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Location Selection for a Company using Analytic Hierarchy Process

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Abstract: Analytic hierarchy process (AHP)—developed by Prof. Thomas L. Saaty (1970s)—is a decision-making method for prioritizing alternatives when multiple criteria needs to be considered. It structures a problem as a hierarchy or a set of integrated levels. AHP is structured into three levels, i.e., goal, criteria, and alternatives. It does not require absolute judgment or assessment but helps us to make a relative assessment between two items at a time. AHP judgments are known as pairwise comparisons. It uses a weighted average approach idea, but it uses a method for assigning ratings and weights that are considered to be more reliable and consistent. A company wants to select a best location for building a new plant from a set of three locations for enlarging its operations. In order to assist such a company, we will be using AHP by taking into account four criteria such as property price, distance from suppliers, quality of labor pool, and labor cost. This study attempts to help the company in selecting the best location so that it can build its new plant and expand its operations by using the aforementioned criteria.

Keywords: Analytic hierarchy process, company, distance from suppliers, labor cost, location selection, multicriteria decision-making problem, property price, quality of labor pool.

I. INTRODUCTION

The procedure of determining the finest selection from all feasible alternatives is known as a decision-making problem. In many decision-making problems, the range of criteria for estimating alternatives is extensive. In other words, for decision-making problems, a decision maker desires to resolve a multicriteria decision-making (MCDM) problem [1]. Analytic hierarchy process (AHP) is one such MCDM problem that was developed by Prof. Thomas L. Saaty in 1970s [1]. AHP is a process that is used to structure a problem as a hierarchy or as a system with dependent loops. It is used to elicit judgments that reflect ideas, feelings, and emotions. It represents judgments with meaningful numbers and synthesizes results. It analyzes sensitivity to changes in judgments. AHP is simple to comprehend and can meritoriously handle data that is qualitative as well as quantitative. It is a learning tool rather than a means to discover the truth. AHP does not comprise a lot of mathematics. It basically consists of principles of decomposition, pairwise comparisons, and priority vector generation and synthesis [2]. AHP is one of the methodologies used in ascertaining the relative importance of a set of attributes [3]. It is premeditated to solve complicated MCDM problems [3]. AHP is based on a distinctive human ability to make thorough decisions about small problems. It expedites decision making by consolidating observations, emotional state, decisions, and reminiscences in a framework that demonstrates forces that affect a decision [3]. It is a procedure for evaluating complex decisions. Decisions are disintegrated into a hierarchy of subproblems that can be explored by associating them with each other. Since associations can be built on concrete data or human judgment, any issue related to a decision can be considered. Assessments are then converted into numerical values by means of weights [4]. With the help of AHP, we can capture subjective as well as objective evaluation measures, providing a valuable mechanism for verifying the steadiness of evaluation measures and alternatives suggested by a team, thus reducing preference in decision making [5]. AHP is a decision aid that provides a decision maker with pertinent information to assist him/her in selecting a "best" alternative or to rank a set of alternatives [6–8]. Moreover, AHP takes into account consistency checking [9], i.e., it permits decision makers to ensure result quality in a comparison matrix [5]. In recent times, computer and Internet have played a crucial role in refining the life of people. The resolution of information technology (IT) has made the whole thing easy, supple, and available [10]. IT has been used in areas such as education, buying and selling, business, and decision making [10]. AHP is used in helping people and organizations in a decision-making process [10]. The modern business-related and trade organization needs to form methods that can help in evaluating human resource performance instead of merely using performance measures for instance competence and usefulness [11]. In that originates the use of AHP. Since a decision maker establishes decisions on the basis of information and understanding and then makes decisions, AHP matches with a decision maker's behavior [12]. The benefit of AHP is its capability to be integrated with numerous techniques such as linear programming, fuzzy logic, among others, which allows a user to excerpt benefits from all collective methods and accomplish a goal in a better manner [13].

Fundamentally, AHP focuses on quantifying relative priorities for a set of alternatives on a ratio scale based on decision makers' judgments and stresses the significance of intuitive judgments of both a decision maker and the consistency of comparison of alternatives in decision-making process [12, 14]. Nowadays, adaptable, easy-to-use, Windows-based software packages are offered to assist group-level decision making when multiple evaluation factors and perspectives are present [15]. Thus, AHP has been excellently applied in various decision-making situations [15]. A company wants to select a best location for building a new plant from a set of three locations (i.e., locations A, B, and C) for enlarging its operations. In order to assist the company, we will be using AHP by taking into account four criteria such as property price, distance from suppliers, quality of labor pool, and labor cost. This study attempts to help the company in selecting the best location from locations A, B, and C so that it can build its new plant and expand its operations by using the aforementioned criteria.

