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A B S T R A C T

of the dissertation for the degree of Doctor of Philosophy

A RESEARCH INTO THE ROLE OF INNOVATIONS IN THE EFFICIENT FUNCTIONING OF BANK BRANCH NETWORKS

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INTRODUCTION

Relevance of the Topic and Degree of Elaboration. The banking sector plays a crucial role in shaping the economy of any country. The current environment is characterized by dynamism, high competitiveness, and accelerated scientific and technological progress, which leads to the continuous expansion of banking activities and the development of new, in-demand banking services and products. All these factors provide a necessary foundation for the efficient and successful operation of the banking sector, which, in turn, is vital for the country's economic development. To ensure the sustainable functioning and growth of banks, it is essential to enhance their operational efficiency through innovations that create competitive advantages.

It should be noted that, at present, the branches of commercial banks in Azerbaijan do not open based on any systematic or methodological principles. This results in the establishment of inefficiently operating branches. Research has shown that there is currently no specific methodology in the Azerbaijani banking sector for the formation of branch networks. Consequently, difficulties arise in organizing the branch network efficiently.

As a result, there is a need for a methodology based on mathematical and statistical calculations to ensure the effective organization of branch networks. For this purpose, various methodologies used globally for the efficient organization of branch networks have been studied. However, it has been determined that no single methodology provides a complete and definitive solution in this area. While methodologies related to banking innovations and the measurement of banking efficiency have been identified, no precise calculation-based methodology has been found that determines the optimal geographical placement of bank branches. Furthermore, as mentioned above, branch locations and networks are often formed based on intuition rather than data, which ultimately leads to inefficiencies—underscoring the necessity of such a methodology.

Although obtaining accurate statistical data on the branches of other banks was not possible, statistical analysis based on the actual

figures of one of the country's largest and systemically important banks, Kapital Bank, reveals that there are branches within its network with relatively low levels of efficiency. This again demonstrates the importance of having a well-founded methodology for the effective organization of branch networks.

Object and subject of research. The object of the research is Kapital Bank and its branches. The subject of the dissertation is the study of the role of innovation in enhancing the efficiency of the bank branch network.

The purpose and objectives of the study. The purpose of the research is to conduct a comprehensive study of the application level of innovation in organizing the bank branch network in Azerbaijan under modern conditions, to identify directions for applying innovations to increase the efficiency of the bank branch network in the country, and to develop scientifically and practically grounded proposals and recommendations for its effective use.

To achieve the above purpose, the dissertation defines a set of interrelated tasks as follows:

1. To analyze the development of the banking system of the Republic of Azerbaijan, summarize trends, and systematize the stages of innovation implementation;
2. To theoretically substantiate the object of applying innovative methods in banking, clarify the essence of the concept of banking innovation, and propose a classification of banking innovations that enhance operational efficiency;
3. To analyze new banking products, technologies, and services from the late 20th to the early 21st century and identify and systematize the main directions of innovative activities of bank branches contributing to increased efficiency and competitiveness in a modern open economy;
4. To summarize global and national experiences in the development of infocommunication technologies as the most promising innovations in banking, and to prepare recommendations for improving their efficiency of use;

5. To develop the basic principles of a systematic approach to enhancing the efficiency of the bank branch network through the use of innovations;

6. To form principles for the effective management of innovative activities of bank branches considering the specifics of banking operations, and based on these principles, to determine the criteria for evaluating the efficiency of banking operations;

7. To substantiate the choice of a method for evaluating the efficiency of the bank branch network that takes into account the peculiarities of innovation application in banking and to build a model for managing innovative activities;

8. To create a system of key performance indicators enabling evaluation of the efficiency of innovative products and technologies applied in banking;

9. To determine the efficiency of bank branches based on the criteria that define the bank's innovative activities and influence the effective performance of branches, using the method of Loan, Non-Loan, Financial and Internal Processes.

Research methods. The methodological basis of the research includes general knowledge methods such as analysis and synthesis, observation, comparison, systematic approach, expert assessments, grouping, and generalization, which help to economically substantiate the main results and proposals of the dissertation.

Main thesis for defense.

1. Determination of the Efficiency of Bank Branches;

2. Identification of targets for increasing the efficiency of bank branches;

3. Provision of a new methodology for determining efficiency and targets;

4. Determination of the optimal number for the efficient organization of the branch network.

The scientific novelty of the dissertation research. The scientific novelty consists of systematizing, substantiating, and mathematically solving theoretical and methodological provisions related to the practical implementation of an innovative activity

mechanism for enhancing the efficiency of Kapital Bank's branch network.

