Analytic Hierarchy Process-based Facility Location Decisions

By

Sakon Klongboonjit

A PROJECT

Presented to the Faculty of Graduate School of Computer and Engineering Management

In Partial Fulfillment of the Requirements for the Degree MASTER OF SCIENCE in COMPUTER AND ENGINEERING MANAGEMENT ASSUMPTION UNIVERSITY

December, 1998
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ASSUMPTION UNIVERSITY

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The Graduate School of Assumption University has approved this final report of the three-credit course, CE 6998 Project, submitted in partial fulfillment of the requirements for the degree of Master of Science in Computer and Engineering Management.
This project report presents a study on Analytic Hierarchy Process (AHP)-based facility location decisions. The AHP can be summarized in four steps: first, breaking down the decision making problem into a hierarchy of interrelated elements; second, applying pair-wise comparison judgments to express the relative strength or intensity of elements in the hierarchy; third, translating judgments into numbers using Saaty’s eigenvector weighting methods; and fourth, arranging the priority of alternatives through a synthesizing procedure. There are three case applications in this report. The first one involves an industrial plant site selection. The second deals with the application in a convenience store location decision. The last applies AHP to a document storage facility location.

The AHP facilitates location decisions by helping decision makers distinguish clearly the priority of each factor and the appropriateness of each alternative with respect to a factor by a procedure of making pair-wise comparisons. In addition, the AHP can assess consistency of judgments which is determined by an eigenvalue; thereby ensuring true reflection of decision makers’ opinions.
ACKNOWLEDGMENTS

I am indebted to the following people and organizations. Without them, this report would not have been possible.

I wish to express sincere gratitude to my advisor, Dr. Chamnong Jungthirapanich. His patient assistance, guidance, and constant encouragement has led me from the report inception to the report completion.

I would like to thank Mr. Sanong Chumchuen, general manager, and staffs at Thai Wah LG Chemical Company Limited, staffs at Hyder Consulting (Thailand) Limited for their help in gathering useful information for use in this project.

Special appreciation is due to my family and my friends for their fervent and continuous encouragement. They always exert a strong willpower for me to successfully complete this project.
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I. INTRODUCTION

For every business, the proper location is very important for the survival of the business. Due to the cost of business, the advantage of business over the competitors, and other result from the location of the business. So, the factors that have impact on selecting the location of business should be considered to obtain the proper location for the business. To obtain the proper location, we can use many techniques such as minimum-cost analysis, ranking model, the center of gravity method, and Delphi technique, etc. But each technique cannot be used with every problem. So, we should select the proper technique to solve the location problem because each technique will need different budget, different resources, and others, and each technique is proper with different situations.

At present, one of the popular techniques for solving location problems is the Analytic Hierarchy Process (AHP). This technique is an efficient method, not complex, but easy to use and understand. It is the technique that is interesting to study. So, this project will study the factors that have impact on the selection of facility locations, to study and introduce the Analytic Hierarchy Process (AHP), and apply this technique to selecting the proper location in the real problem.

A. Purposes of This Project

The purposes of this project are as follows:
• To study the factors that should be considered in selecting the location for business and influence to the survival of the business.

• To study the Analytic Hierarchy Process (AHP).

• To introduce the Analytic Hierarchy Process (AHP) and apply this technique to solve the location problems.

• To show the advantage of the Analytic Hierarchy Process to other businesses.

B. Scope of This Project

In this project, we will scope into:

• Examine location factors and their effects on plant operations.

• Apply the Analytic Hierarchy Process for selecting a facility location.

• Develop a computer program that helps select a facility location with the AHP technique.

C. Steps in the Study

We will study in following these steps:

i. Search and study the documents and theories that involve.

ii. Study the factors that relate to the selection of the location of business.

iii. Study the Analytic Hierarchy Process (AHP).

iv. Find the interesting location problems to do case study.
v. Study the factors that have impact on selecting the proper location of business in each case study.

vi. Set the questionnaires for each case study.

vii. Gather the data for each case study with the questionnaires.

viii. Develop software program to analyze the obtained data with the Analytic Hierarchy Process (AHP).

ix. Analyze the data for each case study with the software program.

x. Conclude and recommend the results that are obtained from each case study.

D. Deliverables

Successful applications of the AHP technique on facility location selection.

E. About This Report

This report consists of many chapters as follows:

- Chapter I Introduction. It is about the purposes and scope of this project, steps in the study, and Deliverables.

- Chapter II Facility Location. It is about the reason in selecting location and the factors that are considered in selecting the location.

- Chapter III The Analytic Hierarchy Process. It is about the Analytic Hierarchy Process (AHP) theory.

- Chapter IV The Application of the Analytic Hierarchy Process in the Plant Site Selection. It is the case study that applies the Analytic Hierarchy Process (AHP) to the
Sorbital plant site selection and compares the result from the AHP with the real decision in selecting the location of the Sorbital plant of company.

- Chapter V The Application of the Analytic Hierarchy Process in the Convenience Store Location Decision. It is the case study that applies the Analytic Hierarchy Process (AHP) for the convenience store location decision and compares the result from the AHP with the real decision in selecting the location of the convenience store of franchise company.

- Chapter VI The Application of the Analytic Hierarchy Process in the Document Warehouse Facility Location. It is the case study that applies the Analytic Hierarchy Process (AHP) for the document warehouse facility location and compares the result from the AHP with the real decision in selecting the location of the document warehouse of the bank.

- Chapter VII Conclusions and Recommendations.
• Moving to congested areas already or about to be over-industrialized.
• Preference for acquiring an existing structure that is improperly located or not designed for the most efficient production.
• Choice of a community with low cultural and educational standards, so that key administrative and technical personnel eventually accept employment elsewhere.

Many of these can be avoided by a careful, open-minded analysis of the entire problem with personal whims and apparently overwhelming factors giving way to reason.

C. Basic Data Required

One of the early tasks is the collection of preliminary information and data with which to begin the decision-making process for the site selection process. Data required for the consideration are:

The data for determining the appropriate land area:

• Establish the total building floor area, including any upper floor levels, to determine probable ground building area. Project the building area in accordance with potential expansion of facilities.

• Check codes for allowable ground coverage, or estimate the total land as a total of all usage factors. Compare this total with legally specified setbacks from property lines to determine that net remaining land will be sufficient.
• Establish parking areas. Parking lots often require an area equaling the net ground area occupied by buildings. Obviously, this depends on the number of car spaces needed. Suburban plants frequently require parking spaces equal in number to 75 percent of their employees. Urban locations, with public transit, may require parking spaces for only 35 percent.

• Others.

Contingency planning, always wise where variables have yet to be resolved, should leave it open whether to acquire more land than minimum conditions would call for. Additional land area can allow for unexpected opportunities for expansion; and an open site appearance can help make it attractive to desired employees.

The basic data is about account.

• Available capital.

• Relationship of product to an area of the country: such as snowmobiles, and peanut butter.

• Necessary support facilities: such as outbuildings, water treatment, waste treatment, and large storage piles.

• Business trends: industry; company.

• Competition.

• Others.
D. Selected Factors for Consideration of Facility Location

As mentioned before, there are many different factors that affect directly the consideration of the selection of the facility location. Different businesses will have different factors to consider. This depends on the type of business. The list of factors below are the factors that the investors should attend to:

- Market.
  - Location.
  - Population trends.
  - Income trends.
  - Consumer characteristics.
  - Retail sales trends.
  - Industrial markets.
  - Competition.

- Raw Material.
  - Type.
  - Location of sources.
  - Characteristics.
  - Price.
  - Terms of sale.
  - Availability.
  - Storage facilities.
• Labor.
  – Cost.
  – Attitudes.
  – Union situation.
  – Supply.
  – Location.
  – Personnel policies in area.
  – Legislation.
  – Recruiting.
  – Community pattern.
  – Relocation.

• Transportation.
  – Modes of transportation.
  – Methods of operation.
  – Handling methods.
  – Facilities.
  – Costs.
  – Freight rates.

• Utilities.
  – Power.
  – Water.
  – Fuel.
  – Waste.
  – Communications.
• Climate.
  - Maximum and minimum temperatures.
  - Direction of winds.
  - Weather changes.
  - Humidity.
  - Elevation.
  - Climatic effects.
  - Special weather hazards.

• Government activities in area.

• Financing.
  - Financial aid available.
  - Requirements.
  - Credit factors.
  - Factors effecting loan terms.
  - Special inducements: taxes, loans, buildings.

• Government and taxes.
  - Structure.
  - Financial assistance.
  - Financial conditions.
  - Civic attitudes.
  - Government attitudes.
  - Government regulations and legislation.
  - Taxes.
  - Future tax prospects.
• Community facilities.

• Community appearance.

• The size of the community.

• Population trend.

• Community planning and zoning.
  - Planning commission.
  - Industrial zoning.
  - Building codes.
  - Traffic and parking.
  - Streets.

• Others.
  - Cost of living.
  - Insurance.
  - Construction costs.
  - Location relative to competition.
  - Size and character of other local industries.
  - Buying habits.

• Individual sites.
  - Requirements.
  - Size and shape of site.
  - Geologic considerations.
  - Cost of development.
  - Location within the community.
  - Availability of transportation.
- Topography.
- Price of land.
- Availability of building.
- Personal factors.
- Intangible consideration.

The selection of a facility location is not a problem to be taken lightly. It is one of the most important decisions a firm is called upon to make, and the wisdom of a choice can influence the profits of a company for years to come.

In this report, the technique which will be discussed later to find the best location for the plant is the Analytic Hierarchy Process. The other techniques will be shown in Appendix A.
III. THE ANALYTIC HIERARCHY PROCESS

A. The Analytic Hierarchy Process (AHP)

The AHP, introduced by Thomas Saaty, is a multi-criteria decision-making technique that is particularly useful for complex multi-attribute alternatives involving subjective or intangible criteria. The method can be summarized as a four-step approach. (Satty, 1980)

Firstly, a decision hierarchy is set up by breaking down the decision problem into a hierarchy of interrelated elements. Figure 3.1 depicts a typical form of the hierarchy.

[Diagram of the hierarchy]

Figure 3.1. Show the Hierarchy of Elements (Goh and et al., 1998)
Secondly, the decision maker is then guided through a series of pair-wise comparison judgments to express the relative strength or intensity of the elements in the hierarchy.

Thirdly, the judgments are translated into numbers using Saaty’s eigenvector weighting methods.

Finally, a list of priority of the alternatives is carried out through a synthesizing procedure. (Goh and et al., 1998)

The AHP has been applied in the highly diversified areas, from economics and planning to telecommunication equipment selection and architecture. The AHP also has been applied to prioritize quality issues associated with projects in an industrial research laboratory. It is appealing because of its ability to deal with large-scale real-world problems, to handle both tangible and intangible attributes, and to monitor the consistency with which a decision maker makes judgments.

B. The Four-Step Approach

The four-step of AHP consists of the following steps as follows:

- Break Down of the Decision Problem into a Hierarchy of Interrelated Element.
  
  i. Determine the goal of the problem.

  ii. Determine the factors that are used to be criteria in making a decision.
iii. Build the hierarchy of every factor.

iv. In the last level, it is the level of alternatives.

An example of the four-level problem in the first step can be illustrated in Figure 3.2.

![Figure 3.2. The Four-Level Problem](image)

- Pair-wise Comparison Judgment. In this step, the factors in each level will be compared by a pair-wise comparison technique under the factor in the upper level. The data will be obtained from the questionnaires which are sent to some experts in the field that involve the problem.

An example of the pair-wise comparison for the four-levels problem in Figure 3.2 is showed as follows:

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<tr>
<th>Column I</th>
<th>absolute</th>
<th>very strong</th>
<th>strong</th>
<th>weak</th>
<th>equal</th>
<th>weak</th>
<th>strong</th>
<th>very strong</th>
<th>absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1</td>
<td>+2 +3 +4 +5 +6 +7 +8 +9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternative 2</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1</td>
<td>+2 +3 +4 +5 +6 +7 +8 +9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternative 3</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1</td>
<td>+2 +3 +4 +5 +6 +7 +8 +9</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Under the Sub-factor 21

<table>
<thead>
<tr>
<th>Column I</th>
<th>absolute</th>
<th>very strong</th>
<th>strong</th>
<th>weak</th>
<th>equal</th>
<th>weak</th>
<th>strong</th>
<th>very strong</th>
<th>absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1</td>
<td>+2 +3 +4 +5 +6 +7 +8 +9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternative 2</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1</td>
<td>+2 +3 +4 +5 +6 +7 +8 +9</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>
Under the Sub-factor 22

<table>
<thead>
<tr>
<th>Column I</th>
<th>abso-</th>
<th>very</th>
<th>strong</th>
<th>weak</th>
<th>equal</th>
<th>weak</th>
<th>strong</th>
<th>very</th>
<th>abso-</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
<td>Alternative 2</td>
</tr>
<tr>
<td>Alternative 1</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
<td>Alternative 3</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
<td>Alternative 3</td>
</tr>
</tbody>
</table>

The explanation of scale comparison can be shown in Table 3.1.

Table 3.1. Meaning of Scale Comparison

<table>
<thead>
<tr>
<th>Intensity of importance</th>
<th>Definition</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equal importance</td>
<td>Two activities contribute equally to the objective</td>
</tr>
<tr>
<td>3</td>
<td>Weak importance of one over another</td>
<td>Experience and judgment slightly favor one activity over another</td>
</tr>
<tr>
<td>5</td>
<td>Essential or strong importance</td>
<td>Experience and judgment strongly favor one activity over another</td>
</tr>
<tr>
<td>7</td>
<td>Very strong or demonstrated importance</td>
<td>An activity is favored very strongly over another; its dominance demonstrated in practice</td>
</tr>
<tr>
<td>9</td>
<td>Absolute importance</td>
<td>The evidence favoring one activity over another is of the highest possible order of affirmation</td>
</tr>
<tr>
<td>2, 4, 6, 8</td>
<td>Intermediate values between adjacent scale values</td>
<td>When compromise is needed</td>
</tr>
</tbody>
</table>

*Example

Under the goal

<table>
<thead>
<tr>
<th>Column I</th>
<th>abso-</th>
<th>very</th>
<th>strong</th>
<th>weak</th>
<th>equal</th>
<th>weak</th>
<th>strong</th>
<th>very</th>
<th>abso-</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
<td>Factor 2</td>
</tr>
</tbody>
</table>

It means factor 1 is slightly more important than factor 2 under the goal.

Under the goal

<table>
<thead>
<tr>
<th>Column I</th>
<th>abso-</th>
<th>very</th>
<th>strong</th>
<th>weak</th>
<th>equal</th>
<th>weak</th>
<th>strong</th>
<th>very</th>
<th>abso-</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
<td>Factor 2</td>
</tr>
</tbody>
</table>

It means factor 2 is more important than factor 1 under the goal.
• Translate the Judgment into Numbers by Using Saaty's Eigenvector Weight Method.

- Transfer the Data in the Second Step into the Reciprocal Matrix. From the judgment in the second step;

Under the goal

<table>
<thead>
<tr>
<th>Column I</th>
<th>absolute</th>
<th>very strong</th>
<th>strong</th>
<th>weak</th>
<th>equal</th>
<th>weak</th>
<th>strong</th>
<th>very absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
</tr>
<tr>
<td>Factor 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Column II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Transfer into Matrix

<table>
<thead>
<tr>
<th>The goal</th>
<th>Factor 1</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>a12</td>
</tr>
<tr>
<td>Factor 2</td>
<td>a21</td>
<td>1</td>
</tr>
</tbody>
</table>

$\text{aji} = \text{The important value of factor i compared with factor j.}$

(It is obtained from the data in the second step.)

$\text{aji} = 1/\text{aij} \text{ (a reciprocal matrix)}$

Under the factor 1

<table>
<thead>
<tr>
<th>Column I</th>
<th>absolute</th>
<th>very strong</th>
<th>strong</th>
<th>weak</th>
<th>equal</th>
<th>weak</th>
<th>strong</th>
<th>very absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-factor 11</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
</tr>
<tr>
<td>Sub-factor 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-factor 12</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
</tr>
<tr>
<td>Sub-factor 12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-factor 13</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
</tr>
<tr>
<td>Sub-factor 13</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Transfer into Matrix

<table>
<thead>
<tr>
<th>The factor 1</th>
<th>Sub-factor 11</th>
<th>Sub-factor 12</th>
<th>Sub-factor 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-factor 11</td>
<td>1</td>
<td>b12</td>
<td>b13</td>
</tr>
<tr>
<td>Sub-factor 12</td>
<td>b21</td>
<td>1</td>
<td>b23</td>
</tr>
<tr>
<td>Sub-factor 13</td>
<td>b31</td>
<td>b32</td>
<td>1</td>
</tr>
</tbody>
</table>

$\text{bji} = 1/\text{bij} \text{ (a reciprocal matrix)}$

Under the factor 2

<table>
<thead>
<tr>
<th>Column I</th>
<th>absolute</th>
<th>very strong</th>
<th>strong</th>
<th>weak</th>
<th>equal</th>
<th>weak</th>
<th>strong</th>
<th>very absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-factor 21</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
</tr>
<tr>
<td>Sub-factor 21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sub-factor 22</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
</tr>
<tr>
<td>Sub-factor 22</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Transfer into Matrix

<table>
<thead>
<tr>
<th>The factor 2</th>
<th>Sub-factor 21</th>
<th>Sub-factor 22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-factor 21</td>
<td>1</td>
<td>c12</td>
</tr>
<tr>
<td>Sub-factor 22</td>
<td>c21</td>
<td>1</td>
</tr>
</tbody>
</table>

$cji = 1/cij \text{ (a reciprocal matrix)}$
Under the Sub-factor 11

<table>
<thead>
<tr>
<th>Column I</th>
<th>absolute very strong strong weak equal weak strong very absolute</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 2</td>
</tr>
<tr>
<td>Alternative 1</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 3</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 3</td>
</tr>
</tbody>
</table>

Transfer into Matrix

<table>
<thead>
<tr>
<th>The Sub-factor 11</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>1</td>
<td>d12</td>
<td>d13</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>d21</td>
<td>1</td>
<td>d23</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>d31</td>
<td>d32</td>
<td>1</td>
</tr>
</tbody>
</table>

dji = 1/dij (a reciprocal matrix)

Under the Sub-factor 12

<table>
<thead>
<tr>
<th>Column I</th>
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<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 2</td>
</tr>
<tr>
<td>Alternative 1</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 3</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 3</td>
</tr>
</tbody>
</table>

Transfer into Matrix

<table>
<thead>
<tr>
<th>The Sub-factor 12</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>1</td>
<td>e12</td>
<td>e13</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>e21</td>
<td>1</td>
<td>e23</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>e31</td>
<td>e32</td>
<td>1</td>
</tr>
</tbody>
</table>
eji = 1/eij (a reciprocal matrix)

Under the Sub-factor 13

<table>
<thead>
<tr>
<th>Column I</th>
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<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 2</td>
</tr>
<tr>
<td>Alternative 1</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 3</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 3</td>
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</table>

Transfer into Matrix

<table>
<thead>
<tr>
<th>The Sub-factor 13</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>1</td>
<td>f12</td>
<td>f13</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>f21</td>
<td>1</td>
<td>f23</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>f31</td>
<td>f32</td>
<td>1</td>
</tr>
</tbody>
</table>
fij = 1/fij (a reciprocal matrix)

Under the Sub-factor 21

<table>
<thead>
<tr>
<th>Column I</th>
<th>absolute very strong strong weak equal weak strong very absolute</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 2</td>
</tr>
<tr>
<td>Alternative 1</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 3</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>+9 +8 +7 +6 +5 +4 +3 +2 +1 +2 +3 +4 +5 +6 +7 +8 +9</td>
<td>Alternative 3</td>
</tr>
</tbody>
</table>
Transfer into Matrix

<table>
<thead>
<tr>
<th>The Sub-factor 21</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>1</td>
<td>g12</td>
<td>g13</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>g21</td>
<td>1</td>
<td>g23</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>g31</td>
<td>g32</td>
<td>1</td>
</tr>
</tbody>
</table>

g_{ij} = 1/g_{ij} (a reciprocal matrix)

Under the Sub-factor 22

<table>
<thead>
<tr>
<th>Column I</th>
<th>absolute</th>
<th>very</th>
<th>strong</th>
<th>weak</th>
<th>equal</th>
<th>weak</th>
<th>strong</th>
<th>very</th>
<th>absolute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
</tr>
<tr>
<td>Alternative 1</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>+9</td>
<td>+8</td>
<td>+7</td>
<td>+6</td>
<td>+5</td>
<td>+4</td>
<td>+3</td>
<td>+2</td>
<td>+1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Column II</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternative 3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Transfer into Matrix

<table>
<thead>
<tr>
<th>The Sub-factor 22</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>1</td>
<td>h12</td>
<td>h13</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>h21</td>
<td>1</td>
<td>h23</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>h31</td>
<td>h32</td>
<td>1</td>
</tr>
</tbody>
</table>

h_{ij} = 1/h_{ij} (a reciprocal matrix)

- Calculate the Eigenvector or the Matrix of Weight for Each Matrix. If there is the reciprocal matrix (size $m \times m$) as follows:

<table>
<thead>
<tr>
<th>The upper factor</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>...</th>
<th>Factor m</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>A12</td>
<td>...</td>
<td>A1m</td>
<td>w1</td>
</tr>
<tr>
<td>Factor 2</td>
<td>A21</td>
<td>1</td>
<td>...</td>
<td>A2m</td>
<td>w2</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Factor m</td>
<td>Am1</td>
<td>Am2</td>
<td>...</td>
<td>1</td>
<td>wn</td>
</tr>
<tr>
<td>Total</td>
<td>(1+A21+...+Am1)</td>
<td>(A12+1+...+Am2)</td>
<td>(A1m+A2m+...+1)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

$w_1$ = The weight of factor 1 under the upper factor.

