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Objective Branch Selection with Multi Criteria Decision Making in Internal Audit Planning

İç Denetim Planlamasında Çok Kriterli Karar Verme ile Objektif Şube Seçimi

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Abstract

In recent years, expectations from internal audit have changed with globalization, diversification of risks, technological innovations and developments, international standards and legal regulations. Within the framework of both legal regulations and international internal audit standards, it has emerged that internal audit activities should integrate a risk-based perspective into internal audit processes rather than the traditional perspective. While this situation affects all internal audit units operating in different sectors, it has affected the internal audit units of banks, which are mandatory units for banks in Turkey, relatively more. The first stage of the risk-based perspective in internal audit is the planning of the areas to be audited through the risk assessments carried out objectively by the internal audit units. However, there are some difficulties as there is no method for objective risk assessment in practice. For this purpose, in this study, an application has been proposed on how a bank's internal audit unit can objectively prioritize the branches that should be audited, based on an imaginary example. In the proposed application, criteria for the branches to be prioritized in the annual internal audit plan were defined and scored, their weights were calculated with the standard deviation method, and the prioritization rankings for the branches were carried out using the ARAS method.

Anahtar Kelimeler: *Internal Audit, Risk Assessment, Internal Audit Planning, Multi Criteria Decision Making, ARAS.*

Jel Kodları: *M40, M42, M49.*

Öz

Son yıllarda küreselleşme, risklerin çeşitlenmesi, teknolojik yenilikler ve gelişmeler, uluslararası standartlar ve yasal düzenlemeler ile birlikte iç denetimden beklentiler de farklılaşmıştır. Gerek yasal düzenlemeler gerekse uluslararası iç denetim standartları çerçevesinde iç denetim faaliyetlerinin geleneksel bakış açısından ziyade risk odaklı bakış açısını iç denetim süreçlerine entegre etmeleri gerekliliği ortaya çıkmıştır. Bu durum farklı sektörlerde faaliyet gösteren tüm iç denetim birimlerinin tamamını etkilemekle birlikte ülkemizde bankalar açısından oluşturulması zorunlu birimler olan banka iç denetim birimlerini görece daha fazla etkilemiştir. İç denetimde risk bazlı bakış açısının birinci aşaması iç denetim birimlerince objektif olarak gerçekleştirilen risk değerlendirmeleri ile denetlenecek alanların planlanmasıdır. Ancak, uygulamada risk değerlendirmesine yönelik objektif bir yöntem bulunmadığından bazı zorluklar yaşanmaktadır. Bu amaçla, bu çalışmada hayali olarak oluşturulan bir örnek üzerinden bir bankanın iç denetim biriminin denetlemesi gereken şubeleri objektif olarak nasıl önceliklendireceğine ilişkin bir uygulama önerisinde bulunulmuştur. Önerilen uygulamada yıllık iç denetim planında önceliklendirilecek şubelere yönelik kriterler tanımlanmış ve notlandırılmış, ağırlıkları standart sapma yöntemiyle hesaplanmış ve şubelere yönelik önceliklendirme sıralamaları ARAS yöntemiyle gerçekleştirilmiştir.

Keywords: *İç Denetim, Risk Değerlendirme, İç Denetim Planlaması, Çok Kriterli Karar Verme, ARAS.*

Jel Codes: *M40, M42, M49.*

1. INTRODUCTION

The most important contribution of internal audit to the enterprises is to support them in reaching their determined objectives by minimizing the risks that may arise with the assurance and consultancy activities it performs. The effective execution of internal audit activities will be useful for the effective and adequate functioning of the internal control, risk management and corporate governance mechanisms.

Although existence of internal audit function and its effectiveness in carrying out its activities are extremely important for all businesses, this situation becomes even more important for banks. The fact that the transactions realized in banks have a relatively higher level of risk compared to other businesses, the existence of relationship based on trust between the bank and its customers, the development of information technologies and electronic banking services, the diversification of the products offered by banks to their customers, the place and importance of the banking sector in the economies of countries has made it essential to establish effective internal audit mechanisms within the banks.

In Turkey, regulations regarding the banking sector are published by the Banking Regulation and Supervision Agency (BRSA). BRSA legislation requires banks to have internal audit units and to ensure the functionality, suitability and adequacy of these units. Responsibility for this is assigned to the boards of directors of banks. According to the Banking Law No. 5411, banks should establish internal audit mechanisms covering their units, branches and partnerships. In this way, compliance of the activities they have carried out with legal and internal regulations and banking principles is reviewed by the mentioned internal audit departments.

Both the BRSA legislation and the international internal audit standards published by the Institute of Internal Auditors (IIA) suggest that internal auditors should conduct their activities with an independent, objective and risk-based approach. At this point, the concept of risk-based approach in internal audit activities comes to the fore. In risk-based approach, the internal audit function should focus on risks as well as controls, prioritize relatively more risky auditable areas, products and systems in the annual planning, considering the risk assessment results and its available resources. Thus, it will be possible to contribute to the achievement of the goals that the enterprise has determined. Also, the limited resources of internal audit activities will be used effectively.

One of the preliminary stages of risk-based internal audit activities is the compilation of the annual internal audit plan, which is prepared by taking into account the risk assessments and their outputs. Most of the banks operating in Turkey have branch networks. Considering the available resources of internal audit function, the number of branches, and the processes, units and activities of the bank other than the branch network, it is not possible to subject all branches of the bank to internal audit every year. Moreover, the legal authorities do not have any expectations in this direction. The important thing here is to include the most appropriate branches within the scope of the annual plan, taking into consideration the risk assessment results carried out objectively by the internal audit units. At this stage, one of the most important challenges encountered in practice is the preparation of the annual internal audit plan with objective evaluations.