The most significant novel provisions personally accepted by the author include:

- Development of a systematic approach to banking, integrating external and internal factors, with a focus on improving performance, innovating operations, and refining risk management;
- Emphasis on priority areas and directions for implementing innovative activities in the creation of banking products and services, considering the potential for enhancing the activities of bank branches and applying innovations;
- Proposal of a logical model for innovation and investment orientation in the development of the bank's branch network, along with performance indicators and a mathematical formula for achieving the innovation strategy's outcomes;
- Definition of criteria affecting the innovative activities and efficient functioning of bank branches, identification of the efficiency of bank branches using criteria such as Loan direction, Non-Loan direction, Financial direction, and Internal processes direction, and proposal of a mathematical model.

Theoretical and practical essence of the research. The research contributes to the development of certain methodological aspects of the innovative activities of Kapital Bank's branch network and enhances its operational efficiency. The main practical results obtained from the research allow the creation of an effective system for the long-term successful development of the bank's branch network. The practical significance also lies in the fact that the proposals developed in the dissertation can be applied in Kapital Bank's activities (the proposals are indeed used in Kapital Bank).

The main provisions and results of the dissertation have been positively evaluated at international and scientific-practical conferences. Practical provisions related to increasing bank efficiency through innovative activities were tested in the creation of the bank's branch network and confirmed by two execution documents issued by Kapital Bank regarding the measurement and improvement of service quality and efficiency of the branch network (from Kapital Bank,

execution certificates №129000/131 and №129000/132 dated 22.01.22 are provided as annexes).

Approbation and implementation. The content of the scientific research conducted in the dissertation has been reflected in 17 published articles, of which 10 were published in journals and publications recommended by the Supreme Attestation Commission of the Russian Federation, and 7 were published in journals recommended by the Supreme Attestation Commission of the Republic of Azerbaijan and collections of international scientific-technical conferences.

The name of the organization conducting the research work. The submitted dissertation was conducted at the Azerbaijan State Oil and Industry University.

The total volume of the dissertation with the volume of structural parts of the dissertation. The submitted dissertation consists of an introduction, three chapters, a conclusion, and a list of references. It includes 46 tables, 20 figures, 3 graphs, and 173 titles of referenced literature. Excluding tables, figures, graphs, and references, the total volume of the dissertation is 210,698 characters (introduction 23,750; Chapter I – 47,004; Chapter II – 71,628; Chapter III – 60,481; conclusion – 7,835), amounting to 163 pages.

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THESIS PRESENTED FOR DEFENSE

Thesis 1. Determination of the Efficiency of Bank Branches:

Various methods are used globally to evaluate the role of innovations in the efficient operation of banks, among which the following methods are widely applied.

There are numerous methods to measure bank efficiency, such as ROA (Return on Assets), ROE (Return on Equity), etc. However, besides indicators like ROA and ROE, there are many other parameters that do not directly involve these ratios but significantly affect the level of efficiency. It is crucial to consider these parameters when calculating efficiency. These indicators include: branch

potential, waiting time ratio, workload, service quality, sales indicators, and others. When assessing the efficiency of bank branches, it is important to take all aspects into account. In this regard, there is a need to develop a more advanced methodology for calculating efficiency.

Taking this necessity into consideration, a new methodology for measuring the efficiency of the bank branch network has been developed by the author. Various theoretical extensions based on the original DEA CCR (Charnes, Cooper, and Rhodes)[1] model have been proposed. DEA (Data Envelopment Analysis) is the most appropriate research method for studying the efficiency of converting multiple inputs into multiple outputs simultaneously.

Concept of efficiency: To explain the concept of efficiency, let us provide a sample example. Here, hypothetical bank branches, their loan portfolios, rental expenses, number of employees, and profits are presented. Inputs (also called resources) and outputs (also called results) are shown. Loan portfolio, rental expenses, and number of employees represent inputs, whereas profit is the output.

The DEA methodology is a powerful tool for measuring the relationship between the use of resources and outcomes in banks.This methodology allows evaluating operational efficiency based on various indicators and identifying potential areas for improvement. The application of DEA methodology in the Azerbaijani banking sector can primarily assist in objectively assessing the performance of branch networks. Using this approach, efficiency levels of branches can be compared based on indicators such as number of employees, assets, profits, and others.

For example, by relating the number of branches and human resources to profits and assets, more optimal management decisions can be made.

It should be noted that based on my research, currently, there is no methodology based on precise mathematical calculations for

[1] Charnes A., Cooper W.W., Rhodes E. Measuring the Efficiency of decision-making units. // -European journal of operational research, - 1978. 2(6),- 429–444.

selecting branch locations according to the efficiency of bank branch networks in Azerbaijan or globally.

Below is the newly developed methodology prepared by the author. Calculations were performed using the branch network and data of Kapital Bank OJSC.