$w_2$ = The weight of factor 2 under the upper factor.

$w_m$ = The weight of factor $m$ under the upper factor.
\[ w_1 = \text{Average}(1/(1+A_{21}+\ldots+A_{m1}), A_{12}/(A_{12}+1+\ldots+A_{m2}), \ldots, A_{m1}/(A_{m1}+A_{2m}+\ldots+1)) \]
\[ = \{1/(1+A_{21}+\ldots+A_{m1})+A_{12}/(A_{12}+1+\ldots+A_{m2})+\ldots+A_{m1}/(A_{m1}+A_{2m}+\ldots+1)\} / m \]

\[ w_2 = \text{Average}(A_{21}/(1+A_{21}+\ldots+A_{m1}), 1/(A_{12}+1+\ldots+A_{m2}), \ldots, A_{2m}/(A_{m1}+A_{2m}+\ldots+1)) \]
\[ = \{A_{21}/(1+A_{21}+\ldots+A_{m1})+1/(A_{12}+1+\ldots+A_{m2})+\ldots+A_{2m}/(A_{m1}+A_{2m}+\ldots+1)\} / m \]

\[ w_m = \text{Average}(A_{m1}/(1+A_{21}+\ldots+A_{m1}), A_{m2}/(A_{12}+1+\ldots+A_{m2}), \ldots, 1/(A_{m1}+A_{2m}+\ldots+1)) \]
\[ = \{A_{m1}/(1+A_{21}+\ldots+A_{m1})+A_{m2}/(A_{12}+1+\ldots+A_{m2})+\ldots+1/(A_{m1}+A_{2m}+\ldots+1)\} / m \]

\([w_1, w_2, \ldots, w_m]\) is the eigenvector for this matrix.

An example

Under the goal

<table>
<thead>
<tr>
<th>The goal</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>a_{12}</td>
<td>w.f.1</td>
</tr>
<tr>
<td>Factor 2</td>
<td>a_{21}</td>
<td>1</td>
<td>w.f.2</td>
</tr>
<tr>
<td>Total</td>
<td>(1+a_{21})</td>
<td>(a_{12}+1)</td>
<td>1</td>
</tr>
</tbody>
</table>

w.f.1 = The weight of factor 1 under the goal.

w.f.2 = The weight of factor 2 under the goal.

w.f.1 = Average ( 1/(1+a_{21}) , a_{12}/(a_{12}+1) )
\[ = \{1/(1+a_{21}) + a_{12}/(a_{12}+1)\} / 2 \]

w.f.2 = Average ( a_{21}/(1+a_{21}) , 1/(a_{12}+1) )
\[ = \{a_{21}/(1+a_{21}) + 1/(a_{12}+1)\} / 2 \]

w.f.1 + w.f.2 = 1 ( It is a reciprocal matrix )

[w.f.1, w.f.2] is the eigenvector for this matrix.
Under the factor 1

<table>
<thead>
<tr>
<th>The factor 1</th>
<th>Sub-factor 11</th>
<th>Sub-factor 12</th>
<th>Sub-factor 13</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-factor 11</td>
<td>1</td>
<td>b12</td>
<td>b13</td>
<td>w.s.f 11</td>
</tr>
<tr>
<td>Sub-factor 12</td>
<td>b21</td>
<td>1</td>
<td>b23</td>
<td>w.s.f 12</td>
</tr>
<tr>
<td>Sub-factor 13</td>
<td>b31</td>
<td>b32</td>
<td>1</td>
<td>w.s.f 13</td>
</tr>
<tr>
<td>Total</td>
<td>(1+b21+b31)</td>
<td>(b12+1+b32)</td>
<td>(b13+b23+1)</td>
<td>1</td>
</tr>
</tbody>
</table>

w.s.f 11 = The weight of Sub-factor 11 under the factor 1.

w.s.f 12 = The weight of Sub-factor 12 under the factor 1.

w.s.f 13 = The weight of Sub-factor 13 under the factor 1.

w.s.f 11 = Average\(\frac{1}{1+b21+b31},\frac{b12}{b12+1+b32},\frac{b13}{b13+b23+1}\)  
= \(\frac{1}{1+b21+b31}+\frac{b12}{b12+1+b32}+\frac{b13}{b13+b23+1}\)/3

w.s.f 12 = Average\(\frac{b21}{1+b21+b31},\frac{1}{b12+1+b32},\frac{b23}{b13+b23+1}\)  
= \(\frac{b21}{1+b21+b31}+\frac{1}{b12+1+b32}+\frac{b23}{b13+b23+1}\)/3

w.s.f 13 = Average\(\frac{b31}{1+b21+b31},\frac{b32}{b12+1+b32},\frac{1}{b13+b23+1}\)  
= \(\frac{b31}{1+b21+b31}+\frac{b32}{b12+1+b32}+\frac{1}{b13+b23+1}\)/3

w.s.f 11 + w.s.f 12 + w.s.f 13 = 1 (It is a reciprocal matrix.)

[w.s.f 11, w.s.f 12, w.s.f 13] is the eigenvector for this matrix.

Under the factor 2

<table>
<thead>
<tr>
<th>The factor 2</th>
<th>Sub-factor 21</th>
<th>Sub-factor 22</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-factor 21</td>
<td>1</td>
<td>c12</td>
<td>w.s.f 21</td>
</tr>
<tr>
<td>Sub-factor 22</td>
<td>c21</td>
<td>1</td>
<td>w.s.f 22</td>
</tr>
<tr>
<td>Total</td>
<td>(1+c21)</td>
<td>(c12+1)</td>
<td>1</td>
</tr>
</tbody>
</table>

w.s.f 21 = The weight of Sub-factor 21 under the factor 2.

w.s.f 22 = The weight of Sub-factor 22 under the factor 2.

w.s.f 21 = Average\(\frac{1}{1+c21},\frac{c12}{c12+1}\)  
= \(\frac{1}{1+c21} + \frac{c12}{c12+1}\) / 2

w.s.f 22 = Average\(\frac{c21}{1+c21},\frac{1}{c12+1}\)
\[ \{ c_{21}/(1+c_{21}) + 1/(c_{12}+1) \} / 2 \]

\[ w.s.f_{21} + w.s.f_{22} = 1 \text{ (It is a reciprocal matrix)} \]

\[ [ w.s.f_{21}, w.s.f_{22} ] \text{ is the eigenvector for this matrix.} \]

Under the Sub-factor 11

<table>
<thead>
<tr>
<th>The Sub-factor 11</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>1</td>
<td>d_{12}</td>
<td>d_{13}</td>
<td>w.a 111</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>d_{21}</td>
<td>1</td>
<td>d_{23}</td>
<td>w.a 112</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>d_{31}</td>
<td>d_{32}</td>
<td>1</td>
<td>w.a 113</td>
</tr>
<tr>
<td>Total</td>
<td>(1+d_{21}+d_{31})</td>
<td>(d_{12}+1+d_{32})</td>
<td>(d_{13}+d_{23}+1)</td>
<td>1</td>
</tr>
</tbody>
</table>

\[ w.a 111 = \text{The weight of Alternative 1 under the Sub-factor 11.} \]
\[ w.a 112 = \text{The weight of Alternative 2 under the Sub-factor 11.} \]
\[ w.a 113 = \text{The weight of Alternative 3 under the Sub-factor 11.} \]

\[ w.a 111 = \text{Average}(1/(1+d_{21}+d_{31}),d_{12}/(d_{12}+1+d_{32}),d_{13}/(d_{13}+d_{23}+1)) \]
\[ = \{1/(1+d_{21}+d_{31})+d_{12}/(d_{12}+1+d_{32})+d_{13}/(d_{13}+d_{23}+1)\}/3 \]

\[ w.a 112 = \text{Average}(d_{21}/(1+d_{21}+d_{31}),1/(d_{12}+1+d_{32}),d_{23}/(d_{13}+d_{23}+1)) \]
\[ = \{d_{21}/(1+d_{21}+d_{31})+1/(d_{12}+1+d_{32})+d_{23}/(d_{13}+d_{23}+1)\}/3 \]

\[ w.a 113 = \text{Average}(d_{31}/(1+d_{21}+d_{31}),d_{32}/(d_{12}+1+d_{32}),1/(d_{13}+d_{23}+1)) \]
\[ = \{d_{31}/(1+d_{21}+d_{31})+d_{32}/(d_{12}+1+d_{32})+1/(d_{13}+d_{23}+1)\}/3 \]

\[ w.a 111 + w.a 112 + w.a 113 = 1 \text{ (It is a reciprocal matrix.)} \]

\[ [ w.a 111, w.a 112, w.a 113 ] \text{ is the eigenvector for this matrix.} \]

Under the Sub-factor 12

<table>
<thead>
<tr>
<th>The Sub-factor 12</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>1</td>
<td>e_{12}</td>
<td>e_{13}</td>
<td>w.a 121</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>e_{21}</td>
<td>1</td>
<td>e_{23}</td>
<td>w.a 122</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>e_{31}</td>
<td>e_{32}</td>
<td>1</td>
<td>w.a 123</td>
</tr>
<tr>
<td>Total</td>
<td>(1+e_{21}+e_{31})</td>
<td>(e_{12}+1+e_{32})</td>
<td>(e_{13}+e_{23}+1)</td>
<td>1</td>
</tr>
</tbody>
</table>

\[ w.a 121 = \text{The weight of Alternative 1 under the Sub-factor 12.} \]
w.a 122 = The weight of Alternative2 under the Sub-factor 12.

w.a 123 = The weight of Alternative3 under the Sub-factor 12.

w.a 121 = \( \text{Average}(1/(1+e21+e31), e12/(e12+1+e32), e13/(e13+e23+1)) \)
\( = \{1/(1+e21+e31)+e12/(e12+1+e32)+e13/(e13+e23+1)\}/3 \)

w.a 122 = \( \text{Average}(e21/(1+e21+e31), 1/(e12+1+e32), e23/(e13+e23+1)) \)
\( = \{e21/(1+e21+e31)+1/(e12+1+e32)+e23/(e13+e23+1)\}/3 \)

w.a 123 = \( \text{Average}(e31/(1+e21+e31), e32/(e12+1+e32), 1/(e13+e23+1)) \)
\( = \{e31/(1+e21+e31)+e32/(e12+1+e32)+1/(e13+e23+1)\}/3 \)

w.a 121 + w.a 122 + w.a 123 = 1 (It is a reciprocal matrix.)

\[ \text{[w.a 121 , w.a 122 , w.a 123]} \] is the eigenvector for this matrix.

Under the Sub-factor 13

<table>
<thead>
<tr>
<th>The Sub-factor 13</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>1</td>
<td>f12</td>
<td>f13</td>
<td>w.a 131</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>f21</td>
<td>1</td>
<td>f23</td>
<td>w.a 132</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>f31</td>
<td>f32</td>
<td>1</td>
<td>w.a 133</td>
</tr>
<tr>
<td>Total</td>
<td>(1+f21+f31)</td>
<td>(f12+1+f32)</td>
<td>(f13+f23+1)</td>
<td>1</td>
</tr>
</tbody>
</table>

w.a 131 = The weight of Alternative1 under the Sub-factor 13.

w.a 132 = The weight of Alternative2 under the Sub-factor 13.

w.a 133 = The weight of Alternative3 under the Sub-factor 13.

w.a 131 = \( \text{Average}(1/(1+f21+f31), f12/(f12+1+f32), f13/(f13+f23+1)) \)
\( = \{1/(1+f21+f31)+f12/(f12+1+f32)+f13/(f13+f23+1)\}/3 \)

w.a 132 = \( \text{Average}(f21/(1+f21+f31), 1/(f12+1+f32), f23/(f13+f23+1)) \)
\( = \{f21/(1+f21+f31)+1/(f12+1+f32)+f23/(f13+f23+1)\}/3 \)

w.a 133 = \( \text{Average}(f31/(1+f21+f31), f32/(f12+1+f32), 1/(f13+f23+1)) \)
\( = \{f31/(1+f21+f31)+f32/(f12+1+f32)+1/(f13+f23+1)\}/3 \)

w.a 131 + w.a 132 + w.a 133 = 1 (It is a reciprocal matrix.)
\[ \text{is the eigenvector for this matrix.} \]

**Under the Sub-factor 21**

<table>
<thead>
<tr>
<th>The Sub-factor 21</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>1</td>
<td>g12</td>
<td>g13</td>
<td>w.a 211</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>g21</td>
<td>1</td>
<td>g23</td>
<td>w.a 212</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>g31</td>
<td>g32</td>
<td>1</td>
<td>w.a 213</td>
</tr>
<tr>
<td>Total</td>
<td>(1+g21+g31)</td>
<td>(g12+1+g32)</td>
<td>(g13+g23+1)</td>
<td>1</td>
</tr>
</tbody>
</table>

w.a 211 = The weight of Alternative 1 under the Sub-factor 21.

w.a 212 = The weight of Alternative 2 under the Sub-factor 21.

w.a 213 = The weight of Alternative 3 under the Sub-factor 21.

\[ \text{w.a 211} = \text{Average}(1/(1+g21+g31), g12/(g12+1+g32), g13/(g13+g23+1)) \]
\[ = \{1/(1+g21+g31)+g12/(g12+1+g32)+g13/(g13+g23+1)\}/3 \]

w.a 212 = Average(g21/(1+g21+g31), 1/(g12+1+g32), g23/(g13+g23+1))
\[ = \{g21/(1+g21+g31)+1/(g12+1+g32)+g23/(g13+g23+1)\}/3 \]

w.a 213 = Average(g31/(1+g21+g31), g32/(g12+1+g32), 1/(g13+g23+1))
\[ = \{g31/(1+g21+g31)+g32/(g12+1+g32)+1/(g13+g23+1)\}/3 \]

w.a 211 + w.a 212 + w.a 213 = 1 (It is a reciprocal matrix.)

[ w.a 211 , w.a 212 , w.a 213 ] is the eigenvector for this matrix.

**Under the Sub-factor 22**

<table>
<thead>
<tr>
<th>The Sub-factor 22</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternative 1</td>
<td>1</td>
<td>h12</td>
<td>h13</td>
<td>w.a 221</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>h21</td>
<td>1</td>
<td>h23</td>
<td>w.a 222</td>
</tr>
<tr>
<td>Alternative 3</td>
<td>h31</td>
<td>h32</td>
<td>1</td>
<td>w.a 223</td>
</tr>
<tr>
<td>Total</td>
<td>(1+h21+h31)</td>
<td>(h12+1+h32)</td>
<td>(h13+h23+1)</td>
<td>1</td>
</tr>
</tbody>
</table>

w.a 221 = The weight of Alternative 1 under the Sub-factor 22.

w.a 222 = The weight of Alternative 2 under the Sub-factor 22.

w.a 223 = The weight of Alternative 3 under the Sub-factor 22.
\[ w.a_{221} = \text{Average}(1/(1+h_{21}+h_{31}), h_{12}/(h_{12}+1+h_{32}), h_{13}/(h_{13}+h_{23}+1)) \]
\[ = \{1/(1+h_{21}+h_{31})+h_{12}/(h_{12}+1+h_{32})+h_{13}/(h_{13}+h_{23}+1)\}/3 \]
\[ w.a_{222} = \text{Average}(h_{21}/(1+h_{21}+h_{31}), 1/(h_{12}+1+h_{32}), h_{23}/(h_{13}+h_{23}+1)) \]
\[ = \{h_{21}/(1+h_{21}+h_{31})+1/(h_{12}+1+h_{32})+h_{23}/(h_{13}+h_{23}+1)\}/3 \]
\[ w.a_{223} = \text{Average}(h_{31}/(1+h_{21}+h_{31}), h_{32}/(h_{12}+1+h_{32}), 1/(h_{13}+h_{23}+1)) \]
\[ = \{h_{31}/(1+h_{21}+h_{31})+h_{32}/(h_{12}+1+h_{32})+1/(h_{13}+h_{23}+1)\}/3 \]
\[ w.a_{221} + w.a_{222} + w.a_{223} = 1 \quad (\text{It is a reciprocal matrix.}) \]

\([ w.a_{221} , w.a_{222} , w.a_{223} ] \text{ is the eigenvector for this matrix.} \]

- Calculate the Consistency Index (C.I.), Consistency Ratio (C.R.), and Eigenvalue ($\lambda_{\text{max}}$). If there is the reciprocal matrix (size m x m) as follows:

<table>
<thead>
<tr>
<th>The upper factor</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>\ldots</th>
<th>Factor m</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>1</td>
<td>A_{12}</td>
<td>\ldots</td>
<td>A_{1m}</td>
<td>w_1</td>
</tr>
<tr>
<td>Factor 2</td>
<td>A_{21}</td>
<td>1</td>
<td>\ldots</td>
<td>A_{2m}</td>
<td>w_2</td>
</tr>
<tr>
<td>\vdots</td>
<td>\vdots</td>
<td>\vdots</td>
<td>\ldots</td>
<td>\vdots</td>
<td>\vdots</td>
</tr>
<tr>
<td>Factor m</td>
<td>A_{m1}</td>
<td>A_{m2}</td>
<td>\ldots</td>
<td>1</td>
<td>w_m</td>
</tr>
<tr>
<td>Total</td>
<td>(1+A_{21}+\ldots+A_{m1})</td>
<td>(A_{12}+1+\ldots+A_{m2})</td>
<td>(A_{1m}+A_{2m}+\ldots+1)</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

\[ A_{ij} = 1/A_{ji} \]
\[ A_{ik} = A_{ij} \ast A_{jk} ; \text{for all } i,j,k \]
\[ A_{ij} = w_i/w_j \quad ; \quad i, j = 1, 2, \ldots, m \]
\[ A_{ji} = w_j/w_i \quad ; \quad i, j = 1, 2, \ldots, m \]

w_1 = \text{The weight of factor 1 under the upper factor.}

w_2 = \text{The weight of factor 2 under the upper factor.}
wm = The weight of factor m under the upper factor.

\[ w_1 = \text{Average}(1/(1+A_{21}+\ldots+A_{ml}), A_{12}/(A_{12}+1+\ldots+A_{ml}), \ldots, A_{1m}/(A_{1m}+A_{2m}+\ldots+1)) \]

\[ = \{1/(1+A_{21}+\ldots+A_{ml})+A_{12}/(A_{12}+1+\ldots+A_{ml})+\ldots+A_{1m}/(A_{1m}+A_{2m}+\ldots+1)\} / m \]

\[ w_2 = \text{Average}(A_{21}/(1+A_{21}+\ldots+A_{ml}), 1/(A_{12}+1+\ldots+A_{ml}), \ldots, A_{2m}/(A_{1m}+A_{2m}+\ldots+1)) \]

\[ = \{A_{21}/(1+A_{21}+\ldots+A_{ml})+1/(A_{12}+1+\ldots+A_{ml})+\ldots+A_{2m}/(A_{1m}+A_{2m}+\ldots+1)\} / m \]

\[ w_m = \text{Average}(A_{ml}/(1+A_{21}+\ldots+A_{ml}), A_{m2}/(A_{12}+1+\ldots+A_{ml}), \ldots, 1/(A_{1m}+A_{2m}+\ldots+1)) \]

\[ = \{A_{ml}/(1+A_{21}+\ldots+A_{ml})+A_{m2}/(A_{12}+1+\ldots+A_{ml})+\ldots+1/(A_{1m}+A_{2m}+\ldots+1)\} / m \]

\[ [w_1, w_2, \ldots, w_m] \text{ is the eigenvector for this matrix.} \]

Multiple the matrix \((A_{ij})\) by its eigenvector on the right.

\[
\begin{pmatrix}
1 & A_{12} & \ldots & A_{1m} \\
A_{21} & 1 & \ldots & A_{2m} \\
\vdots & \vdots & \ddots & \vdots \\
A_{ml} & A_{m2} & \ldots & 1
\end{pmatrix} \cdot \begin{pmatrix}
w_1 \\
w_2 \\
\vdots \\
w_m
\end{pmatrix} = \begin{pmatrix}
y_1 \\
y_2 \\
\vdots \\
y_m
\end{pmatrix}
\]

\[
\lambda_{\text{max}} = \text{Average} (y_1/w_1, y_2/w_2, \ldots, y_m/w_m)
\]

\[
= \{y_1/w_1 + y_2/w_2 + \ldots + y_m/w_m\} / m
\]

(If the matrix \((A_{ij})\) is the consistency matrix \(\lambda_{\text{max}}\) will equal to \(m\).)

The Consistency Index (C.I.) will show the deviation of \(\lambda_{\text{max}}\) from \(m\).

\[ \text{C.I.} = (\lambda_{\text{max}} - n) / (n - 1) \]

(The data obtained from the second step will be used in making a decision, if the C.I. is less than 0.1.)

The Consistency Ratio (C.R.) is the ratio of C.I. to R.I.
C.R. = C.I. / R.I.

R.I. is the Random Index (We shall call it the consistency index of a randomly generated reciprocal matrix from the scale 1 to 9, with reciprocals forced).

At Oak Ridge National Laboratory, colleagues generated an average R.I. for matrices of order 1 - 15. It can be shown in the Table 3.2.

