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Representation of a model based on decision support system to rank branches of bank using Promethee method (case study: Saman Bank)

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Abstract

The process of assessment of units' performance and comparison of them has been regarded as a strategic process in the organizations with different units. This process goes true in the banks as the most important symbol of money market and their inevitable effect on economic development of society. Banks can perceive the weaknesses and strengths in each of their branches by ranking their branches and suggest suitable instructions for progress to their managers in each of branches. The present research intends to design a decision support system based on Promethee II method at lower cost and time and higher accuracy despite the quantitative and qualitative indices. This system has been made to rank 10 selected branches of Saman bank. Output of the proposed system is the rank assigned to each branch. Ultimately, analysis of sensitivity has been made to help for managers' decision making about their indices and weight.

Keywords: performance assessment, decision support system, Promethee method, ranking, branches of bank

Introduction

Currently, banks especially domestic banks assess units' performance and rank their branches during more periods of time due to time-consuming and high cost of this process and also neglect considering all the quantitative and qualitative factors that might come effective in ranking the branches so as to simplify such process. On the other hand, since ranking in made manually in most of banks, assessors prefer to use simpler ranking methods such as simple ratios and so forth. Therefore, the present research intends to design a decision support system to fulfill it at less time and cost and more accuracy by automizing

ranking despite huge number of indices. Further, it can use more useful methods which might be more complicated than previous simple methods and might not be economically effective to use them in manual. In addition to these factors, using a decision support system to rank branches, it can analyze the sensitivities to ensure about the early selections and change the indices and their values dependent on environmental changes for the assessors of the branches. To date numerous methods have been used to rank branches in some domestic banks. These methods which are witnessed in various research works include data envelopment analysis, taxonomy, principal component analysis, simple financial ratios and so forth. The present research seeks to use Promethee II among multi-criteria decision making methods which have been less likely used (Barns & Vincke, 1985).

Aims of research

The main purpose of this research is to design a decision support system to rank branches of bank using Promethee method to help for more efficient ranking process in branches of bank.

The applied aim of research: any bank which intends to evaluate the branches and rank them can use this proposed model and decision support system.

Theoretical background and literature review

Decision support system

Decision support system refers to an interactive information system and assists the managers to manipulate the information and appear them in desired forms. Then they organize them in different forms and make particular decisions based on a new order given to them (Daft, 2004). Decision support system is called to a certain type of applied automatically (or semi- automatic) information systems that provide managers' required processed information to support decision making process. Yet, these systems have not a direct role in decision making, but allowing the managers to make decision faster and easier using some computations. Therefore, major aims of decision support system include reduce uncertainties and misinterpretations, increase the speed of decision-making, increase credibility and increase the degree of desirability of made decisions (Jafaar Nejad et al. 2009).

Decision making and its role in management

To managers, assignments, responsibilities and roles are taken into consideration that some are particularly for managers and some are assigned to the managers with more severity than other staffs. The assignments such as planning, organizing, leadership, control and resource management are regarded as the assignments put on managers' shoulder. In all managerial assignments, manager has a constant, major and inseparable role separate from levels, type and area of management practice. Strategic to operating managers, organization's board of directors, supervisors and executives, the line managers, and support and staff managers have involved in selecting the right way so as to resolve problems or achieve the opportunities and development. Due to significance of this role and its inseparable presence in organizational life of managers, the principle below has been proposed:

Decision making=management (Ahmadi, 2007)

PROMETHEE method is a method to rank an infinite set of items among more consistent criteria (Behzadian & Pirdashti, 2009).

PROMETHEE method

Indeed, this model has been designed to resolve the multi-criteria problems. The main features of this method lies on this fact that the required information of this method are comprehensible for the analysts and decision makers, mentioned as the most comprehensible multi-criteria methods(Pomerol and Barba-Romero, 2000).

Literature review

Secme et al.(2009) examined Turkish Banking Sector using Analytic Hierarchy Process and TOPSIS. In this research, the largest five commercial banks of Turkish Banking Sector are examined and these banks are evaluated in terms of several financial and non-financial indicators (Secme et al. 2009).