Based on this problem encountered in practice, the aim of this study is to propose an objective application that the bank internal audit units can use in their risk assessments they make while preparing their plans for the selection of the branches to be audited. For this purpose, an internal audit unit was created for a fictitious bank and an annual internal audit plan was prepared for the branch audits of this unit using multi criteria decision making (MCDM) methods. Evaluation criteria were defined, values were given to these criteria by the authors, criteria weights were calculated with the standard deviation method, and the risk rankings of the branches were performed using the ARAS method.

The contribution of this study to the literature is that it proposes an objective application that bank internal audit units can use in their risk assessments while determining the branches to be audited during the preparation of their annual internal audit plans. To the best of our knowledge there is no such study in the literature for internal audit. In addition, this study is one of the few studies in the literature on the use of MCDM methods in internal audit activities.

In the first part of the study, conceptual information about internal audit, risk-based internal audit and internal audit activities in banks is explained. Afterwards, MCDM methods used in the proposed model in the application section of the study are explained in detail. In the following section, academic studies in the national and international literature on the use of MCDM methods in internal audit activities are summarized. Afterwards, the study is completed with sample application and conclusion sections.

2. CONCEPTUAL FRAMEWORK

Internal audit with its definition made by the IIA is an assurance and consultancy activity that aims to improve and add value to the activities of the company it works for. Internal auditors carry out their work independently and objectively. The internal audit activity reviews the efficiency and effectiveness of the corporate governance, risk management and control processes with a systematic and disciplined perspective, makes suggestions for improvements regarding these processes and supports the enterprise to achieve its goals (IIA, 2019: 242). Internal audit is an evaluation activity performed by the company's own employee audit staff. It helps management for the sustainable growth of the enterprises and ensures the development of their competitiveness (Ridley, 2008: 20).

The main fields of activity of internal audit are divided into categories as assurance and consultancy services. Assurance services are objective and independent reviews carried out in order to provide an opinion on the system, process and activities of the enterprise in the light of the audit evidence examined. Consulting activities, on the other hand, refer to advisory services fulfilled by the internal audit unit (IIA, 2016: 2). Main responsibility of senior management is to establish internal audit activities and to ensure their functionality and effectiveness. For this reason, the perspectives, transparency and efforts of the top management team are important in terms of the effectiveness of the internal audit function and its potential to add value to the organization (Gökoğlan, 2022: 949).

Internal audit unit is an important component of the enterprise-wide risk management process with its assurance and consulting activities. All aspects of risks should be taken into consideration in internal audit processes. At this point, risk-based internal audit comes to the fore. Risk-based internal audit can be defined as a process of planning the internal audit

activities by considering the risk areas and existing controls of the enterprise. It consists of the stages of understanding business processes, risk assessment, planning internal audit activities, determining the scope of work and performing examinations, and reporting the findings (Celayir, 2021: 148-152).

In today's world, it is necessary to apply a risk-based perspective in line with the expectations of both legal authorities and international good practices regarding internal audit. With the audit activities to be carried out on a risk-based approach, the areas to be audited will be identified effectively, and both the economic resources and the human resources of the internal audit unit will be used effectively (Menekse & Camgoz Akdag, 2022: 2).

According to BRSA legislation, an internal audit unit that reports to the board should be established within banks. Periodic and risk-based activities carried out by the internal audit units of the banks consist of preparation and implementation of the annual internal audit plan, carrying out the fieldwork, reporting the findings and conducting follow-ups for open issues (BRSA, 2014). In parallel with the legal regulations for the banking sector in Turkey, international internal audit standards also require the internal auditors to consider the business objectives and set priorities for the areas of the business that need to be audited from a risk-based perspective (IIA, 2019).

3. STANDARD DEVIATION METHOD

The standard deviation method is an objective method used to determine the evaluation criteria weights defined in MCDM problems. In this method, lower weight values are calculated for evaluation criteria that have lower values among alternatives. The main stages to be followed during the implementation of this method are explained below (Zardari et al., 2015: 34-35):

Stage 1: Creation of the Decision Matrix

The decision matrix is created as mentioned in equation (1). In the equation, m represents the number of alternatives and n represents the number of evaluation criteria.

$$X_{ij} = \begin{bmatrix} X_{11} & X_{12} & \dots & X_{1j} & \dots & X_{1n} \\ \vdots & \vdots & & \vdots & \vdots & \vdots \\ X_{i1} & X_{i2} & \dots & X_{ij} & \dots & X_{in} \\ \vdots & \vdots & & \vdots & & \vdots \\ X_{m1} & X_{m2} & \dots & X_{mj} & \dots & X_{mn} \end{bmatrix} \quad i = 1, 2 \dots, m \text{ ve } j = 1, 2, \dots, n \qquad (1)$$

Stage 2: Normalizing the Decision Matrix

In the second step, decision matrix is normalized using the equation (2) below.

$$Y_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{n} X_{ij}^2}} \qquad (2)$$

Stage 3: Calculation of Standard Deviation Values of Evaluation Criteria

Standard deviation values of the evaluation criteria used in the study are calculated by using the equation (3).

$$\sigma_j = \sqrt{\frac{\sum_{i=1}^{m}(Y_{ij}-\bar{Y}_{ij})^2}{m}} \quad (3)$$

j= 1,2,…,n

Stage 4: Determination of Criterion Weights

In the last stage of the method, the weight values of the criteria are calculated using the equation (4) below.