Table 3.2. The Average R.I.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>0.58</td>
<td>0.9</td>
<td>1.12</td>
<td>1.24</td>
<td>1.32</td>
<td>1.41</td>
<td>1.49</td>
<td>1.51</td>
<td>1.48</td>
<td>1.56</td>
<td>1.57</td>
<td>1.59</td>
<td></td>
</tr>
</tbody>
</table>

- Calculate a List of Priority of Each Alternative and Select the Best Alternative. From the example in the third step, we can calculate the weight of each alternative under the goal and compare them as follows:

The value of w.f 1, w.f 2, w.s.f 11, w.s.f 12, w.s.f 13, w.s.f 21, w.s.f 22, w.a 111, w.a 112, w.a 113, w.a 121, w.a 122, w.a 123, w.a 131, w.a 132, w.a 133, w.a 211, w.a 212, w.a 213, w.a 221, w.a 222, w.a 223 in the third step, we can show them for each level in Figure 3.3.
Figure 3.3. The Weight of Each Factor in Each Level
From the Figure 3.3:

The weight of alternative 1 under the Sub-factor 11 is \( w.a_{111} \).
The weight of alternative 1 under the Sub-factor 12 is \( w.a_{121} \).
The weight of alternative 1 under the Sub-factor 13 is \( w.a_{131} \).
The weight of alternative 1 under the Sub-factor 21 is \( w.a_{211} \).
The weight of alternative 1 under the Sub-factor 22 is \( w.a_{221} \).
The weight of alternative 2 under the Sub-factor 11 is \( w.a_{112} \).
The weight of alternative 2 under the Sub-factor 12 is \( w.a_{122} \).
The weight of alternative 2 under the Sub-factor 13 is \( w.a_{132} \).
The weight of alternative 2 under the Sub-factor 21 is \( w.a_{212} \).
The weight of alternative 2 under the Sub-factor 22 is \( w.a_{222} \).
The weight of alternative 3 under the Sub-factor 11 is \( w.a_{113} \).
The weight of alternative 3 under the Sub-factor 12 is \( w.a_{123} \).
The weight of alternative 3 under the Sub-factor 13 is \( w.a_{133} \).
The weight of alternative 3 under the Sub-factor 21 is \( w.a_{213} \).
The weight of alternative 3 under the Sub-factor 22 is \( w.a_{223} \).

The weight of alternative 1 under the factor 1 is equal to
\[ (w.a_{111} \times w.s.f_{11}) + (w.a_{121} \times w.s.f_{12}) + (w.a_{131} \times w.s.f_{13}) \].

The weight of alternative 2 under the factor 1 is equal to
\[ (w.a_{112} \times w.s.f_{11}) + (w.a_{122} \times w.s.f_{12}) + (w.a_{132} \times w.s.f_{13}) \].

The weight of alternative 3 under the factor 1 is equal to
\[ (w.a_{113} \times w.s.f_{11}) + (w.a_{123} \times w.s.f_{12}) + (w.a_{133} \times w.s.f_{13}) \].

The weight of alternative 1 under the factor 2 is equal to
\[ (w.a_{211} \times w.s.f_{21}) + (w.a_{221} \times w.s.f_{22}) \].
The weight of alternative 2 under the factor 2 is equal to
\[(w.a212* w.s.f 21) + (w.a222* w.s.f 22).\]

The weight of alternative 3 under the factor 2 is equal to
\[(w.a213* w.s.f 21) + (w.a223* w.s.f 22).\]

The weight of alternative 1 under the goal is equal to
\[
\left[(w.a11* w.s.f 11) + (w.a12* w.s.f 12) + (w.a13* w.s.f 13)\right] * w.f 1 + \\
\left[(w.a21* w.s.f 21) + (w.a22* w.s.f 22)\right] * w.f 2.
\]

The weight of alternative 2 under the goal is equal to
\[
\left[(w.a11* w.s.f 11) + (w.a12* w.s.f 12) + (w.a13* w.s.f 13)\right] * w.f 1 + \\
\left[(w.a21* w.s.f 21) + (w.a22* w.s.f 22)\right] * w.f 2.
\]

The weight of alternative 3 under the goal is equal to
\[
\left[(w.a11* w.s.f 11) + (w.a12* w.s.f 12) + (w.a13* w.s.f 13)\right] * w.f 1 + \\
\left[(w.a21* w.s.f 21) + (w.a22* w.s.f 22)\right] * w.f 2.
\]

Selecting the greatest value of the weight of alternative under the goal is the best alternative.
IV. APPLICATION OF THE AHP IN THE PLANT SITE SELECTION

From chapter 2 and chapter 3, the facility location and the analytic hierarchy process are described. Thus, the application of the knowledge from these two chapters for considering the plant site location will be discussed in this chapter.

A. Step 1: Break Down of the Decision Problem into a Hierarchy of Interrelated Elements

In this case, we have data about it as follows:

- Organization. In this case study, we will study the location selection problem in one organization, named the X company. The executives of the company wants to build a new factory to produce the Sorbitol (Appendix C) which is used in many industries (such as toothpaste, cosmetic, drug, food, etc.). Its main raw material is cassava. The estimated capacity of the new factory is 6,000 tons of Sorbitol per year while the estimated investment is 220,000,000 baht.

- The Factors in Each Level.
  
  - Level 1, Level of the goal for decision making. For the X company, the goal is the best location for the new Sorbitol factory.
  
  - Level 2, Level of the main factors that are considered for decision making. In this case, these factors consist of the monetary factors and non-monetary factors.
  
  - Level 3, Level of the sub-factors of each main factor. In this case, each main factor consists of many sub-factors as follows:
• Sub-factors of the monetary factors.
  – Initial Cost.
  – Annual Cost.

• Sub-factors of the non-monetary factors.
  – Material Availability.
  – Utility System.
  – Labor Availability.
  – Community Attitude.
  – Marketing Advantage.
  – Land Advantage.

level 4, Level of alternatives. After X company’s committee members consider many locations in different places, the committee is interested in three locations which are land in Nakhon-Ratchasima, Kallasin, and Rayong.

• The Details of Each Main Factor, and Each Sub-Factor.
  – The Monetary Factors. For the monetary factors, we consider the costs for the operating process of the factory: such as land cost, building cost, material cost, transportation cost of material, transportation cost of product, etc. These factors can be divided into two sub-factors, the initial cost, and the annually cost.

The initial cost is the cost in the starting period of the business: such as land cost, building cost, electric system, machine cost, tool, etc.

The annual cost is the cost of each year after running the business. There are many types of this cost as follows: transportation cost of material, transportation cost of product, labor cost, utility cost, material cost, fuel cost, tax, and others.
- The Non-monetary Factors. These factors have impact on the business. The business can be run efficiently, if these factors are proper. For this case, we consider six types of sub-factors: material availability, utility system, labor availability, community attitude, marketing advantage, and land advantage.

Material availability: the business must be easy to find and to obtain raw materials. Utility system: the selected area should provide good infrastructures (such as communication system, electric system, water supply system, etc.) and also include other important units for the community (such as hospital, school, bank, post office, police station, etc.). Labor availability: the human resource is one important factor for the business. Knowledgeable people in the area should be easily available. Community attitude: the communities in the business area should have good attitude to the business to avoid problems in the future. Marketing Advantage: the business location should be near the market. It will reduce the transportation cost, and other costs. It is easy to contract the customers. It will be an advantage for competition, if the location is appropriate. It may also increase the marketing share for the business, and Land Advantage, besides considering the cost of land, we will also consider the other problem about the land: such as the impact from the neighbor factory, the topography of the land, the climate, the law and regulation, etc.

- The Details of Each Alternative.

- The Land in Nakhon-Ratchasima. X company is the land owner. There is the cassava factory beside of the land. If X company decides to build the new factory here, the factory will be near the source of raw materials. It can reduce the transportation cost of raw materials and easy to reach available raw materials. The map of this land will be shown in Figure 4.1.
- The Land in Kallasin. X company is the land owner. There is a cassava factory beside of the land. If X company decides to build the new factory here, the factory will be near the source of raw materials. It can reduce the transportation cost of raw materials and easy to reach available raw materials. The map of this land will be shown in Figure 4.2.

- The Land in Rayong. X company is the land owner. There is a cassava factory in neighbor area of the land. If X company decides to build the new factory here, the factory will be near the source of raw materials. It can reduce the transportation cost of raw materials and easy to reach available the raw materials. The map of this land will be shown in Figure 4.3.

The details of each province will be in the Appendix B.

- The Hierarchy of All Elements.

Given:

- \( C_1 \) = The monetary factor
- \( C_2 \) = The non-monetary factor
- \( C_{11} \) = The initial cost
- \( C_{12} \) = The annually cost
- \( C_{21} \) = The material availability
- \( C_{22} \) = The utility system
- \( C_{23} \) = The labor availability
- \( C_{24} \) = The community attitude
- \( C_{25} \) = The marketing advantage
- \( C_{26} \) = The land advantage
- \( A_1 \) = The land in Nakhon-Ratchasima
Figure 4.1. A Map of Land in Nakhon-Ratchasima
Figure 4.2. A Map of Land in Kallasin
Figure 4.3. A Map of Land in Rayong
The land in Kallasin

The land in Rayong

The hierarchy of all elements will be shown in Figure 4.4.

When we finish step 1, we could set the relationship of each element in a hierarchical form. We will use this relationship to be criteria in interviewing some experts for gathering the data in step 2.

Figure 4.4. The Hierarchy of All Elements in Plant Site Selection
B. Step 2: Pair-Wise Comparison Judgment

In this step, the factors in each level will be compared by a pair-wise comparison technique under the factors in the upper level. Data employed in this study are obtained from the interview of some experts in the field that is involved in the problem.

In this case, we interview three experts: Mr. AA, Mr. BB, and Mr. CC. The data from these experts is shown below:

Given:

C1 = The monetary factor
C2 = The non-monetary factor
C11 = The initial cost
C12 = The annually cost
C21 = The material availability
C22 = The utility system
C23 = The labor availability
C24 = The community attitude
C25 = The marketing advantage
C26 = The land advantage
A1 = The land in Nakhon-Ratchasima
A2 = The land in Kallasin
A3 = The land in Rayong
1. Data from Mr. AA

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C. Step 3: Translate the Judgments into Numbers with Saaty’s Eigenvector Weighting

Methods

In this step, we will translate the judgments from step 2 into the weight of each factor, the Consistency Index (C.I.), and the Consistency Ratio (C.R.).

In calculating the weight of each factor, the C.I., and the C.R. will be calculated by the software program (Appendix D) which is developed for this purpose.

Now, considering the data from step 2.

Given:

C1 = The monetary factor
C2 = The non-monetary factor
C11 = The initial cost
C12 = The annually cost
C21 = The material availability
C22 = The utility system
C23 = The labor availability
C24 = The community attitude
C25 = The marketing advantage
C26 = The land advantage
A1 = The land in Nakhon-Ratchasima
A2 = The land in Kallasin
A3 = The land in Rayong
1. Data from Mr. AA

Under the best location (the goal)

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Transfer into Matrix

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Size of Matrix \(= n \times n = 2 \times 2\)

R.I. = 0

\(\lambda_{\text{max}} = 2\)

C.I. = \((\lambda_{\text{max}} - n)/(n-1) = 0\)

C.R. = C.I./R.I. = 0

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Size of Matrix \(= n \times n = 2 \times 2\)

R.I. = 0

\(\lambda_{\text{max}} = 2\)

C.I. = \((\lambda_{\text{max}} - n)/(n-1) = 0\)

C.R. = C.I./R.I. = 0

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| Column II |  |  |  |  |  |  |  |  |  |
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| C23       |  |  |  |  |  |  |  |  |  |
| C24       |  |  |  |  |  |  |  |  |  |
| C25       |  |  |  |  |  |  |  |  |  |
| C26       |  |  |  |  |  |  |  |  |  |

Transfer into Matrix

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Size of Matrix = n x n = 6 x 6

R.I. = 1.24

λmax = 6.404

C.I. = (λmax - n)/(n-1) = 0.081

C.R. = C.I./R.I. = 0.065

Under the C11

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50
Size of Matrix \( = n \times n \) \( = 3 \times 3 \)

R.I. \( = 0.58 \)

\( \lambda_{\text{max}} = 3.003 \)

C.I. \( = (\lambda_{\text{max}} - n)/(n-1) \) \( = 0 \)

C.R. \( = \text{C.I.}/\text{R.I.} \) \( = 0 \)

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Size of Matrix \( = n \times n \) \( = 3 \times 3 \)

R.I. \( = 0.58 \)

\( \lambda_{\text{max}} = 3.039 \)

C.I. \( = (\lambda_{\text{max}} - n)/(n-1) \) \( = 0.019 \)

C.R. \( = \text{C.I.}/\text{R.I.} \) \( = 0.033 \)

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Size of Matrix = n x n = 3 x 3

R.I. = 0.58

$\lambda_{max}$ = 3.039

C.I. = $(\lambda_{max} - n)/(n-1)$ = 0.019

C.R. = C.I./R.I. = 0.033

Under the C22

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Column II

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Transfer into Matrix

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Size of Matrix = n x n = 3 x 3

R.I. = 0.58

$\lambda_{max}$ = 3.007

C.I. = $(\lambda_{max} - n)/(n-1)$ = 0.003

C.R. = C.I./R.I. = 0.006
Under the C23

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Size of Matrix $= n \times n = 3 \times 3$

R.I. $= 0.58$

$\lambda_{max} = 3.004$

C.I. $= (\lambda_{max} - n)/(n-1) = 0.002$

C.R. $= C.I./R.I. = 0.003$

Under the C24

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Size of Matrix $= n \times n = 3 \times 3$

R.I. $= 0.58$

$\lambda_{max} = 3.006$

C.I. $= (\lambda_{max} - n)/(n-1) = 0.003$
C.R. = C.I./R.I. = 0.005

Under the C25

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Transfer into Matrix

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Size of Matrix  =  n x n  = 3 x 3

R.I.  = 0.58

λmax = 3

C.I.  = (λmax - n)/(n-1)  = 0

C.R.  = C.I./R.I.  = 0

Under the C26

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Size of Matrix  =  n x n  = 3 x 3

R.I.  = 0.58
\[ \lambda_{\text{max}} = 3.054 \]

\[ \text{C.I.} = \frac{(\lambda_{\text{max}} - n)/(n-1)}{} = 0.027 \]

\[ \text{C.R.} = \frac{\text{C.I.}}{\text{R.I.}} = 0.046 \]

2. Data from Mr. BB

Under the best location (the goal)

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Transfer into Matrix

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Size of Matrix \( = n \times n = 2 \times 2 \)

R.I. \( = 0 \)

\[ \lambda_{\text{max}} = 2 \]

\[ \text{C.I.} = \frac{(\lambda_{\text{max}} - n)/(n-1)}{} = 0 \]

\[ \text{C.R.} = \frac{\text{C.I.}}{\text{R.I.}} = 0 \]

Under the C1

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Size of Matrix \( = n \times n = 2 \times 2 \)
\[ R.I. = 0 \]

\[ \lambda_{\text{max}} = 2 \]

\[ \text{C.I.} = (\lambda_{\text{max}} - n)/(n-1) = 0 \]

\[ \text{C.R.} = \text{C.I.}/R.I. = 0 \]

Under the C2

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Size of Matrix \( = n \times n \) = 6 \times 6

R.I. = 1.24

\[ \lambda_{\text{max}} = 6.276 \]

\[ \text{C.I.} = (\lambda_{\text{max}} - n)/(n-1) = 0.055 \]

C.R. = C.I./R.I. = 0.040
Under the C11

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Size of Matrix = $n \times n = 3 \times 3$

R.I. = 0.58

$\lambda_{\text{max}} = 3.018$

C.I. = $(\lambda_{\text{max}} - n)/(n-1) = 0.009$

C.R. = C.I./R.I. = 0.016

Under the C12

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Size of Matrix = $n \times n = 3 \times 3$

R.I. = 0.58

$\lambda_{\text{max}} = 3.025$

C.I. = $(\lambda_{\text{max}} - n)/(n-1) = 0.012$
C.R. = C.I./R.I. = 0.021

Under the C21

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Size of Matrix = n x n = 3 x 3

R.I. = 0.58

λ_max = 3.087

C.I. = (λ_max - n)/(n-1) = 0.043

C.R. = C.I./R.I. = 0.075

Under the C22

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Size of Matrix = n x n = 3 x 3

R.I. = 0.58
\[ \lambda_{\text{max}} = 3.035 \]

C.I. = \((\lambda_{\text{max}} - n)/(n-1)\) = 0.018

C.R. = C.I./R.I. = 0.030

Under the C23

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Size of Matrix = n x n = 3 x 3

R.I. = 0.58

\[ \lambda_{\text{max}} = 3.005 \]

C.I. = \((\lambda_{\text{max}} - n)/(n-1)\) = 0.003

C.R. = C.I./R.I. = 0.005

Under the C24

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Transfer into Matrix

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Size of Matrix = \( n \times n = 3 \times 3 \)

R.I. = 0.58

\( \lambda_{\text{max}} = 3.018 \)

C.I. = \((\lambda_{\text{max}} - n)/(n-1)\) = 0.009

C.R. = C.I./R.I. = 0.016

Under the C25

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Size of Matrix = \( n \times n = 3 \times 3 \)

R.I. = 0.58

\( \lambda_{\text{max}} = 3 \)

C.I. = \((\lambda_{\text{max}} - n)/(n-1)\) = 0

C.R. = C.I./R.I. = 0

Under the C26

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Transfer into Matrix

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Size of Matrix = $n \times n = 3 \times 3$

R.I. = 0.58

$\lambda_{\text{max}} = 3$

C.I. = $(\lambda_{\text{max}} - n)/(n-1) = 0$

C.R. = C.I./R.I. = 0

3. Data from Mr. CC

Under the best location (the goal)

<table>
<thead>
<tr>
<th>Column I</th>
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<th>strong</th>
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Transfer into Matrix

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Size of Matrix = $n \times n = 2 \times 2$

R.I. = 0

$\lambda_{\text{max}} = 2$

C.I. = $(\lambda_{\text{max}} - n)/(n-1) = 0$

C.R. = C.I./R.I. = 0
Under the C1

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Transfer into Matrix

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Size of Matrix $= n \times n = 2 \times 2$

R.I. = 0

$\lambda_{\text{max}} = 2$

C.I. = $(\lambda_{\text{max}} - n)(n-1) = 0$

C.R. = C.I./R.I. = 0

Under the C2

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Transfer into Matrix

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Size of Matrix $= n \times n = 6 \times 6$

R.I. $= 1.24$

$\lambda_{\text{max}} = 6.401$

C.I. $= (\lambda_{\text{max}} - n)/(n-1) = 0.080$

C.R. $= \text{C.I.}/\text{R.I.} = 0.064$

Under the C11

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Transfer into Matrix

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Size of Matrix $= n \times n = 3 \times 3$

R.I. $= 0.58$

$\lambda_{\text{max}} = 3.087$

C.I. $= (\lambda_{\text{max}} - n)/(n-1) = 0.043$

C.R. $= \text{C.I.}/\text{R.I.} = 0.075$

Under the C12

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63
Transfer into Matrix

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Size of Matrix $= n \times n = 3 \times 3$

R.I. $= 0.58$

$\lambda_{\text{max}} = 3.004$

C.I. $= (\lambda_{\text{max}} - n)/(n-1) = 0.002$

C.R. $= \text{C.I.}/\text{R.I.} = 0.003$

Under the C21

<table>
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<tr>
<td>A2</td>
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Transfer into Matrix

<table>
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<th>Weight</th>
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Size of Matrix $= n \times n = 3 \times 3$

R.I. $= 0.58$

$\lambda_{\text{max}} = 3.009$

C.I. $= (\lambda_{\text{max}} - n)/(n-1) = 0.005$

C.R. $= \text{C.I.}/\text{R.I.} = 0.008$
Under the C22

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<td>+4</td>
<td>+3</td>
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<td>A1</td>
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<td>+8</td>
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<td>+3</td>
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<td>+1</td>
</tr>
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<td>A2</td>
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Transfer into Matrix

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<tr>
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<td>0.110</td>
</tr>
<tr>
<td>A3</td>
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<td>3</td>
<td>1</td>
<td>0.309</td>
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</tbody>
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Size of Matrix  \( = n \times n \)  \( = 3 \times 3 \)

R.I.  = 0.58

\( \lambda_{max} = 3.004 \)

C.I.  = \( \frac{(\lambda_{max} - n)}{(n-1)} \)  \( = 0.002 \)

C.R.  = C.I./R.I.  \( = 0.003 \)

Under the C23

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<td>A1</td>
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<td>+8</td>
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<td>+6</td>
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Transfer into Matrix

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<th>Weight</th>
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<tr>
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</tbody>
</table>

Size of Matrix  \( = n \times n \)  \( = 3 \times 3 \)

R.I.  = 0.58

\( \lambda_{max} = 3.018 \)

C.I.  = \( \frac{(\lambda_{max} - n)}{(n-1)} \)  \( = 0.009 \)
C.R. = C.I./R.I. = 0.016

Under the C24

<table>
<thead>
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</tr>
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<tr>
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Transfer into Matrix

<table>
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<td>A3</td>
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Size of Matrix = n x n = 3 x 3

R.I. = 0.58

λmax = 3.004

C.I. = (λmax - n)/(n-1) = 0.002

C.R. = C.I./R.I. = 0.003

Under the C25

<table>
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<tr>
<th>Column I</th>
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<tr>
<td>A2</td>
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Transfer into Matrix

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<tr>
<td>A2</td>
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<tr>
<td>A3</td>
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<td>1/2</td>
<td>1</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Size of Matrix = n x n = 3 x 3

R.I. = 0.58
\[ \lambda_{\text{max}} = 3 \]
\[ C.I. = \frac{(\lambda_{\text{max}} - n)}{(n-1)} = 0 \]
\[ C.R. = \frac{C.I.}{R.I.} = 0 \]

Under the C26

<table>
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<tr>
<th>Column I</th>
<th>absolute</th>
<th>very strong</th>
<th>strong</th>
<th>weak</th>
<th>equal</th>
<th>weak</th>
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</thead>
<tbody>
<tr>
<td>A1</td>
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<td>+8</td>
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<td>+6</td>
<td>+5</td>
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Transfer into Matrix

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<tr>
<td>A3</td>
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</tbody>
</table>

Size of Matrix \( = n \times n \) \( = 3 \times 3 \)

R.I. \( = 0.58 \)

\[ \lambda_{\text{max}} = 3 \]
\[ C.I. = \frac{(\lambda_{\text{max}} - n)}{(n-1)} = 0 \]
\[ C.R. = \frac{C.I.}{R.I.} = 0 \]

D. Step 4: Calculate a List of Priority of Each Alternative and Select the Best Alternative

In this step, we will use the weight of each factor under the factor in upper level from step 3 to be the data to calculate the weight of each alternative under the goal. When we finish the calculation in this step, all alternatives will be arranged from the most important alternative to the least important alternative. So, we will select the best location among many alternatives.
Given:

C1 = The monetary factor
C2 = The non-monetary factor
C11 = The initial cost
C12 = The annually cost
C21 = The material availability
C22 = The utility system
C23 = The labor availability
C24 = The community attitude
C25 = The marketing advantage
C26 = The land advantage
A1 = The land in Nakhon-Ratchasima
A2 = The land in Kallasin
A3 = The land in Rayong

1. Data from Mr. AA

Under the best location (the goal)

The weight of C1 is 0.875.
The weight of C2 is 0.125.