The remainder of this paper is structured as follows. Section 2 briefs about the literature review of AHP. Section 3 explains various steps and a detailed explanation as to how a location is selected for a company via AHP. Section 4 concludes the study.

II. LITERATURE REVIEW

AHP is used in many areas such as office, planning, fitness, advertising, predicting finance, schooling, technology, risk analysis, sports, and transportation [10]. Omkarprasad [13] described about some applications where AHP is used in areas such as making location allocation decisions and determining demand forecasting for inventories [16]. The significance of AHP could be used to recognize and analyze certain barriers that could postpone a specific project's implementation, e.g., classifying and analyzing barriers that could postpone biomass cooking stove implementation. AHP is used to solve such problems [17]. Maggie elaborated that AHP can be beneficial in connecting many decision makers with contradictory objectives to attain at an agreement or a common decision. In her study, an AHP-based model is devised and applied to a real case study to scrutinize its possibility in selecting a retailer for a telecommunications system. AHP is used to disentangle the problem of selecting a house for residents. It provides a tactic for analysis and makes a cost-effective, tailored, lithe, and logical design plan [18, 19]. Al-Harbi used AHP in project management for selecting a best contractor by constructing a hierarchical structure for pre-qualification criteria and contractors who desire to qualify for a project [12]. Lai et al. made use of AHP for selecting software, and this software is known as multimedia authorizing system. They used group decision making that comprised six software engineers [20]. Al Khalil used AHP for selecting an appropriate project delivery technique [21]. Byun used AHP's extended version in selecting a car [22]. Tam and Tummala used AHP in selecting a vendor for a telecommunication system—which is a multifaceted, multiperson, and MCDM problem. They found AHP to be useful because it involves numerous decision makers with dissimilar contradictory intentions to attain at a consensus decision, which is an organized process and decreases time for the selection of a vendor [19]. Noci and Toletti used AHP together with fuzzy approach for the selection of quality-based programs [23]. Schniederjans and Garvin used AHP to select multiple cost drivers for activity-based costing through multiobjective programming methodology [24]. Shang and Toshiyuki used AHP for selecting a manufacturing system. This technique inspects nonmonetary criteria allied with corporate goals and continuing objectives besides identifying the most efficient and adaptable manufacturing system [25]. Ceha and Hiroshi presented an AHP-based heuristic algorithm to facilitate airplane selection for operation on airport pairs [26]. Kim and Youngohc established a model for identifying quality-based priorities for choosing an expert shell as an instructional tool for an expert system course [27].

A. Phases inAHP

a) Decompose a problem into a hierarchy.
b) Collect input data by pairwise comparisons of criteria at each level of hierarchy.
c) Estimate criteria and alternatives relative weights and check consistency in pairwise comparisons.
d) Aggregate the relative weights of criteria and alternatives to obtain a global ranking of each alternative with regard to a goal.

B. Consistency Index (CI)

It is a measure of deviation of consistency [28].

$$CI = (\lambda_{max} - M)/M - 1, \quad \textbf{(1)}$$

where λ_{max} is the maximum eigen value of the pairwise comparison matrix. When CI = 0 or λ_{max} = n → perfect consistency, whereas when CI = 0.1 → accepted threshold value. The smaller the value of CI, the smaller is the deviation from consistency.

C. Consistency Ratio (CR)

$$CR = CI/RI, \quad \textbf{(2)}$$

where RI is the random index. Normally, CR of 0.1 is considered as acceptable.

D. Advantages of AHP

a) Decision hierarchy and pairwise comparisons make AHP easy to comprehend.
b) The use of subjective scale such as strongly preferred rather than a quantitative scale is especially useful when it is difficult to formalize some criteria quantitatively.
c) It is usually much easier to compare two items at a time than to compare many items at once.

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E. Disadvantages of AHP

a) The decision hierarchy in AHP assumes independence among criteria which is not always appropriate.
b) The subjective scale is subject to human errors and predisposition.
c) The number of pairwise comparisons becomes quite extensive when the number of attributes and alternatives is large.

