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REVIEW AND PRIORITIZATION OF EFFECTIVE FACTORS ON LOCATING ATM BY USING ANALYTICAL HIERARCHY PROCESS

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ABSTRACT

The locating science determines a proper place(s) for activities or services. The present research has two main purposes one of which is achieving the highest market share and the other minimizing the distance of customer's access to ATMs, and it attempts to determine the criteria of optimal location of ATM station for the case study of Shahr Bank in the spatial realm of the district 7 of the large city Tehran. In this respect, in order to determine the criteria for the customer to select a bank, a questionnaire was developed with the AHP method with four factors duration of travel, waiting time, qualitative level of services, validity and safety, and the questionnaire was randomly distributed among the members of the statistical population including 60 persons in 5 branches of the banks of the district 7 and the related information was collected. In this stage of the research, it was specified that two factors of duration of travel and waiting time have the highest ranks.

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INTRODUCTION

Locating is one of the industry engineering sciences focusing on which leads to the reduction of costs and success of the industrial units. Locating centers [locating buildings and centers] is defined as selecting a location for one or more centers by considering other center and the available constraints; in such a way that a special purpose becomes optimal. This purpose can be the cost of transportation, providing fair services to the customers, taking the largest market in one's hand and so on. Doing location studies requires specialties including research in the operation, methods of decision making, geography [geology and climate], engineering economy, computer, mathematics, marketing, and city designing sciences and so on.

Spending so much money in order to create economical firms and also paying attention to relations and facility in accessibility are indicative of the importance of the issue of accurate location and determining the proper spatial situation for this group of those who are active in economy in such a way that it is possible for the majority of citizens to use these firms easily and accurately. This necessity becomes more tangible when the process of increase of population and subsequent to it growth of the city and increase of the cost of the location and also lack of a uniform distribution of the population in various sections of the city are considered. Banks, as a part of the economical firms which have a daily interaction with people, are especially sensitive for selecting the proper location in order to maximize their share of the market and to increase customers' satisfaction through quick accessibility [9]Factors such as population density, farness or closeness to the main street, distance from branches and ATMs of the branches of this bank or the others, distance from special places such as business complexes and centers and also value of the land are the effective criteria in locating in the domain of banking.

Accordingly, the present research reviews the locating criteria as its main purpose and locates the ATMs of Shahr Bank in the district 7 of the municipality of Tehran in their case study. Location science determines proper location[s] for activities and services. The oldest theory in this regard is traced back to the theory of Pier do Dermeh [1600]. He wanted to solve an issue with this content that there are three points in space and a forth point is supposed to be found the sum of the distance of which with those three points is minimum. Then, Weber in 1909 presented a more complex method. He determined proper locations for industrial activities. In 1826, Fan

Tanen suggested a model for analyzing agricultural models and Hetling reviewed the location of supplying goods based on spatial competition in 1926. In his model, there were two suppliers along the linear path and through competition along with this line selected the location of their activity in a place in which the prices would be moderated and the maximum profit would be obtained. [1]

In 1993, Walter Crystaller attempted to express the spatial design of the cities and villages of the Southern Germany. His researches became the infrastructure of many geographers who were interested in the locating science in such a way that the researches of 1960s and 1970s have been focused on his work. The mentioned theories were the infrastructure of the locating science and spatial analyses. Most of these researches are traced back to the period before computers were used. In this period, calculations and modelings are done manually and there were basic constraints in constructing more complex models; but through introducing computers with high speed and strong software in the field of spatial modeling, the possibility of complex spatial issues were created and some researchers could model more complex issues such as Walter Izard, Leon Cooper, Charles Royl, Michelle Titz and Lewis Hakimi.[2]

One of the people that have done valuable researches in the field of spatial sciences is Tabler. He created and developed a model for spatial analysis of the distribution of the urban population in America. The results of his researches have been the intellectual and strategic infrastructure of many of the next quantitative models. His theory has been named the first law of geography. According to the first law of geography, objects are related to one another but things that are closer to one another have a stronger relationship with one another in comparison with those that are not close to one another [3]

Location is the center of cautious and voluntary actions of people [4]. Increase of demand for the employment of a special location is due to the cautious performances and occurrences of people which lead to the increase of competition in people, institutes and firms for establishment in a certain location. As the capitalist economy view and approach to location as economical goods develop, competition for the establishment in the most appropriate location is intensified and selecting the most appropriate location was considered as the main purpose of economical activities [4] Appropriateness of a special place for activity of a service depends on some factors to a large extent which are selected and evaluated during locating that service. In this respect, numerous and various factors which affect locating decision can be named [2].