Under the C1

The weight of C11 is 0.250.
The weight of C12 is 0.750.
Under the C2
The weight of C21 is 0.312.
The weight of C22 is 0.242.
The weight of C23 is 0.165.
The weight of C24 is 0.049.
The weight of C25 is 0.131.
The weight of C26 is 0.101.

Under the C11
The weight of A1 is 0.648.
The weight of A2 is 0.123.
The weight of A3 is 0.229.

Under the C12
The weight of A1 is 0.633.
The weight of A2 is 0.261.
The weight of A3 is 0.106.

Under the C21
The weight of A1 is 0.261.
The weight of A2 is 0.633.
The weight of A3 is 0.106.
Under the C22
The weight of A1 is 0.669.
The weight of A2 is 0.088.
The weight of A3 is 0.243.

Under the C23
The weight of A1 is 0.230.
The weight of A2 is 0.648.
The weight of A3 is 0.122.

Under the C24
The weight of A1 is 0.129.
The weight of A2 is 0.595.
The weight of A3 is 0.276.

Under the C25
The weight of A1 is 0.333.
The weight of A2 is 0.333.
The weight of A3 is 0.333.

Under the C26
The weight of A1 is 0.333.
The weight of A2 is 0.526.
The weight of A3 is 0.141.
The weight of each factor under the factor at the upper level is shown in Figure 4.5.

Figure 4.5. The Weight of Each Factor under the Factor at the Upper Level (Mr.AA)
From Figure 4.5.

• Nakhon-Ratchasima (A1).

Under the C1
The weight of A1 under C1 = [0.648*0.250]+[0.633*0.750]
= 0.637

Under the C2
The weight of A1 under C2 = [0.261*0.312]+[0.669*0.242] +[0.230*0.165]+[0.129*0.049] 
+[0.333*0.131]+[0.333*0.101]
= 0.365

Under the best location (the goal)
The weight of A1 under the goal = [0.637*0.875]+[0.365*0.125]
= 0.603

• Kallisin (A2).

Under the C1
The weight of A2 under C1 = [0.123*0.250]+[0.261*0.750]
= 0.227
Under the C2

The weight of A2 under C2 = [0.633*0.312]+[0.088*0.242]

+ [0.648*0.165]+[0.595*0.049]

+ [0.333*0.131]+[0.526*0.101]

= 0.452

Under the best location (the goal)

The weight of A2 under the goal = [0.227*0.875]+[0.452*0.125]

= 0.255

• Rayong (A3).

Under the C1

The weight of A3 under C1 = [0.229*0.250]+[0.106*0.750]

= 0.136

Under the C2

The weight of A3 under C2 = [0.106*0.312]+[0.243*0.242]

+ [0.122*0.165]+[0.276*0.049]

+ [0.333*0.131]+[0.141*0.101]

= 0.183

Under the best location (the goal)

The weight of A3 under the goal = [0.136*0.875]+[0.183*0.125]
Mr. AA’s selection

The weight of A1 under the goal = 0.603
The weight of A2 under the goal = 0.255
The weight of A3 under the goal = 0.142

A1 > A2 > A3

So, the best location is the location at Nakhon-Ratchasima (A1).

2. Data from Mr. BB

Under the best location (the goal)
The weight of C1 is 0.857.
The weight of C2 is 0.143.

Under the C1
The weight of C11 is 0.333.
The weight of C12 is 0.667.

Under the C2
The weight of C21 is 0.294.
The weight of C22 is 0.239.
The weight of C23 is 0.145.
The weight of C24 is 0.058.
The weight of C25 is 0.165.
The weight of C26 is 0.099.

Under the C11
The weight of A1 is 0.557.
The weight of A2 is 0.123.
The weight of A3 is 0.320.

Under the C12
The weight of A1 is 0.681.
The weight of A2 is 0.202.
The weight of A3 is 0.117.

Under the C21
The weight of A1 is 0.284.
The weight of A2 is 0.619.
The weight of A3 is 0.097.

Under the C22
The weight of A1 is 0.627.
The weight of A2 is 0.110.
The weight of A3 is 0.263.
Under the C23
The weight of A1 is 0.277.
The weight of A2 is 0.595.
The weight of A3 is 0.128.

Under the C24
The weight of A1 is 0.118.
The weight of A2 is 0.613.
The weight of A3 is 0.269.

Under the C25
The weight of A1 is 0.333.
The weight of A2 is 0.333.
The weight of A3 is 0.333.

Under the C26
The weight of A1 is 0.400.
The weight of A2 is 0.400.
The weight of A3 is 0.200.

The weight of each factor under the factor at the upper level is shown in Figure 4.6.
The Goal

The Best Location

The Main Factors

C1 = 0.857
C2 = 0.143

The Sub-factors

C11 = 0.333 C12 = 0.667 C21 = 0.294 C22 = 0.239 C23 = 0.145 C24 = 0.058 C25 = 0.165 C26 = 0.099

The Alternatives

A1
C11: A1 = 0.320
C12: A1 = 0.117
C21: A1 = 0.097
C22: A1 = 0.263
C23: A1 = 0.128
C24: A1 = 0.269
C25: A1 = 0.333
C26: A1 = 0.200

A2
C11: A2 = 0.123
C12: A2 = 0.202
C21: A2 = 0.619
C22: A2 = 0.110
C23: A2 = 0.595
C24: A2 = 0.613
C25: A2 = 0.333
C26: A2 = 0.400

A3
C11: A3 = 0.320
C12: A3 = 0.117
C21: A3 = 0.097
C22: A3 = 0.263
C23: A3 = 0.128
C24: A3 = 0.269
C25: A3 = 0.333
C26: A3 = 0.200

Figure 4.6. The Weight of Each Factor under the Factor at the Upper Level (Mr.BB)
From Figure 4.6.

- Nakhon-Ratchasima (A1).

Under the C1
The weight of A1 under C1 = \([0.557*0.333]+[0.681*0.667]\)

= 0.639

Under the C2
The weight of A1 under C2 = \([0.284*0.294]+[0.627*0.239] +[0.227*0.145]+[0.118*0.058]+[0.333*0.165]+[0.400*0.099]\)

= 0.368

Under the best location (the goal)
The weight of A1 under the goal = \([0.639*0.857]+[0.368*0.143]\)

= 0.600

- Kallasin (A2).

Under the C1
The weight of A2 under C1 = \([0.123*0.333]+[0.202*0.667]\)

= 0.176
Under the C2
The weight of A2 under C2 = [0.619\times 0.294]+[0.110\times 0.239]
  +[0.595\times 0.145]+[0.613\times 0.058]
  +[0.333\times 0.165]+[0.400\times 0.099]
  = 0.425

Under the best location (the goal)
The weight of A2 under the goal = [0.176\times 0.857]+[0.425\times 0.143]
  = 0.212

- Rayong (A3).

Under the C1
The weight of A3 under C1 = [0.320\times 0.333]+[0.117\times 0.667]
  = 0.185

Under the C2
The weight of A3 under C2 = [0.097\times 0.294]+[0.263\times 0.239]
  +[0.128\times 0.145]+[0.269\times 0.058]
  +[0.333\times 0.165]+[0.200\times 0.099]
  = 0.200

Under the best location (the goal)
The weight of A3 under the goal = [0.185\times 0.857]+[0.200\times 0.143]
Mr. BB’s selection

The weight of A1 under the goal = 0.600
The weight of A2 under the goal = 0.212
The weight of A3 under the goal = 0.187

A1 > A2 > A3

So, the best location is the location at Nakhon-Ratchasima (A1).

3. Data from Mr. CC

Under the best location (the goal)
The weight of C1 is 0.833.
The weight of C2 is 0.167.

Under the C1
The weight of C11 is 0.333.
The weight of C12 is 0.667.

Under the C2
The weight of C21 is 0.297.
The weight of C22 is 0.230.
The weight of C23 is 0.196.
The weight of C24 is 0.049.
The weight of C25 is 0.125.
The weight of C26 is 0.103.

Under the C11
The weight of A1 is 0.619.
The weight of A2 is 0.097.
The weight of A3 is 0.284.

Under the C12
The weight of A1 is 0.648.
The weight of A2 is 0.230.
The weight of A3 is 0.122.

Under the C21
The weight of A1 is 0.324.
The weight of A2 is 0.587.
The weight of A3 is 0.089.

Under the C22
The weight of A1 is 0.581.
The weight of A2 is 0.110.
The weight of A3 is 0.309.
Under the C23

The weight of A1 is 0.269.
The weight of A2 is 0.613.
The weight of A3 is 0.118.

Under the C24

The weight of A1 is 0.110.
The weight of A2 is 0.581.
The weight of A3 is 0.309.

Under the C25

The weight of A1 is 0.400.
The weight of A2 is 0.400.
The weight of A3 is 0.200.

Under the C26

The weight of A1 is 0.429.
The weight of A2 is 0.429.
The weight of A3 is 0.142.

The weight of each factor under the factor at the upper level is shown in Figure 4.7.
The Goal

The Best Location

The Main Factors

The Sub-factors

The Alternatives

Figure 4.7. The Weight of Each Factor under the Factor at the Upper Level (Mr.CC)
From Figure 4.7.

- Nakhon-Ratchasima (A1).

Under the C1

The weight of A1 under C1 = \[0.619\times0.333\]+\[0.648\times0.667\]  
= 0.638

Under the C2

The weight of A1 under C2 = \[0.324\times0.297\]+\[0.581\times0.230\]  
\[+0.269\times0.196\]+\[0.110\times0.049\]  
\[+0.400\times0.125\]+\[0.429\times0.103\]  
= 0.382

Under the best location (the goal)

The weight of A1 under the goal = \[0.638\times0.833\]+\[0.382\times0.167\]  
= 0.595

- Kallasin (A2).

Under the C1

The weight of A2 under C1 = \[0.097\times0.333\]+\[0.230\times0.667\]  
= 0.186
Under the C2

The weight of A2 under C2 = [0.587*0.297] + [0.110*0.230]

+ [0.613*0.196] + [0.581*0.049]

+ [0.400*0.125] + [0.429*0.103]

= 0.442

Under the best location (the goal)

The weight of A2 under the goal = [0.186*0.833] + [0.442*0.167]

= 0.229

• Rayong (A3).

Under the C1

The weight of A3 under C1 = [0.284*0.333] + [0.122*0.667]

= 0.176

Under the C2

The weight of A3 under C2 = [0.089*0.297] + [0.309*0.230]

+ [0.118*0.196] + [0.309*0.049]

+ [0.200*0.125] + [0.142*0.103]

= 0.175

Under the best location (the goal)

The weight of A3 under the goal = [0.176*0.833] + [0.175*0.167]
Mr. CC's selection

The weight of A1 under the goal = 0.595

The weight of A2 under the goal = 0.229

The weight of A3 under the goal = 0.176

A1 > A2 > A3

So, the best location is the location at Nakhon-Ratchasima (A1).

From the AHP technique, the best location for the Sorbital plant is at Nakhon-Ratchasima.

E. Compare the Result with Company Procedure

We will consider the technique that the committee of X company use in selecting the Sorbital plant location. The technique used by the committee of X company is the Decision Matrix. There are many factors that are considered by the committee of X company, they are Marketing Advantage, Land Advantage, Material Availability, Labor Availability, Utility System, Community Attitude, Initial Cost, and Annually Cost.

The weight of each factor (from 1 to 10) is assigned as follows:

The weight of Marketing Advantage is 7.

The weight of Land Advantage is 8.

The weight of Material Availability is 10.
The weight of Labor Availability is 9.

The weight of Utility System is 8.

The weight of Community Attitude is 6.

The weight of Initial Cost is 6.

The weight of Annually Cost is 6.

There are three alternatives, 1) the land in Nakhon-Ratchasima, 2) the land in Kallasin, and 3) the land in Rayong.

From these factors, we can create the decision-making table. The decision-making table is shown in Table 4.1.

Table 4.1. The Decision-Making Table for the Plant Site Location

<table>
<thead>
<tr>
<th>Factors</th>
<th>Weight</th>
<th>Score (1-10)</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td>Nakhon Ratchasima</td>
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<tr>
<td>1. Marketing Advantage</td>
<td>7</td>
<td>7</td>
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<td>2. Land Advantage</td>
<td>8</td>
<td>8</td>
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<tr>
<td>3. Material Availability</td>
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<td>6. Community Attitude</td>
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<td>6</td>
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<tr>
<td>7. Initial Cost</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>8. Annually Cost</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

From interviewing the manager of X company, we obtain the score data of each alternative that the committee of X company assigned for the real selection of location of Sorbital plant in the past. The data are shown in Table 4.2.
Table 4.2. The Real Data in Selecting the Sorbital Plant Location

<table>
<thead>
<tr>
<th>Factors</th>
<th>Weight</th>
<th>Score (1-10)</th>
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<tr>
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<tr>
<td>1. Marketing Advantage</td>
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<td>2. Land Advantage</td>
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<tr>
<td>3. Material Availability</td>
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<td>4. Labor Availability</td>
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<td>5. Utility System</td>
<td>8</td>
<td>9</td>
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<tr>
<td>6. Community Attitude</td>
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<td>8</td>
</tr>
<tr>
<td>7. Initial Cost</td>
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<td>8. Annually Cost</td>
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<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

The Score for Each Alternative

Land in Nakhon-Ratchasima

Score = \[ \frac{(9 \times 7) + (9 \times 8) + (9 \times 10) + (9 \times 9) + (9 \times 8) + (8 \times 6) + (8 \times 6) + (8 \times 6)}{60} \]

= \[ \frac{522}{60} \]

= 8.7

Land in Kallasin

Score = \[ \frac{(9 \times 7) + (8 \times 8) + (9 \times 10) + (8 \times 9) + (6 \times 8) + (6 \times 6) + (8 \times 6) + (8 \times 6)}{60} \]

= \[ \frac{469}{60} \]

= 7.82

Land in Rayong

Score = \[ \frac{(9 \times 7) + (7 \times 8) + (8 \times 10) + (7 \times 9) + (8 \times 8) + (8 \times 6) + (8 \times 6) + (8 \times 6)}{60} \]

= \[ \frac{470}{60} \]

= 7.83
So, the best location for the Sorbital plant is at Nakhon-Ratchasima.

In reality, X company invested in the Sorbital plant at Nakhon-Ratchasima.

From the AHP result, the best location of the Sorbital plant is at Nakhon-Ratchasima. It is the same result as the decision of X company in the past.
Chapter 2 and chapter 3 describe the facility location and the analytic hierarchy process. Thus, the application of the knowledge from these two chapters for consideration in selecting the convenience store location will be discussed in this chapter.

A. Step 1: Break Down of the Decision Problem into a Hierarchy of Interrelated Elements

In this case, we have data about it as follows:

- **Investment.** In this case study, we will study the location selection problem in franchise business. Three investors, Mr. K, Mr. Q, and Mr. J, want to invest in the convenience store, the FFF Store (assumed name). The estimated initial cost for investment in this store is 2,400,000 baht. The estimated cost for operating cost and utility is 35,000 to 45,000 baht per month. The estimated labor cost for nine employees (three shifts per day, three employees per shift) is 54,000 baht per month. The estimated cost for one manager is 15,000 baht per month. The revenue is 30% of net profit for rented building and 70% of net profit for own building. The contact period is 9 years.

Before franchiser will accept these investors to be franchisee, franchiser must survey the area around investors' building to see what the level of purchase power is whether, the location is proper for investment or not, etc. So, to invest in this
convenience store, the investors' building must be accepted by the franchiser that it is in the proper location and it is economical to investment.

- The Factors in Each Level.

  - Level 1, Level of the goal for decision making. For this investment, the goal is the best location for the FFF Store.

  - Level 2, Level of the factors that are considered for decision making. In this case, there are many factors that are considered as follows:

    - Initial cost.
    - Operating cost.
    - Demand Level.
    - Environment Conditions.
    - Resource Availability.
    - Customer Accessibility.

  - Level 3, Level of the alternatives. In this case, the investors have two own building in Bangkok.

    - The building in Soi St. Louis 3.
    - The building on New Chan road.

- The Details of Each Factor. (Longenecker, 1994)

  Initial Cost, it is the cost at the starting period of the business: building cost and the first sign contact cost.

  Operating Cost, it is the cost in each month after running business. It consists of labor cost, refill goods cost, utility cost, etc.

  Demand Level, the store location selection should consider the people factor strongly. The proper location should be in the home community because it
has many people in the area. This means that has high demand. If it has high demand, the store will have a trend to obtain high revenue.

Environment Condition, the store must operate within the environmental conditions of its location. This condition can hinder or promote success. For example, weather is an environmental factor that has traditionally influenced location decisions. Other environment conditions, such as competition, laws, and public attitudes, to name a few, are all part of the business environment. The time to evaluate all these environmental conditions is prior to making a location decision.

Resource Availability, the store location is an important factor to consider when selecting a location. Land, water supply, labor supply, transportation facilities, and waste disposal are just a few of the site-related factors that have a bearing on location costs.

Customer Accessibility, For the convenience store, customer accessibility is one important factor to be considered in selecting its location. The store must be located conveniently to customers.

- The Details of Each Alternative.

Building in Soi St. Louis 3: Soi St. Louis 3 area is a big community. It has a lot of offices, schools, and houses in this area. The map of this area is shown in Figure 5.1.

- Initial cost is 2,400,000 baht.

- Forecasted demand. High demand is about 30,000 baht per day or 900,000 baht per month. Low demand is about 20,000 baht per day or 600,000 baht per month.
- Operating cost and utility cost. High demand is about 40,000 baht per month. Low demand is about 35,000 baht per month.

- Labor cost is about 69,000 baht per month.

- Estimated revenue. High demand: Net profit is about 750,000 baht per month. Revenue for investors is 70% of net profit, it is about 500,000 baht per month. Low demand: Net profit is about 560,000 baht per month. Revenue for investors is 70% of net profit, it is about 390,000 baht per month.

Building on New Chan Road: This area consists of many small communities, some offices, and some industrial equipment stores. The map of this area is shown in Figure 5.2.

- Initial cost is 2,400,000 baht.

- Forecasted demand. High demand is about 20,000 baht per day or 600,000 baht per month. Low demand is about 10,000 baht per day or 300,000 baht per month.

- Operating cost and Utility cost. High demand is about 40,000 baht per month. Low demand is about 25,000 baht per month.

- Labor cost is about 69,000 baht per month.

- Estimated revenue. High demand: Net profit is about 490,000 baht per month. Revenue for investors is 70% of net profit, it is about 343,000 baht per month. Low demand: Net profit is about 206,000 baht per month. Revenue for investors is 70% of net profit, it is about 144,000 baht per month.
• The Hierarchy of All Elements.

Given:

\[ C_1 = \text{The initial cost} \]

\[ C_2 = \text{The operating cost} \]

\[ C_3 = \text{The demand level} \]

\[ C_4 = \text{The environment conditions} \]

\[ C_5 = \text{The resource availability} \]

\[ C_6 = \text{The customer accessibility} \]

\[ A_1 = \text{The building in Soi St. Louis 3} \]

\[ A_2 = \text{The building on New Chan Road} \]

The hierarchy of all elements will be shown in Figure 5.3.
Figure 5.1. A Map of Building in Soi St. Louis 3
Figure 5.2. A Map of Building on New Chan Road
When we finish step 1, we could set the relationship of each element in the hierarchy form. We will use this relationship to be a criterion for interviewing some staffs who are involved in the location checking process of the franchise company for gathering data in step 2.