The method used in the calculations is DEA CRS (Constant Returns to Scale)[2]. The data of 96 branches of Kapital Bank and their indicators were utilized in the calculations.

Table 1 presents the top 10 branches with the highest efficiency scores, along with their input and output indicators, ranked according to their efficiency levels. In the tables, the "Region/City" column denotes "B" for branches located within Baku and "R" for branches located in regions.

Efficiency calculations according to Financial, Loan, Non-Loan, and Internal Processes directions have been performed. For demonstration, the calculation in the Financial direction is shown. Calculations in other directions are carried out following the same procedure.

Table 1.

Top 10 most financially efficient branches and their indicators (in manat)

#	R/B	Names	crste	Profit	Loan portfolio	Cash and cash equivalents
1.	R	Nakhchivan	1	7 077 420	14 985 647	15 218 701
2.	B	Narimanov	1	4 759 486	10 463 330	216 236
3.	R	Salyan	1	5 870 529	18 212 561	170 769
4.	R	Yevlakh	1	4 021 206	12 914 558	116 703
5.	R	Jalilabad	0,99	5 027 165	15 337 004	157 645
6.	R	Aghjabadi	0,97	7 581 738	23 959 138	231 056
7.	R	Shirvan	0,94	5 623 953	15 851 684	224 078
8.	R	Lankaran	0,92	6 029 963	17 670 531	237 429
9.	R	Aghdam	0,92	4 771 119	15 307 323	167 304
10.	R	Sabirabad	0,91	6 114 748	19 201 540	222 544

Source: compiled by the author

[2] Li Z., Crook J., Andreeva G. Dynamic prediction of financial distress using Malmquist DEA // Expert Systems with Applications. – 2017. – Vol. 80. – S. 94–106.

Thesis 2. Identification of targets for increasing the efficiency of bank branches:

The FTP (Fund Transferring Price) tool reflects the difference between the branch's required assets and liabilities, which is either "purchased" from or "sold" to the branch by the head office.

When the resulting interest margin is positive, the branch's profit increases; when negative, the profit decreases. Calculation of overall efficiency. To calculate the overall efficiency, the efficiency coefficient determined for each direction is multiplied by its respective weight, and the sum of these products is computed.

Using this method, the efficiency level of all branches was calculated. Table 2 shows the top 10 branches with the highest overall efficiency rating, ranked according to their efficiency scores.

Table 2.

Top 10 branches with the highest overall efficiency and their indicators

Weight				0.2692	0.2666	0.2718	0.1924
#	R/B	Names	crste	Loan	Non-Loan	Financial	Internal Processes
1	B	Absheron	0,864	0,605	0,853	1,000	1,000
2	B	Bakikhanov	0,842	0,420	1,000	1,000	1,000
3	R	Aghjabadi	0,831	0,972	0,852	1,000	0,500
4	R	Jalilabad	0,830	0,985	0,957	0,720	0,691
5	R	Salyan	0,825	1,000	0,752	0,860	0,664
6	R	Fuzuli	0,804	0,887	0,726	1,000	0,577
7	B	Binagadi	0,796	0,730	0,830	0,837	0,799
8	B	Sumgayit	0,796	0,553	0,883	0,957	0,818
9	B	Narimanov	0,795	1,000	0,597	0,526	1,000
10	R	Aghdam	0,771	0,915	0,942	0,836	0,437

Source: compiled by the author

Table 3 presents the 10 branches with the lowest overall efficiency, ranked according to their efficiency scores.

Calculation of target projection: Here, targets can be set for two directions. Reduction of figures in input parameters (in other words, reduction of operational, financial, and human resources) and increase of figures in output parameters (improvement of efficiency, service quality, and financial results) are defined as targets.

Table 3.

The 10 branches with the lowest overall efficiency and their indicators

Weight				0.2692	0.2666	0.2718	0.1924
#	R/B	Names	crste	Loan	Non-Loan	Financial	Internal Processes
87.	B	Ganjlik mall	0,496	0,515	0,348	0,484	0,692
88.	R	Gobustan	0,494	0,492	0,249	0,534	0,780
89.	R	Kangarli	0,485	0,599	0,135	0,372	.0,969
90.	R	Shahbuz	0,471	0,975	0,168	0,129	0,670
91.	R	Dashkasan	0,456	0,472	0,176	0,500	0,758
92.	R	Shimal	0,436	0,265	0,374	0,495	0,680
93.	B	J.Jabbarli	0,430	0,389	0,683	0,052	0,673
94.	R	Ordubad	0,430	0,485	0,254	0,181	0,949
95.	R	Sadarak	0,427	0,517	0,165	0,188	1,000
96.	R	Janub	0,380	0,374	0,360	0,000	0,951

Source: compiled by the author

These targets are called "projection" in English. In the dissertation, this term will be referred to as "target projection" in Azerbaijani.