Pomerol and Barba-Romero (2001) have compared the banks in China in terms of performance using nine financial ratios. A linear planning model was invented by Persentili & Guven to evaluate performance of banks through use of their balance sheets.

Darat et al.(2002) in a research examined efficiency of banks in Mena region. In this study, efficiency of cost and technique of bank at this region during 1994-1997 was evaluated using data envelopment analysis. In this study, information of banks has been taken based on balance sheets and loss and profit statements using DEA, indicating that efficiency of costs equals to 68%.

davis & Albrigt(2009) in a research examined the branches of United States banking organization aiming at examining the relationship between implementation of balanced scorecard and financial performance of various branches of a bank, deduced that the branches of bank which have used balanced scorecard outperforms than rest of branches which have not used balanced scorecard in terms of key financial indices.

Shokat pour & Asghari zadeh(2009) in an applied study examined competence of the manufacturers of oil equipment based on PROMSORT. In this research, 9 indices have been detected to evaluate manufacturers of oil equipment and the companies have been classified to four groups(excellent, good, average and poor) using PROMSORT method.

Research method

The present research is an applied-developmental study, as it seeks to acquire the required knowledge to use this method to achieve a particular aim, that is, a review on a domestic bank. Further, since the data are used to describe the branches and make decision about their ranking, the present research is a descriptive study in terms of data collection. In this research, the experts' views have been used to validate the proposed system. In this method, after providing the system for the experts and assessing the performance of branches in bank, they were asked to give response to the questions in the questionnaire. To analyze the results, t-test with Cutpoint=3 has been used. Ultimately, the results from this test have been analyzed to assess creditability of designed decision support system.

Data collection method

In this study, library method is one of the data collection methods in which the existing references and sources in the context of ranking branches of banks, various ranking methods, PROMETHEE method, standards for ranking branches of bank, decision support systems and so forth were examined.

Statistical population, sampling method and sample size

In this study, the statistical population consists of all branches of Saman Bank which are evaluated and ranked based on the proposed model in this study. Since performance of the proposed system does not associate to the sample size, points of view of 30 experts among various bank sectors and university units were asked.

Data analysis

Analysis of the results from banking expert questionnaire concerning the indices for ranking branches of bank

One-sample t-test has been used to analyze each of indices for evaluating performance of the branches mentioned in the questionnaire. In this way, the responses have been divided into two groups (3 >) which means average and greater and (3 =<) which means little and very little; according to the definition for Test Value=3, mean test has been made for each index. The reason to use t distribution lies on acceptance of parametric facet of Likret scale, thus one-sample t-test has been used since there is no information on the variance of population and the sample distribution is normal. A hypothesis test has been defined for each index, e.g. the hypothesis test relating to index 1 includes:

H0: the index "Current interest free deposit loan" affects results from ranking the branches of Saman Bank to an average or less extent.

H1: the index "Current interest free deposit loan" affects results from ranking the branches of Saman Bank to an average, high or very high extent.

The value under 0.05 indicates rejecting null hypothesis and accepting alternative hypothesis. Therefore, concerning the first index at 95% confidence level, it can say that the index "Current interest free deposit loan" affects the results from ranking branches of bank to an extent greater than average. Thus the first hypothesis is accepted. The hypothesis test relating to the rest of indices is avoided elaborating for summarization. The obtained results concerning rest of indices have been summarized in the table of one-sample descriptive statistics for the indices of performance assessment of branches represented in appendix a. according to these results, the indices with mean greater than t-value (3) are considered as the selected indices for ranking branches of bank that have been represented in table 1 and rest of indices have been omitted.

