuring job analyses/descriptions for administrative personnel (%).	20
G4O1	G4O1I5	Satisfaction level with Management Information Systems software and applications.	10
G4O2	G4O2I1	Number of units with Quality Management System and/or Educational Accreditation Certificates.	40
G4O2	G4O2I2	Student satisfaction level.	15
G4O2	G4O2I3	Academic staff satisfaction level.	15
G4O2	G4O2I4	Administrative staff satisfaction level (%).	15
G4O2	G4O2I5	Total hours of training provided on quality management.	15
G4O3	G4O3I1	Satisfaction level with institutional culture.	20
G4O3	G4O3I2	Total number of publications related to university activities.	15
G4O3	G4O3I3	Number of meetings held by the advisory boards of the university and its units.	25
G4O3	G4O3I4	Number of international students enrolled in undergraduate and graduate programs.	20
G4O3	G4O3I5	Number of bilateral exchange program agreements established with other universities.	20
G5O1	G5O1I1	University's position in the Entrepreneurial and Innovative University Index.	40
G5O1	G5O1I2	Number of students ranking in the top 10,000 in university entrance exams who choose the university.	10
G5O1	G5O1I3	Average success ranking of students placed in departments with the highest scores (e.g., Medicine, Dentistry, Physical Therapy and Rehabilitation, Law, Education Faculties).	10
G5O1	G5O1I4	University's national academic ranking (URAP Index).	30
G5O1	G5O1I5	Number of informational activities organized for prospective students.	10
G5O2	G5O2I1	Number of courses focusing on innovation and entrepreneurship.	20
G5O2	G5O2I2	Number of entrepreneurship projects.	30
G5O2	G5O2I3	Number of students accepted into pre-incubation programs.	15
G5O2	G5O2I4	Number of courses, training sessions, and trips focused on entrepreneurship and innovation.	15
G5O2	G5O2I5	Number of companies established within Technopark by academic staff, students, and alumni.	20

Table 5
Priorities of Criteria

Criteria	C2	C1	C4	C3	C5
$w_{j(k)}$	1	2.1	3	3	7

Table 6
The Importance Levels of the Goals

Criteria	G1	G2	G4	G3	G5
$w_{j(k)}$	1	1	1,2	1,3	2

Table 7
The Weights of Goals

Criteria	G1	G2	G4	G3	G5
$w_{j(k)}$	0,24	0,23	0,19	0,21	0,13

Table 8
The Weights of Objectives

Goal Code	Objective Code	Weight of Objective	Global Weight (Goal Weight * Objective Weight)
G1	G1O1	0,50	0,120
G1	G1O2	0,50	0,120
G2	G2O1	0,21	0,048
G2	G2O2	0,22	0,051
G2	G2O3	0,19	0,044
G2	G2O4	0,18	0,040
G2	G2O5	0,20	0,046
G3	G3O1	0,18	0,034
G3	G3O2	0,17	0,032
G3	G3O3	0,13	0,025
G3	G3O4	0,12	0,023
G3	G3O5	0,11	0,021
G3	G3O6	0,15	0,029
G3	G3O7	0,14	0,027
G4	G4O1	0,44	0,093
G4	G4O2	0,30	0,062
G4	G4O3	0,26	0,055
G5	G5O1	0,50	0,065
G5	G5O2	0,50	0,065