Table 4 shows the target projections calculated for the 10 branches with the lowest efficiency scores.

Table 4.

Calculation of target projections for profit of the 10 branches with the lowest efficiency scores (in manat)

Branch	Profit	
	Actual	Target Projection
Ganjlik mall	2,568,286	5,310,146
Gobustan	944,060	1,769,102
Kangarli	430,115	1,154,703
Shahbuz	146,139	1,132,168
Dashkasan	1,090,134	2,181,487
Shimal	614,635	1,241,185
J.Jabbarli	1,618,114	3,138,160
Ordubad	161,508	892,859
Sadarak	130,130	691,009
Janub	-313,551	778,282

Source: compiled by the author

As the results indicate, calculating efficiency has significant practical importance. With this newly developed methodology, it is possible to determine the efficiency of branches by taking into account numerous parameters and criteria.

Thesis 3: Provision of a new methodology for determining efficiency and targets:

In this methodology, Kapital Bank and its branch network are again considered as the research object. This methodology extensively employs the efficiency calculation method developed by the author and presented in the previous paragraph.[3] For the preparation of the methodology, branches of Kapital Bank operating within a specific geographic area (perimeter) were selected, and it was determined in which parts of this area, in what quantity, and of what size (large or small) branches should be opened. The area chosen is Abbas Mirza Sharifzade Street and its surrounding territories (commonly referred to as Yasamal). Potential locations for branches: the total length of A.M.Sharifzade Street is approximately 4 km. The minimal distance between two branches can be assumed as 1 km, since the average distance a person would travel to a bank is about 1 km. Considering these factors, selecting 4 of the mentioned potential points is reasonable. These are "ASAN Service", "Inshaatchilar metro station", "Tibb Technical School", and "Bizim Market". It should be noted that these names are conditional and correspond to the names of the most popular establishments located at these points; this approach is used for ease of spatial understanding. Identification of real and hypothetical branches: It should be specially noted that Kapital Bank currently operates one branch in this area, namely the "Inshaatchilar" branch. To determine where, how many, and of what size (large/small) branches should be located in this area, the concept of hypothetical branches will be applied in the following steps. Hypothetical branches refer to imaginary branches that do not yet exist but whose potential efficiency if opened will be assessed. Hypothetical branches are considered small-sized branches. It should also be noted that the

[3] Naghiyev M.O. Characteristics of using methods to evaluate the efficiency of bank branches // Azərbaycan Ali Texniki Məktəblərinin Xəbərləri Jurnalı. Bakı. – 2022. No 6, (24), – s. 76-83.

existing Inshaatchilar branch is classified as a large branch. The 4 potential branch locations mentioned above have been identified. Our objective is to use a mathematical calculation methodology to preliminarily determine whether the branches opened at these 4 (or 3, or 2) locations would collectively be more efficient than the existing Inshaatchilar branch. Taking these points into account, we define 1 real and 4 hypothetical branches (the abbreviation "hb" before hypothetical branches stands for "hypothetical branch"). Real branch: Inshaatchilar branch ("b" denotes an actual (real) bank branch). Hypothetical branches: 1. Asan hb, 2. Inshaatchilar hb, 3. Bizim hb, 4. Tibb hb. It should be noted that to ensure the accuracy of results, a simulation will also be conducted for the hypothetical Inshaatchilar branch located in the area of the Inshaatchilar metro station where the real Inshaatchilar branch operates. Profit/loss forecasting: From the previous paragraph, it is understood that profit is one of the most important indicators for the bank among the efficiency calculations. Therefore, a profit/loss forecast report will be prepared for both the real and hypothetical branches. Branch expenses: To keep calculations manageable and considering the nature of the task, branch expenses have been divided into three main categories. Rental expense: Rent for a 150 sq.m. branch space (appropriate for a small-sized branch) based on current rental prices in the area. Salary expenses: Salary and other social payments for the staff working in the 150 sq.m. area. Other expenses: All expenses other than rent and salaries, combined.

Table 5.

Total expenses of branches (in manat)

Branch	Inshaatchi-lar b.	"ASAN hb"	"Inshaatchi-lar hb"	"Tibb hb"	"Bizim hb"
Rent expense	403,104	96,000	120,000	36,000	45,000
Salary expense	252,000	210,000	210,000	210,000	210,000
Other expenses(150%)	982,656	459,000	495,000	369,000	382,500
Total expenses	1,637,760	765,000	825,000	615,000	637,500

Source: compiled by the author

It should be noted that interest expenses are not included in the cost structure because interest expenses are accounted for in FTP. branch revenues: Since hypothetical branches do not exist in reality,

they do not have revenues. However, it is possible to estimate their hypothetical revenues. A new methodology has been developed by me to calculate these hypothetical revenues.