$$W_j = \frac{\sigma_j}{\sum_{i=1}^{n}\sigma_j} \quad (4)$$

j= 1,2,…,n

4. ARAS METHOD

The ARAS method was developed by Turksis & Zavadskas (2010) and is used to rank the alternatives in MCDM problems. In this method, performance levels of the alternatives used in the study and the ratio of each alternative to the ideal alternative are determined (Dadelo et al., 2012: 68). The basic steps followed during the application of the ARAS method are as follows (Karabasevic et al., 2016: 55-56):

Stage 1: Creating the Decision Matrix

In the first stage, the decision matrix is created with the help of equation (5). In the equation, m represents the number of alternatives and n represents the number of evaluation criteria.

$$X_{ij} = \begin{bmatrix} X_{01} & X_{02} & \dots & X_{0j} & \dots & X_{0n} \\ \vdots & \vdots & & \vdots & \vdots & \vdots \\ X_{i1} & X_{i2} & \dots & X_{ij} & \dots & X_{in} \\ \vdots & \vdots & & \vdots & & \vdots \\ X_{m1} & X_{m2} & \dots & X_{mj} & \dots & X_{mn} \end{bmatrix} \quad (5)$$

i= 0,1,…..,m

j= 0,1,…..,n

X_{ij}= signifies the value of the i^{th} alternative for the j^{th} criterion.

X_{0j}= it is the optimal value of j^{th} criterion

Optimal values in the decision matrix are calculated depending on their benefit or cost values with the help of equations (6) and (7).

$X_{0j} = \max_i X_{ij}$ in case of benefit (6)

$X_{0j} = \min_i X_{ij}$ in case of cost (7)

Stage 2: Normalizing the Decision Matrix

In the second step, decision matrix is normalized using the equations (8) and (9) below. The normalized decision matrix is calculated in two different ways, depending on whether the evaluation criteria are benefit or cost oriented.

For benefit-oriented evaluation criteria:

$$X_{ij}^{*} = \frac{X_{ij}}{\sum_{i=0}^{m} X_{ij}} \quad (8)$$

For cost-oriented evaluation criteria:

$$X_{ij}^{*} = \frac{\left(\frac{1}{X_{ij}}\right)}{\sum_{i=0}^{m}\left(\frac{1}{X_{ij}}\right)} \quad (9)$$

Stage 3: Generating the Weighted Normalized Decision Matrix

Weighted normalized decision matrix is obtained by using the equation (10) below.

$$(\hat{X}_{ij}) = (X_{ij}^{*}) * W_j \quad (10)$$

W_j= criteria weights

X_{ij}*= normalized decision matrix elements

Stage 4: Calculation of the Optimum Function Value

In the fourth stage, the optimum function value is obtained by making use of the equation (11).

$$S_i = \sum_{j=1}^{n} \hat{X}_{ij} \quad (11)$$

S_i= optimal value of the i^{th} alternative

Stage 5: Calculation of Utility Function Values of Alternatives

The utility degree of each alternative used in the study is calculated by means of the equation (12).

$$K_i = \frac{S_i}{S_0} \quad (12)$$

i= 0,1,…..,m

S_0= the function value of the optimum alternative with the highest function value in the fourth stage

Stage 6: Ranking the Alternatives

In the last stage, the values obtained in the fifth stage are ordered from largest to smallest, and the rankings of the alternatives are obtained.

5. LITERATURE REVIEW

The studies in the literature on the use of MCDM methods in internal audit are presented in Table 1. As a result of the examination of national and international academic studies on the subject, it has been determined that there is no study on planning of the branches to be audited by the internal audit units of banks during their annual internal audit plan preparation. In addition, it has been observed that there are very few studies on the use of MCDM methods in internal audit activities. When evaluated from these aspects, it is thought that this study and its application proposal will contribute to the literature.

Table 1: Results of the Literature Review

Author(s)	Method(s)	Scope	Explanation
Bradbury & Rouse (2002)	DEA	Internal audit risk evaluation	In the study, an application for the evaluation of the risk factors for the units of an enterprise by the internal audit units using DEA method is included.
Seol & Sarkis (2005)	AHP	Internal auditor selection	An application proposal for the use of the AHP method in selecting internal auditors is included in the study. Cognitive, appreciative, behavioural skills for internal auditors are defined and analysed with the AHP method.
Krüger & Hattingh (2006)	AHP, GP	Internal audit time allocation	In the case study, time allocation of the internal audit function is performed with the integrated AHP-GP method using qualitative and quantitative evaluation criteria.
Shimada et al. (2007)	AHP	Information systems auditing risk assessment	In the study, an application proposal is made with the AHP method for risk assessments to be carried out within the scope of information systems.
Mizrahi & Ness-Weisman (2007)	AHP	Effectiveness of internal audit	The effectiveness of the internal audit activities in the municipalities is analysed by using the AHP method for 3 local municipalities selected as an example, taking into account the elimination of the detected findings.
Sueyoshi et al. (2009)	DEA, AHP	Internal audit prioritization	An application proposal is developed to determine the areas that need to be audited by the internal audit unit of a rental car company by using MCDM techniques.
Ös (2010)	AHP	Audit universe determination	In the study, an application proposal is given for the determination of the audit universe with AHP, one of the MCDM methods, in risk-based internal audit activities.
Alizadeh (2011)	Fuzzy AHP	Internal audit effectiveness	Efficiency of internal audit in Iran is examined with the fuzzy AHP method. The obtained results reveal that the organizational criteria are of higher importance compared to other criteria.
E Costa et al. (2012)	MACBETH	Auditing predictive maintenance program	In the study, an application for the audit of the predictive maintenance program in a hospital operating in Spain is included using MACBETH method.
Zhao & Li (2013)	AHP	Internal audit outsourcing	In the study, a model proposal is presented for the use of the AHP method in content determination decisions regarding the outsourcing of the internal audit function.