Table 9
The Weights of Performance Indicators

Indicator Code	Indicator Percentage	Objective weight	Global weight	Indicator Code	Indicator Percentage	Objective weight	Global weight
G1O1I1	0,2	0,120	0,024	G3O3I5	0,200	0,0247	0,005
G1O1I2	0,2	0,120	0,024	G3O4I1	0,200	0,0228	0,005
G1O1I3	0,15	0,120	0,018	G3O4I2	0,200	0,0228	0,005
G1O1I4	0,3	0,120	0,036	G3O4I3	0,200	0,0228	0,005
G1O1I5	0,15	0,120	0,018	G3O4I4	0,200	0,0228	0,005
G1O2I1	0,3	0,120	0,036	G3O4I5	0,200	0,0228	0,005
G1O2I2	0,15	0,120	0,018	G3O5I1	0,400	0,0209	0,008
G1O2I3	0,2	0,120	0,024	G3O5I2	0,600	0,0209	0,013
G1O2I4	0,2	0,120	0,024	G3O6I1	0,200	0,0285	0,006
G1O2I5	0,15	0,120	0,018	G3O6I2	0,200	0,0285	0,006
G2O1I1	0,35	0,048	0,017	G3O6I3	0,150	0,0285	0,004
G2O1I2	0,25	0,048	0,012	G3O6I4	0,150	0,0285	0,004
G2O1I3	0,2	0,048	0,010	G3O6I5	0,300	0,0285	0,009
G2O1I4	0,2	0,048	0,010	G3O7I1	0,500	0,0266	0,013
G2O2I1	0,4	0,051	0,020	G3O7I2	0,500	0,0266	0,013
G2O2I2	0,4	0,051	0,020	G4O1I1	0,300	0,0931304	0,028
G2O2I3	0,2	0,051	0,010	G4O1I2	0,200	0,0931304	0,019
G2O3I1	0,4	0,044	0,017	G4O1I3	0,200	0,0931304	0,019
G2O3I2	0,2	0,044	0,009	G4O1I4	0,200	0,0931304	0,019
G2O3I3	0,4	0,044	0,017	G4O1I5	0,100	0,0931304	0,009
G2O4I1	0,25	0,040	0,010	G4O2I1	0,400	0,062087	0,025
G2O4I2	0,2	0,040	0,008	G4O2I2	0,150	0,062087	0,009
G2O4I3	0,25	0,040	0,010	G4O2I3	0,150	0,062087	0,009
G2O4I4	0,2	0,040	0,008	G4O2I4	0,150	0,062087	0,009
G2O4I5	0,1	0,040	0,004	G4O2I5	0,150	0,062087	0,009
G2O5I1	0,5	0,046	0,023	G4O3I1	0,200	0,0547826	0,011
G2O5I2	0,5	0,046	0,023	G4O3I2	0,150	0,0547826	0,008
G3O1I1	0,35	0,034	0,012	G4O3I3	0,250	0,0547826	0,014
G3O1I2	0,25	0,034	0,009	G4O3I4	0,200	0,0547826	0,011
G3O1I3	0,2	0,034	0,007	G4O3I5	0,200	0,0547826	0,011
G3O1I4	0,2	0,034	0,007	G5O1I1	0,400	0,065	0,026
G3O2I1	0,3	0,032	0,010	G5O1I2	0,100	0,065	0,007
G3O2I2	0,15	0,032	0,005	G5O1I3	0,100	0,065	0,007
G3O2I3	0,15	0,032	0,005	G5O1I4	0,300	0,065	0,020
G3O2I4	0,2	0,032	0,006	G5O1I5	0,100	0,065	0,007

G3O2I5	0,2	0,032	0,006	G5O2I1	0,200	0,065	0,013
G3O3I1	0,2	0,025	0,005	G5O2I2	0,300	0,065	0,020
G3O3I2	0,2	0,025	0,005	G5O2I3	0,150	0,065	0,010
G3O3I3	0,2	0,025	0,005	G5O2I4	0,150	0,065	0,010
G3O3I4	0,2	0,025	0,005	G5O2I5	0,200	0,065	0,013

Table 10
The Performance Measurement (PM) of the Indicator G1O1I1 by Years

Years	2019				2020			2021			2022			2023		
Indicator	A	B	C	PM	B	C	PM	B	C	PM	B	C	PM	B	C	PM
G1O1I1	31	30	24,2	6,80	29	23,33	3,84	28	20	3,67	27	20,51	2,62	26	21,78	1,84

Table 11
The Performance Measurement (PM) of all Indicators Associated with the Strategic Plan