Table 1. The selected indices to evaluate performance of branches and rank the branches

Type of index	Row	Name of index	Weight of index	Approximate weight of index
Deposit indices	1	Current interest free deposit loan	4.63	5
	2	interest free deposit loan	3.87	4
	3	Short -term Investment deposits	3.63	4
	4	Long-term Investment deposits	4.17	4

	5	Deposit Insurance	4.43	4
	7	Foreign Currency Deposits	3.93	4
Facilities indices	9	Purchase due	4.03	4
	10	granted Interest-free loan	3.47	3
	11	Civic participation murabaha	4.37	4
	12	Instalment Sale	4.50	4
	13	Hire purchase	4.10	4
	14	Joâle	4.30	4
	15	Government Facilities	4.60	5
	16	Housing facilities	4.47	4
Efficiency indices	18	The amount of net profit including the profit account	4.23	4
	19	Ratio of earnings to costs	4.33	4
	20	Operating income rate	4.17	4
	21	Operating cost rate	4.50	4
	22	Ratio of demands to facilities	3.47	3
	23	No of documents	3.57	4

Data analysis

After entering the data into the software, various analyses are made that are possible in software VISUAL PROMETHEE. The results from various PROMETHEE ranking methods and analyses relating to it will be elaborated below. Now the results from use of PROMETHEE method on data in software VISUAL PROMETHEE and various analyses are examined.

GAIA Visual Analysis

Here, the result from GALA analysis about various branches in terms of considered standards is displayed in figure 1.

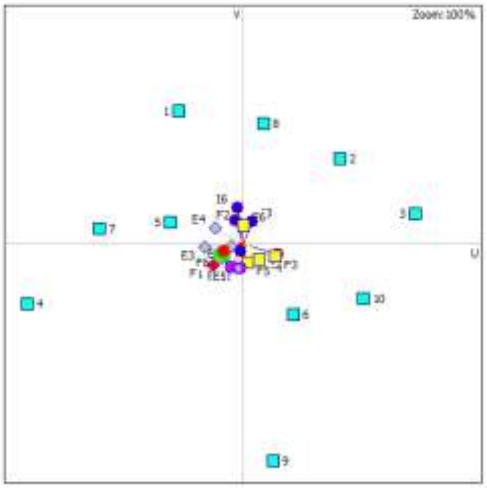


Figure 1. Result from GALA analysis

In GAIA Visual Analysis, three categories of information are displayed.

1-items

2-criteria

3-weight of criteria which are displayed with arrows

In this space, items refer to ten branches which have been selected as the sample group among various branches of Saman Bank on which ranking has been made in form of this proposed system. The criteria refer to indices for performance assessment of branches of bank obtained from the theoretical background. Weight of criteria was obtained using the experts' view given to each of indices based on importance of each of indices. In this diagram, the items which have many common points approach to each other. As shown in diagram, two branches of 5 and 7 and two branches of 6 and 10 are similar to each other. Further, it can say that branches of 1 and 9 differ from other items.

The result from partial ranking of branches of bank via PROMETHEE I method

Partial ranking of branches of bank is the result from use of PROMETHEE I. partial ranking implies paired comparison of items with each other and ranking them based on their strengths than rest of items(phi+) and their weaknesses than rest of items(phi-). The results from these two rankings will not be the same. In figure 3, the results from partial ranking of branches of bank have been displayed.

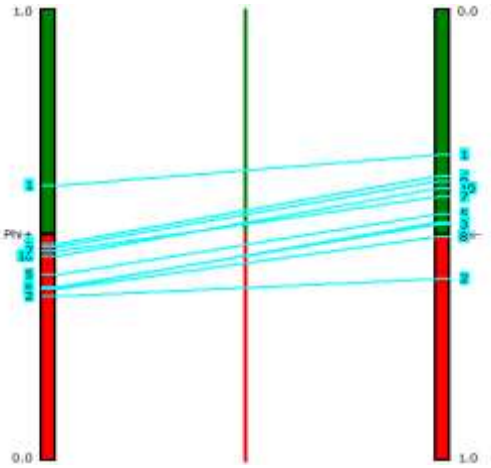


Figure 3. The result from partial ranking promethee I

This figure indicates the result from ranking branches using PROMETHEE I. in this state, the branches are ranked based on two criteria phi+ and phi-.