Shinde (2017)	AHP	Enterprise application selection for audit	It is a study for the selection of applications using the AHP method during the performance audits of IT systems.
Petridis et al. (2019)	AHP, TOPSIS, non-linear programming	Internal auditor selection	In order to use MCDM methods for internal auditor selection purposes, an application is performed specifically for the internal auditors working in the Greek branch of an international company. Analyses are made with criteria determined according to different skill sets of internal auditors.
Prasad (2019)	SWARA, ARAS	Internal auditor selection	An application proposal is made for selecting internal safety auditors in construction companies with MCDM methods. SWARA and ARAS methods are used.
Chen & Yang (2019)	AHP, DEMATEL	Green marketing internal audit criteria establishment	In the study, a prioritization proposal is made with integrated AHP-DEMATEL techniques that can be used in green marketing internal audit activities. 16 evaluation criteria under 4 different categories are used in the study.
Karakaya, G. (2021)	AHP	Internal auditors' duties	Perspectives of public internal auditors on their duties and responsibilities determined by legal regulations were analysed using the AHP method.
Wang et al. (2021)	Fuzzy AHP, MCGP	Internal audit planning	In the study, an application is carried out using MCDM methods for the compilation of audit plan of an internal audit unit. Planning application is made for 28 assurance and consultancy activities defined under the 5 risk categories determined in the study.
Filho et al. (2021)	TOPSIS	Analyzing internal audit processes	In the study, the internal audit processes of the companies operating in Brazil are analysed within the framework of ISO 19011. Rankings of defined evaluation criteria are made by TOPSIS method.
Shiue et al. (2021)	DEMATEL, ANP	Continuous auditing	The study investigates the factors that affect the success of continuous auditing. DEMATEL and ANP methods are used in the study, and then the zero–one goal programming method is used for the distribution of resources.
Menekse & Camgoz-Akdag (2022)	Spherical fuzzy Electre	Internal audit planning	In the study, which is carried out using three different approaches, a decision support model is suggested for prioritizing the units of an organization in terms of internal audit planning, considering the components of COSO internal control framework. In the

			study, 4 alternatives and 5 evaluation criteria (COSO components) are used.
Kai et al. (2022)	AHP	Internal audit quality assessment index	An index suggestion is made for the evaluation internal audit activities in terms of quality. In the ranking made with the AHP method, it is concluded that the internal audit process is the most prioritized dimension.
Sarıkale & Kandemir (2022)	AHP	Remote and onsite branch audits	In the study, the practices of banks for remote and on-site branch audits are compared using AHP, one of the MCDM methods. 8 criteria are determined and these criteria are evaluated by internal auditors. The advantages and disadvantages of both types of audits are identified.
Modirkia et al. (2023)	AHP	Performance quality of internal audit	Factors related to the performance of internal audit quality in listed companies are ranked with AHP method.

6. APPLICATION

In this section, an application proposal to be used in the prioritization of the bank branches to be audited within the scope of the annual internal audit plan of a fictitious bank internal audit unit is given.

6.1. Objective

The objective of the study is to develop an objective model for determining the branches to be included in the annual internal audit plans of the bank's internal audit units from a risk-based perspective.

6.2. Scope

The scope of this study consists of the internal audit unit of a fictitious bank. In the implementation proposal, the details of which will be given in the next subsection, a prioritization study will be carried out only for the branches of the relevant bank. There are two main reasons for this. Firstly, since a significant part of banking transactions take place in branches, branches carry significant risks for banks, and therefore, it is extremely important for internal audit units making sound risk assessments regarding branches. Another reason is that, based on the best information, there is no study in the literature on prioritizing the branches to be audited by the bank's internal audit units.

Prior to implementation, the following assumptions were made regarding our case:

- Internal audit unit consists of 10 internal auditors.
- Head office, branch, subsidiary and information technology audits are carried out by the internal audit unit.
- Internal audit unit makes annual risk assessments specific to each auditable area in line with the legal requirements and international standards, and allocates its limited resources to relatively more risky areas.

- Auditable areas were determined in the risk assessments made for other areas apart from branch network, and 8 internal auditors were assigned to these areas.
- The bank has 15 branches and these branches are audited by 2 internal auditors in order of priority.
- The sum of man-day resources of these 2 internal auditors is sufficient to carry out the audit of 8 branches within a year.
- For this reason, it will be decided which 8 of the 15 branches should be prioritized according to risk assessments to be carried out by internal audit unit.

6.3. Method

In this study, an application proposal was developed by using MCDM methods. For this purpose, alternatives and evaluation criteria were defined, evaluation criteria were classified as beneficial and non-beneficial, their weights were determined using the standard deviation method and their rankings were made with the ARAS method.

6.4. Analysis

As stated in the previous sections, the fictitious bank that is the subject of our study has 15 branches. These branches constitute alternatives for the analyses to be made. In Table 2, the list of these branches and their codes to be used in the analysis are presented.

Table 2: List of Branches (Alternatives) and Assigned Codes

Code	Branch Name
Branch -1	Kadıköy Branch
Branch -2	Mecidiyeköy Branch
Branch -3	Beşiktaş Branch
Branch -4	Ataşehir Branch
Branch -5	Beyoğlu Branch
Branch -6	Ankara Branch
Branch -7	İzmir Branch
Branch -8	Kayseri Branch
Branch -9	Trabzon Branch
Branch -10	Konya Branch
Branch -11	Erzurum Branch
Branch -12	Gaziantep Branch
Branch -13	Adana Branch
Branch -14	Kocaeli Branch
Branch -15	Rize Branch

In order to prioritize these branches by the internal audit unit, 9 evaluation criteria were determined. These criteria have been defined by the authors in the light of their professional and academic backgrounds. The selection of criteria was made by taking into account mainly the credit and operational risk factors. In different analyses and academic studies, it will be possible to benefit from different evaluation criteria specific to the bank, taking into account the variety and type of products and services and bank types such as deposit, investment and development banks.