For this purpose, four indicators will be used: identification of the "etalon" branch, the population living around the real and hypothetical branches, the number of pedestrians passing in front of the real and hypothetical branches, and the number of vehicles passing in front of the real and hypothetical branches. Using these indicators, it will be possible to calculate the revenues of hypothetical branches. identification of the "etalon" branch: The concept of the "etalon" branch is introduced for calculations. This is necessary for estimating the financial indicators of hypothetical branches.

As shown in the table, the G.Garayev branch has average indicators and the most suitable location and format for calculation. Therefore, the G.Garayev branch is accepted as the "etalon" branch.

Table 6.

Efficiency coefficients of Kapital Bank branches

#	R/B	Branch	crste	#	R/B	Branch	crste
1.	B	Absheron	0,864	15.	B	Ahmadli	0,716
2.	B	Bakikhanov	0,842	16.	B	G.Garayev	0,709
3.	B	Binagadi	0,796	17.	B	Garadagh	0,677
4.	B	Sumgayit	0,796	18.	B	Surakhani	0,650
5.	B	Narimanov	0,795	19.	B	Bravo 1	0,607
6.	B	Gubadli	0,764	20.	B	Ticaret	0,604
7.	B	Narimanov KM	0,755	21.	B	Badamdar	0,594
8.	B	Bravo 2	0,753	22.	B	Bravo 3	0,593
9.	B	28 May	0,732	23.	B	Nizami	0,546
10.	B	Khazar	0,731	24.	B	Sabunchu	0,542
11.	B	Shusha	0,722	25.	B	Inshaatchilar	0,538
12.	B	H.Aslanov	0,719	26.	B	Icharishahar	0,509
13.	B	Sahil	0,718	27.	B	Ganjlik mall	0,496
14.	B	Neftchilar KM	0,718	28.	B	J.Jabbarli	0,430

Source: compiled by the author

Population, pedestrian count, and vehicle count (traffic): After identifying the "etalon" branch, a comparison should be made between this branch and the hypothetical branches. For precise location

calculations, data on the number of residents living near this site, as well as the number of pedestrians and vehicles passing by this point, will be used. Recalculation of the income of the "Gara Garayev" branch, which is the "etalon" branch, taking into account the FTP (Fund Transferring Price): Before proceeding to the main calculations, the income of the "Gara Garayev" branch must be recalculated because the bank's statistics did not consider FTP. The income of the Gara Garayev branch is recalculated taking FTP into account. Calculation of the total income of hypothetical branches: We have data on population, pedestrian, and vehicle flow for both hypothetical branches and the "etalon" branch.

Additionally, since the exact income figure of the "etalon" branch is known, we are able to forecast the income of the hypothetical branches. The location of the "etalon" branch corresponds to the locations of the hypothetical branches, and since the efficiency indicator of the "etalon" branch is close to the average among all bank branches, the forecasting calculations will be as realistic as possible. The total forecasted income (including FTP) is calculated using the DEA methodology. To ensure accuracy, the number of employees has been added to the input data. Table 7 shows the expected (forecasted) incomes of the branches.

Table 7.

Forecasted incomes of hypothetical branches (revenue in manat)

Branch	Pedes-trian count	Vehicle count	Popula-tion	Emp-loyee	Actual revenue	Forecasted revenue
Gara Garayev	11 927	14 951	55 000	22	5 445 972	-
Inshaatchilar b.	10 005	9 418	258 000	14	X	3 430 551
"Inshaatch. hb"	10 005	9 418	75 000	10	X	2 475 442
"Tibb hb"	1 731	6 908	31 000	10	X	790 390
"ASAN hb"	5 731	6 749	45 000	10	X	2 458 355
"Bizim hb"	5 278	14 935	107 000	10	X	2 409 980

Source: compiled by the author

As seen from the table, the "actual revenue" column reflects the actual revenue of the "Gara Garayev" branch, which is the

"benchmark" branch. Based on the data, the revenue forecast for hypothetical branches was calculated using the DEA method (the "projected revenue" column). To obtain more accurate results, the revenue of the real branch "Inshaatchilar" was not taken from actual figures but calculated using the same methodology.

Calculation of hypothetical branches' profit: As is well known, profit is calculated by subtracting costs from revenue. The amount of costs for each hypothetical branch has been determined above. Additionally, the projected revenues of the hypothetical branches have been calculated. Taking all this information into account, it is possible to calculate the projected profit of the hypothetical branches. Table 8 shows the expected net income of the branches.