Indicator Code/ Years	2019	2020	2021	2022	2023	Indicator Code/ Years	2019	2020	2021	2022	2023
G1O1I1	6,80	3,84	3,67	2,62	1,84	G3O3I5	-6,80	-3,80	-3,47	-2,20	-0,88
G1O1I2	-0,90	-3,02	0,49	-0,51	-1,17	G3O4I1	5,00	1,00	1,50	3,00	0,33
G1O1I3	0,00	6,50	15,00	9,75	7,83	G3O4I2	20,80	-1,30	-0,73	-0,10	-0,84
G1O1I4	1,00	2,00	1,57	-0,75	-0,60	G3O4I3	1,12	-1,04	-1,37	0,93	-1,24
G1O1I5	-0,50	-0,25	-0,17	-0,11	-0,07	G3O4I4	2,60	0,00	3,20	-0,05	-0,12
G1O2I1	1,03	1,03	1,34	1,15	1,19	G3O4I5	0,40	2,27	1,91	1,28	1,09
G1O2I2	13,40	1,20	1,34	2,96	0,10	G3O5I1	1,20	-0,17	0,17	0,00	-0,36
G1O2I3	51,84	0,46	0,47	0,46	0,45	G3O5I2	4,02	-0,21	-0,07	0,20	-0,22
G1O2I4	6,00	1,33	1,37	1,96	1,87	G3O6I1	-7,00	-1,86	-0,67	-1,06	-0,86
G1O2I5	1,00	1,24	1,41	1,47	1,44	G3O6I2	-0,39	-0,27	-0,13	-0,11	-0,11
G2O1I1	1,09	0,99	2,13	0,39	-0,08	G3O6I3	0,77	1,11	32,21	15,11	14,45
G2O1I2	12,20	9,26	3,59	4,41	1,82	G3O6I4	-0,79	-0,02	-0,02	0,26	0,39
G2O1I3	-10,64	-1,76	-0,87	-1,68	-1,64	G3O6I5	3,10	-0,50	0,40	0,90	-0,04
G2O1I4	1,00	1,00	2,40	5,13	2,63	G3O7I1	-9,00	-4,50	-1,75	-1,40	-1,17
G2O2I1	0,86	2,80	3,00	0,11	3,33	G3O7I2	3,07	0,45	0,96	0,85	0,73
G2O2I2	-2,00	-1,00	-1,25	-1,50	-1,46	G4O1I1	2,70	1,57	-0,08	0,98	0,82
G2O2I3	7,50	-1,25	-0,71	2,22	-0,50	G4O1I2	6,55	1,40	-0,03	0,36	0,29
G2O3I1	-0,75	-0,68	-0,39	-0,43	-0,59	G4O1I3	-1,66	-1,08	0,35	1,03	2,03
G2O3I2	-2,00	-1,13	-2,00	-1,33	-0,96	G4O1I4	-42,00	-12,89	-26,53	-5,25	-2,81
G2O3I3	0,73	-0,81	-0,77	-0,59	1,49	G4O1I5	0,00	3,37	2,57	2,33	1,72
G2O4I1	2,00	4,50	3,33	1,25	2,20	G4O2I1	0,75	0,88	0,33	-0,30	-0,20
G2O4I2	1,00	0,75	0,50	0,50	1,50	G4O2I2	4,90	1,60	0,96	0,69	0,47
G2O4I3	39,33	3,63	-0,38	13,44	1,30	G4O2I3	-2,35	-1,05	-0,73	-0,94	-0,75

G2O4I4	0,00	3,67	-0,67	-7,13	-5,18	G4O2I4	-1,95	-2,35	-0,92	-0,38	-0,30
G2O4I5	-1,00	0,25	-0,35	-0,50	-0,37	G4O2I5	7,00	0,63	1,00	1,00	0,50
G2O5I1	4,00	4,50	2,67	2,75	1,40	G4O3I1	-4,87	-1,90	-1,69	-4,79	-3,83
G2O5I2	2,00	0,28	3,00	1,92	1,83	G4O3I2	7,70	-2,13	-1,43	8,29	4,55
G3O1I1	6,96	1,05	-4,18	1,25	0,22	G4O3I3	-1,50	4,00	6,71	1,20	1,92
G3O1I2	-2,20	-1,90	-1,13	-1,20	-0,96	G4O3I4	11,11	18,05	5,70	12,08	8,08
G3O1I3	-0,20	46,40	-1,10	-1,10	-1,28	G4O3I5	77,00	-1,04	-1,36	-2,38	-3,44
G3O1I4	0,33	-2,12	-1,31	-1,61	-1,68	G5O1I1	-2,50	-2,80	-1,25	-1,00	-1,67
G3O2I1	2,90	0,70	0,99	0,07	0,05	G5O1I2	-2,52	-2,57	-1,35	-1,24	-0,79
G3O2I2	0,99	5,01	7,91	10,23	62,30	G5O1I3	1,04	0,45	3,94	4,49	0,74
G3O2I3	1,15	-10,30	-7,02	0,58	-4,49	G5O1I4	3,00	0,50	-2,67	-3,50	-3,00
G3O2I4	21,10	2,60	3,60	4,25	1,12	G5O1I5	6,63	-6,23	-3,72	0,35	0,71
G3O2I5	58,33	-4,00	4,37	2,91	-1,84	G5O2I1	2,88	0,92	0,76	1,21	0,79
G3O3I1	2,00	-3,00	12,67	5,75	4,20	G5O2I2	9,50	4,50	8,17	2,75	2,20
G3O3I2	-3,60	-0,50	1,00	-2,05	-1,16	G5O2I3	13,60	4,50	-1,67	-0,20	2,41
G3O3I3	4,00	0,60	0,17	0,00	0,00	G5O2I4	13,33	-2,76	-1,17	-1,03	-1,10
G3O3I4	1,50	4,65	-1,03	-1,08	-3,24	G5O2I5	8,00	7,25	5,33	-5,88	-4,50

Table 12
Ranking the Performance of Years According to Goals and the Strategic Plan

Years	Rank for G1	Rank for G2	Rank for G3	Rank for G4	Rank for G5	Rank for Strategic Plan
2019	1	1	1	1	1	1
2020	5	2	2	4	3	4
2021	2	4	4	5	2	2
2022	3	3	3	2	4	3
2023	4	5	5	3	5	5