

A Study of Multiple Criteria Decision Analysis For Real Estate

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Abstract

Nowadays, the world is facing the revolution of Internet. So the world has reacted in several ways to the "E" technology such as E-government, E-learning, E-application, E-commerce and E-business and so on and so forth. At the same time web sites creation is very popular and people use web sites to advertise their businesses and to expand their marketing. Also, many people are attempting to find homes use of computers from the internet. So, this study is intended to study how we can help not only the users who attempt to find home via the internet but also to handle requirements of the users as their multi-criteria. Since, the method of Multiple Criteria Decision Analysis(MCDA) is a set of systematic procedures for analyzing complex decision problems, we implemented a Multi-Criteria Decision Analysis that enables to make selection amongst multiple alternatives in line with a purpose for Real Estate System (Yangon Division).

Key Words: *Multiple criteria decision analysis, Analytic hierarchy process, and, E technology*

1. Introduction

In the mid-1990s, the visually oriented World Wide Web captured the public's attention and drove unprecedented development of web related technologies. The web has grown exponentially over since, expanding at the rate of more than 1,000 new web sites a day. The electronic market has grown right along with it.

A decision support system is a class of computer based information system or knowledge based system that supports decision making activities. Most of our important decisions require a multiple-criteria decision making process. Some decisions may be made considering a single criterion, but these are very limited to the simple and relatively unimportant ones. Almost no decisions of significance can be made based on only one criterion. Given these conditions, the two terms "multiple-criteria" and "decision making" are nearly inseparable, especially when making complex decisions that require consideration of all the different aspects that affect the decision [2]. Decision making is the process of arriving at a determination based on consideration of available alternatives. Multiple-criteria decision making

involves making a decision based on more than one criterion.

Multi-Criteria Decision Making is generally used as a synonym for MCDM. It's based on a logic that ranks analytically the alternatives that meet the requested multiple criteria fully. Methods of MCDM are sometimes split into two types, depending on the property of the solution space. One is Multiple Attribute Decision Making (MADM), which deals with picking the most desired solution from an explicit list of finite alternatives [10].

Decision making to solve unstructured problems is now also supported by expert system, for example a decision regarding the choice of home .In present situation, it is difficult to get suitable home under user consideration. MCDA can solve to choose the suitable home based upon the data from the user preferences.

The following section contains a shallow description of some works in the literature concerning the improvement of Analytic Hierarchy Process (AHP) and Multi-Criteria Decision Analysis. Section 1 is the introduction section. Section 2 explains the related works. Section 3 is dedicated to the proposed Analytic Hierarchy Process (AHP) and Multi- Criteria Decision Analysis (MCDA). Application of AHP Method in Home Selection is presented in sections 4. Finally, we present the conclusions in section 5.

2. Related Works

AHP can be applied in many applications. The following applications illustrate the wide breath of areas to which AHP has been applied.

A Rama Mohan Reddy, Prof. M Naidu and Prof. P.Govindarajulu implemented the AHP method in the selection of software architecture in October 2007[3].T.Myint, Khine (M.C.Sc (Thesis), 2010) discussed about cyber home finding system based on the agent technology with the help of NLP processing [7]. Reza Rostamzadeh and Saudah bt. Sofian developed the Prioritizing Effective 7Ms to improve production systems performance by using AHP technique [6]. Sedigheh Lotfi, Kiomarth Habibi and Mohammad J.Koohsari analysed about urban land development using Multi-Criteria Decision Model [10]. H.Y.Shwe (M.C.Sc (Thesis), 2004) introduced about how to make Decision Support System for Supplier Selection by using AHP [4].

In this paper, we present how we can make multiple criteria decision analysis for real estate.

3. Multiple Criteria Decision Analysis (MCDA)

MCDA is a set of systematic procedures for analyzing complex decision problems. These procedures include dividing the decision problems into smaller more understandable parts: analyzing each part; and integrating the parts in a logical manner to produce a meaningful solution [12]. Multi-criteria decision analysis (MCDA) aims at highlighting these conflicts and deriving a way to come to a compromise in a transparent process. Unlike methods that assume the availability of measurements, measurements in MCDA are derived or interpreted subjectively as indicators of the strength of various preferences. Preferences differ from decision maker to decision maker, so the outcome depends on who is making the decision and what their goals and preferences [1].