Phi+ indicates strength of an item than rest of items; further phi+ arranges the branches from the highest amount to the least amount from up to down. Phi- displays weakness of an item to rest of items. In the right side of the figure, Phi- arranges the least to highest amount of branches from up to down. Phi+ and phi- are used to rank items, but they have not the same results. Where the line relating to each branch is considered above the line relating to another branch, this implies that branch outperforms another branch. Where the lines cut each other, this implies that result from ranking branches using phi+ and phi- is not the same, whereby the branches cannot be compared using PROMETHEE I method. As seen in figure, the results from ranking branches based on phi+ are not consistent with ranking based on phi-. Concerning this ranking at both states, branch 1 is the best item and branch 2 is the worst item than rest of items.

Result from total ranking of branches of bank using PROMETHEE II method

Total ranking of branches of bank using PROMETHEE II method ranks the branches based on phi criterion which is acquired from the difference between phi+ and phi-. Indeed, this method ranks all the branches based on value of phi on a strip from up to down. Phi can be a negative value. Indeed, the value will range from -1 to +1. In figure 4, the ultimate result from ranking branches of bank via PROMETHEE II has been represented.

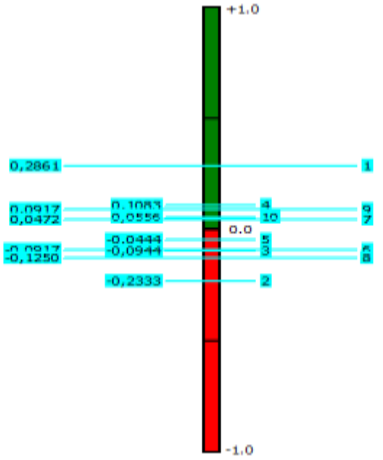


Figure 4. The result from total ranking promethee II

With regard to figure above, it can perceive that branch 1 has been the best branch and then branches 4, 9, 10, 7, 5, 6, 3, 8 and 2 are ranked.

Display of the results from ranking branches of bank via PROMETHEE Diamond

In figure 5, the results from ranking branches of bank at the state of PROMETHEE Diamond have been displayed that obtain the information entailed output of ranking branches of bank via PROMETHEE II.

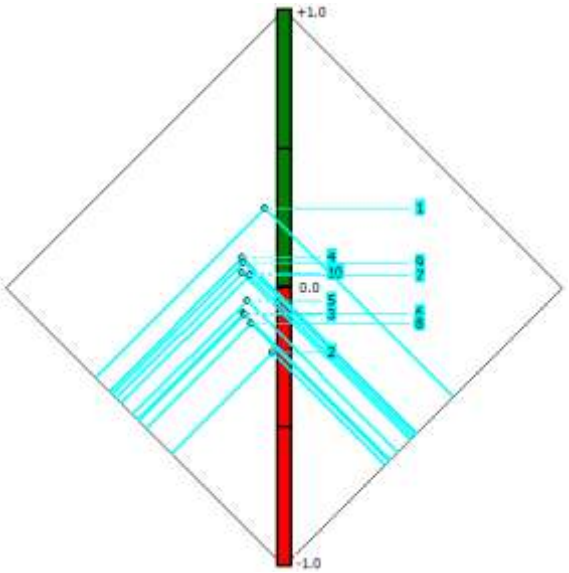


Figure 5. Display of the results from ranking branches of bank via PROMETHEE Diamond

PROMETHEE Diamond refers to another item to display the results from ranking PROMETHEE. Indeed, the results from ranking branches are based on PROMETHEE II method, displayed in three-dimensional form.

Ranking branches using PROMETHEE II

In table 6, the results from ranking branches have been represented in table that ranks given to the branches have been displayed in table from up to down. In contrast, the values of Phi+ and phi- and value of phi which has obtained from the difference between these two values has been represented.

PROMETHEE Flow Table

	action	Phi	Phi+	Phi-
1	1	0,2861	0,6097	0,3236
2	4	0,1083	0,4792	0,3708
3	9	0,0917	0,4736	0,3819
4	10	0,0556	0,4528	0,3972
5	7	0,0472	0,4625	0,4153
6	5	-0,0444	0,4111	0,4556
7	6	-0,0917	0,3819	0,4736
8	3	-0,0944	0,3833	0,4778
9	8	-0,1250	0,3792	0,5042
10	2	-0,2333	0,3639	0,5972

Table 6. the results from ranking branches via PROMETHEE II

Analysis of sensitivity

Analysis of sensitivity about weight of criteria

Figure 7 represents analysis of sensitivity relating to weight of criterion I1, interest free deposit loan.