III. LOCATION SELECTION FOR A COMPANY USING AHP

A company is endeavoring to select a new location in order to enlarge its operations. It wants to use AHP for deciding which will be an appropriate location for building its new plant. The company has to decide the best location based on following criteria: property price, distance from suppliers, quality of labor pool, and labor cost. There are three locations, i.e., A, B, and C, from which the company can decide. Given below are the matrices with criteria and preferences:

TABLE IPROPERTY PRICE

	A	B	C
A	1	3	2
B	1/3	1	1/5
C	1/2	5	1

TABLE II DISTANCE FROM SUPPLIERS

	A	B	C
A	1	6	1/3
B	1/6	1	1/9
C	3	9	1

TABLE III QUALITY OF LABOR POOL

	A	B	C
A	1	1/3	1
B	3	1	7
C	1	1/7	1

TABLE IV LABOR COST

	A	B	C
A	1	1/3	1/2
B	3	1	4
C	2	1/4	1

Solution

A. Property Price

Step 1: Sum (add up) all values in each column. Here, for property price, we columnwise perform the sum [addition] of locations A, B, and C, i.e., 1 + 1/3+ 1/2 = 11/6, 3 + 1 + 5 = 9, and 2 + 1/5 + 1 = 16/5, respectively.

TABLE VPROPERTY PRICE

	A	B	C
A	1	3	2
B	1/3	1	1/5
C	1/2	5	1
Total	**11/6**	**9**	**16/5**

Step 2: Values in each column are divided by corresponding column sums. Now, once 11/6, 9, and 16/5 are obtained from the above step, we use these values columnwise to individually divide with values given in the matrix. For example, for **location A** [1 ÷ 11/6 = 6/11, 1/3 ÷ 11/6 = 2/11, and 1/2 ÷ 11/6 = 3/11], **location B** [3 ÷ 9 = 3/9, 1 ÷ 9 = 1/9, and 5 ÷ 9 = 5/9], and **location C** [2 ÷ 16/5 = 5/8, 1/5 ÷ 16/5 = 1/16, and 1 ÷ 16/5 = 5/16].

TABLE VIPROPERTY PRICE

	A	B	C
A	6/11	3/9	5/8
B	2/11	1/9	1/16
C	3/11	5/9	5/16

*Note that values in each column sum to 1 (i.e., 6/11 + 2/11 + 3/11 = 1, 3/9 + 1/9 + 5/9 = 1, and 5/8 + 1/16 + 5/16 = 1).

Step 3: Next, we convert fractions to decimals and find the average of each row. In other words, once we have converted fractions into decimals, we then take rowwise average, e.g., (0.5455 + 0.3333 + 0.6250) ÷ 3 = 0.5013, (0.1818 + 0.1111 + 0.0625) ÷ 3 = 0.1185, and (0.2727 + 0.5556 + 0.3125) ÷ 3 = 0.3803.

TABLE VIIPROPERTY PRICE

	A	B	C	Rowwise average
A	6/11 = ~0.5455	3/9 = ~0.3333	5/8 = ~0.6250	**0.5013**
B	2/11 = ~0.1818	1/9 = ~0.1111	1/16 = ~0.0625	**0.1185**
C	3/11 = ~0.2727	5/9 = ~0.5556	5/16 = ~0.3125	**0.3803**

B. Distance from suppliers

Step 1: Sum (add up) all values in each column. Here, for distance from suppliers, we columnwise perform the sum [addition] of locations A, B, and C, i.e., 1 + 1/6 + 3 = 25/6, 6 + 1 + 9 = 16, and 1/3 + 1/9 + 1 = 13/9, respectively.

TABLE VIIIDISTANCE FROM SUPPLIERS

	A	B	C
A	1	6	1/3
B	1/6	1	1/9
C	3	9	1
Total	**25/6**	**16**	**13/9**

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Step 2: Values in each column are divided by corresponding column sums. Now, once 25/6, 16, and 13/9 are obtained from the above step, we use these values columnwise to individually divide with values given in the matrix. For example, for **location A** [1 ÷ 25/6 = 6/25, 1/6 ÷ 25/6 = 1/25, and 3 ÷ 25/6 = 18/25], **location B** [6 ÷ 16 = 3/8, 1 ÷ 16 = 1/16, and 9 ÷ 16 = 9/16], and **location C** [1/3 ÷ 13/9 = 3/13, 1/9 ÷ 13/9 = 1/13, and 1 ÷ 13/9 = 9/13].