Afterwards, the objective functions of the determined evaluation criteria are defined. The evaluation criteria and objective functions to be used in the study are presented below.

Table 3: Objective Functions of Evaluation Criteria

Code	Evaluation Criteria	Objective Function
C-1	Latest internal audit report score	Beneficial
C-2	Average banking experience of branch employees	Beneficial
C-3	Credit Registration Bureau score averages of branch employees	Beneficial
C-4	Loan coverage ratio	Beneficial
C-5	Average number of daily transactions per cashier	Non-beneficial
C-6	Increase in branch loan volume	Non-beneficial
C-7	Percentage increase in NPL (Non-performing Loan) ratio	Non-beneficial
C-8	Time elapsed since the branch's last audit date	Non-beneficial
C-9	Total operational losses	Non-beneficial

The explanations and scoring methods of the selected evaluation criteria specified in Table 3 are explained below.

C-1. *Latest internal audit report score:* It is assumed that internal auditors grade audit reports on quad scale. Internal audit report grades vary between 1-4. 1 represents the worst grade and 4 represents the best grade.

C-2. *Average banking experience of branch employees:* It shows the average banking experience of branch employees in years as of the risk assessment date.

C-3. *Credit Registration Bureau score averages of branch employees:* It is a criterion for the indebtedness and payment performance of branch employees. A high individual credit score indicates a good payment performance. This criterion shows the average individual credit scores of the branch employees as of the risk assessment date. This score varies between 0-1900.

C-4. *Loan Coverage Ratio:* It represents the collateralized portion of the total loan balance of the branch in percentage as of the risk assessment date.

C-5. *Average number of daily transactions per cashier:* It shows the daily average number of transactions of the cashiers working in the branch in the last year as of risk assessment date.

C-6. *Increase in branch loan volume:* It expresses the increase in the total loan volume as a percentage since the previous audit date of the branch.

C-7. *Percentage increase in NPL (Non-performing Loan) ratio:* It shows the percentage increase in the NPL ratio since the branch's previous audit date.

C-8. *Time elapsed since the branch's last audit date:* This criterion considers the time elapsed since the last audit date of the branch in years. In this study, it is assumed that the branches are audited within a 5-year cycle. For this reason, this criterion includes values between 1 and 5.

C-9. *Total operational losses:* It represents the total amount of operational losses in TL since the previous audit in the branch. Relevant amounts are shown in thousand TL.

6.4.1. Standard Deviation Method

In this section, some values were assigned by the authors for the evaluation criteria determined in the previous section, and the criteria weights were calculated using the standard deviation method. First of all, the Decision Matrix in Table 4 was created within the framework of the values assigned to the evaluation criteria by the authors.

Table 4: Decision Matrix

Alternatives/ Criteria	1	2	3	4	5	6	7	8	9
Branch -1	4	13.2	656	0.55	71.3	10.5	1.2	3	1,006
Branch -2	3	11.7	713	0.43	62.8	12.2	3.7	2	2,347
Branch -3	3	14.1	501	0.61	66.1	3.5	1.9	4	1,342
Branch -4	1	9.8	801	0.39	84.0	6.7	3.8	3	856
Branch -5	2	8.9	743	0.54	79.3	8.9	9.6	5	301
Branch -6	4	10.4	699	0.49	60.5	10.2	6.8	1	1,211
Branch -7	4	10.8	614	0.66	49.7	10.7	4.4	1	2,113
Branch -8	3	12.2	658	0.43	57.8	9.6	5.1	3	755
Branch -9	1	7.7	803	0.55	53.9	5.4	6.2	3	912
Branch -10	4	15.3	521	0.62	78.2	7.1	10.1	5	643
Branch -11	3	17.5	627	0.59	81.1	6.9	8.6	1	899
Branch -12	2	13.6	774	0.41	72.3	9.8	4.2	4	1,117
Branch -13	4	14.9	811	0.64	69.6	9.2	7.7	2	1,819
Branch -14	2	11.7	691	0.57	57.3	11.1	5.1	4	2,020
Branch -15	3	9.3	823	0.41	59.9	10.3	3.3	3	913
Range	3	9.8	322	0.27	34.3	8.7	8.9	4	2,046

Afterwards, the Normalized Decision Matrix below was obtained by using the equation (2).

Table 5: Normalized Decision Matrix

Alternatives/ Criteria	1	2	3	4	5	6	7	8	9
Branch -1	1	0.175	0.004	5.223	0.042	0.345	0.112	0.75	0.002
Branch -2	1	0.155	0.004	4.084	0.037	0.401	0.346	0.50	0.004
Branch -3	1	0.187	0.003	5.793	0.039	0.115	0.178	1.00	0.002
Branch -4	0	0.130	0.005	3.704	0.049	0.220	0.356	0.75	0.001
Branch -5	1	0.118	0.005	5.128	0.047	0.292	0.899	1.25	0.000
Branch -6	1	0.138	0.004	4.653	0.035	0.335	0.637	0.25	0.002
Branch -7	1	0.143	0.004	6.268	0.029	0.351	0.412	0.25	0.003
Branch -8	1	0.162	0.004	4.084	0.034	0.315	0.478	0.75	0.001
Branch -9	0	0.102	0.005	5.223	0.032	0.177	0.581	0.75	0.001
Branch -10	1	0.203	0.003	5.888	0.046	0.233	0.946	1.25	0.001
Branch -11	1	0.232	0.004	5.603	0.048	0.227	0.805	0.25	0.001
Branch -12	1	0.180	0.005	3.894	0.042	0.322	0.393	1.00	0.002
Branch -13	1	0.197	0.005	6.078	0.041	0.302	0.721	0.50	0.003
Branch -14	1	0.155	0.004	5.413	0.034	0.365	0.478	1.00	0.003
Branch -15	1	0.123	0.005	3.894	0.035	0.338	0.309	0.75	0.001
Average	0.956	0.160	0.004	4.995	0.039	0.289	0.510	0.733	0.002

After the creation of the Normalized Decision Matrix, the standard deviation values of the evaluation criteria were calculated by using the equation (3). Calculated values are given in the table below.

