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Fanp For Selecting The Best Energy Systems Influence The Agricultural Productivity In The Tehran Province

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Abstract: In the economics literature, aggregate productivity refers to the amount of output obtained from given levels of inputs in an economy or a sector. It is an important topic of study, because productivity is one of the two fundamental sources of larger income streams; the other being savings, which permit more inputs to be employed. In the hanging and rapid technological changes conditions, no doubt, energy management is guaranteed for agricultural productivity. Since, nonrenewable energies had been injuring and have different social destructions. And economic aspects with regard to the decreasing of nonrenewable energy are not affordable. Therefore, attention and orientation to renewable energy seem to be necessary. Furthermore, reviewing of nonrenewable and renewable systems in different aspects such as social and economic is the important issue, which requires critical and investigation analysis. In this paper, we seek to use the Fuzzy analytical network process (FANP) for selecting the best energy systems influence the agricultural productivity in the Tehran province. This method is validated using the structural validation approach.

Key words: System, Renewable, Fuzzy Analytical Network Process (FANP).

INTRODUCTION

In the economics literature, aggregate productivity refers to the amount of output obtained from given levels of inputs in an economy or a sector. It is an important topic of study, because productivity is one of the two fundamental sources of larger income streams; the other being savings, which permit more inputs to be employed. In the hanging and rapid technological changes conditions, no doubt, energy management is guaranteed for agricultural productivity. Since, nonrenewable energies had been injuring and have different social destructions. And economic aspects with regard to the decreasing of nonrenewable energy are not affordable. Therefore, attention and orientation to renewable energy seem to be necessary (Krautkraemer, J., 1999; Boyle G 1998). Reviewing the economic and social systems of renewable energy is very important, and that some of the reasons are as follows:

Technology revolution and the huge impact of technological developments in the use of energy resources are increasing. Since, one of the factors affecting productivity in various areas of industrial and non industrial is energy management. On the other hand, according to unpredictable needs of society and industry for energy and reducing of nonrenewable energy resources, human has propelled inevitably to the use of energy obtained from renewable energy systems (Boyle G 1998; Hotelling, H., 1931). Social - economic system studies are the main steps step of studies. Because the implementation of any system designs for power supply to a region without the associated of institutions and local residents together would be doomed to failure. Therefore, it is necessary before any implementation of any system in a region should be prepared the assessment of the desires, needs, capacities and area residents. In other words, it should be prepared the careful evaluation of how to pay for electricity supply using renewable energy systems by the inhabitants of the region and its interaction with the changing pattern of life. Preliminary studies will be beneficial to system designers in various fields, including technical and economic evaluation.

To study and analyze these problems, we should be able to answer some basic questions: What energy systems should be used in agricultural section? And also provides conditions for output quality and appropriate scheduling. What factors affected on the conditions of improvement of agricultural productivity, and how they can identify and provide the appropriate response to them? Algorithm presented in this paper is based on the FANP; it can measure a relationship between the strategic factors that can make good such as AHP, ANP methods based on the independence factors. The AHP technique cannot measure to exist dependence between the factors, because the AHP compared to factors completely

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independent, and finally this method cannot effectively be an appropriate method considers assessing the effect of internal and environmental factors (Kaya D. 2006; Boyle G 1998; Temple, J., 1999).

The study is set eight major sections, the second part deals with the nonrenewable and renewable systems. The third part presents agricultural productivity. The forth part describes the proposed algorithm based on the FANP method. The fifth part presents research methodology. The sixth part is expressed case study in Tehran province, and in the next sections, it will be discussed analysis and presentation of research findings and suggestions for future research results.