At the time of establishing a device for the services of the bank, numerous factors shall be considered including spatial situation, price of land, path quality, access to the important hubs and centers of the city, safety, models of development and services [5]. In order to identify the criteria associated with locating this kind of services, it is necessary to first consider the effective assumptions and principles on the patterns of spatial behavior of the customers and managers of the relevant organizations; therefore, the patterns of spatial behavior can be considered as a set of behavioral relationships based on which a customer goes for a facility with the intention of receiving a service or a company provides its services in a certain place. According to the definition above, there are two different dimensions in the patterns of spatial behavior such as customer and company or the managers of the company providing services [6].

For an economical firm providing proper services, high quality of services, operation speed and competitive prices are important but all of these are influenced by the location factor because if the location of the business unit is selected improperly, all of the factors are overshadowed and its positive impacts are faded; thus proper location creates a strategic advantage for the company in comparison with the competitors. Therefore, establishing an economical firm in proper locations and in the best possible condition leads to the prevention of loss of capital [by considering the constraint of capital and time which is always apparent] as well as development of required business and also cycle of goods/services provided for customers is improved and the firm is in a desirable condition [7].

In the banking industry, like other industries, in addition to the competition concerning cost of presenting services, there are other competitive factors the most important of which is how the service is provided for the customer [8]. Among these, the number and location of the establishment of ATMs are especially important because they determine the rate and easiness of the accessibility of bank services, cover more regions and more potential customers are in the range of attraction of bank and on the other hand, the relevant costs including movement cost for reaching the closest branch reduces and therefore the number of times the customers go to banks will be

increased and they will use more services and therefore the profitability of the banks increases by taking the fees of transactions into consideration.

Shahr Bank is an effective economical firm in the area of bank services of the country with the number seven thousand and nine hundred billion rials capita in the July of 2014 and this bank was officially launched in 2009 and therefore can be called a young bank. Various reasons including increase of profitability, prevention of the loss of capita;, having more market share, increase of efficiency, project of organizing and reviewing again has led it to put the establishment of its bank branches in his program. Among these, ATMs and self-bank devices are also especially considered. Nonetheless, no research has yet been done on the effective factors on accurate location of these branches.

Given the items expressed, the purpose of this research is to determine the effective factors in the respect of establishing ATMs so that the authorities would make an effective decision in this regard by considering other information. For this purpose, the required geographical location is considered based on the official divisions. In this research, according to the definition above and the suggestion of the authorities of the bank, district 7 of the city Tehran is studied as the pilot region.

Determining the location of the financial firm is a key step towards financial firms because the results of this decision become apparent in the long run and have crucial effects from the economical, environmental and social dimensions and so on. One of the aspects of the impacts within an organization will be its direct impact on the profitability of the financial firm and from the dimension of outside of the organization, building a big financial firm in a region can affect various economical, social, cultural and environmental conditions and so on. Determining the location of the financial firm has an important in the rate of preliminary investment at the time of its foundation economically. Also, at the time of using it, this decision making has a key impact on the final price of the goods/service [research center of development of technology of university Jihad, 1990]. In addition, establishing one or more industrial units in the optimal locations and in the best conditions possible not only improves the cycle of materials and services for the customers, but the financial firms are put in a desirable condition. Decisions associated with selection and learning location features of a center can have a great impact o the ability of achieving and preserving the competitive advantage [9]. In reviewing jobs with quick returns, it has been specified that more than 50 percent of them are bankrupted in the first year and about 30 percent of them are bankrupted after two years and go to have another job. Although in the beginning of launching these jobs, all of the aspects of presenting services are reviewed, but not paying attention to the important issue of the location of firm causes the productive unit not to reach the required profitability and therefore its purpose [10]. Doing proper and accurate location studies will have social, environmental, cultural and economical impacts on the region where the location of it is as well as its economical impact on the performance of the industrial unit. In addition, regional features are also considered as effective key factors in determining the location of the locating issues. By considering these sayings, the necessity of the present project is specified.