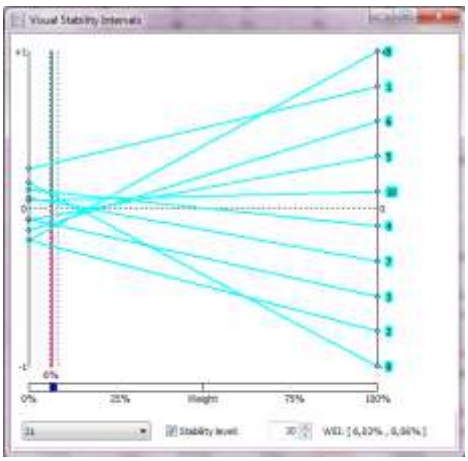


Figure 7. Analysis of sensitivity relating to interest free deposit loan

The horizontal strip displays percent of criterion I1 to sum of weight of criteria which equals to 6%. The green and red horizontal strip indicates the results from ranking 10 branches based on criterion I1. Two horizontal dot point lines around green and red lines indicate high and low level of the ranges that change in weight of criterion I1 at this range will have no effect on the results from ranking branches; the values shown in the right side ranging from 6.02% to 8.06%, i.e. the results from ranking will remain constant until weight of criterion I1 changes at the range of 6.02% to 8.06%. another analysis on this figure is that rank of branches 4, 7, 2, 3 and 0 reduce by increasing weight of criterion I1, while rank of branches 8, 1, 6, 5 and 10 increases by increasing weight of criterion I1. This implies that branches 4, 7, 2, 3 and 9 have not high sensitivity than index I1, while this index has a huge effect to determine final rank of branches 8, 1, 6, 5 and 10. Figure 8 indicates analysis of the sensitivity relating to weight of criterion F6.

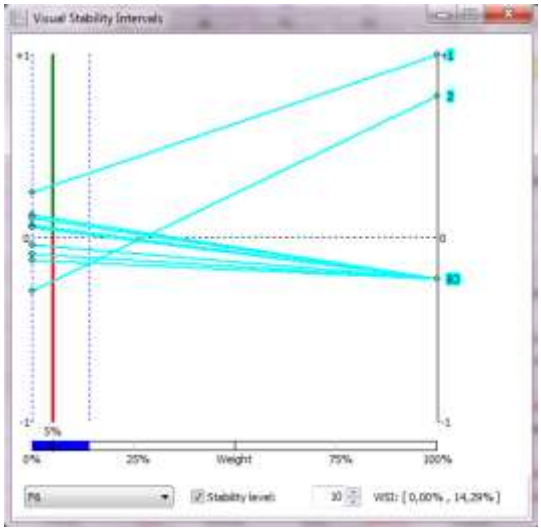


Figure 8. Analysis of the sensitivity relating to criterion (F6)

The horizontal strip displays percent of criterion F6 to sum of weight of criteria which equals to 5%. The green and red horizontal strip indicates the results from ranking 10 branches based on criterion F6. Two horizontal dot point lines around green and red lines indicate high and low level of the ranges that change in weight of criterion F6 at this range will have no effect on the results from ranking branches; the values shown in the right side ranging from 0% to 14.29%, i.e. the results from ranking will remain constant until weight of criterion F6 changes at the range of 0% to 14.29%.

Discussion and conclusion

Decision support system which has been designed to rank branches of bank increases extent of accuracy, speed and ease of ranking improves the extent of flexibility in ranking. This is due to this fact that it can add or omit new indices to the checklist of branches' assessment indices well suited to the environmental changes, or it can change weight of the indices, add or omit various branches in the checklist of all the branches which are ranked, for which it can consider various scenarios, compare the results, examine status of each branch about each index and propose approaches to improve the rank of that branch from

various aspects. While the result from all these changes can be observed at the moment, for which there is no need to put time and effort to achieve these results. The secondary result of this research lies on output of decision support system which is the checklist of ranked branches. The result from ranking 10 various branches of Saman bank considered in the present research has been represented in table below.