B. Step 2: Pair-Wise Comparison Judgment

In this step, the factors at each level will be compared by a pair-wise comparison technique under the factors at the upper level. Data employed in this study are obtained from interviewing some staffs who are involved in the location checking process.
In this case, we interview three staffs: Mr. XX, Mr. YY, and Mr. ZZ. The data from these staffs are shown below:

Given:

\[\begin{align*}
C_1 &= \text{The initial cost} \\
C_2 &= \text{The operating cost} \\
C_3 &= \text{The demand level} \\
C_4 &= \text{The environment conditions} \\
C_5 &= \text{The resource availability} \\
C_6 &= \text{The customer accessibility}
\end{align*}\]

\[\begin{align*}
A_1 &= \text{The building in Soi St. Louis 3} \\
A_2 &= \text{The building on New Chan Road}
\end{align*}\]

1. Data from Mr. XX

Under the best location (the goal)

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2. Data from Mr. YY

Under the best location (the goal)

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Under the C1

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Under the C3

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Under the C4

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Under the C5

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Under the C6

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3. Data from Mr. ZZ

Under the best location (the goal)

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Under the C1

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Under the C4

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Under the C5

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Under the C6

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C. Step 3: Translate the Judgments into Numbers with Saaty’s Eigenvector Weighting Methods

In this step, we will translate the judgment from step 2 into the weight of each factor, the Consistency Index (C.I.), and the Consistency Ratio (C.R.).

In calculating the weight of each factor, the C.I., and the C.R., they will be calculated by the software program (Appendix D) which is developed for this purpose.

Now, considering the data in step 2.

Given:

\[
C1 = \text{The initial cost} \\
C2 = \text{The operating cost}
\]
C3 = The demand level
C4 = The environment conditions
C5 = The resource availability
C6 = The customer accessibility
A1 = The building in Soi St. Louis 3
A2 = The building on New Chan Road

1. Data from Mr. XX

Under the best location (the goal)

<table>
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Transfer into Matrix

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Size of Matrix = n x n = 6 x 6

R.I. = 1.24

λ_{max} = 6.230
C.I. = \((\lambda_{\text{max}} - n)/(n-1)\) = 0.046

C.R. = C.I./R.I. = 0.037

Under the C1

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Transfer into Matrix

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Size of Matrix = n x n = 2 x 2

R.I. = 0

\(\lambda_{\text{max}} = 2\)

C.I. = \((\lambda_{\text{max}} - n)/(n-1)\) = 0

C.R. = C.I./R.I. = 0

Under the C2

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Transfer into Matrix

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Size of Matrix = n x n = 2 x 2

R.I. = 0

\(\lambda_{\text{max}} = 2\)
C.I. = (λ_{\text{max}} - n)/(n-1) = 0  
C.R. = C.I./R.I. = 0  

Under the C3

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Transfer into Matrix

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Size of Matrix = n x n = 2 x 2  
R.I. = 0  
λ_{\text{max}} = 2  
C.I. = (λ_{\text{max}} - n)/(n-1) = 0  
C.R. = C.I./R.I. = 0  

Under the C4

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Transfer into Matrix

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<td>0.5</td>
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</tbody>
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Size of Matrix = n x n = 2 x 2  
R.I. = 0  
λ_{\text{max}} = 2
C.I. = (λ_{max} - n)/(n-1) = 0
C.R. = C.I./R.I. = 0

Under the C5

<table>
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Transfer into Matrix

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Size of Matrix = n x n = 2 x 2
R.I. = 0
λ_{max} = 2
C.I. = (λ_{max} - n)/(n-1) = 0
C.R. = C.I./R.I. = 0

Under the C6

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Transfer into Matrix

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Size of Matrix = n x n = 2 x 2
R.I. = 0
λ_{max} = 2
C.I. = (λ_{max} - n)/(n-1) = 0

C.R. = C.I./R.I. = 0

2. Data from Mr. YY

Under the best location (the goal)

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Transfer into Matrix

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Size of Matrix = n x n = 6 x 6

R.I. = 1.24

λ_{max} = 6.484

C.I. = (λ_{max} - n)/(n-1) = 0.096

C.R. = C.I./R.I. = 0.078
Under the C1

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Transfer into Matrix

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Size of Matrix  = n x n  = 2 x 2

R.I.  = 0

\( \lambda_{\text{max}} = 2 \)

C.I. = \( (\lambda_{\text{max}} - n)/(n-1) \) = 0

C.R. = C.I./R.I. = 0

Under the C2

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Transfer into Matrix

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Size of Matrix  = n x n  = 2 x 2

R.I.  = 0

\( \lambda_{\text{max}} = 2 \)

C.I. = \( (\lambda_{\text{max}} - n)/(n-1) \) = 0

C.R. = C.I./R.I. = 0
Under the C3

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**Transfer into Matrix**

Size of Matrix = \( n \times n \) = 2 x 2

R.I. = 0

\( \lambda_{\text{max}} = 2 \)

C.I. = \( (\lambda_{\text{max}} - n)/(n-1) \) = 0

C.R. = C.I./R.I. = 0

Under the C4

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**Transfer into Matrix**

Size of Matrix = \( n \times n \) = 2 x 2

R.I. = 0

\( \lambda_{\text{max}} = 2 \)

C.I. = \( (\lambda_{\text{max}} - n)/(n-1) \) = 0

C.R. = C.I./R.I. = 0
Under the C5

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Size of Matrix = n x n = 2 x 2

R.I. = 0

$\lambda_{\text{max}} = 2$

$C.I. = (\lambda_{\text{max}} - n)/(n-1) = 0$

$C.R. = C.I./R.I. = 0$

Under the C6

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Size of Matrix = n x n = 2 x 2

R.I. = 0

$\lambda_{\text{max}} = 2$

$C.I. = (\lambda_{\text{max}} - n)/(n-1) = 0$

$C.R. = C.I./R.I. = 0$
3. Data from Mr. ZZ

Under the best location (the goal)

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Transfer into Matrix

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Size of Matrix = n x n = 6 x 6

R.I. = 1.24

$\lambda_{max}$ = 6.374

C.I. = $\frac{(\lambda_{max} - n)}{(n-1)}$ = 0.074

C.R. = C.I./R.I. = 0.060

Under the C1

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111
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Size of Matrix = n x n = 2 x 2

R.I. = 0

$\lambda_{\text{max}} = 2$

C.I. = $(\lambda_{\text{max}} - n)/(n-1) = 0$

C.R. = C.I./R.I. = 0

Under the C2

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Transfer into Matrix

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<td>0.667</td>
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<tr>
<td>A2</td>
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Size of Matrix = n x n = 2 x 2

R.I. = 0

$\lambda_{\text{max}} = 2$

C.I. = $(\lambda_{\text{max}} - n)/(n-1) = 0$

C.R. = C.I./R.I. = 0

Under the C3

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Size of Matrix  \(= n \times n\)  \(= 2 \times 2\)

R.I.  \(= 0\)

\(\lambda_{\text{max}} = 2\)

C.I.  \(= (\lambda_{\text{max}} - n)/(n-1) = 0\)

C.R.  \(= \text{C.I.}/\text{R.I.} = 0\)

Under the C4

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<tr>
<td>A2</td>
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Size of Matrix  \(= n \times n\)  \(= 2 \times 2\)

R.I.  \(= 0\)

\(\lambda_{\text{max}} = 2\)

C.I.  \(= (\lambda_{\text{max}} - n)/(n-1) = 0\)

C.R.  \(= \text{C.I.}/\text{R.I.} = 0\)

Under the C5

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Transfer into Matrix

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Size of Matrix \(= n \times n = 2 \times 2\)

R.I. \(= 0\)

\(\lambda_{\text{max}} = 2\)

C.I. \(= (\lambda_{\text{max}} - n)/(n-1) = 0\)

C.R. \(= \text{C.I./R.I.} = 0\)

Under the C6

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<td>A2</td>
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<td>0.333</td>
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</table>

Size of Matrix \(= n \times n = 2 \times 2\)

R.I. \(= 0\)

\(\lambda_{\text{max}} = 2\)

C.I. \(= (\lambda_{\text{max}} - n)/(n-1) = 0\)

C.R. \(= \text{C.I./R.I.} = 0\)
D. Step 4: Calculate a List of Priority of Each Alternative and Select the Best Alternative

In this step, we will use the weight of each factor under the factor at the upper level from step 3 to be the data to calculate the weight of each alternative under the goal. When we finish the calculation in this step, all alternatives will be arranged from the most important alternative to the least important alternative. So, we will select the best location among many alternatives.

Given:

\begin{align*}
C_1 &= \text{The initial cost} \\
C_2 &= \text{The operating cost} \\
C_3 &= \text{The demand level} \\
C_4 &= \text{The environment conditions} \\
C_5 &= \text{The resource availability} \\
C_6 &= \text{The customer accessibility} \\
A_1 &= \text{The building in Soi St. Louis 3} \\
A_2 &= \text{The building on New Chan Road}
\end{align*}

1. Data from Mr.XX

Under the best location (the goal)

The weight of \(C_1\) is 0.211.

The weight of \(C_2\) is 0.422.
The weight of C3 is 0.133.
The weight of C4 is 0.046.
The weight of C5 is 0.061.
The weight of C6 is 0.125.

Under the C1
The weight of A1 is 0.5.
The weight of A2 is 0.5.

Under the C2
The weight of A1 is 0.667.
The weight of A2 is 0.333.

Under the C3
The weight of A1 is 0.8.
The weight of A2 is 0.2.

Under the C4
The weight of A1 is 0.5.
The weight of A2 is 0.5.

Under the C5
The weight of A1 is 0.667.
The weight of A2 is 0.333.

Under the C6
The weight of A1 is 0.75.
The weight of A2 is 0.25.

The weight of each factor under the factor at the upper level is shown in Figure 5.4.

Figure 5.4. The Weight of Each Factor under the Factor at the Upper Level (Mr.XX)
From Figure 5.4.

- Building in Soi St. Louis 3 (A1).

Under the best location (the goal)

The weight of A1 under the goal = \[0.211*0.500]+[0.422*0.667]
\[+0.133*0.800]+[0.046*0.500]
\[+0.061*0.667]+[0.125*0.750]
= 0.651

- Building on New Chan Road (A2).

Under the best location (the goal)

The weight of A2 under the goal = \[0.211*0.500]+[0.422*0.333]
\[+0.133*0.200]+[0.046*0.500]
\[+0.061*0.333]+[0.125*0.250]
= 0.347

Mr. XX's selection

The weight of A1 under the goal = 0.651

The weight of A2 under the goal = 0.347

A1 > A2

So, the best location is the Building in Soi St. Louis 3 (A1).
2. Data from Mr. YY

Under the best location (the goal)

The weight of $C_1$ is 0.214.
The weight of $C_2$ is 0.403.
The weight of $C_3$ is 0.141.
The weight of $C_4$ is 0.036.
The weight of $C_5$ is 0.063.
The weight of $C_6$ is 0.140.

Under the $C_1$

The weight of $A_1$ is 0.5.
The weight of $A_2$ is 0.5.

Under the $C_2$

The weight of $A_1$ is 0.75.
The weight of $A_2$ is 0.25.

Under the $C_3$

The weight of $A_1$ is 0.8.
The weight of $A_2$ is 0.2.

Under the $C_4$

The weight of $A_1$ is 0.5.
The weight of A2 is 0.5.

Under the C5
The weight of A1 is 0.5.
The weight of A2 is 0.5.

Under the C6
The weight of A1 is 0.75.
The weight of A2 is 0.25.

The weight of each factor under the factor at the upper level is shown in Figure 5.5.

Figure 5.5. The Weight of Each Factor under the Factor at the Upper Level (Mr. YY)
From Figure 5.5.

- Building in Soi St. Louis 3 (A1).

Under the best location (the goal)

The weight of A1 under the goal = \[(0.214*0.500) + (0.403*0.750) + (0.141*0.800) + (0.036*0.500) + (0.063*0.500) + (0.140*0.750)\] = 0.676

- Building on New Chan Road (A2).

Under the best location (the goal)

The weight of A2 under the goal = \[(0.214*0.500) + (0.403*0.250) + (0.141*0.200) + (0.036*0.500) + (0.063*0.500) + (0.140*0.250)\] = 0.320

Mr. YY’s selection

The weight of A1 under the goal = 0.676

The weight of A2 under the goal = 0.320

A1 > A2

So, the best location is the Building in Soi St. Louis 3 (A1).
3. Data from Mr.ZZ

Under the best location (the goal)

The weight of C1 is 0.231.
The weight of C2 is 0.401.
The weight of C3 is 0.132.
The weight of C4 is 0.041.
The weight of C5 is 0.058.
The weight of C6 is 0.134.

Under the C1

The weight of A1 is 0.5.
The weight of A2 is 0.5.

Under the C2

The weight of A1 is 0.667.
The weight of A2 is 0.333.

Under the C3

The weight of A1 is 0.75.
The weight of A2 is 0.25.

Under the C4

The weight of A1 is 0.5.
The weight of A2 is 0.5.

Under the C5

The weight of A1 is 0.333.
The weight of A2 is 0.667.

Under the C6

The weight of A1 is 0.667.
The weight of A2 is 0.333.

The weight of each factor under the factor at the upper level is shown in Figure 5.6.

Figure 5.6. The Weight of Each Factor under the Factor at the Upper Level (Mr.ZZ)
From Figure 5.6.

- Building in Soi St. Louis 3 (A1).

Under the best location (the goal)

The weight of A1 under the goal = \[0.231 \times 0.500 + 0.401 \times 0.667 + 0.132 \times 0.750 + 0.041 \times 0.500 + 0.058 \times 0.333 + 0.134 \times 0.667\]

\[+ 0.132 \times 0.750 + 0.041 \times 0.500 + 0.058 \times 0.333 + 0.134 \times 0.667\]

\[= 0.612\]

- Building on New Chan Road (A2).

Under the best location (the goal)

The weight of A2 under the goal = \[0.231 \times 0.500 + 0.401 \times 0.333 + 0.132 \times 0.250 + 0.041 \times 0.500 + 0.058 \times 0.667 + 0.134 \times 0.333\]

\[+ 0.132 \times 0.250 + 0.041 \times 0.500 + 0.058 \times 0.667 + 0.134 \times 0.333\]

\[= 0.386\]

Mr. ZZ’s selection

The weight of A1 under the goal = 0.612

The weight of A2 under the goal = 0.385

A1 > A2

So, the best location is the Building in Soi St. Louis 3 (A1).
E. Compare the Result with Company Procedure

We will consider the technique that the franchisee uses in selecting the convenience store location. The technique used by franchisee is the Decision Tree. There are many factors that are considered by the franchisee. They are the initial cost, the operating cost, the demand level, the environment conditions, the resource availability, and the customer accessibility.

The details of each alternative building are as follows:

- **Building in Soi St. Louis 3.**
  - Initial cost is 2,400,000 baht.
  - Forecasted demand. High demand is about 30,000 baht per day or 900,000 baht per month. Low demand is about 23,000 baht per day or 690,000 baht per month.
  - Operating cost and Utility cost. High demand is about 40,000 baht per month. Low demand is about 35,000 baht per month.
  - Labor cost is about 69,000 baht per month.
  - Estimated revenue. High demand: Net profit is about 750,000 baht per month. Revenue for investors is 70% of net profit, it is about 500,000 baht per month. Low demand: Net profit is about 560,000 baht per month. Revenue for investors is 70% of net profit, it is about 390,000 baht per month.
  - The contact period is 9 years.
  - High demand: The probability is 75%.
- Low demand: The probability is 25%.

- Building on New Chan Road.
  - Initial cost is 2,400,000 baht.
  - Forecasted demand. High demand is about 20,000 baht per day or 600,000 baht per month. Low demand is about 10,000 baht per day or 300,000 baht per month.
  - Operating cost and Utility cost. High demand is about 40,000 baht per month. Low demand is about 25,000 baht per month.
  - Labor cost is about 69,000 baht per month.
  - Estimated revenue. High demand: Net profit is about 490,000 baht per month. Revenue for investors is 70% of net profit, it is about 343,000 baht per month. Low demand: Net profit is about 206,000 baht per month. Revenue for investors is 70% of net profit, it is about 144,000 baht per month.
  - The contact period is 9 years.
  - High demand: The probability is 75%.
  - Low demand: The probability is 25%.

The data of two locations can be summarized in Figure 5.7. (Taha, 1995)

The evaluation of Building in Soi St. Louis 3 :

\[ E\{\text{Soi St. Louis 3}\} = [(500,000*0.75) + (390,000*0.25)] * 108 - 2,400,000 \]

\[ = 48,630,000 \text{ baht} \]

The evaluation of Building on New Chan Road :

\[ E\{\text{New Chan Road}\} = [(343,000*0.75) + (144,000*0.25)] * 108 - 2,400,000 \]

\[ = 29,271,000 \text{ baht} \]

We can see that \( E\{\text{Soi St. Louis 3}\} > E\{\text{New Chan Road}\} \).
So, the best location for the FFF Store is at Building in Soi St. Louis 3.

In reality, the investors invested in the Building in Soi St. Louis 3.

From the AHP result, the best location of the FFF Store is the Building in Soi St. Louis 3. It is the same result as the decision of franchisee and investors in the past.
Figure 5.7. Summarized Data of Two Locations for the Convenience Store Location Decision
VI. THE APPLICATION OF THE AHP IN THE DOCUMENT STORAGE FACILITY LOCATION

The facility location and the analytic hierarchy process are described in chapter 2 and chapter 3. Thus, the application of the knowledge from these two chapters for considering the selection of the document storage location will be discussed in this chapter.

A. Step 1: Break Down of the Decision Problem into a Hierarchy of Interrelated Elements

- Organization. In this case study, we will study the location selection problem in one organization, named the CH bank (assumed name). The executives of the bank want to find one document warehouse in Bangkok for keeping the customer's documents. There are a lot of document warehouses in Bangkok or perimeter. In considering, the selected document warehouse must have good surveillance systems, good systems in keeping and retrieving documents, to have good service level, to have good delivery system, be a famous warehouse, and charge proper fee rate. And the contact period should be 5 years. The expected quantity of documents are about 1,600 cartons per year (carton size L: 16 ¾ inches, W:12 ¼ inches, H:10 ¾ inches).

- The Factors at Each Level.

  - Level 1, Level of the goal for decision making. For the CH bank, the goal is the best location for document storage.

  - Level 2, Level of the factors that considered for decision making. In this case, there are many factors that are considered as follows:
- Fee charge.
- Surveillance system.
- Keeping and retrieving system.
- Delivery system.
- Service level.

- Level 3, Level of the alternatives. There are two document warehouse that the executives of CH bank are interested in them. They are as follows:

  - The document warehouse in Chachoengsao.
  - The document warehouse in Samuthprakarn.

- The Details of Each Factor.

  Fee Charge, we consider about the expenses that the bank must pay to the document warehouse. There are many expenses: such as the expenses for collection service, the expense for storage, the expense for retrieval from racking, the expense for delivery to client premises, etc.

  Surveillance System, we consider about the preventive systems that avoid and prevent damage or loss of documents. Such as infra-red intruder alarm system, proven pest control system, flood prevention system, etc.

  Keeping and Retrieving System, we consider the method and technology that are used to keep and retrieve the documents: such as use of computer management system.

  Delivery System, we consider the transportation system that is used to provide service to customers. Such as the number of document trucks in the warehouse, and how to delivery documents.

  Service Level, we consider the service that the document warehouse prepares for customers.
• The Details of Each Alternative

The Document Warehouse in Chachoengsao, There are the details of the service
and expenses as follows:

- Collection service. Collection from client premises.
  Cost: Baht 10 per carton/tube.
  or client may deliver in their own vehicles.

- Storage. Storage of cartons/tubes is by calendar month or part thereof
  basis.
  Cost: Baht 15 per standard carton.
  Baht 40 per standard tubes.
  Non-standard cartons are charged pro-rated against standard carton.

- Retrieval from racking (includes return to system charge). This service is
  for the initial removal of cartons/tubes from storage racks for either permanent
  withdrawal (destruction), onwards delivery to client offices, or to viewing room,
  and for the updating of computer management system.
  Cost: First 20 cartons/tubes are free of charge per each withdrawal.
  Thereafter: Baht 20 per carton/tube.

- Delivery to client premises (cost includes delivery/collection).
  Cost: Baht 1,000 for up to 20 cartons/tubes, same day retrieval.
  Cost: Baht 400 for up to 20 cartons/tubes, next day retrieval.
  Thereafter, by negotiation depending on the number of items
  retrieved.

  Standard tube (diameter 5 inches).
Cost: Baht 35 per standard carton-subject to change.

Baht 70 per standard tube-subject to change.

Non-standard cartons can be quoted for if required.

Cartons/tubes are delivered free of charge on an on-going basis providing that a maximum order of 50 cartons/tubes is made. Order of less than 50 cartons/tubes carry a flat fee delivery charge of baht 200.

- Viewing room (subject to availability). The viewing room is for clients who wish to access cartons at storage center. Reasonable photocopying, local facsimile and phone services are available along with refreshment on a free of charge basis during normal office hours.

  Cost: Free of charge.

- Carton/tube loading and indexing (standard indexing only). This service is for clients who wish the warehouse to assist indexing and loading of cartons/tubes at storage facilities. Supervision may be by clients representative and subject to prior inspection of the indexing requirement.

  Cost: Baht 20 per carton indexed.

  Baht 35 per tube indexed.

  If ring binders are required to be returned to clients, add baht 5 to the above standard indexing charge per ring binder.

  If indexing or assistance is required out of premises then, add 10 baht to the above standard indexing charge per carton.

- Destruction.

  Cost: Baht 15 per standard carton.

  Baht 40 per standard tube.
- Bar-code identification label

Cost: Free of charge.

The advantages of using this warehouse.

- Seven days a week immediate access to records and archives by authorized personnel.
- Day & Night man guard services by Guard-force.
- Full surveillance systems including infra-red intruder alarm systems.
- Day scan movements surveillance cameras.
- Computerized access control system for entry into storage center.
- Full proven pest control system.
- Full tested flood prevention program.
- Six vehicles for retrieval services, seven days a week.
- Over 500 clients daily being serviced by staff each day in areas that range from Rayong to Hua Hin.
- Guaranteed 4 hours retrieval services.