Table 6: Standard Deviation Values of Evaluation Criteria

Alternatives/ Criteria	1	2	3	4	5	6	7	8	9
Branch -1	0,143	0,000	0,000	0,052	0,000	0,003	0,158	0,000	0,000
Branch -2	0.002	0.000	0.000	0.831	0.000	0.012	0.027	0.054	0.000
Branch -3	0.002	0.001	0.000	0.636	0.000	0.030	0.110	0.071	0.000
Branch -4	0.387	0.001	0.000	1.668	0.000	0.005	0.024	0.000	0.000
Branch -5	0.083	0.002	0.000	0.018	0.000	0.000	0.151	0.267	0.000
Branch -6	0.143	0.000	0.000	0.117	0.000	0.002	0.016	0.234	0.000
Branch -7	0.143	0.000	0.000	1.619	0.000	0.004	0.010	0.234	0.000
Branch -8	0.002	0.000	0.000	0.831	0.000	0.001	0.001	0.000	0.000
Branch -9	0.387	0.003	0.000	0.052	0.000	0.013	0.005	0.000	0.000
Branch -10	0.143	0.002	0.000	0.797	0.000	0.003	0.190	0.267	0.000
Branch -11	0.002	0.005	0.000	0.369	0.000	0.004	0.087	0.234	0.000
Branch -12	0.083	0.000	0.000	1.214	0.000	0.001	0.014	0.071	0.000
Branch -13	0.143	0.001	0.000	1.172	0.000	0.000	0.045	0.054	0.000
Branch -14	0.083	0.000	0.000	0.175	0.000	0.006	0.001	0.071	0.000
Branch -15	0.002	0.001	0.000	1.214	0.000	0.002	0.040	0.000	0.000
α_j	0.341	0.035	0.001	0.847	0.006	0.076	0.242	0.322	0.001

Finally, the weights were calculated based on the equation (4) and the values in Table 7 were reached.

Table 7: Weights of Evaluation Criteria

	1	2	3	4	5	6	7	8	9
W_j	0.1825	0.0185	0.0003	0.4528	0.0032	0.0405	0.1294	0.1723	0.0005

When the values in Table 7 are examined, the first three most important evaluation criteria are loan coverage ratio, latest internal audit score and time elapsed since the branch's last audit date. Despite that, the three least important criteria are Credit Registration Bureau score averages of branch employees, total operational losses and average number of daily transactions per cashier.

The criteria weights obtained using the standard deviation method were calculated objectively, taking into account the actual values of the evaluation criteria, without any intervention and subjective input.

6.4.2. ARAS Method

Branch rankings were carried out using ARAS, one of the objective ranking methods. The optimal values calculated are presented in Table 8, taking into account the Decision Matrix in equation (5).

Table 8: Optimal Values

Criteria/ Alternatives	1	2	3	4	5	6	7	8	9
Criteria Weights	0.1825	0.0185	0.0003	0.4528	0.0032	0.0405	0.1294	0.1723	0.0005
Branch -1	4	13.2	656	0.55	71.3	10.5	1.2	3	1,006
Branch -2	3	11.7	713	0.43	62.8	12.2	3.7	2	2,347
Branch -3	3	14.1	501	0.61	66.1	3.5	1.9	4	1,342
Branch -4	1	9.8	801	0.39	84.0	6.7	3.8	3	856
Branch -5	2	8.9	743	0.54	79.3	8.9	9.6	5	301
Branch -6	4	10.4	699	0.49	60.5	10.2	6.8	1	1,211
Branch -7	4	10.8	614	0.66	49.7	10.7	4.4	1	2,113
Branch -8	3	12.2	658	0.43	57.8	9.6	5.1	3	755
Branch -9	1	7.7	803	0.55	53.9	5.4	6.2	3	912
Branch -10	4	15.3	521	0.62	78.2	7.1	10.1	5	643
Branch -11	3	17.5	627	0.59	81.1	6.9	8.6	1	899
Branch -12	2	13.6	774	0.41	72.3	9.8	4.2	4	1,117
Branch -13	4	14.9	811	0.64	69.6	9.2	7.7	2	1,819
Branch -14	2	11.7	691	0.57	57.3	11.1	5.1	4	2,020
Branch -15	3	9.3	823	0.41	59.9	10.3	3.3	3	913
Optimum	4	17.5	823	0.66	84.0	12.2	10.1	1	301

Then, depending on whether the evaluation criteria are beneficial and non-beneficial, the Benefit-Oriented Transformed Decision Matrix was prepared as follows.