Nonrenewable and Renewable Energy Systems:

However, it is worth keeping in mind that after Hotelling (1931) the main emphasis in the economics of nonrenewable resources has perhaps been put on physical resource depletion and on sustainability models that &should not be taken as literal descriptions of the economy' (Krautkraemer, J., 1999). This is in contrast to the present need to understand the history and future development of fossil fuels consumption. It is in contrast also to the present growth theory where models are evaluated against their empirical implications (Temple, J., 1999). Backstop (or renewable, expendable) energy technology, which plays an important role in the study by Chakravorty *et al*., (1997). has been introduced into economic models by Nordhaus (1973). In Heal (1976) backstop technology refers to some future form of solar energy that is assumed to be available without limits but at high costs, which prevents its large scale commercial use. In typical models, the future switch to the backstop occurs when fossil fuels are physically depleted. In some models it is possible to speed up the introduction of a new energy technology (i.e. a discrete technological breakthrough) by investing in research and development (Dasgupta, P., Heal, G., 1974).

Since, a renewable energy system is integrated two or more sources of energy with the goal of providing a zone charge, therefore, one of the most basic concepts in the design of renewable energy systems is to identify types of systems. In this paper, the purpose of the renewable energy system is a system in which renewable energy wind. Solar and biomass are used as the main energy sources. In general case, a system refers to systems that uses combine two or more sources of energy. On the other hand, a renewable energy system can be used integrated renewable energy and non renewable energy sources. Usually in these cases, they are used the generators (with different types of fuels), batteries, or both in addition to renewable sources. The main reason is that it is impossible in some cases the use of renewable sources to supply in a specific region (due to lack of appropriate renewable sources and non economic the using renewable sources). at the same time, in some cases may be due to the appropriate potential of existence renewable energy sources for production are more than demand. In this mode if systems have not the renewable energy storage system, the renewable power energy goes to waste, or they have not been used renewable energy systems by installing smaller than the region potential. Therefore, it is very important considering the non renewable energy supply sources (as backup supply sources in addition to renewable sources and an appropriate energy storage system seems reasonable. Therefore, different renewable systems are:

- Renewable energy systems without storage system and none renewable sources.
- Renewable energy systems with none renewable sources and without storage system.
- Renewable energy systems without none renewable sources and with storage system.
- Renewable energy systems with none renewable sources and storage system.

Types of renewable energy sources include wind energy, hydropower, solar energy and Renewable energy systems is the new age of energy production and have many challenges. However, preliminary studies must be some features among which we can mention the following characteristics:

Social Studies:

Studies should lead to better understanding of the studied areas. One of the aspects that should be investigated is the discussion of social studies. In these studies, they will be examined the cultural and ideological structure, lifestyle, health, national and local language, literacy and education, and scientific skill level. Along with social studies, the priority's region must be examined for growth and development. Therefore, what will be the residents of the development priorities, has a considerable role of the future decision making in the region?

Technical Studies:

Another part of studies is technical studies. In technical studies, regional location, Habitat fragmentation and how animal populations in the region are important. Another factor that should be examined by technical studies is the human resource of the region. Human resources is important for installation and maintaining of systems in the region, the system in the long term. Assessment the potential of renewable energy sources in the region is another important factor in the technical evaluation. It needs to gather accurate information about potential regional resources, including renewable energy sources wind, solar, biomass and water resources. In the technical evaluation, it must be investigated regional topography and atmospheric conditions for construction of the regional system. Kind of weather can occur in technical criteria of system design for renewable energy. In the technical evaluation, reserves of non renewable resources should also be reviewed in the region. However, the amount of resources and access to resources are important. Besides the above, other parameters that play an important role in technical studies are time consuming and how to determine the parameters of the current situation and predict the growing future. This parameter is important in system design. Because, there are direct correlations between system capacity and level of disposable in the region.

Economical Studies:

The economic studies are to determine the selling price. This means that by providing the renewable energy systems for applicants, it should be paid the cost by the applicants. Determine the rate of cost to pay depends to interest of applicants. In economic studies, it is not ignored the role of organizations and sponsors. These organizations can be local or international organizations. In fact, these organizations play an important role in compensating the real costs of different plans and local revenue sources. Finally, local studies required during admission price of electricity supply through the implementation of renewable energy systems should be evaluated by the residents. In this study, which should be evaluated in terms of population as how much electricity price is acceptable and what percentage of that population will pay the price of electricity? Another part of the economic studies will return to investigate the ability of the private sector in the region. Plans in the private sector will play an important supportive role. There are regional organizations of local institutions will increase the capacity of plans. On the other hand, the public of ongoing projects in a region can be an important index in evaluating the success rate of plans in the region. Because, whatever level of public plans in a region may be fewer reasons and urged the general reluctance in implementing similar projects in the region.