The Document Warehouse in Samuthprakarn. There are the details of service and expenses as follows:

- Collection service. Collection from client premises.

Cost: Baht 10 per carton/tube.

or client may deliver in their own vehicles.

- Storage. Storage of cartons/tubes is by calendar month or part thereof basis.

Cost: Baht 13 per standard carton.

Baht 35 per standard tubes.
Non-standard cartons are charged pro-rated against standard carton.

- Retrieval from racking (includes return to system charge). This service is for the initial removal of cartons/tubes from storage racks for either permanent withdrawal (destruction), onwards delivery to client offices, or to viewing room, and for the updating of computer management system.

  Cost: First 30 cartons/tubes are free of charge per each withdrawal.

  Thereafter: Baht 25 per carton/tube.

- Delivery to client premises (cost includes delivery/collection).

  Cost: Baht 1,100 for up to 25 cartons/tubes, same day retrieval.

  Cost: Baht 500 for up to 25 cartons/tubes, next day retrieval.

  Thereafter by negotiation depending on number of items retrieved.


  Standard tube (diameter 5 inches).

  Cost: Baht 30 per standard carton-subject to change.

  Baht 70 per standard tube-subject to change.

  Non-standard cartons can be quoted for if required.

  Cartons/tubes are delivered free of charge.

- Viewing room (subject to availability). The viewing room is for clients who wish to access cartons at storage center. Reasonable photocopying, local facsimile and phone services are available along with refreshment on a free of charge basis during normal office hours.

  Cost: Free of charge.

- Carton/tube loading and indexing (standard indexing only). This service is for clients who wish the warehouse to assist with indexing and loading of
cartons/tubes at storage facilities. Supervision may be by clients representative and subject to prior inspection of the indexing requirement.

Cost: Baht 25 per carton indexed.

Baht 35 per tube indexed.

- Destruction.

Cost: Baht 15 per standard carton.

Baht 40 per standard tube.

- Bar-code identification label.

Cost: Free of charge.

The advantages of using this warehouse.

- Seven days a week immediate access to records and archives by authorized personnel.

- Day & Night man guard services by Guard-force.

- Day scan movements surveillance cameras.

- Computerized access control system for entry into storage center.

- Full proven pest control system.

- Full tested flood prevention program.

- Eight vehicles for retrieval services, seven days a week.

- Guaranteed 4 hours retrieval services.

• The Hierarchy of All Elements.

Given:

\[
\begin{align*}
C1 & = \text{Fee charge} \\
C2 & = \text{Surveillance system} \\
C3 & = \text{Keeping and retrieving system}
\end{align*}
\]
C4 = Delivery system
C5 = Service level
A1 = The document warehouse in Chachoengsao
A2 = The document warehouse in Samuthprakarn

The hierarchy of all elements will be shown in Figure 6.1.

When we finish step 1, we could set the relationship of each element in the hierarchy form. We will use this relationship to be a criterion for interviewing some bank officers who are involved in selecting the location for storing documents of the CH bank for gathering the data in step 2.

Figure 6.1. The Hierarchy of All Elements in Document Storage Facility Location
B. Pair-Wise Comparison Judgment

In this step, the factors at each level will be compared by a pair-wise comparison technique under the factors at the upper level. Data employed in this study are obtained from interviewing some officers who are involved in selecting the location for storing documents.

In this case, we send the questionnaires to three staffs: Mr. MM, Mr. NN, and Mr. OO. The data from these staffs is shown below:

Given:

- C1 = Fee charge
- C2 = Surveillance system
- C3 = Keeping and retrieving system
- C4 = Delivery system
- C5 = Service level
- A1 = The document warehouse in Chachoengsao
- A2 = The document warehouse in Samuthprakarn
1. Data from Mr. MM

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138
2. Data from Mr. NN

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Under the C3

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Under the C4

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Under the C5

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140
C. Step 3: Translate the Judgments into Numbers with Saaty’s Eigenvector Weighting Methods

In this step, we will translate the decision from step 2 into the weight of each factor, the Consistency Index (C.I.), and the Consistency Ratio (C.R.).

In calculating the weight of each factor, the C.I., and the C.R. will be calculated by the software program (Appendix D) which is developed for this purpose.

Now, considering the data from step 2.

Given:

C1 = Fee charge

C2 = Surveillance system

C3 = Keeping and retrieving system

C4 = Delivery system

C5 = Service level

A1 = The document warehouse in Chachoengsao

A2 = The document warehouse in Samuthprakarn
1. Data from Mr. MM

Under the best location (the goal)

<table>
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<tr>
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Transfer into Matrix

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Size of Matrix \(= n \times n = 6 \times 6\)

R.I. = 1.12

\(\lambda_{\text{max}} = 5.278\)

C.I. = \((\lambda_{\text{max}} - n)/(n-1)\) = 0.069

C.R. = C.I./R.I. = 0.062

Under the C1

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Transfer into Matrix

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Size of Matrix \( = n \times n \) \( = 2 \times 2 \)

R.I. \( = 0 \)

\( \lambda_{\text{max}} = 2 \)

C.I. \( = (\lambda_{\text{max}} - n)/(n-1) \) \( = 0 \)

C.R. \( = \text{C.I.}/\text{R.I.} \) \( = 0 \)

Under the C2

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Transfer into Matrix

Size of Matrix \( = n \times n \) \( = 2 \times 2 \)

R.I. \( = 0 \)

\( \lambda_{\text{max}} = 2 \)

C.I. \( = (\lambda_{\text{max}} - n)/(n-1) \) \( = 0 \)

C.R. \( = \text{C.I.}/\text{R.I.} \) \( = 0 \)

Under the C3

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Transfer into Matrix
Size of Matrix \( = n \times n = 2 \times 2 \)

R.I. = 0

\( \lambda_{\text{max}} = 2 \)

C.I. = \((\lambda_{\text{max}} - n)/(n-1)\) = 0

C.R. = C.I./R.I. = 0

Under the C4

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Transfer into Matrix

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Size of Matrix \( = n \times n = 2 \times 2 \)

R.I. = 0

\( \lambda_{\text{max}} = 2 \)

C.I. = \((\lambda_{\text{max}} - n)/(n-1)\) = 0

C.R. = C.I./R.I. = 0

Under the C5

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Transfer into Matrix

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\( \lambda_{\text{max}} = 2 \)
C.I.  = \( (\lambda_{\text{max}} - n)/(n-1) \)  = 0
C.R.  = C.I./R.I.  = 0

2. Data from Mr. NN

Under the best location (the goal)

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Transfer into Matrix

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R.I.  = 1.12
\( \lambda_{\text{max}} = 5.154 \)
C.I.  = \( (\lambda_{\text{max}} - n)/(n-1) \)  = 0.038
C.R.  = C.I./R.I.  = 0.034
Under the C1

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Transfer into Matrix

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Size of Matrix  =  n x n  =  2 x 2

R.I. = 0

\( \lambda_{\text{max}} = 2 \)

C.I. = \( (\lambda_{\text{max}} - n)/(n-1) \) = 0

C.R. = C.I./R.I. = 0

Under the C2

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Transfer into Matrix

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Size of Matrix  =  n x n  =  2 x 2

R.I. = 0

\( \lambda_{\text{max}} = 2 \)

C.I. = \( (\lambda_{\text{max}} - n)/(n-1) \) = 0

C.R. = C.I./R.I. = 0
Under the C3

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Transfer into Matrix

Size of Matrix \( = n \times n = 2 \times 2 \)

R.I. \( = 0 \)

\( \lambda_{\text{max}} = 2 \)

C.I. \( = \frac{\lambda_{\text{max}} - n}{n-1} = 0 \)

C.R. \( = \frac{\text{C.I.}}{\text{R.I.}} = 0 \)

Under the C4

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Transfer into Matrix

Size of Matrix \( = n \times n = 2 \times 2 \)

R.I. \( = 0 \)

\( \lambda_{\text{max}} = 2 \)

C.I. \( = \frac{\lambda_{\text{max}} - n}{n-1} = 0 \)

C.R. \( = \frac{\text{C.I.}}{\text{R.I.}} = 0 \)
Under the C5

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Transfer into Matrix

Size of Matrix = n x n = 2 x 2

R.I. = 0

λmax = 2

C.I. = (λmax - n)/(n-1) = 0

C.R. = C.I./R.I. = 0

3. Data from Mr. OO

Under the best location (the goal)

<table>
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<tr>
<td>C2</td>
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</tr>
<tr>
<td>C3</td>
<td>3</td>
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<td>0.339</td>
</tr>
<tr>
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<td>1/4</td>
<td>1/4</td>
</tr>
<tr>
<td>C5</td>
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Transfer into Matrix

The goal: C1 C2 C3 C4 C5 Weight

C1 1 1/3 1/3 2 1 0.124
C2 3 1 1 4 3 0.339
C3 3 1 1 4 3 0.339
C4 1/2 1/4 1/4 1 1/2 0.073
C5 1 1/3 1/3 2 1 0.124
Size of Matrix = n x n = 6 x 6

R.I. = 1.12

$\lambda_{\text{max}} = 5.026$

C.I. = $(\lambda_{\text{max}} - n)/(n-1) = 0.007$

C.R. = C.I./R.I. = 0.006

Under the C1

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<tr>
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<td>+6</td>
<td>+5</td>
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Transfer into Matrix

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</tr>
<tr>
<td>A2</td>
<td>3</td>
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Size of Matrix = n x n = 2 x 2

R.I. = 0

$\lambda_{\text{max}} = 2$

C.I. = $(\lambda_{\text{max}} - n)/(n-1) = 0$

C.R. = C.I./R.I. = 0

Under the C2

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<td>+3</td>
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<td>+1</td>
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Transfer into Matrix

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<tr>
<td>A2</td>
<td>1/2</td>
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Size of Matrix = $n \times n = 2 \times 2$

R.I. = 0

$\lambda_{\text{max}} = 2$

C.I. = $(\lambda_{\text{max}} - n)/(n-1) = 0$

C.R. = C.I./R.I. = 0

Under the C3

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<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>A2</td>
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<td>1</td>
<td></td>
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Transfer into Matrix

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<tr>
<td>A2</td>
<td>1/3</td>
<td>1</td>
<td>0.25</td>
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</table>

Size of Matrix = $n \times n = 2 \times 2$

R.I. = 0

$\lambda_{\text{max}} = 2$

C.I. = $(\lambda_{\text{max}} - n)/(n-1) = 0$

C.R. = C.I./R.I. = 0

Under the C4

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<td>3</td>
<td>4</td>
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Transfer into Matrix

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<tbody>
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<td>0.5</td>
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<tr>
<td>A2</td>
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<td>1</td>
<td>0.5</td>
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</table>

Size of Matrix = $n \times n = 2 \times 2$
R.I. = 0

\( \lambda_{\text{max}} = 2 \)

C.I. = \( \frac{\lambda_{\text{max}} - n}{(n-1)} \) = 0

C.R. = C.I./R.I. = 0

Under the C5

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Transfer into Matrix

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<th>Weight</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>A2</td>
<td>1/2</td>
<td>1</td>
<td>0.333</td>
</tr>
</tbody>
</table>

Size of Matrix = \( n \times n \) = 2 x 2

R.I. = 0

\( \lambda_{\text{max}} = 2 \)

C.I. = \( \frac{\lambda_{\text{max}} - n}{(n-1)} \) = 0

C.R. = C.I./R.I. = 0

D. Step 4: Calculate a List of Priority of Each Alternative and Select the Best Alternative

In this step, we will use the weight of each factor under the factor at the upper level from step 3 to be the data to calculate the weight of each alternative under the goal. When we finish the calculation in this step, all alternatives will be arranged from the most important alternative to the least important alternative. So, we will select the best location among many alternatives.
Given:

C1 = Fee charge
C2 = Surveillance system
C3 = Keeping and retrieving system
C4 = Delivery system
C5 = Service level
A1 = The document warehouse in Chachoengsao
A2 = The document warehouse in Samuthprakarn

1. Data from Mr. MM

Under the best location (the goal)
The weight of C1 is 0.163.
The weight of C2 is 0.322.
The weight of C3 is 0.299.
The weight of C4 is 0.080.
The weight of C5 is 0.135.

Under the C1
The weight of A1 is 0.25.
The weight of A2 is 0.75.

Under the C2
The weight of A1 is 0.75.
The weight of $A_2$ is 0.25.

Under the C3

The weight of $A_1$ is 0.667.
The weight of $A_2$ is 0.333.

Under the C4

The weight of $A_1$ is 0.5.
The weight of $A_2$ is 0.5.

Under the C5

The weight of $A_1$ is 0.667.
The weight of $A_2$ is 0.333.

The weight of each factor under the factor at the upper level is shown in Figure 6.2.
The Goal

The Factors

The Alternatives

Figure 6.2. The Weight of Each Factor under the Factor at the Upper Level (Mr.MM)

From Figure 6.2.

- The document warehouse in Chachoengsao (A1).

Under the best location (the goal)

The weight of A1 under the goal = [0.163*0.250]+[0.322*0.750]

+ [0.299*0.667]+[0.080*0.500]

+ [0.135*0.667]

= 0.612
• The document warehouse in Samuthprakarn (A2).

Under the best location (the goal)

The weight of A1 under the goal = \([0.163*0.750]+[0.322*0.250] +[0.299*0.333]+[0.080*0.500] +[0.135*0.333] \]

= 0.387

Mr.MM’s selection

The weight of A1 under the goal = 0.612

The weight of A2 under the goal = 0.387

A1>A2

So, the best location is the document warehouse in Chachoengsao (A1).

2. Data from Mr.NN

Under the best location (the goal)

The weight of C1 is 0.149.

The weight of C2 is 0.351.

The weight of C3 is 0.329.

The weight of C4 is 0.078.

The weight of C5 is 0.093.
Under the C1
The weight of A1 is 0.2.
The weight of A2 is 0.8.

Under the C2
The weight of A1 is 0.75.
The weight of A2 is 0.25.

Under the C3
The weight of A1 is 0.75.
The weight of A2 is 0.25.

Under the C4
The weight of A1 is 0.5.
The weight of A2 is 0.5.

Under the C5
The weight of A1 is 0.75.
The weight of A2 is 0.25.

The weight of each factor under the factor at the upper level is shown in Figure 6.3.
The Goal

The Best Location

The Factors

The Alternatives

From Figure 6.3.

- The document warehouse in Chachoengsao (A1).

Under the best location (the goal)

The weight of A1 under the goal = [0.149*0.200]+[0.351*0.750]
  +[0.329*0.750]+[0.078*0.500]
  +[0.093*0.750]
  = 0.649
- The document warehouse in Samuthprakarn (A2).

Under the best location (the goal)

The weight of A1 under the goal = \[0.149 \times 0.800\] + \[0.351 \times 0.250\] + \[0.329 \times 0.250\] + \[0.078 \times 0.500\] + \[0.093 \times 0.250\]

= 0.351

Mr. NN's selection

The weight of A1 under the goal = 0.649

The weight of A2 under the goal = 0.351

A1 > A2

So, the best location is the document warehouse in Chachoengsao (A1).

3. Data from Mr. OO

Under the best location (the goal)

The weight of C1 is 0.124.

The weight of C2 is 0.339.

The weight of C3 is 0.339.

The weight of C4 is 0.073.

The weight of C5 is 0.124.
Under the C1
The weight of A1 is 0.25.
The weight of A2 is 0.75.

Under the C2
The weight of A1 is 0.667.
The weight of A2 is 0.333.

Under the C3
The weight of A1 is 0.75.
The weight of A2 is 0.25.

Under the C4
The weight of A1 is 0.5.
The weight of A2 is 0.5.

Under the C5
The weight of A1 is 0.667.
The weight of A2 is 0.333.

The weight of each factor under the factor at the upper level is shown in Figure 6.4.
The Goal

The Best Location

The Factors

C1=0.124 C2=0.339 C3=0.339 C4=0.073 C5=0.124

The Alternatives

A1

A2

C1: A1=0.250 C1:A2=0.750
C2: A1=0.667 C2:A2=0.333
C3: A1=0.750 C3:A2=0.250
C4: A1=0.500 C4:A2=0.500
C5: A1=0.667 C5:A2=0.333

Figure 6.4. The Weight of Each Factor under the Factor at the Upper Level (Mr.OO)

From Figure 6.4.

- The document warehouse in Chachoengsao (A1).

Under the best location (the goal)

The weight of A1 under the goal = [0.124*0.250]+[0.339*0.667] +[0.339*0.750]+[0.073*0.500] +[0.124*0.667]

= 0.631
• The document warehouse in Samuthprakarn (A2).

Under the best location (the goal)

The weight of A1 under the goal = \[0.124\times 0.750]+[0.339\times 0.333]\]
\+[0.339\times 0.250]+[0.073\times 0.500]
\+[0.124\times 0.333]
= 0.368

Mr. OO’s selection

The weight of A1 under the goal = 0.631

The weight of A2 under the goal = 0.368

A1 > A2

So, the best location is the document warehouse in Chachoengsao (A1).

E. Compare the Result with Company Procedure

We will consider the technique that the officers of CH Bank use in selecting the Document Storage location. The technique used by the offices of CH Bank is the Net Present Value Evaluation. In considering, the officers of CH Bank use financial data from each document warehouse and the advantage of each document warehouse is the criterion in selecting the document storage location.

The estimated number of documents is about 1,600 cartons per year.

The contact periods are 5 years.
The interest rate, $i$, is 15% per year.

- The Document Warehouse in Chachoengsao.

**YEAR 1**

- Storage cost is 15 baht per carton per month.

  Number of documents = 1,600 cartons per year

  Storage cost = \(1,600 \times 15 \times 12\)

  = 288,000 baht

- Carton loading and indexing is 20 baht per carton (only year 1).

  Number of documents = 1,600 cartons per year

  Carton loading & indexing cost = \(1,600 \times 20\)

  = 32,000 baht

- Other costs (Such as: collection service cost, retrieval from racking cost, delivery cost, etc.).

  Estimated other costs = 20,000 baht

  So; Total cost for year 1 = 340,000 baht

**YEAR 2**

- Storage cost is 15 baht per carton per month.

  Number of documents = 1,600 cartons per year

  Storage cost = \(1,600 \times 15 \times 12\)

  = 288,000 baht
- Other costs (Such as: collection service cost, retrieval from racking cost, delivery cost, etc.).

Estimated other costs = 20,000 baht
So; Total cost for year 2 = 308,000 baht

YEAR 3

- Storage cost is 15 baht per carton per month.

Number of documents = 1,600 cartons per year
Storage cost = 1,600 x 15 x 12
= 288,000 baht

- Other costs (Such as: collection service cost, retrieval from racking cost, delivery cost, etc.).

Estimated other costs = 20,000 baht
So; Total cost for year 3 = 308,000 baht

YEAR 4

- Storage cost is 15 baht per carton per month.

Number of documents = 1,600 cartons per year
Storage cost = 1,600 x 15 x 12
= 288,000 baht

- Other costs (Such as: collection service cost, retrieval from racking cost, delivery cost, etc.).

Estimated other costs = 20,000 baht
So; Total cost for year 4 = 308,000 baht
YEAR 5

- Storage cost is 15 baht per carton per month.

Number of documents = 1,600 cartons per year

Storage cost = 1,600 x 15 x 12
= 288,000 baht

- Other costs (Such as: collection service cost, retrieval from racking cost, delivery cost, etc.).

Estimated other costs = 20,000 baht

So; Total cost for year 5 = 308,000 baht

The cash flow for the document warehouse in Chachoengsao is shown in Figure 6.5.

Figure 6.5. Show the Cash Flow of the Document Warehouse in Chachoengsao

Net Present Value (NPV) = 340,000 + 308,000/(1+0.15) + 308,000/(1+0.15)^2
+ 308,000/(1+0.15)^3 + 308,000/(1+0.15)^4
= 1,219,333.34 baht
The Document Warehouse in Samuthprakarn.

YEAR 1

- Storage cost is 13 baht per carton per month.

Number of documents = 1,600 cartons per year

Storage cost = 1,600 x 13 x 12

= 249,600 baht

- Carton loading and indexing is 25 baht per carton (only year 1).

Number of documents = 1,600 cartons per year

Carton loading & indexing cost = 1,600 x 25

= 40,000 baht

- Other costs (Such as: collection service cost, retrieval from racking cost, delivery cost, etc.).

Estimated other costs = 30,000 baht

So, Total cost for year 1 = 319,600 baht

YEAR 2

- Storage cost is 13 baht per carton per month.

Number of documents = 1,600 cartons per year

Storage cost = 1,600 x 13 x 12

= 249,600 baht

- Other costs (Such as: collection service cost, retrieval from racking cost, delivery cost, etc.).

Estimated other costs = 30,000 baht
So; Total cost for year 2 = 279,600 baht

YEAR 3
- Storage cost is 13 baht per carton per month.
Number of documents = 1,600 cartons per year
Storage cost = 1,600 x 13 x 12
= 249,600 baht
- Other costs (Such as: collection service cost, retrieval from racking cost, delivery cost, etc.).
Estimated other costs = 30,000 baht
So; Total cost for year 3 = 279,600 baht

YEAR 4
- Storage cost is 13 baht per carton per month.
Number of documents = 1,600 cartons per year
Storage cost = 1,600 x 13 x 12
= 249,600 baht
- Other costs (Such as: collection service cost, retrieval from racking cost, delivery cost, etc.).
Estimated other costs = 30,000 baht
So; Total cost for year 4 = 279,600 baht

YEAR 5
- Storage cost is 13 baht per carton per month.
Number of documents  =  1,600 cartons per year

Storage cost  =  1,600 x 13 x 12

=  249,600 baht

- Other costs (Such as: collection service cost, retrieval from racking cost, delivery cost, etc.).