Table 9: Benefit-Oriented Transformed Decision Matrix

Criteria/ Alternatives	1	2	3	4	5	6	7	8	9
Criteria Weights	0.1825	0.0185	0.0003	0.4528	0.0032	0.0405	0.1294	0.1723	0.0005
Branch -1	4	13.2	656	0.55	0.014	0.095	0.833	0.333	0.001
Branch -2	3	11.7	713	0.43	0.016	0.082	0.270	0.500	0.000
Branch -3	3	14.1	501	0.61	0.015	0.286	0.526	0.250	0.001
Branch -4	1	9.8	801	0.39	0.012	0.149	0.263	0.333	0.001
Branch -5	2	8.9	743	0.54	0.013	0.112	0.104	0.200	0.003
Branch -6	4	10.4	699	0.49	0.017	0.098	0.147	1.000	0.001
Branch -7	4	10.8	614	0.66	0.020	0.093	0.227	1.000	0.000
Branch -8	3	12.2	658	0.43	0.017	0.104	0.196	0.333	0.001
Branch -9	1	7.7	803	0.55	0.019	0.185	0.161	0.333	0.001
Branch -10	4	15.3	521	0.62	0.013	0.141	0.099	0.200	0.002
Branch -11	3	17.5	627	0.59	0.012	0.145	0.116	1.000	0.001
Branch -12	2	13.6	774	0.41	0.014	0.102	0.238	0.250	0.001
Branch -13	4	14.9	811	0.64	0.014	0.109	0.130	0.500	0.001
Branch -14	2	11.7	691	0.57	0.017	0.090	0.196	0.250	0.000
Branch -15	3	9.3	823	0.41	0.017	0.097	0.303	0.333	0.001
Optimum	4	17.5	823	0.66	0.012	0.082	0.099	1.000	0.003

In the next step, the decision matrix was normalized with the help of equations (8) and (9) and values in the following table were obtained.

Table 10: Normalized Decision Matrix

Criteria/ Alternatives	1	2	3	4	5	6	7	8	9
Criteria Weights	0.1825	0.0185	0.0003	0.4528	0.0032	0.0405	0.1294	0.1723	0.0005
Branch -1	0.085	0.066	0.058	0.064	0.058	0.048	0.213	0.043	0.051
Branch -2	0.064	0.059	0.063	0.050	0.066	0.042	0.069	0.064	0.022
Branch -3	0.064	0.071	0.045	0.071	0.063	0.145	0.135	0.032	0.038
Branch -4	0.021	0.049	0.071	0.046	0.049	0.076	0.067	0.043	0.060
Branch -5	0.043	0.045	0.066	0.063	0.052	0.057	0.027	0.026	0.171
Branch -6	0.085	0.052	0.062	0.057	0.068	0.050	0.038	0.128	0.043
Branch -7	0.085	0.054	0.055	0.077	0.083	0.047	0.058	0.128	0.024
Branch -8	0.064	0.061	0.058	0.050	0.072	0.053	0.050	0.043	0.068
Branch -9	0.021	0.039	0.071	0.064	0.077	0.094	0.041	0.043	0.057
Branch -10	0.085	0.077	0.046	0.073	0.053	0.071	0.025	0.026	0.080
Branch -11	0.064	0.088	0.056	0.069	0.051	0.074	0.030	0.128	0.057
Branch -12	0.043	0.068	0.069	0.048	0.057	0.052	0.061	0.032	0.046
Branch -13	0.085	0.075	0.072	0.075	0.060	0.055	0.033	0.064	0.028
Branch -14	0.043	0.059	0.061	0.067	0.072	0.046	0.050	0.032	0.026
Branch -15	0.064	0.047	0.073	0.048	0.069	0.049	0.077	0.043	0.056
Optimum	0.085	0.088	0.073	0.077	0.049	0.042	0.025	0.128	0.171

Then, using equation (10) Weighted Normalized Decision Matrix is obtained which was calculated using the weights of the evaluation criteria. This matrix is presented in the table below.

Table 11: Weighted Normalized Decision Matrix

Criteria/ Alternatives	1	2	3	4	5	6	7	8	9
Criteria Weights	0.1825	0.0185	0.0003	0.4528	0.0032	0.0405	0.1294	0.1723	0.0005
Branch -1	0.016	0.001	0.000	0.029	0.000	0.002	0.028	0.007	0.000
Branch -2	0.012	0.001	0.000	0.023	0.000	0.002	0.009	0.011	0.000
Branch -3	0.012	0.001	0.000	0.032	0.000	0.006	0.017	0.006	0.000
Branch -4	0.004	0.001	0.000	0.021	0.000	0.003	0.009	0.007	0.000
Branch -5	0.008	0.001	0.000	0.029	0.000	0.002	0.003	0.004	0.000
Branch -6	0.016	0.001	0.000	0.026	0.000	0.002	0.005	0.022	0.000
Branch -7	0.016	0.001	0.000	0.035	0.000	0.002	0.008	0.022	0.000
Branch -8	0.012	0.001	0.000	0.023	0.000	0.002	0.006	0.007	0.000
Branch -9	0.004	0.001	0.000	0.029	0.000	0.004	0.005	0.007	0.000
Branch -10	0.016	0.001	0.000	0.033	0.000	0.003	0.003	0.004	0.000
Branch -11	0.012	0.002	0.000	0.031	0.000	0.003	0.004	0.022	0.000
Branch -12	0.008	0.001	0.000	0.022	0.000	0.002	0.008	0.006	0.000
Branch -13	0.016	0.001	0.000	0.034	0.000	0.002	0.004	0.011	0.000
Branch -14	0.008	0.001	0.000	0.030	0.000	0.002	0.006	0.006	0.000
Branch -15	0.012	0.001	0.000	0.022	0.000	0.002	0.010	0.007	0.000
Optimum	0.016	0.002	0.000	0.035	0.000	0.002	0.003	0.022	0.000

In the last stage, optimum function values and utility function values were calculated using the equations (11) and (12), and the following alternative rankings were obtained.