RESEARCH MODEL

Estimation of the AHP model in order to determine the effective factors on locating the ATM device, now with one of the most famous multivariate decision making methods [MADM] called AHP, we determine the effective factors on locating the ATM device. When there is a considerable difference between the factors written in the AHP questionnaire and the probability of the overlap of the numbers is low and since the probability of the presence of significant numbers for the concept of the degree of possibility is low, the traditional method must be used and therefore, in this research, the traditional method of AHP has been used instead of the fuzzy method. AHP is a multivariate decision making process and there is at least three different levels in each mode in such a way that elements of each level are related to one another. The first level called "purpose" has been specified and as its name shows, it is related to the purpose of the decision maker of processing the model. The second level is related to the criteria and in that the criteria which are involved in the decision making process are reviewed. The third level is associated with the options in which elements out of which the selection is done or those that are ranked in order of preference are mentioned.

In this research, the first level which is "purpose" shows the ranking of the effective factors on the location of the ATM. The second level which is "criteria" includes an overall criterion for achieving an optimal model for competing in the selection of the ATM. The third level is "options" which includes the four factors the duration of travelling till reaching the location of the ATM, the time of waiting in the line of the ATM, qualitative level of the

services provided by the ATM, validity and safety of the ATM. These four factors have been selected based on the previous researches. It can be said that in total, all of the previous researches have somehow considered these four overall categories. These factors are explained in more details as we go on.

Duration of travel until reaching the location of the ATM device

This factor is important because in cases when the distance between ATMs is long, the customer shall spend a certain amount of time and therefore cost for reaching the location. Consequently, at the time of selecting one of the two devices with similar conditions, they prefer to spend less time and cost for reaching the devices.
b-The time of waiting in the line of ATM.

One of the most tiring stages of each work is spending a certain amount of time for achieving the purpose. Waiting in the ATM lines are important until the customer prefers to travel a distance instead of wait in the line of an ATM to reach an ATM with no other customer and he/she won't need to wait in a long line anymore.

Qualitative level of the services provided by the ATM

Some of the services of the bank are only done by certain ATMs. For instance, if the customer needs to change his/her password or attempts to receive the second password for the credit card, he or she shall go to the ATM of that same bank. Also, in other cases, such as immediate electricity bill, the bill can only be paid by a certain bank. Thus, selecting a device in some cases depends so much on the type of the service which can be provided by the ATM.

Validity and safety of the ATM

Due to many bank robberies in the recent years, the internet accounts and also customers in front of the ATMs, the importance of this factor has become more apparent. The safety factor can be affected by the presence or absence of surveillance cameras and also location of the device in crowded places with traffic or vice versa. In addition, in cases where a device shows an error of execution one time or more, due to customer's lack of trust, this device will be eliminated from the list of ATMs of a customer and perhaps this lack of confidence in a device would be transferred to others as well.