TABLE IXDISTANCE FROM SUPPLIERS

	A	B	C
A	6/25	3/8	3/13
B	1/25	1/16	1/13
C	18/25	9/16	9/13

*Note that values in each column sum to 1 (i.e., 6/25, 1/25, and 18/25 = 1, 3/8 + 1/16 + 9/16 = 1, and 3/13 + 1/13 + 9/13 = 1).

Step 3: Next, we convert fractions to decimals and find the average of each row. In other words, once we have converted fractions into decimals, we then take rowwise average, e.g., (0.24 + 0.375 + 0.2307) ÷ 3 = 0.2819, (0.04 + 0.0625 + 0.0769) ÷ 3 = 0.0598, and (0.72 + 0.5625 + 0.6923) ÷ 3 = 0.6583.

TABLE XDISTANCE FROM SUPPLIERS

	A	B	C	Rowwise average
A	6/25 = ~0.24	3/8 = ~0.375	3/13 = ~0.2307	**0.2819**
B	1/25 = ~0.04	1/16 = ~0.0625	1/13 = ~0.0769	**0.0598**
C	18/25 = ~0.72	9/16 = ~0.5625	9/13 = ~0.6923	**0.6583**

C. Quality of labor pool

Step 1: Sum (add up) all values in each column. Here, for quality of labor pool, we columnwise perform the sum [addition] of locations A, B, and C, i.e., 1 + 3 + 1 = 5, 1/3 + 1 + 1/7 = 31/21, and 1 + 7 + 1 = 9, respectively.

TABLE XIQUALITY OF LABOR POOL

	A	B	C
A	1	1/3	1
B	3	1	7
C	1	1/7	1
Total	**5**	**31/21**	**9**

Step 2: Values in each column are divided by corresponding column sums. Now, once 5, 31/21, and 9 are obtained from the above step, we use these values columnwise to individually divide with values given in the matrix. For example, for **location A** [1 ÷ 5 = 1/5, 3 ÷ 5 = 3/5, and 1 ÷ 5 = 1/5], **location B** [1/3 ÷ 31/21 = 7/31, 1 ÷ 31/21 = 21/31, and 1/7 ÷ 31/21 = 3/31], and **location C** [1 ÷ 9 = 1/9, 7 ÷ 9 = 7/9, and 1 ÷ 9 = 1/9].

TABLEXIIQUALITY OF LABOR POOL

	A	B	C
A	1/5	7/31	1/9
B	3/5	21/31	7/9
C	1/5	3/31	1/9

*Note that values in each column sum to 1 (i.e., 1/5 + 3/5 + 1/5 = 1, 7/31 + 21/31 + 3/31 = 1, and 1/9 + 7/9 + 1/9 = 1).

Step 3: Next, we convert fractions to decimals and find the average of each row. In other words, once we have converted fractions into decimals, we then take rowwise average, e.g., (0.2 + 0.2258 + 0.1111) ÷ 3 = 0.1789, (0.6 + 0.6774 + 0.7778) ÷ 3 = 0.6851, and (0.2 + 0.0968 + 0.1111 = 0.1360).

TABLE XIIIQUALITY OF LABOR POOL

	A	B	C	Rowwise average
A	1/5 = 0.2	7/31 = ~0.2258	1/9 = ~0.1111	**0.1789**
B	3/5 = 0.6	21/31 = ~0.6774	7/9 = ~0.7778	**0.6851**
C	1/5 = 0.2	3/31 = ~0.0968	1/9 = ~0.1111	**0.1360**

D. Labor cost

Step 1: Sum (add up) all values in each column. Here, for labor cost, we columnwise perform the sum [addition] of locations A, B, and C, i.e., 1 + 3 + 2 = 6, 1/3 + 1 + 1/4 = 19/12, and 1/2 + 4 + 1 = 11/2, respectively.

TABLE XIVLABOR COST

	A	B	C
A	1	1/3	1/2
B	3	1	4
C	2	1/4	1
Total	**6**	**19/12**	**11/2**

Step 2: Values in each column are divided by corresponding column sums. Now, once 6, 19/12, and 11/2 are obtained from the above step, we use these values columnwise to individually divide with values given in the matrix. For example, for **location A** [1 ÷ 6 = 1/6, 3 ÷ 6 = 1/2, and 2 ÷ 6 = 1/3], **location B** [1/3 ÷ 19/12 = 4/19, 1 ÷ 19/12 = 12/19, and 1/4 ÷ 19/12 = 3/19], and **location C** [1/2 ÷ 11/2 = 1/11, 4 ÷ 11/2 = 8/11, and 1 ÷ 11/2 = 2/11].