PROMETHEE Flow Table

	action	Phi	Phi+	Phi-
1	1	0,2861	0,6097	0,3236
2	4	0,1083	0,4792	0,3708
3	9	0,0917	0,4736	0,3819
4	10	0,0556	0,4528	0,3972
5	7	0,0472	0,4625	0,4153
6	5	-0,0444	0,4111	0,4556
7	6	-0,0917	0,3819	0,4736
8	3	-0,0944	0,3833	0,4778
9	8	-0,1250	0,3792	0,5042
10	2	-0,2333	0,3639	0,5972

Figure 9. Result from ranking branches

Response to the research questions

-how is the macro architecture of a decision support system which is designed to rank branches in terms of components and relationship between them?
-which algorithm will be considered in the deduction engine of the proposed decision support system to rank branches of bank?
-what information are entailed in input data of the proposed decision support system?
-how it can use outputs of the proposed decision support system in major decisions? Response to the first question: the macro architecture of a decision support system which is designed to rank branches is in this way that firstly the input data including ranking indices of branches of bank, weight of indices, parameters of PROMETHEE method such as preference functions allocated to each index and determination of maximum or minimum aim of each index to improve rank of branch, checklist of the branches which are supposed to be ranked and a series of other information are entered into the system and then these data are used to rank branches of bank based on PROMETHEE II. Then a series of analysis of sensitivities and analyses to see what will occur under study on extent of sensitivity of parameters against change and study on extent of effect of these parameters on ultimate results of ranking will be proposed. Ultimately, output of this model will be a report of checklist of branches which are ranked in various ways.
Response of the second question: the algorithm used in the model of this decision support system to rank branches of bank entail the stages in PROMETHEE II method which are entered into software VISUAL PROMETHEE.

Response to the third question: to achieve the indices used to rank branches, firstly an early checklist of indices which is a series of the indices used in various banks in recent years were considered. Ultimately, to select important indices among existing indices and achieve the values of each index, a questionnaire was distributed among bank experts and the results from the questionnaire were tested in software SPSS via t-test and the indices with their mean above 3 were used as the selected indices in this practice. The indices used to rank branches of Saman bank have been represented in table 1.

Response to the fourth question: this decision support system takes each important index and criterion to the decision makers about the performance assessment of branches of bank and proposes the results from assessment by implementation of Promethee method.

References

Ahmadi, M. (2007). " decision making, approaches and techniques " . Human Development journal: - issue 11 , Database of Management Articles,

Asghar pour , MJ (2006). Multi-criteria decision making , Tehran : Tehran University Press , Fourth Edition

Asgharizadeh , E. Nasrolahi , M . (2006). " Ranking of companies based on excellence model criteria – Promethee method".

Asgharizadeh , E. Shokat pour, M . (2009). " Assessing competence -based oil equipment manufacturers based on Promsort". Sharif Industrial Engineering and Management , Vol. 1-27 , No. 1 , S39-45 .

Barns,J.P., B.,VinckeMareschal .1986. How to select and how to rank projects: The PROMETHEEmethod. European Journal of Operational Research 24 (2) , 228–238.

Behzadian,M., M.,Pirdashti .2009. Selection of the Best Module Design for Ultrafiltration (UF)

Daft , Richard L. (2004) .theoretical theory and design of organization. Trans- Ali Parsaeian and Seyed Mohammad Arabi, the Cultural Research Bureau , Third Edition , Tehran

Jafarnejad , A. Rahbar, A. Moghadas poor, S. Vahedi Moghaddam, M (2009). "A decision support model to evaluate the scientific and research papers management". Journal of Technology Management, Volume 1 , Number 3 , 2009, page of 19 to 36

Secme. Y .N.,Bayrakdaroglu,A., & Kahraman, c. 2009,"Fuzzy performance Evalution in Turkish Banking sector using Analytic Hierarchy Process and TOPSIS",Expert system with application,36 ,11699-11709.