METHODS

The present research is a descriptive research of the survey kind in terms of its method. It is descriptive because it describes a situation or condition in detail. Also, the method of the present research is an experimental research in terms of purpose, because the result of the research can be of help for managers and employees of the studied organization and even other governmental organizations. Ultimately, the research is a field study in terms of data collection. About the data collection method in this research, it can be said that the library data collection method will be used in terms of the theoretical principles of the research. The research questionnaire will be of the researcher-made type and it is designed based on the AHP method. The statistical population of the research includes the elites of the banking industry, especially employees and managers of Shahr Bank which have been filled out based on the accessibility of the maximum rate of the sample volume possible. It is necessary to explain that bank managers and employees respond to the questions of the questionnaire as the bank customers. According to the information of the manager, public relations of Shahr Banks in the domain of the district seven of Tehran, 70-80 employees are active. The cause of approximation of the number of employees is the movement of managers and CEOs of the branches of Shahr Bank. According to the Morgan table, which has been presented below, the minimum number of the sample volume for this number of population is about 60 persons. Accordingly, 65 questionnaires were prepared in total and then distributed among the statistical population and a number of 60 questionnaires were completely filled out which have been used in this research. Since in this research the most important data collection tool and measurement of variables is the questionnaire, the validity of the questionnaire is especially important for the validity of the research. For this purpose, three type of validity were considered: content, construct and face validity. And its validity was confirmed and the reliability is calculated through Cronbach's alpha method by using SPSS software easily. As the results show, Cronbach's alpha of the AHP questionnaire is equal to 0.896 which is very desirable.

RESULTS AND DISCUSSION

Execution of the AHP method:

The Analytical Hierarchy Process [AHP] is a decision making method in which the decision maker [or the decision making group] is enabled to form their required issue and according to the obtained structure, they do some comparisons in order to determine the priority of the options mentioned in the decision making. AHP requires paired comparisons and the decision makers starts his/her work by drawing the overall hierarchy of his/her decision, and specifies the hierarchy of factors and various options which

shall be considered in the decision. Then, the paired comparison is done which ends with the determination and evaluation of the factors. I this method, the advantages of this method is using it in the decision making with the qualitative criteria. The other advantage of this method is structuring the issue of decision making with forming the hierarchy. Classifying the criteria from top to bottom causes the complex issues to be reviewed systematically by the AHP. Now, the application of AHP is more seen in the decision making of the socioeconomical systems of assignment of sources, evaluation of performance, determination of the sequence of the work and other things. This method is a decision making method which enables the decision maker to form the required issue and do some comparisons based on the obtained structure in order to determine the priority of the options mentioned in the decision making. This technique was first mentioned by Thomas Saati in 1980. Another advantage of this method is using it in the decision making with qualitative criteria [11]

Stages of using the AHP method

In using the AHP method for the decision making issue, there are four basic stages as follows [11] Forming the hierarchy and the classification of the required issue has this order: at the top of the hierarchy there is the great and overall purpose of the decision making issue and in lower levels there are attributes and criteria which are somehow effective on the quality of the purpose [if necessary, the criteria can be divided into more detailed subcategories] and finally, the options and selection of the decision making are in the last level. This situation creates an overall and standard framework which will be similar for all issues despite the type of the issue. The number of the levels depends on the complexity of the issue. Since the principles of the AHP model is based on the paired comparisons, Dr. Sa'ati suggests that if possible the number of the factors at each level wouldn't be more than 9 factors. Of course, this isn't necessarily considered as a constraint for this method [11]The second stage includes paired comparisons of the factors written at any level of hierarchy in responding to the realization of the purposes o meeting the needs of the purpose or the factors of the higher level. These comparisons are written in a matrix called "paired comparison matrix". This matrix has two main properties. First, the diameter of this matrix is the number one and second, preferring some factors has a reversible property. In relation with the determination of the nominal rate of the preference of a factor, it might be imagined that some numbers can be considered for these comparisons. However, in the AHP model, it is discussed that direct assignment of such weights absolutely practically will lead to the incompatibility of calculations with the obtained results. For instance, it is possible that as Dr. Sa'ati says, we select the lowest of the n factors and objects we are comparing [in terms of the studied attribute] and for instance we give the coefficient 1 to it and weigh the rest of them in relation with the unit [lowest factor]. In his opinion, although this process might be completely accurate in theory and logically, but the application of this method is almost impractical and the obtained results will not be reliable and compatible. Therefore, he suggests the relative and paired comparisons for this purpose and in order to avoid the application of the single and absolute numbers, a 9-degree scale has been used the accuracy of which has been proved based on a optometric experiment in physics. In the third stage of the process of the paired model, the relative weights of the factors are calculated at each level. The methodology of this calculation is as follows. If the comparer could know the actual weights of n factors being compared, then the relative paired comparisons matrix of the factors will be as follows.