Estimated other costs  =  30,000 baht

So; Total cost for year 5  =  279,600 baht

The cash flow for the document warehouse in Samuthprakarn is shown in Figure 6.6.

![Cash Flow Diagram](image)

Figure 6.6. Show the Cash Flow of the Document Warehouse in Samuthprakarn

Net Present Value (NPV)  =  319,600 + 279,600/(1+0.15) + 279,600/(1+0.15)^2

+ 279,600/(1+0.15)^3 + 279,600/(1+0.15)^4

= 1,117,851.95 baht

We can see that NPV {Chachoengsao} > NPV {Samuthprakarn}.

It shows that the expense when using the document warehouse in Chachoengsao is more than the expense when using the document warehouse in Samuthprakarn.
So, the best location for storing documents is of the CH Bank at the document warehouse in Samuthprakarn.

In reality, officers of the CH Bank select the document warehouse in Samuthprakarn.

From the AHP result, the best location for storing documents of the CH Bank is the document warehouse in Chachoengsao. It is the different result with the decision of officers of the CH Bank. The difference of results will be discussed in chapter VII.
VII. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

The Analytic Hierarchy Process (AHP) is one of the multi-criteria decision-making techniques. It is an efficient technique that is not complex and is easy to use. So, it is interesting to apply this technique for selecting facility location in different businesses.

The Analytic Hierarchy Process (AHP) consists of four steps.

1. Break down of the decision problem into a hierarchy of interrelated element.
2. Pair-wise comparison judgment.
3. Translate the judgment into numbers by using Saaty’s eigenvector weight method.
4. Calculate a list of priority of each alternative and select the best alternative.

In this report, there are three case applications in different businesses that are analyzed with the AHP technique. The first case study is the application of the analytic hierarchy process in the plant site selection. The second case study is the application of the analytic hierarchy process in the convenience store location decision. The third case study is the application of the analytic hierarchy process in the document storage facility location.
Each case study can be concluded as follows:


- With the AHP technique, the hierarchy of interrelated elements of all factors, sub-factors, and alternatives are as follows:

  Level 1: The goal is the best location for the new Sorbital factory.

  Level 2: Level of the main factors that consist of the monetary factors and non-monetary factors.

  Level 3: Level of the sub-factors of each main factor.

    - Sub-factors of the monetary factors.
      - Initial Cost.
      - Annually Cost.

    - Sub-factors of the non-monetary factors.
      - Material Availability.
      - Utility System.
      - Labor Availability.
      - Community Attitude.
      - Marketing Advantage.
      - Land Advantage.

  Level 4: Level of the alternatives.

    - Land in Nakhon-Ratchasima.
    - Land in Kallasin.
Land in Rayong.

The hierarchy form is shown in Figure 4.4 in chapter IV.

• The data obtained from three experts and calculated with the AHP technique show that:
  
  – The monetary factors are more important than the non-monetary factors.
  
  – Under the monetary factors, the initial cost is the most important.
  
  – Under the non-monetary factors, the material availability, the utility system, the labor availability, and the marketing advantage are very important, when compared with others.
  
  – Under the goal, the best location for the new Sorbital factory is the land in Nakhon-Ratchasima.

• In practice, the technique that is used is decision-matrix. The factors that are used in considering are the same as the factors that are used in considering with the AHP technique. By the same factors, the results from decision-matrix and AHP are the same. The best location for new Sorbital factory is the land in Nakhon-Ratchasima.

2. Case II: The Application of the Analytic Hierarchy Process in the Convenience Store Location Decision

• With the AHP technique, the hierarchy of interrelated element of all factors, sub-factors, and alternatives are as follows:

  Level 1: The goal is the best location for the FFF Store.

  Level 2: Level of the factors that are considered for decision-making.
  
  – Initial Cost.
- Operating Cost.
- Demand Level.
- Environment Conditions.
- Resource Availability.
- Customer Accessibility.

Level 3: Level of the alternatives.

- The building in Soi St. Louis 3.
- The building on New Chan road.

The hierarchy form is shown in Figure 5.3 in chapter V.

- The data obtained from three staffs and calculated with the AHP technique show that:
  - Operating cost, initial cost, demand level, and customer accessibility are more important, when compared with others.
  - Under the goal, the best location for FFF store is the building in Soi St. Louis 3.
- In practice, the technique that is used is decision-tree. The factors that are used in considering, are the same as the factors that are used in considering with the AHP technique. By the same factors, the result from decision-tree and AHP are the same. The best location for FFF store is the building in Soi St. Louis 3.

- With the AHP technique, the hierarchy of interrelated element of all factors, sub-factors, and alternatives are as follows:

  Level 1: The goal is the best location for document storage.

  Level 2: Level of the factors that are considered for decision-making.

  - Fee Charge.
  - Surveillance System.
  - Keeping and Retrieving System.
  - Delivery System.
  - Service Level.

  Level 3: Level of the alternatives.

  - The document warehouse in Chachoengsao.
  - The document warehouse in Samuthprakan.

The hierarchy form is shown in Figure 6.1 in chapter VI.

- The data obtained from three officers and calculated with the AHP technique show that:

  - Surveillance system, keeping and retrieving system, and fee charge are more important, when compared with others.

  - Under the goal, the best location for document storage of CH bank is the document warehouse in Chachoengsao.
In practice, the technique that is used is net present value evaluation. The factor that is used in considering, is the fee charge only. The result from net present value evaluation shows that the best location for document storage of CH bank is the document warehouse in Samutprakarn. This result is different from AHP technique. Because of this result, with net present value evaluation, fee charge is only one factor that is considered, but with AHP technique, fee charge, surveillance system, keeping and retrieving system, delivery system, and service level are factors that are considered. But under the fee charge factor only, both of two techniques show that the best location for document storage of CH bank is the document warehouse in Samutprakarn. It shows that under the same factor, both of the two techniques give the same result.

B. Recommendations

From studying, there are the recommendations as follows:

- The factors that relate with the problem are necessary and important to be considered with the AHP technique. So, in different problems, the factors must be set for each problem. These factors should be set by persons who have knowledge and experience in that problem.

- With the AHP technique, the data should be obtained from many persons who have knowledge and experience in the problem, so that the result from the AHP technique will have high reliability.
• If the result that are obtained from many persons are more different, the best alternative cannot be obtained because each person has his own opinion on the problem. In this case, the Delphi technique should be used to support the AHP technique.

• At present, computer is very efficient. Computer program should be used in calculating.

The AHP facilitates location decisions by helping decision makers distinguish clearly the priority of each factor and the appropriateness of each alternative with respect to a factor by a procedure of making pair-wise comparisons. In addition, the AHP can assess consistency of judgments which is determined by an eigenvalue, thereby ensuring true reflection of decision makers’ opinions.
APPENDIX A

OTHER LOCATION MODELS
A. Single Facility Location

This is the mathematics approach that is used for locating a single plant, terminal, warehouse, or retail/service point. It has been variously known as the exact center-of-gravity approach, the grid method, centroid method, or p-median method. The approach is simple since transportation cost is the only location factor. This model is classified as a static continuous locational model.

Given a set of points that represent source points and demand points, along with their volumes that are to be moved to or from a facility of unknown location, where should that facility be located? Total transportation costs will be minimized if the sum of the volume at a point times the transportation rate to ship to the point times the distance to the point is minimized. That is,

\[
\text{Min.} \quad TC = \sum_i (V_i d_i R_i) \quad (1)
\]

where
- \(TC\) = total transportation cost
- \(V_i\) = volume at point \(i\)
- \(R_i\) = transportation rate to point \(i\)
- \(d_i\) = distance to point \(i\) from the facility to be located

The facility location is found by solving two equations for the coordinates of the location. These exact center-of-gravity coordinates are

\[
- X = \frac{\sum_i (V_i R_i X_i / d_i)}{\sum_i (V_i R_i / d_i)} \quad (2)
\]

and

\[
- Y = \frac{\sum_i (V_i R_i Y_i / d_i)}{\sum_i (V_i R_i / d_i)} \quad (3)
\]

where
- \(X, Y\) = coordinate points of the located facility
- \(X_i, Y_i\) = coordinate points of source and demand points

The distance \(d_i\) is estimated by

\[
d_i = K \sqrt{(X_1 - X)^2 + (Y_1 - Y)^2} \quad (4)
\]

where \(K\) represents a scaling factor to convert one unit of coordinate distance into a more common distance measure such as miles or kilometers.

The solution process involves several steps which are outlined as follows:
1. Determine the X,Y coordinate points for each source and demand point, along with point volumes and linear transportation rates.

2. Approximate the initial location from the center-of-gravity formulas by omitting the distance term \( d_i \) as follows:

\[
X = \frac{\sum_i (v_i R_i X_i)}{\sum_i (v_i R_i)} \tag{5}
\]

and

\[
Y = \frac{\sum_i (v_i R_i Y_i)}{\sum_i (v_i R_i)} \tag{6}
\]

3. Using \( X, Y \) from step 2, calculate \( d_i \). The scaling factor \( K \) need not be used at this point.

4. Substitute \( d_i \) into Equations (2) and (3), and solve for the revised \( X, Y \) coordinates.

5. Recalculate \( d_i \) based on the revised \( X, Y \) coordinates.

6. Repeat step 4 and 5 until either of the \( X, Y \) coordinates do not change for successive iterations, or they change so little that continuing the calculations is not fruitful.

7. Finally, calculate the total cost for the best location, if desired, by using Equation (1).

B. Multiple Facility Location

The more complex, yet more realistic, location problem for most firms occurs when two or more plants must be located simultaneously. This problem is common because all but the smallest companies have more than one facility in their business systems. It is complex because these plants cannot reasonably be treated as economically independent, and the number of possible location configurations becomes enormous.

A number of location methods have been developed that aid in answering some or all of these questions. Several of these, although by no means an exhaustive selection, are presented here to show the variety and power of the approaches. Location methods have been categorized as exact, simulation, and heuristic.

1. Exact Methods

Exact methods refer to those procedures with the capability to guarantee either a mathematically optimum solution to the location problem, or at least a solution of known accuracy. In many respects, this is an ideal approach to the problem of location. However, the approach can result in long computer running times and huge memory requirements, and a compromised problem definition when applied to practical
problems. Calculus and mathematical programming models are examples of this approach, and both will be illustrated.

a. Multiple Center-of-Gravity Approach.

The nature of the multiple facility location problem can be seen if we use the exact center of gravity approach in a multi-location format. Recall that this is a calculus-based model that finds the minimum transportation cost solution for an intermediate facility located among origin and destination points. If more than one facility is to be located, then it is necessary to preassign the origin/destination points to one of the not-yet-located plants. Then, an exact center-of-gravity location is found for each of the sub-problems. There are many ways that these assignments can be made to the plants, especially when considering many plants and when there is a large number of origin/destination points in the problem. Instead of trying every possible way of assigning the points to the plants, forming as many clusters are formed by grouping the points that are the closest to each other. The number of plants is varied and the problem is solved again.

The best solution is the one that minimizes the sum of total cost.

b. Mixed-Integer Linear Programming

Mathematicians have labored for many years to develop efficient algorithms that have a broad enough problem description to be of practical value in dealing with the large, complex location problem frequently encountered in facility location design and yet provide a mathematically optimum solution. They have experimented with the use of sophisticated management science techniques, either to enrich the analysis or to provide improved methods for solving this difficult problem optimally. These methods are goal programming, tree search methods, and dynamic programming, among others. Perhaps the most promising of these class is the mixed-integer linear programming approach.

The problem can be solved using general integer linear programming computer software packages.

2. Simulation Methods

A simulation plant-location model refers to a mathematical representation of a business system by algebraic and logic statements that can be manipulated with the aid of a computer. Given a realistic representation of the economic and statistical relationships, the simulation model is used to evaluate the impact of various configurations. Simulation models are unlike algorithmic location models in that the analyst or manager must specify the particular plants in the network to be evaluated. Whether optimal or nearly optimal location patterns are uncovered depends on the allocations to them that are selected for evaluation. Whereas algorithmic models search for the best number, location, and size of the plants, a simulation model attempts to find the best network through repeated application of the model, given different allocation pattern choices. The quality of the results and the efficiency with which they are obtained depend on the skill and insight of the user in selecting the locations to be analyzed.
3. Heuristic Methods

Heuristics can be referred to as any principles or concepts that contribute to reducing the average time to search for a solution. Heuristics are sometimes referred to as rules of thumb that guide problem solving. When applied to problems of location, such rules of thumb, which are a consequence of insight into the solution process, allow good solutions to be obtained quickly from numerous alternatives. Although heuristic methods do not guarantee that an optimum solution has been found, the benefits of reasonable computer running times and memory requirements, good representations of reality, and a satisfactory solution quality are reasons to consider the heuristic approach to facility location.
APPENDIX B

DETAILS OF EACH ALTERNATIVE

(THE PLANT SITE LOCATION SELECTION)
A. Nakhon Ratchasima (มหาวิทยาลัยราชภัฏนครราชสีมา, พ.ศ. 2535)

1. Basic Data

a. Location and Boundary
Nakhon Ratchasima is one province in north-east of Thailand. Its area is about 20,548.16 square kilometers.
The north connect with Chaiyaphom, Khonkaen
The south connect with Prachinburi, Nakhon-Nayok
The east connect with Burerum
The west connect with Saraburi, Chaiyaphom, Lopburi

b. Topography
The south area is a chain of mountains and plateau. The height is more than 250 meters from sea level.
The middle area is a plateau. The height is between 200-250 meters from sea level.
The north area, some area is a wave plain, the height is about 200 meters from sea level, and some area is the low-lying land, the height is less than 200 meters from sea level.

c. Climate
The average temperature is 33 °c. The highest temperature is 39.7 °c in April. The lowest temperature is 16.7 °c in December.
The average rain fall level is 1,108.7 millimeters per year. The maximum rain fall level is 261.3 millimeters in September. The minimum rain fall level is 3.6 millimeters in December.

d. People
From record on 31 December 1991, There are 2,385,195 people, to be male 1,162,298 people and to be female 1,222,897 people.
The details of people are as follows:

<table>
<thead>
<tr>
<th>Age &lt; 13 years old</th>
<th>720,329 people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &gt; 13 years old and to be laboring people</td>
<td></td>
</tr>
<tr>
<td>■ Employable</td>
<td>1,275,883 people</td>
</tr>
<tr>
<td>■ Non-employable</td>
<td>25,241 people</td>
</tr>
<tr>
<td>total</td>
<td>1,301,124 people</td>
</tr>
</tbody>
</table>

| Age > 13 years old and not to be laboring people | 363,742 people |

2. Economics

a. Agriculture
■ Cultivation
■ Cattle
■ Fishery
b. Industry
From record in year 1991:
There are 6,869 factories. The estimated investment is about 13,103,809 million baht. There are 54,123 employees in the factories.

c. Service Business

d. Financial Business
There are 106 financial institutes.

3. Utility System

a. Transportation System
   Road
   - Mitrtrapaph Road
   - Highway No. 201, 202, 205, 206, 207, 224, and 304
   - Urban Road 6 lines

   Rail
   - North-east railway 2 lines

   Air
   - There is one airport.

b. Communication System
   Post Office
   - There are 166 offices of post office.

   Telephone
   - There are 23,288 numbers of phone number.

c. Electrical Supply
   There are 45 electrical sub-stations to provide service to the users.

d. Water Supply
   There are 3 water sub-stations to provide service to users. Their capacity is 88,000 cubic meters per day.

e. Public Health
From record in year 1991
   - 33 hospitals
   - 29 dental clinics
   - 118 clinics
   - 6 public health centers
   - 259 health centers
   - 53 deliver child centers
   - 288 medicine shops
   - 213 doctors
   - 29 dentists
   - 29 pharmacists
   - 527 nurses
   - 1,474 health authorities
4. Cassava

<table>
<thead>
<tr>
<th>Year</th>
<th>Area(rai)</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>kg / rai</td>
</tr>
<tr>
<td>1989</td>
<td>1,422,896</td>
<td>2,153</td>
</tr>
<tr>
<td>1990</td>
<td>1,731,541</td>
<td>2,125</td>
</tr>
<tr>
<td>1991</td>
<td>1,410,396</td>
<td>2,226</td>
</tr>
<tr>
<td>1992</td>
<td>1,685,845</td>
<td>2,210</td>
</tr>
</tbody>
</table>

B. Kallasin (พานิชย์จังหวัดกาฬสินธุ์, พ.ศ.2535)

1. Basic Data

a. Location and Boundary
   Kallasin is the one province in north-east of Thailand. Its area is about 6,963.70 square kilometers.
   The north connect with Sakhol Nakhon, Udonthani
   The south connect with Mookdahan, Royed
   The east connect with Khonkhaen, Mahasarakam
   The west connect with Mahasarakam, Royed

b. Topography
   The north area is a chain of mountains, plain, and thick forest. The area is about 1,973.55250 square kilometers.
   The middle area is hills, plain, and sparse forests. The area is about 2,966.29 square kilometers.
   The south area is a low-lying land and morass. The area is about 2,023.86 square kilometers.

c. Climate
   There are three seasons in each year. The temperature is very high in summer and very low in winter.

d. People
   From record on 31 December 1991, There are 923,519 people, to be male 460,216 people and to be female 463,303 people.
   The details of people are as follows:

   Age < 11 years old 246,900 people
   Age > 11 years old and to be laboring people
   ▪ Employable 379,300 people
   ▪ Non-employable 87,360 people
   total 484,660 people
   Age > 11 years old and not to be laboring people 182,909 people
2. Economics

a. Agriculture
   - Cultivation
   - Cattle
   - Fishery

b. Industry
   From record in year 1991:
   There are 1,604 small factories.

c. Service Business

d. Financial Business
   There are 17 financial institutes.

3. Utility System

a. Transportation System
   Road
   - Highway No. 213, 214, and 209
   - Urban Road 7 lines

b. Communication System
   Post Office
   There are 20 post offices.
   Telephone
   There are 4,096 phone numbers.

c. Electrical Supply
   There are 2 electrical sub-stations provide to service to the users.

d. Water Supply
   There are 5 water sub-stations provide to service to users. Their capacity are 12,520 cubic meters per day.

e. Public Health
   From record in year 1991
   - 14 hospitals
   - 7 dental clinics
   - 20 clinics
   - 2 public health centers
   - 127 health centers
   - 14 deliver child centers
   - 78 medicine shops
   - 51 doctors
   - 10 dentists
   - 12 pharmacists
   - 562 nurses
4. Cassava

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (rai)</th>
<th>Productivity</th>
<th>kg / rai</th>
<th>ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>1988</td>
<td>482,197</td>
<td>1,985</td>
<td>938,666</td>
<td></td>
</tr>
<tr>
<td>1989</td>
<td>336,063</td>
<td>1,881</td>
<td>632,134</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>394,303</td>
<td>1,990</td>
<td>784,662</td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td>337,849</td>
<td>1,943</td>
<td>656,440</td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>560,686</td>
<td>1,968</td>
<td>1,103,403</td>
<td></td>
</tr>
</tbody>
</table>

C. Rayong (พาณิชย์จังหวัดระยอง, พ.ศ. 2535)

1. Basic Data

a. Location and Boundary
Rayong is one province in east of Thailand. Its area is about 3,552 square kilometers.
The north connect with Chonburi
The south connect with Gulf of Thailand
The east connect with Chanthaburi
The west connect with Chonburi

b. Topography
The north and east area is mountain and forest.
The south area is plain of soil and small hill.

c. Climate
The average temperature is 28.2 °C.
The average rain fall level is 1,360 millimeters per year.

d. People
From record on 31 December 1991, There are 459,840 people, 233,680 male and 226,160 female.
The details of people are as follows:

Age < 13 years old 120,563 people
Age > 13 years old and to be laboring people
  - Employable 230,521 people
  - Non-employable 13,159 people
  total 243,680 people
Age > 13 years old and not to be laboring people 76,572 people
2. Economics

   a. Agriculture
      - Cultivation
      - Cattle
      - Fishery

   b. Industry
      From record in year 1991:
      There are 725 factories. The estimated investment is about 23,908.095 million baht. There are 16,385 employees in the factories.

   c. Service Business

   d. Financial Business
      There are 48 financial institutes.

3. Utility System

   a. Transportation System
      Road
      - Sukhumvit Road
      - Highway No. 3138, 3191, 3192, 3140, 3145, and 3161
      - Urban Road 6 lines
      Water
      Air
      There is one airport.

   b. Communication System
      Post Office
      There are 16 post offices.
      Telephone
      There are 16,046 phone numbers.

   c. Electrical Supply
      There are 3 electrical stations provide to service to users.

   d. Water Supply
      There are 12 water stations provide to service to users.

   e. Public Health
      From record in year 1991
      - 3 hospitals
      - 16 dental clinics
      - 60 clinics
      - 26 deliver child centers
      - 132 medicine shops
      - 68 doctors
      - 20 dentists
4. Cassava

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (rai)</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>kg / rai</td>
</tr>
<tr>
<td>1988</td>
<td>557,258</td>
<td>2,500</td>
</tr>
<tr>
<td>1989</td>
<td>448,641</td>
<td>2,490</td>
</tr>
<tr>
<td>1990</td>
<td>382,091</td>
<td>2,500</td>
</tr>
<tr>
<td>1991</td>
<td>295,918</td>
<td>2,500</td>
</tr>
<tr>
<td>1992</td>
<td>277,694</td>
<td>2,500</td>
</tr>
</tbody>
</table>
Sorbitol is polyhydric alcohol. It is produced with chemical process, Catalytic Hydrogenation Process, by cutting the chain of glucose molecule at 120°C with high pressure, using Raney-Nickel as cataly. It may be called D-Sorbitol, D-Glucitol, or D-Gluco-Hexanehexol.

\[
\begin{align*}
\text{CH}_2\text{OH} & \quad \text{CH}_2\text{OH} \\
\text{H} & \quad \text{H} \\
\text{H} & \quad \text{C} \\
\text{H} & \quad \text{C} \\
\text{HO} & \quad \text{OH} \\
\text{H} & \quad \text{C} \\
\text{H} & \quad \text{C} \\
\text{HO} & \quad \text{C} \\
\text{H} & \quad \text{C} \\
\text{H} & \quad \text{C} \\
\text{O} & \quad \text{OH}
\end{align*}
\]

Dextrose (D-Glucose)  \quad \text{Ni}  \quad \rightarrow  \quad D-\text{Sorbitol}

Sorbitol is a food additive. It is used in many ways: such as to be humectant and moisture conditioner in producing toothpaste, drug, and cosmetic, to be bodying texturizing in confectionery product, etc.