To ensure more accurate calculations, the profits of the "Inshaatchilar" branch and the hypothetical branches were calculated using the DEA method in comparison with the "Etalon" branch.

Table 8.

Calculation of branches' profits (in manat)

Branch	Inshaatchi-lar b.	"Inshaatchi-lar hb"	"ASAN hb"	"Tibb hb"	"Bizim hb"
Total revenue	3 430 551	2 475 442	2 458 355	790 390	2 409 980
Rent expense	403 104	120 000	96 000	36 000	54 000
Salary expense	252 000	210 000	210 000	210 000	210 000
Other expenses	982 656	495 000	459 000	369 000	396 000
Total expenses	1 637 760	825 000	765 000	615 000	660 000
Profit	1 792 791	1 650 442	1 693 355	175 390	1 749 980

Source: compiled by the author

Thesis 4. Determination of the optimal number for the efficient organization of the branch network:

The concept of combination refers to the overall efficiency of several hypothetical branches. This may involve 2, 3, or 4 hypothetical branches and can be implemented in different combinations. The efficiency comparison of these combinations is calculated using the DEA methodology.[4]

[4] Naghiyev M.O. Data envelopment analysis for identification of bank branches appropriate locations in terms of their efficient operation // Journal of regional and international competitiveness, Russia, Yaroslavl, – 2024. Vol.5, – p. 51-63.

Thus, for example, if the efficiency results show that:

- Hypothetical branch 1 + 2 > Inshaatchilar branch, then it is worthwhile to open 2 small branches instead of the Inshaatchilar branch;
- Hypothetical branch 1 + 2 + 3 > Inshaatchilar branch, then it is worthwhile to open 3 small branches instead of the Inshaatchilar branch;
- Hypothetical branch 1 + 2 + 3 + 4 > Inshaatchilar branch, then it is worthwhile to open 4 small branches instead of the Inshaatchilar branch, or vice versa.

Calculation of the efficiency of combinations.

The number of possible combinations is greater than the examples provided, and ultimately, it is advisable to open branches (or retain the existing branch) according to the version with the higher efficiency score.

Calculations were performed using the DEA CRS (Data Envelopment Analysis with Constant Returns to Scale) method.

Table 9.

Overall efficiency calculation: Efficiency scores of hypothetical branch combinations and the Inshaatchilar branch (in manat)

#	Branch	crste	Profit	Salary expense	Rent expense	Other expenses
64	Inshaat.+Bizim+ASAN hb	0,381	5 093 777	630 000	270 000	1 350 000
65	Inshaat. hb +Bizim hb	0,381	3 400 422	420 000	174 000	891 000
67	İnshaat. hb + ASAN hb	0,375	3 343 797	420 000	216 000	954 000
76	Inshaat. branch	0,335	1 792 791	252 000	403 104	982 656
82	Inshaat. hb+Biz. hb + ASAN hb + Tibb hb	0,295	5 269 166	840 000	306 000	1 719 000
87	Biz.hb+ASAN hb+Tibb hb	0,271	3 618 725	630 000	186 000	1 224 000
88	Inshaat.+ Bizim+ Tibb hb	0,267	3 575 811	630 000	210 000	1 260 000
89	Inshaat. + ASAN.+ Tibb hb	0,263	3 519 186	630 000	252 000	1 323 000
96	Bizim hb + Tibb hb	0,216	1 925 370	420 000	90 000	765 000
97	ASAN hb + Tibb hb	0,21	1 868 745	420 000	132 000	828 000
99	Inshaat. hb + Tibb hb	0,205	1 825 831	420 000	156 000	864 000

Source: compiled by the author

To obtain more accurate results, combinations of branches were included in the overall list of "Kapital Bank" branches, and the efficiency of all bank branches was calculated, assuming that each combination functions as a single consolidated branch. The table presents only the results of the combinations and the "Inshaatchilar" branch. For comparison, the first column shows the sequential number of each combination/branch in the bank's overall branch efficiency ranking. In the calculations, costs were considered as "input" data, and profit as "output" data. The version with the highest score is regarded as the most efficient.

As a result:

- Inefficient: Inshaatchilar hb + Bizim hb + ASAN hb + Tibb hb
- Inefficient: Inshaatchilar hb + ASAN hb + Tibb hb
- Inefficient: Inshaatchilar hb + Bizim hb + Tibb hb
- Inefficient: Bizim hb + ASAN hb + Tibb hb
- Inefficient: Inshaatchilar hb + Tibb hb
- Inefficient: ASAN hb + Tibb hb
- Inefficient: Bizim hb + Tibb hb
- Efficient: Inshaatchilar hb + Bizim hb
- Efficient: Inshaatchilar hb + ASAN hb
- Most efficient: Inshaatchilar hb + Bizim hb + ASAN hb.