$$A = \text{Matrix -} \begin{bmatrix} w_1/w_2 & w_1/w_2 & \cdots & w_1/w_n \\ w_2/x_1 & w_2/w_2 & \cdots & w_2/w_n \\ w_n/w_2 & w_n/w_2 & \cdots & w_n/w_n \end{bmatrix}$$

this case, the relative weights can obviously calculated through each of the matrixes of A. on other words, matrix A was a 1st degree matrix and the following equation is seen [Azar and Rajabzadeh, 2002, p64]:

$$A.W = n.W$$

In which, W=[w_1,w_2,…,w_n] is the vector of actual weight and n factors with elements. In the matrix algebra, n.W in equation [1] are respectively called "special Eigen value" and "right Eigen vector" of matrix A. In the AHP model, it is argued that since the judger does not know anything about the vector W [components of this vector [w_1,w_2,…,w_n] are not specified in it], therefore he/she is not able to determine the relative paired weights of matrix A with a 100 percent accuracy. Thus, matrix A, which is the outcome of his/her personal judgment, is logically incompatible. Estimation of the vector W, which is shown by wˆ, can be calculated through the equation below [2]

$$\hat{A}.\hat{w} = \lambda max.\hat{w}$$

In which Â is the paired comparison of the factors which are presented by the decision maker [respondent]. λmax is the largest "special Eigen value" of matrix Aˆ and wˆ is the "right Eigen vector" of matrix Aˆ and it is an estimation of the actual rate of the vector wˆ. In addition, the rate of λmax can be considered as an estimation of n. Professor Sa'ati has shown that always λmax≥n. The closer λmax gets to n, the degree of compatibility of the matrix A increases and based on this attribute, a scale called CI or "scale or degree of compatibility" and CR "compatibility ratio" are calculated as follows:

$$CI = [\lambda max - n] / n - 1$$

In which CI is the average of the degree of compatibility of the random variables [Azar, 2005, p 81]. As an empirical law, if CR≤%10 the matrix A is acceptable [judgment of the decision maker about preferring the factors compared] and otherwise, the written things in A more than A is incompatible which leads to reliable results. In this case, it is necessary for the paired comparisons to be repeated until an acceptable compatibility ratio [lower than or equal to 10%] is reached by the decision maker. Sa'ati showed that estimation of W vector can be obtained from the repeated calculation equations and this algorithm is now available in a software called Expert Choice or a similar software and that is how the degree of compatibility of the paired comparison matrix can be calculated as well. In addition, it must be considered that the special Eigen value method is only of the methods of estimating the W vector and there are also other methods but none of them are as known as this one and they have not been used. The final stage of the process of the AHP model includes the determination of the relative importance of each of

the options of decision making in relation with the overall purpose and criteria of the considered issue. For this purpose, relative weights of the factors at the Kth level [overall purpose of the issue] are calculated as follows:

$$C(1,K) = \prod_{i=1} B_i$$

In which, C[1 ,K] is the relative combined vector at the Kth level in relation with the factors of the first level and B_i of a n i-1*n matrix the rows of which form the vector wˆ. n_i is the number of the factors of the ith factors and in fact it is n in the equation A.W=n .W and i in the equation is only to show the level [12, 13].

CONCLUSION

In this research, it has been attempted to recognize the effective factors on selecting an ATM device from the perspective of the customer. In this respect, a questionnaire was developed based on the AHP method and four factors duration of travel, waiting time, qualitative level of services, validity and safety were reviewed as the factors for selecting a device. The questionnaire was randomly distributed among the members of the statistical population including 60 persons in 5 branches of the banks of the district 7 and the related information was collected. After collecting the data, the data was analyzed in the software special for the AHP method which is Express Choice and the results showed that the two factors of duration of travel and waiting time have the highest ranks. Therefore, the research model accepted these two factors as the factors for the customer to select the ATM.

CONFLICT OF INTEREST
Authors declare no conflict of interest.

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