Attribute of Sorbitol.
1. Moisture Conditioning Agent (Humectant)
2. Natural Sweetness
3. Protein Protection
4. Chelating Agent

Advantage of Sorbitol in business.
1. To be humectant or stabilizer for:

1.1 Food Product
- Confectionery
- Biscuits, cake, pastries
- Meat-based products, sauces, mayonnaise, fats

1.2 Paper Product
Use Sorbitol to improve the quality of paper.

1.3 Glue Product
Sorbitol will improve the quality of glue: such as improve high solid content.
1.4 Textile Industry
   • Spinning
   • Sizing
   • Printing and Finishing

1.5 Cream Polishes Product

1.6 Tawing Process for Leather

1.7 Concrete Producing
   Sorbitol will improve some attributes of concrete:
   • Extent time to forming process.
   • Reduce volume of water that required.
   • Others

1.8 Poly-Uretane Foam Producing

1.9 Alhyd Resing Process

2. Reduce the loss of Protein from Cryoprotectant

3. To be Bulk Sweetener

4. Use in Foodstuff Producing

5. Use in Cosmetics Product

6. Use in Toothpaste Producing

7. Use in Drug Producing

8. Others
APPENDIX D

THE SOURCE CODE OF THE AHP PROGRAM
In this section, we will show the details of the software program that is written in Pascal Language. This program is developed to aid the selection of the site location by The Analytic Hierarchy Process technique.

The source code of this program will be shown as follows:

```pascal
program AHP;
uses crt;
var level:integer;
    n:integer;
    max:real;
    mxname:string[15];
    lamda,ci,cr:real;
    NumFac:array [1..10] of integer;
    NumSub:array [1..10,1..15] of integer;
    FacName:array [1..10,1..80] of string[15];
    AltName:array [1..10,1..15] of string[15];
    ac:array [1..10,1..15,1..20] of real;
    a:array [1..15,1..15] of real;
    wc1,wc2:array [1..15,1..15] of real;
    sum:array [1..15] of real;
    ri:array [1..15] of real;
    w,wt:array [1..15] of real;
    y: array [1..15] of real;
    i,j,k,l,m,o:integer;
    lock,ro,len,code,ck,x,z,q,x1,y1,x2,y2,x3,y3,x4,y4,n1,n2,n3,n4;r:integer;
    xx,yy:byte;
    st:string;
    ch:string;
    pre:char;

Procedure cal;
begin
    ri[1]:=0; ri[2]:=0; ri[3]:=0.58; ri[4]:=0.9; ri[5]:=1.12; ri[6]:=1.24;
    ri[7]:=1.32; ri[8]:=1.41; ri[9]:=1.45; ri[10]:=1.49; ri[11]:=1.51;
    ri[12]:=1.48; ri[13]:=1.56; ri[14]:=1.57; ri[15]:=1.59;
    lock:=0;
    clrscr;
    writeln("This step is the pair-wise comparison !!!");
    writeln('Please, put the data.'); writeln;
    writeln('PRESS ENTER KEY WHEN READY !!!');
    for i:=1 to (level-1) do
        begin
            if i<=(level-1) then
                begin
                    n:=0;
                    for j:=1 to NumFac[i] do
                        begin
```
if lock=0 then
begin

clrscr;
writeln('Under the ',FacName[i,j]);
writeln('----------------------------------');
x:=8;z:=4;
for q:=1 to NumSub[i,j] do
begin
    gotoXY(x,z);
    write(FacName[i+1,q+n]);
    x:=x+6;
end;
x:=3;z:=5;
for q:=1 to NumSub[i,j] do
begin
    gotoXY(x,z);
    write(FacName[i+1,q+n]);
    z:=z+1;
end;
x:=9;z:=5;
for q:=1 to NumSub[i,j] do
begin
    gotoXY(x,z);
    write(' l ');
    x:=x+6;z:=z+1;
end;
x1:=15;y1:=5;x2:=7;y2:=6;
x3:=9;y3:=6;x4:=13;y4:=5;
for k:=1 to (NumSub[i,j]-1) do
begin
    n1:=x1;n2:=y2;
    n3:=y3;n4:=x4;
    for l:=k+1 to NumSub[i,j] do
begin
    gotoXY(1,20);
write(FacName[i+1,l+n]);
write('
 is more important than ');
write(FacName[i+1,l+n]);
writeln('
(YES OR NO)');
write('Ans (y or n): ');
ck:=0;
repeat
    xx:=whereX; yy:=whereY;
readln(ch);
len:=length(ch);
if (ch='y') or (ch='n') then
    ck:=1;
end;
end;
end;
if (ch<>'y')or(ch<>'n') then
  gotoXY(xx,yy);
for ro:=1 to len do
  write(' ');
  gotoXY(xx,yy);
until ck=1;
writeln;

write
('Select scale 1-9:');
if ch='y' then
  begin
    gotoXY(n1,y1);
    ck:=0;
    repeat
      xx:=whereX; yy:=whereY;
      readln(st);
      len:=length(st);
      Val(st,a[k,l],code);
      if code=0 then ck:=1;
      if code<>0 then
        begin
          gotoXY(xx,yy);
          for ro:=1 to len do
            write(' ');
          gotoXY(xx,yy);
        end;
    until ck=1;

    a[l,k]:=1/a[k,l];
    gotoXY(x2,n2);
    write(a[l,k]:6:3);
  end;
if ch='n' then
  begin
    gotoXY(x3,n3);
    ck:=0;
    repeat
      xx:=whereX; yy:=whereY;
      readln(st);
      len:=length(st);
      Val(st,a[l,k],code);
      if code=0 then ck:=1;
      if code<>0 then
        begin
          gotoXY(xx,yy);
          for ro:=1 to len do
            write(' ');
          gotoXY(xx,yy);
        end;
  end;
end;
until ck=1;

a[k,l]:=1/a[l,k];
gotoXY(n4,y4);
write(a[k,l]:6:3);
end;
n1:=n1+6;n2:=n2+1;
n3:=n3+1;n4:=n4+6;
gotoXY(1,20);
for r:=1 to 80 do
  write('');
gotoXY(1,21);
for r:=1 to 80 do
  write('');
gotoXY(1,22);
end;
xl:=xl+6;yl:=yl+1;x2:=x2+6;y2:=y2+1;
x3:=x3+6;y3:=y3+1;x4:=x4+6;y4:=y4+1;
end;
clrscr;
writeln('Under the ',FacName[i,j]);
writeln('-----------------------------------------');
lamda:=0;
for m:=1 to 15 do begin
  sum[m]:=0;
  w[m]:=0;
  y[m]:=0;
end;
for m:=1 to NumSub[i,j] do begin
  for o:=1 to NumSub[i,j] do begin
    sum[m]:=sum[m]+a[o,m];
  end;
end;
for m:=1 to NumSub[i,j] do begin
  for o:=1 to NumSub[i,j] do begin
    w[m]:=w[m]+a[m,o]/sum[o];
  end;
  w[m]:=w[m]/NumSub[i,j];
  wcl[i+1,m+n]:=w[m];
end;
for m:=1 to NumSub[i,j] do
begin
  for o:=1 to NumSub[i,j] do
  begin
    y[m]:=y[m]+(a[m,o]*w[o]);
  end;
end;
for m:=1 to NumSub[i,j] do
begin
  lamda:=lamda+(y[m]/w[m]);
end;
lamda:=lamda/NumSub[i,j];
ci:=(lamda-NumSub[i,j])/(NumSub[i,j]-1);
if (NumSub[i,j]=1) or (NumSub[i,j]=2) then
  cr:=0;
if (NumSub[i,j]>2) then
  cr:=ci/tr[NumSub[i,j]];
for m:=1 to NumSub[i,j] do
begin
  writeln('The Weight of', FacName[i+1,m+n], '=', w[m]:6:3);
end;
writeln('The Consistency Index(C.I.) =', ci:6:3);
writeln('The Consistency Ratio(C.R.) =', cr:6:3);
if ci<=0.1 then
  writeln('It is O.K.);
if ci>0.1 then
begin
  lock:=1;
  writeln('!!!This data is not accepted!!!');
  writeln('!!! C.I. > 0.1 !!!');
end;
n:=n+NumSub[i,j];
writeln;
writeln('PRESS ENTER KEY TO CONTINUE !!!');
readln;
end;
end;
if i=(level-1) then
begin
  for j:=1 to NumFac[i] do
  begin
    for m:=1 to NumSub[i,j] do
    begin
    end;
end;
end;

if lock=0 then
begin

clrscr;
writeln('Under the ',FacName[i,j]);
writeln('--------------------------------
1');
x:=8;z:=4;
for q:=1 to NumSub[i,j] do
begin
  gotoXY(x,z);
  write(AltName[i+1,q]);
  x:=x+6;
end;
x:=3;z:=5;
for q:=1 to NumSub[i,j] do
begin
  gotoXY(x,z);
  write(AltName[i+1,q]);
  z:=z+1;
end;
x:=9;z:=5;
for q:=1 to NumSub[i,j] do
begin
  gotoXY(x,z);
  write('1 ');
  x:=x+6;z:=z+1;
end;
x1:=15;y1:=5;x2:=7;y2:=6;
x3:=9;y3:=6;x4:=13;y4:=5;
for k:=1 to (NumSub[i,j]-1) do
begin
  n1:=x1;n2:=y2;
  n3:=y3;n4:=x4;
  for l:=k+1 to NumSub[i,j] do
  begin
    gotoXY(1,20);
    write(AltName[i+1,k]);
    write('
 is more important than ');
    write(AltName[i+1,l]);
    writeln('(YES OR NO)');
    write('Ans (y or n): ');
    ck:=0;
    repeat
      xx:=whereX; yy:=whereY;
      readln(ch);
      len:=length(ch);
      if (ch='y') or (ch='n') then
        ck:=1;
    end;
  end;
end;
end;
end.
if (ch<>'y')or(ch<>'n') then
  gotoXY(xx,yy);
  for ro:=1 to len do
    write(' ');  
  gotoXY(xx,yy);
  until ck=1;
  writeln;

  write
  ('Select scale 1-9:');
  if ch='y' then
    begin
      gotoXY(n1,y1);
      ck:=0;
      repeat
        xx:=whereX; yy:=whereY;
        readln(st);
        len:=length(st);
        Val(st,a[k,l],code);
        if code=0 then ck:=1;
        if code<>0 then
          begin
            gotoXY(xx,yy);
            for ro:=1 to len do
              write(' ');  
            gotoXY(xx,yy);
          end;
      until ck=1;
      a[l,k]:=1/a[k,l];
      gotoXY(x2,n2);
      write(a[l,k]:6:3);
      end;
    if ch='n' then
      begin
        gotoXY(x3,n3);
        ck:=0;
        repeat
          xx:=whereX; yy:=whereY;
          readln(st);
          len:=length(st);
          Val(st,a[l,k],code);
          if code=0 then ck:=1;
          if code<>0 then
            begin
              gotoXY(xx,yy);
              for ro:=1 to len do
                write(' ');  
              gotoXY(xx,yy);
            end;
      end;
    end;
  end;

end;
until ck=1;

a[k,l]:=1/a[l,k];
gotoXY(n4,y4);
write(a[k,l]:6:3);
end;
n1:=n1+6;n2:=n2+1;
n3:=n3+1;n4:=n4+6;
gotoXY(1,20);
for r:=1 to 80 do
write('');
gotoXY(1,21);
for r:=1 to 80 do
write('');
gotoXY(1,22);
for r:=1 to 80 do
write('');
end;
x1:=x1+6;y1:=y1+1;x2:=x2+6;y2:=y2+1;
x3:=x3+6;y3:=y3+1;x4:=x4+6;y4:=y4+1;
end;
clrscr;
writeln('Under the FacName[i,j]);
writeln('----------------------------------');
lamda:=0;
for m:=1 to 15 do
begin
sum[m]:=0;
w[m]:=0;
y[m]:=0;
end;
for m:=1 to NumSub[i,j] do
begin
for o:=1 to NumSub[i,j] do
begin
sum[m]:=sum[m]+a[o,m];
end;
end;
for m:=1 to NumSub[i,j] do
begin
for o:=1 to NumSub[i,j] do
begin
w[m]:=w[m]+a[m,o]/sum[o];
end;
w[m]:=w[m]/NumSub[i,j];
ac[i+1,j,m]:=w[m];
end;
200
for m:=1 to NumSub[i,j] do
  begin
    for o:=1 to NumSub[i,j] do
      begin
        y[m]:=y[m]+(a[m,o]*w[o]);
      end;
  end;
for m:=1 to NumSub[i,j] do
  begin
    lamda:=lamda+(y[m]/w[m]);
  end;
lamda:=lamda/NumSub[i,j];
ci:=(lamda-NumSub[i,j])/(NumSub[i,j]-1);
if (NumSub[i,j]=1)or(NumSub[i,j]=2) then
  cr:=0;
if (NumSub[i,j]>2) then
  cr:=ci/ri[NumSub[i,j]];
for m:=1 to NumSub[i,j] do
  begin
    writeln('The Weight of ',
      AltName[i+1,m], ' = ',
      w[m]:6:3);
  end;
writeln('The Consistency Index(C.I.) = ',
  ci:6:3);
writeln('The Consistency Ratio(C.R.) = ',
  cr:6:3);
if ci<=0.1 then
  writeln('It is O.K.');
if ci>0.1 then
  begin
    lock:=1;
    writeln('!!!This data is not accepted!!!');
    writeln('!!! C.I. > 0.1 !!!');
    end;
writeln;
writeln('PRESS ENTER KEY TO CONTINUE !!!');
readln;
end;
end;
if lock=0 then
  begin
    for i:=1 to 15 do wt[i]:=0;
    for i:=1 to NumFac[level] do
      begin
        end;
      end;
end;
if lock=0 then
  begin
    for i:=1 to 15 do wt[i]:=0;
    for i:=1 to NumFac[level] do
      begin
        end;
      end;
end;
for m:=1 to 15 do
  for n:=1 to 15 do wc2[m,n]:=0;
n:=0;
for j:=1 to NumFac[level-1] do
  begin
    wc2[(level-1),j]:=wc1[(level-1),j]*ac[level,j,i];
  end;
for j:=(level-2) downto 2 do
  begin
    for k:=1 to NumFac[j] do
      begin
        for l:=1 to NumSub[j,k] do
          begin
            wc2[j,k]:=wc2[j,k]+wcl[j,k]*wc2[j+1,l+n];
          end;
n:=n+NumSub[j,k];
        end;
      end;
for j:=1 to NumFac[2] do
  begin
    wt[i]:=wt[i]+wc2[2,j];
  end;
clrscr;
write('THE BEST ALTERNATIVE FOR THIS PROBLEM.(UNDER ');
writeln(FacName[1,1],')');
writeln('----------------------------------------------------
1
');
for i:=1 to NumFac[level] do
  begin
    writeln('The weight of ',AltName[level,i], ' = ', wt[i]:6:3);
  end;
max:=wt[1];
mxname:=AltName[level,1];
for i:=2 to NumFac[level] do
  begin
    if wt[i] > max then
      begin
        max:=wt[i];
        mxname:=AltName[level,i];
      end;
  end;
writeln;
writeln('FROM AHP TECHNIQUE');
writeln('!!!! THE BEST ALTERNATIVE IS ',mxname,' !!!!');
end;
end;
BEGIN

Repeat

\texttt{pre:='C';}
for \texttt{i:=1 to 15 do a[i,i]:=1;}
NumFac[1]:=1;
clsr;
\texttt{writeln('Put the number of levels!');}
\texttt{write('The number of levels = ');
ck:=0;}
\texttt{repeat}
\texttt{xx:=whereX; yy:=whereY;}
\texttt{readln(st); len:=length(st);}
\texttt{Val(st,level,code);}
\texttt{if code=0 then ck:=1;}
\texttt{if code<>0 then}
\texttt{begin}
\texttt{gotoXY(xx,yy); for ro:=1 to len do write('');}
\texttt{gotoXY(xx,yy);
end;
until ck=1;}
\texttt{For i:=1 to level do}
\texttt{begin}
\texttt{if i=1 then writeln('Please,put the name of factors in each level.');}
\texttt{writeln('PRESS ENTER KEY TO CONTINUE.');}
\texttt{readln;}
\texttt{clsr;}
\texttt{writeln('level ',i);
if i=1 then}
\texttt{begin}
\texttt{writeln('This is the level of goal !!!');}
\texttt{write('The Goal is '); readln(FacName[1,1]);}
\texttt{end;}
\texttt{if (i>1) and (i<level) then}
\texttt{begin}
\texttt{writeln('How many factors are there in this level?');}
\texttt{write('The number of factors in this level = ');
ck:=0;}
\texttt{repeat}
\texttt{xx:=whereX; yy:=whereY;}
\texttt{readln(st); len:=length(st);}
\texttt{Val(st,NumFac[i],code);}
\texttt{if code=0 then ck:=1;}
\texttt{if code<>0 then}
\texttt{begin}
\texttt{gotoXY(xx,yy); for ro:=1 to len do write('');}
\texttt{end;}
\texttt{end;
gotoXY(xx,yy);
end;
until ck=1;

if i=2 then NumSub[1,1]:=NumFac[2];
for j:=1 to NumFac[i] do
begin
write('Factor No.',j,' is ');
readln(FacName[i,j]);
if i< (level-1) then
begin
writeln('How many sub-factors for ',
FacName[i,j],
' are there in the next level?');
write('Number of sub-factors for ',
FacName[i,j],':=');
ck:=0;
repeat
xx:=whereX; yy:=whereY;
readln(st); len:=length(st);
Val(st,NumSub[i,j],code);
if code=0 then ck:=1;
if code<>0 then
begin
gotoXY(xx,yy); for ro:=1 to len do write(' ');
gotoXY(xx,yy);
end;
until ck=1;
end;
end;
end;
if i=level then
begin
writeln('This is the level of Alternative !!!!');
writeln('How many the Alternatives are there in this problem?');
write('The number of Alternatives = ');
ck:=0;
repeat
xx:=whereX; yy:=whereY;
readln(st); len:=length(st);
Val(st,NumFac[i],code);
if code=0 then ck:=1;
if code<>0 then
begin
gotoXY(xx,yy); for ro:=1 to len do write(' ');
gotoXY(xx,yy);
end;
end;
until ck=1;

for j:=1 to NumFac[i] do
begin
    write('Alternative No.',j,' is ');
    readln(AltName[i,j]);
end;
end;

for i:=1 to NumFac[(level-1)] do
begin
    NumSub[(level-1),i]:=NumFac[level];
end;

if lock=0 then
begin
    writeln;
    writeln('<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>');
    writeln('<<< THE END >>>');
    writeln('<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>');
    writeln('!!! PRESS ENTER KEY TO END THE PROGRAM !!!');
end;
if lock=1 then
begin
    writeln;
    writeln('<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>');
    writeln('<<< ERROR IN GATHERING DATA PROCESS >>>');
    writeln('<<< PLEASE, RETURN TO COLLECT NEW DATA >>>');
    writeln('<<<<<<<<<<<<<<<<<<<<<<>>>>>>>>>>>>>>>>>>>>');
    writeln('!!! PRESS ENTER KEY TO END THE PROGRAM !!!');
end;
readln;
clrscr;
writeln('PRESS "C" TO RESTART THE PROGRAM AGAIN.');
writeln('PRESS "E" TO EXIT THE PROGRAM.');
write('SELECT "C" OR "E":'); pre:=readkey;

until (pre ='e')or(pre='E') ;

END.
BIBLIOGRAPHY

THAI REFERENCES

1. ทินโชคจิตรภาพสินธุ์, สำนักงาน ข้อมูลการคลังจัดหน้างวดคลังสินธุ์ประจำปี 2534
   ภาพสินธุ์: ทินโชคจิตรภาพสินธุ์, 2535

2. ทินโชคจิตรวัฒนาศิริ, สำนักงาน ข้อมูลการคลังจัดหน้างวดวัฒนาศิริประจำปี 2534
   วัฒนาศิริ: ทินโชคจิตรวัฒนาศิริ, 2535

3. ทินโชคจิตรระดม, สำนักงาน ข้อมูลการคลังจัดหน้าระดมประจำปี 2534
   ระดม: ทินโชคจิตรระดม, 2535

4. สมพักพี ศิริศักดิ์. การออกแบบและวางแผนโรงงาน พิมพ์ครั้งที่ 1 กรุงเทพมหานคร:
   สมาคมส่งเสริมเทคโนโลยี (ไทย-อังกฤษ), 2531

ENGLISH REFERENCES

   Statistical Process Control,” IEEE Transactions on Engineering Management,