Table 12: Optimum Function Values, Utility Function Values and Rankings

Criteria	1	2	3	4	5	6	7	8	9	S_i	K_i	Ranking
Branch -1	0.016	0.001	0.000	0.029	0.000	0.002	0.028	0.007	0.000	0.083	1.045	2
Branch -2	0.012	0.001	0.000	0.023	0.000	0.002	0.009	0.011	0.000	0.057	0.723	8
Branch -3	0.012	0.001	0.000	0.032	0.000	0.006	0.017	0.006	0.000	0.074	0.936	3
Branch -4	0.004	0.001	0.000	0.021	0.000	0.003	0.009	0.007	0.000	0.045	0.564	15
Branch -5	0.008	0.001	0.000	0.029	0.000	0.002	0.003	0.004	0.000	0.048	0.600	13
Branch -6	0.016	0.001	0.000	0.026	0.000	0.002	0.005	0.022	0.000	0.072	0.902	5
Branch -7	0.016	0.001	0.000	0.035	0.000	0.002	0.008	0.022	0.000	0.083	1.049	1
Branch -8	0.012	0.001	0.000	0.023	0.000	0.002	0.006	0.007	0.000	0.052	0.653	11
Branch -9	0.004	0.001	0.000	0.029	0.000	0.004	0.005	0.007	0.000	0.051	0.636	12
Branch -10	0.016	0.001	0.000	0.033	0.000	0.003	0.003	0.004	0.000	0.061	0.763	7
Branch -11	0.012	0.002	0.000	0.031	0.000	0.003	0.004	0.022	0.000	0.074	0.927	4
Branch -12	0.008	0.001	0.000	0.022	0.000	0.002	0.008	0.006	0.000	0.046	0.585	14
Branch -13	0.016	0.001	0.000	0.034	0.000	0.002	0.004	0.011	0.000	0.069	0.864	6
Branch -14	0.008	0.001	0.000	0.030	0.000	0.002	0.006	0.006	0.000	0.053	0.670	10
Branch -15	0.012	0.001	0.000	0.022	0.000	0.002	0.010	0.007	0.000	0.054	0.679	9
Optimum	0.016	0.002	0.000	0.035	0.000	0.002	0.003	0.022	0.000	0.079	1.000	

As a result of weighting the determined evaluation criteria with the standard deviation method and ranking them with the ARAS method, the results in Table 12 were obtained. In the scope part of the study, it was stated that the internal audit unit had the resources to audit 8 branches. Therefore, according to the analysis results, İzmir (Branch-7), Kadıköy (Branch-1), Beşiktaş (Branch-3), Erzurum (Branch-11), Ankara (Branch-6), Adana (Branch-13), Konya (Branch-10) and Mecidiyeköy (Branch-2) branches will be included in the annual planning of the internal audit unit.

7. CONCLUSION

Internal audit function provides reasonable assurance regarding the efficiency and adequacy of the corporate governance, risk management and internal control processes. Within the framework of the legal regulations in Turkey, it is necessary to establish internal audit units within banks to audit all the activities of banks, branches and partnerships subject to consolidation periodically with risk-based approach. Both the legislation in Turkey and the international standards reveal that internal auditors should act risk-based and objective while performing their duties. However, in practice, ensuring complete objectivity, especially in the process of preparing the annual plans, stands out as one of the most significant challenges faced by practitioners.

The aim of this study is to develop an objective application proposal that can be used in the process of annual audit plan preparation, based on this problem experienced by practitioners. For this purpose, in the study, a risk assessment and an annual internal audit plan was applied for a bank that was designed as imaginary.

In the study, some assumptions were made and 9 evaluation criteria were defined for the selection of bank branches to be included in the annual internal audit plan. Values were assigned to the defined criteria by the authors, weighting of criteria was carried out by the standard deviation method, and ranking of branches was made by the ARAS method. As a

result, it was determined objectively which branches should be included in the annual plan, taking into account the available resources of the fictitious internal audit unit.

With the application proposed in this study, annual internal audit plans for branch audits of bank internal audit units can be prepared objectively. In addition, since the proposed application is risk-based and objective, it is thought that the assessments made within the scope of this application meet the expectations of the legal authorities in Turkey and are consistent with the requirements of international standards of internal audit. Besides, our study will contribute to the scientific and systematic planning of internal audit activities.

At the same time, this application can be used by the internal audit units of the banks to determine the audit priorities of the headquarters units, processes and partnerships subject to consolidation. Apart from banks, there are also different businesses that have internal audit units, branch networks, regional offices, and subsidiaries. The mentioned application proposal can also be integrated into the internal audit processes of these enterprises for risk assessment and planning purposes.

The application proposal has a flexible structure. Different methods can be used instead of the weighting and ranking methods used in this study by the internal audit units. However, if the internal audit units decide to include the audit opinion, the views of the senior management, audit committee or the board in the preparation of the annual internal audit plan, analyses can be carried out by integrating objective and subjective MCDM methods. In this way, by adding some subjective inputs to the model, the top-down approach as well as the bottom-up approach will be included in the assessment process at the same time.

There are many studies in the literature using MCDM methods in different scientific fields. However, studies in the field of internal audit, which is a sub-branch of accounting science, are extremely limited. When the existing studies are examined, it has been determined that there is no study on the bank's internal audit units to prioritize the branches of the bank while preparing their annual internal audit plans. The aim of the study is to contribute to the literature with this aspect.

The application of different MCDM methods for internal audit planning purposes can be the subject of research in academic studies to be carried out in the upcoming periods. In addition, apart from the risk assessment of internal audit activities and the preparation of annual internal audit plan; different academic studies can also be carried out by using MCDM methods for identifying significance levels of internal audit findings, scoring internal audit reports, hiring internal audit staff and performance evaluation of internal auditors.

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