3.1 Analytical Hierarchy Process (AHP)

The Analytic Hierarchy Process is a structured technique for dealing with complex decisions. Rather than prescribing a "correct" decision, the AHP helps the decision makers find the one that best suits their needs and their understanding of the problem [9]. AHP is very useful when the decision-making process is complex, for instance, by being unstructured. Indeed, when the decision cycle involves taking into account a variety of multiple criteria which rating is based on a multiple-value choice, AHP splits the overall problem to solve into as many evaluations of lesser importance, while keeping at the same time their part in the global decision [6].

Users of the AHP first decompose their decision problem into a hierarchy of more easily comprehended sub-problems, each of which can be analyzed independently. The elements of the hierarchy can relate to any aspect of the decision problem- tangible or intangible, carefully measured or roughly estimated, well- or poorly-understood-anything at all that applies to the decision at hand[10]. The Figure 1 shows the basic structure of the AHP hierarchy.

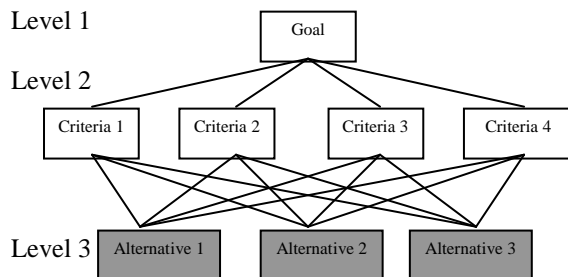


Figure 1. Basic Structure of AHP Model

4. Case Study: Application of Multiple Criteria Decision For Real Estate

The case study system is composed with two main modules: administrator module and user module.

In the administrator module, the administrator has to log in with their password. If the password was correct then the administrator was successfully logged in. Then the administrator can insert, update, and delete any information related to home.

In the user module, they have to input their preferences such as home type, purpose, price and location to find out the relevant home. The location is limited with three parts such as **Downtown** (Lanmadaw, Latha, Dagon, Kywaktatar, Pabedan, Pazundaung, Botahatuang), **Urban1** (Mayangone, Yankin, Tarmwe, Kyeemyindaing, Thingangyun, Kamaryut, Bahan, Alone, Sanchaung) and **Urban2** (Southokkalapa, Northokkalapa, Eastdagon, Dagonseikkan, Thuwana, Hlaingtharyar, Insein, Mingalardon, Shwepyithar) to calculate with AHP.

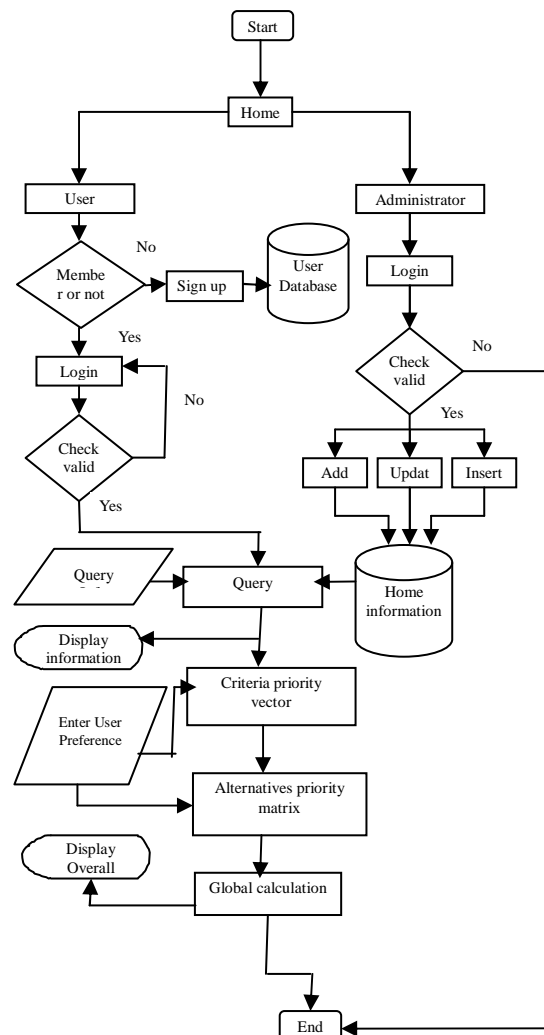


Figure 2. System Flow Diagram

4.1 AHP Method in Real Estate

The Analytical Hierarchy Process (AHP) allows the policy to do this by structuring the problem hierarchically and guiding him/her through a sequence of pair-wise comparison judgments. For making a recommendation of the best home selection, the steps of the AHP are setting up hierarchy, pair-wise comparison, establishing priority vector and obtaining the overall ranking.