Taking profit into account, this is the most effective combination.

In conclusion, two efficient combinations are identified: "Inshaatchilar hf + ASAN hf" and "Inshaatchilar hf + Bizim hf + ASAN hf." The latter is considered the most effective due to higher projected profit. This suggests that these three small branches may outperform the existing large Inshaatchilar branch.

Overall, this dissertation covers innovative developments, digital and physical banking channels, associated risks, branch network efficiency, and other key issues. In the near future, a parallel development of digital and traditional banking is anticipated.

This study introduces a new efficiency measurement model using the DEA (Data Envelopment Analysis) method. The proposed methodology allows for more precise and objective measurement of branch performance. It also supports optimal branch network design and identification of profitable locations. Detailed implementation

using Kapital Bank data is provided. Additionally, it introduces a model for determining whether one large branch or several small ones are more efficient in a given area.

It is especially noteworthy that the methodologies presented in this dissertation are currently employed at Kapital Bank.

The question of where and at what scale branches should be opened within a given perimeter can be accurately determined using these methodologies on a mathematical basis. These approaches can be used to organize the operations of banks, other financial institutions, and companies more efficiently. The results obtained during the dissertation can also be applied to other economic sectors. These methodologies are beneficial not only outside banking but also in retail trade networks and other service sectors.

It should be noted that the preparation of this dissertation utilized real data, empirical observations, and information gathered through visits to various regions. Analysis of different literature sources and global approaches allowed linking this dissertation to international practice. I am confident that the results of this work, particularly the new methodologies, will be useful not only in the banking sector but also for companies operating in other fields and various segments of the economy.[5] The new methodologies developed can play a crucial role in optimizing bank operations, improving efficiency, and strengthening their market position.

The methods presented in the dissertation contribute significantly to further optimizing branch networks with modern technologies, ensuring higher quality and faster customer services. Moreover, the application of precise analytical approaches in banks' decision-making processes enables more efficient management. Using these methodologies will facilitate not only banks themselves but also their customers in obtaining greater benefits. The innovations obtained as a result of this dissertation will ultimately support the long-term success of banks and other economic entities. The application of these methods will assist in enhancing the efficiency of bank branches and in making

[5] Naghiyev M.O. DEA method for measuring the activity efficiency of the enterprise // Azərbaycan Ali Texniki Məktəblərinin Xəbərləri jurnalı, Bakı, – 2024. Cild 26, Buraxılış 2 (184), – s. 82-89.

decisions about opening new branches or restructuring existing ones. Practical implementation of these approaches may have a positive impact on our economy and offer a new perspective for resolving other issues related to the banking sector.

I would also like to emphasize that this dissertation can make a significant contribution not only to the management of bank branch networks but also to increasing efficiency in the national economy. The proposed methodologies and approaches have practical significance not only for banks but also for organizations operating in other sectors.

RESULTS

1. Digital and traditional banking, as well as bank risks, have been studied. The DEA methodology, its operating mechanisms, efficiency measurement in foreign banks using this methodology, and prospects for its application in the Azerbaijani banking sector have been analyzed. Using the DEA methodology, new mathematical approaches have been developed for measuring the efficiency of commercial banks' branches, including those operating in the Azerbaijani banking sector, exemplified by Kapital Bank OJSC. These approaches can also be utilized for the optimal management of branch networks.

2. Key bank performance indicators such as sales metrics of Loan products, sales metrics of non-Loan products, deposit attraction, Loan portfolio, profitability, cash and cash equivalents, as well as quality indicators including waiting time, service rate, average service time, and others have been grouped into four distinct categories. Efficiency levels were determined for each category. To improve the accuracy of calculations, new coefficients—workload coefficient, customer potential coefficient, and location coefficient—were defined and applied in efficiency assessments. The primary efficiency assessment introduced four novel categories not previously utilized: Loan Direction, Non-Loan Direction, Financial Direction, and Internal Processes Direction. Key bank indicators were grouped under these categories and calculated accordingly.

3. As a result, the efficiency in the Loan Direction was calculated with an average score of 0.66 across 96 branches. Among urban branches, 68%, i.e., 19 out of 28 branches, scored above the average,

while 57% of regional branches, i.e., 39 out of 68 branches, scored below the average. Similarly, efficiency in the Non-Loan Direction was measured with an average score of 0.51. Notably, 96% of urban branches (27 out of 28) scored above the average, whereas 87% of regional branches (59 out of 68) scored below the average.

4. One of the most significant indicators, the Financial Direction, recorded an average branch score of 0.60. It was found that 82% of urban branches (23 out of 28) had efficiency scores below the average, while 68% of regional branches (46 out of 68) scored above the average. The main service quality indicator, the Internal Processes Direction, had an average score of 0.82. Among urban branches, 54% (15 out of 28) scored above the average, while 56% of regional branches (38 out of 68) scored below the average.