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TABLE XVLABOR COST

	A	B	C
A	1/6	4/19	1/11
B	1/2	12/19	8/11
C	1/3	3/19	2/11

*Note that values in each column sum to 1 (i.e., 1/6 + 1/2 + 1/3 = 1, 4/19 + 12/19 + 3/19 = 1, and 1/11 + 8/11 + 2/11 = 1).

Step 3: Next, we convert fractions to decimals and find the average of each row. In other words, once we have converted fractions into decimals, we then take rowwise average, e.g., (0.1667 + 0.2105 + 0.0909) ÷ 3 = 0.1560, (0.5 + 0.6315 + 0.7272) ÷ 3 = 0.6196, and (0.3333 + 0.1578 + 0.1818) ÷ 3 = 0.2243.

TABLE XVILABOR COST

	A	B	C	Rowwise average
A	1/6 = ~0.1667	4/19 = ~0.2105	1/11 = ~0.0909	**0.1560**
B	1/2 = 0.5	12/19 = ~0.6315	8/11 = ~0.7272	**0.6196**
C	1/3 = ~0.3333	3/19 = ~0.1578	2/11 = ~0.1818	**0.2243**

The following table is obtained (i.e., we prepare a matrix, as shown below, [locations A, B, and C vs. property price, distance from suppliers, quality of labor pool, and labor cost] by considering the rowwise average calculated in Step 3 of property price, distance from suppliers, quality of labor pool, and labor cost:

TABLE XVIIROWWISE AVERAGE OF PROPERTY PRICE, DISTANCE FROM SUPPLIERS, QUALITY OF LABOR POOL, AND LABOR COST

Locati ons	Property price	Distance from suppliers	Quality of labor pool	Labor cost
A	0.5013	0.2819	0.1789	0.1560
B	0.1185	0.0598	0.6851	0.6196
C	0.3803	0.6583	0.1360	0.2243

TABLE XVIIIPAIRWISE COMPARISON MATRIX

	Prop erty price	Distance from suppliers	Quality of labor pool	Labor cost
Property price	1	1/5	3	4
Distance from suppliers	5	1	9	7
Quality of labor pool	1/3	1/9	1	2
Labor cost	1/4	1/7	1/2	1

Step 1: Sum (add up) all values in each column. Here, we columnwise perform the sum [addition] of property price, distance from suppliers, quality of labor pool, and labor cost, i.e., 1 + 5 + 1/3 + 1/4 = 79/12, 1/5 + 1 + 1/9 + 1/7 = 458/315, 3 + 9 + 1 + 1/2 = 27/2, and 4 + 7 + 2 + 1 = 14, respectively.

TABLE XIXPAIRWISE COMPARISON MATRIX

	Prop erty price	Distance from suppliers	Quality of labor pool	Labor cost
Property price	1	1/5	3	4
Distance from suppliers	5	1	9	7
Quality of labor pool	1/3	1/9	1	2
Labor cost	1/4	1/7	1/2	1
Total	**79/12**	**458/315**	**27/2**	**14**

Step 2: Values in each column are divided by corresponding column sums. Now, once 79/12, 458/315, 27/2, and 14 are obtained from the above step, we use these values columnwise to individually divide with values given in the matrix. For example, for **property price** [1 ÷ 79/12 = 12/79, 5 ÷ 79/12 = 60/79, 1/3 ÷ 79/12 = 4/79, and 1/4 ÷ 79/12 = 3/79], **distance from suppliers** [1/5 ÷ 458/315 = 4/29, 1 ÷ 458/315 = 20/29, 1/9 ÷ 458/315 = 20/261, and 1/7 ÷ 458/315 = 20/203], **quality of labor pool** [3 ÷ 27/2 = 2/9, 9 ÷ 27/2 = 2/3, 1 ÷ 27/2 = 2/27, and 1/2 ÷ 27/2 = 1/27], and **labor cost** [4 ÷ 14 = 2/7, 7 ÷ 14 = 1/2, 2 ÷ 14 = 1/7, and 1 ÷ 14 = 1/14].