4.1.1 Setting up Hierarchy

(1) Establishing Goal on Selection

To begin with, the problem must be structured into a hierarchy. The first level (level 1) denotes the overall goal of the decision-maker. In real estate, *the goal is to find the best home among the feasible set of home.*

(2) Establishing Criteria on Selection

The second level (level 2) consists of several different factors that contributes to goal. The number of factors involved can vary from case to case in the AHP. Since main investigation is to provide for home data, we focus on six factors: *location, price, size, style, electricity and water supply.* So these six factors will act as *multiple criteria* in AHP approach.

(3) Establishing Alternatives

The last level (level 3) of the hierarchy is alternatives, which are to be evaluated in terms of the criteria in the level above i.e. list of home under consideration. After defining these three steps, the case study, real estate system can be viewed as shown in Figure 3.

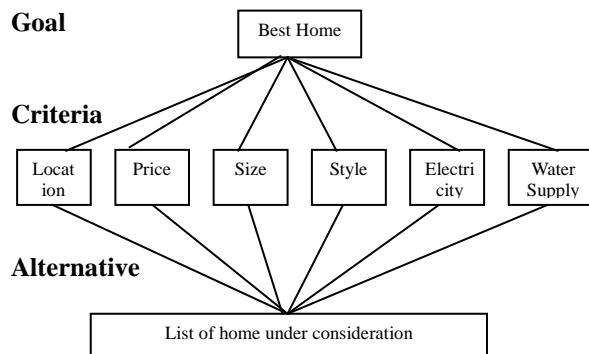


Figure 3. Hierarchy Structure of the System

4.2 Pair-wise comparison making and establishing priority vector

Pair wise comparisons are done on criteria and alternatives base on each criterion. The pair wise comparison scales are used as user's preference according to the following Table 1. In the pair-wise comparison step, $N(N-1)/2$ pair of comparison are required. N is the total number of criteria (or) the total number of alternatives.

In this real estate system, we need to make 15 pairs of comparison on each alternative as we focus on six criteria.

Intensity	Definition	Explanation
1	Equal Importance	Two factors contribute equally to the objective
3	Moderate Importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment slightly favor one element over another
7	Very strong importance	One element is favored very strongly over another, it's dominate is demonstrated in practice.
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation.
2,4,6,8	Intermediate values	When compromise is needed

Table 1: The pair wise comparison scale for the AHP

To establish priority vector, we need to obtain priority values for criteria and alternatives that have been pair-wised in above step. AHP uses the synthesization procedure for criteria and alternatives on each criterion that provided the priority vectors.

The two procedures that we use for these steps are as follow;

```

Procedure 1: EstPriorityVector (matrix P, int m) {
    Begin
    Step1: Building square matrix;
    for (int i = 0; i < m; i ++){
        for (int j = 0; j < m; j ++){
            Examine the indius (i & j);
            If (equal) Set Pij as 0;
            Else
            {
                Accept weight;
                Set Pij as weight;
                Set Pji as 1/weight;
            }
        }
    }
    Step2: Call Synthesization Procedure;
    End
}

```

```

Procedure 2: Syntheization Procedure ( matrix P,
float * sum){
    Begin
    for (int i = 0; i < P.length; i ++){
        for (int j = 0; j < P.length; j ++){
            // Sum the value in each column;
            Set sumi as by adding (sumi & Pij);
            // Compute the average for the element;
            Set sumi as by dividing sumi with
            length of P;
        }
    }
    return sum as PriorityVector;
    End
}

```

4.4 Obtaining the overall ranking

This step in AHP is done by following procedure. To get the global priority, we use the local priorities for both alternatives and criteria.

```

Procedure 3: GlobalPriority ( matrix P, matrix C,
vector rank){
    Begin
    Accept PriorityVector;
    Store as a row of P;
    Until ( there is no PriorityVector)
    Repeat
        Accept CriteriaVector;
        Store as a row of C;
        Until ( there is no CriteriaVector)
        For (int i=0; i < P; i ++){
            Set rank as 0.0;
            For (int k=0; k < C; k++){
                Set tempi as by multiple (Pk & Ck);
                Set ranki as by adding (tempi & ranki);
            }
        }
        return rank;
    End
}

```

5. Conclusion

AHP provides an artifact of the work and of the decision. AHP is powerful mathematically elegant and effective way to help making decision based on the user criteria. The efficiency of AHP allows the user to meet their goal in a timely manner without making hard decision and difficult discussions. The proposed Home finding system, it can support the best choice of the users who buys suitable home. Also AHP based cyber home finding system can help to fulfill the user requirements and provide without wasting time.

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