5. A matrix model was developed to determine the weight shares of these directions for the first time in this format. The calculated weight shares were: 26.92% for Loan Direction, 26.66% for Non-Loan Direction, 27.18% for Financial Direction, and 19.24% for Internal Processes Direction.

6. A final efficiency score, incorporating all components, was calculated for each of the 96 branches. The average efficiency score for bank branches was determined to be 0.634. The Absheron branch was identified as the most efficient with a score of 0.864, while the Janub branch had the lowest efficiency score of 0.380. Among urban branches, 64% (18 out of 28) scored above the average, and among regional branches, 62% (42 out of 68) scored below the average.

7. Consequently, a new methodology was developed that allows measuring the efficiency levels of individual branches within branch networks of all banks, based on rigorous mathematical calculations rather than intuition. As noted in the dissertation, previous studies often used a simplified DEA approach (e.g., examples from Japanese banks) to estimate efficiency. The key difference of the methodology developed here lies in incorporating numerous performance indicators significantly impacting branch operations, calculating them separately across different directions, and employing precise calculation tools such as FTP (Fund Transfer Pricing), matrix methods, and others, thereby enabling more accurate determination of branch efficiency.

8. One advantage of the methodology is the ability to set target projections for branches with low efficiency to improve their performance. Based on the calculations, target projections were assigned to increase the daily demand Loan portfolio of the Ganjlik Mall branch from 1,145,917 AZN to 4,088,048 AZN; to raise the Birkart portfolio of the Dashkasan branch from 1,090,134 AZN to 2,181,487 AZN; and to transform the Janub branch's loss of 313,551 AZN into a profit of 778,282 AZN. Achieving these target projections allows the respective branches to increase their efficiency levels.

9. Furthermore, a specialized calculation methodology was developed to determine the optimal number of branches in a given territory that would be most efficient for the bank. For example, an optimal branch count calculation was performed for Kapital Bank within a specified area. To enable this calculation, the concept of a "hypothetical branch" was introduced, allowing comparison between actual branches and hypothetical ones.

10. Actual cost data of branches were utilized, and hypothetical costs were determined. Characteristics such as population size, pedestrian traffic, and vehicle traffic within specified perimeters were defined to conduct the calculations. To serve as a reference point ("benchmark"), another Kapital Bank branch located in the area with characteristic features was selected—the G.Garayev branch, considered the "Etalon" (benchmark) branch with an efficiency score of 0.709. Subsequent calculations were conducted based on this branch's performance indicators.

11. The FTP (Fund Transfer Pricing) method was applied to accurately calculate the branches' exact profit. Using this method, a total income forecast of 5,445,972 AZN was computed for the "Etalon" G.Garayev branch.

12. Utilizing the DEA methodology, projected income figures for hypothetical branches were generated. Detailed studies provided cost forecasts and target projections for the following hypothetical branches: Inshaatchilar branch with 1,792,791 AZN, "Inshaatchilar hb" with 1,650,442 AZN, "ASAN hb" with 1,693,355 AZN, "Tibb hb" with 175,390 AZN, and "Bizim hb" with 1,749,980 AZN profit forecasts.

13. The concept of "combination" was introduced for determining the efficient number of branches. Different combinations of branches were grouped, and the calculated indicators of these grouped hypothetical branches were compared with those of Kapital Bank's actual branches using DEA methodology. The most efficient group was identified. After final calculations, the top three efficient combinations were: "Inshaatchilar hb+ASAN hb" with a 0.375 score, "Inshaatchilar hb+Bizim hb" with a 0.381 score, and "Inshaatchilar+ Bizim+ASAN hb" with a 0.381 score. Considering the 5,093,777 AZN indicator, the combination of "Inshaatchilar+Bizim+ASAN hb" was deemed the most efficient. It was concluded that having these three branches in these precise locations within the specified territory is optimal.

14. Thus, it became possible to determine the number and precise locations of branches that would be most efficient in a given area.

15. Accordingly, decisions on opening or closing bank branches in the network can now be made based on concrete performance indicators and precise calculations using the new methodology rather than relying on intuitive or ad hoc approaches. The new approach and calculation methodology outlined in the dissertation can be used to increase the efficiency of branch networks for both foreign and domestic banks.

16. It is recommended that banks operating in Azerbaijan organize their branch networks not intuitively but based on statistical calculations.

17. Commercial banks are advised to form their branch networks using the methodology developed herein.

18. For accurate measurement and comparison of branch efficiency, it is recommended to use the FTP (Fund Transfer Pricing) method to calculate profitability separately for each branch.

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