TABLE XXPAIRWISE COMPARISON MATRIX

	Prop erty price	Distance from suppliers	Quality of labor pool	Labor cost
Property price	12/79	4/29	2/9	2/7
Distance from suppliers	60/79	20/29	2/3	1/2
Quality of labor pool	4/79	20/261	2/27	1/7
Labor cost	3/79	20/203	1/27	1/14

*Note that values in each column sum to 1 (i.e., 12/79 + 60/79 + 4/79 + 3/79 = 1, 4/29 + 20/29 + 20/261 + 20/203 = 1, and 2/7 + 1/2 + 1/7 + 1/14 = 1).

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Step 3: Next, we convert fractions to decimals and find the average of each row. In other words, once we have converted fractions into decimals, we then take rowwise average, e.g., (0.1518 + 0.1379 + 0.2222 + 0.2857) ÷ 4 = 0.1994, (0.7594 + 0.6896 + 0.6667 + 0.5) ÷ 4 = 0.6539, (0.0506 + 0.0766 + 0.0740 + 0.1428) ÷ 4 = 0.0860, and (0.0379 + 0.0985 + 0.0370 + 0.0714) ÷ 4 = 0.0612.

TABLE XXIROWWISE AVERAGE OF PAIRWISE COMPARISON MATRIX

	Property price	**Distance from suppliers**	**Quality of labor pool**	**Labor cost**	**Rowwise average**
Property price	12/79 = ~0.1518	4/29 = ~0.1379	2/9 = ~0.2222	2/7 = ~0.2857	**0.1994**
Distance from suppliers	60/79 = ~0.7594	20/29 = ~0.6896	2/3 = ~0.6667	1/2 = 0.5	**0.6539**
Quality of labor pool	4/79 = ~0.0506	20/261 = ~0.0766	2/27 = ~0.0740	1/7 = ~0.1428	**0.0860**
Labor cost	3/79 = ~0.0379	20/203 = ~0.0985	1/27 = ~0.0370	1/14 = ~0.0714	**0.0612**

Row average = preference vector for criteria

TABLE XXIIROWWISE AVERAGE OF PROPERTY PRICE, DISTANCE FROM SUPPLIERS, QUALITY OF LABOR POOL, AND LABOR COST FROM PAIRWISE COMPARISON MATRIX

Property price	0.1994
Distance from suppliers	0.6539
Quality of labor pool	0.0860
Labor cost	0.0612

Step 4: Final calculation [Multiplying Tables XXIII and XXIV]

TABLE XXIIIROWWISE AVERAGE OF PROPERTY PRICE, DISTANCE FROM SUPPLIERS, QUALITY OF LABOR POOL, AND LABOR COST

Locations	**Property price**	**Distance from suppliers**	**Quality of labor pool**	**Labor cost**
A	0.5013	0.2819	0.1789	0.1560
B	0.1185	0.0598	0.6851	0.6196
C	0.3803	0.6583	0.1360	0.2243

TABLE XXIV
ROWWISE AVERAGE OF PROPERTY PRICE, DISTANCE FROM SUPPLIERS, QUALITY OF LABOR POOL, AND LABOR COST FROM PAIRWISE COMPARISON MATRIX

Property price	0.1994
Distance from suppliers	0.6539
Quality of labor pool	0.0860
Labor cost	0.0612

Location A score = 0.1994 × (0.5013) + 0.6539 × (0.2819) + 0.0860 × (0.1789) + 0.0612 × (0.1560) = **0.3092**

Location B score = 0.1994 × (0.1185) + 0.6539 × (0.0598) + 0.0860 × (0.6851) + 0.0612 × (0.6196) = **0.1595**

Location C score = 0.1994 × (0.3803) + 0.6539 × (0.6583) + 0.0860 × (0.1360) + 0.0612 × (0.2243) = **0.5317**

TABLE XXVLOCATION SCORES

Locations	**Scores**
A	0.3092
B	0.1595
C	0.5137

Location C (0.5317) >**Location A** (0.3092) >**Location B** (0.1595)

Based on the calculated score, **location C** is one of the best locations that a company can select for expanding its business operations.

IV. CONCLUSION

AHP offers a suitable approach for solving complex MCDM problems. This paper demonstrated with an illustrative example as to how a best location can be selected from locations A, B, and C using AHP, and we finally came to a conclusion that location C is the best location. The closer the final values are with each other, the more careful a user should be. This is true with any MCDM method. The example in this paper strongly suggests that when some alternatives appear to be very close with each other, then the decision maker needs to be very cautious. An apparent remedy is to try to consider additional decision criteria that can assist in discriminating among alternatives. Although the search for finding the best MCDM method may never end, research in this area of decision making is still critical and valuable in many scientific and engineering applications.

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