Agricultural Productivity:

In the economics literature, aggregate productivity refers to the amount of output obtained from given levels of inputs in an economy or a sector. It is an important topic of study, because productivity is one of the two fundamental sources of larger income streams; the other being savings, which permit more inputs to be employed. The analysis to follow examines productivity in the agricultural sectors of less developed countries (LDCs), where, contrary to the case of the developed world, productivity decline appears to have been widespread.

There is a substantial body of literature measuring multifactor agricultural productivity in the US (Boserup, E., 1965). On the other hand, so far as we are aware, the only studies of multifactor agricultural productivity in LDCs are the ones by Fulginiti and Perrin (1993), Kawagoe *et al*., (1985), Lau and Yotopoulos (1989) and Kawagoe and Hayami (1985).

Fulginiti and Perrin, examining essentially the same 1961±1985 LDC data set as in the present study, did not report direct measures of productivity change, but the results from their Cobb±Douglas production speci®cation (reported in the present study) showed technological regression for 14 of the 18 countries. Kawagoe *et al*., (1985), using data for 1960, 1970 and 1980 in 21 developed countries (DCs) and 22 LDCs, estimated cross-country production functions with dummy variables for 1970 and 1980. They found technological regression during both decades for the LDCs, but technological progress in the DCs. Kawagoe and Hayami (1985) found similar results in that data set, using an indirect production function. Lau and Yotopoulos results also showed negative productivity for LDCs during the 1970s, but an increase during the 1960s. Land degradation and low agricultural productivityare severe problems in Uganda. Although Uganda's soils were once considered to be among the most fertile in the tropics (Chenery, 1960), problems of soil nutrient depletion, erosion, and other manifestations of land degradation appear to be increasing. The rate of soil nutrient depletion is among the highest in sub- Saharan Africa, and soil erosion is a serious problem, especially in highland areas (Bagoora, 1988). Land degradation contributes to low and in many cases declining agricultural productivity in Uganda. Farmers' yields are typically less than one-third of potential yields found on research stations, and yields of most major crops have been stagnant or declining since the early 1990s (Pender *et al*., 2004).

Acoording these reviews in two sections (energy and productivity), the main factor influence on productivity in Agricultural section is energy system, therefor, in this paper we seek to selecting best energy systems using FANP Method.

Fuzzy Analytical Network Process:

The FANP is a generalization of the Like AHP, while the AHP represents a framework with a unidirectional hierarchical AHP relationship, the FANP allows for complex interrelationships among decision levels and attributes. The FANP feedback approach replaces hierarchies with networks in which the relationships between levels are not easily represented as higher or lower, dominant or subordinate, direct or indirect (Temple, J., 1999; Heal, G., 1976; Dasgupta, P., Heal, G., 1974; Pender *et al*., 2004). Figure 1 presents Structural difference between hierarchy (a) and network (b).

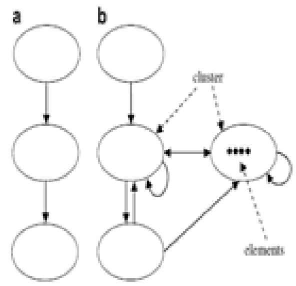

Fig. 1: Structural difference between hierarchy (a) and network (b).

FANP is considered comprehensive and explanatory for multipurpose decision-making discussions and also for solving complex decision-making issues. Studies by Yüksel and Dagˇdeviren used ANP to select information system projects that are internally dependent. These studies saw no requirement for doing an ideal zero and one programming. Karsak**,** Partovi and Corredoira have used ANP in quality activity development (Bagoora, F.D.K., 1988; Mı´gueza J.L. Lo *et al*., 2010; Dincer I. 2002). A system with reflective state can be explained by a network. The structural difference between the hierarchy and the network is depicted in Figure 1. The existent element in each cluster can affect all or some of the other cluster elements. A network may contain main clusters, middle clusters, and final clusters. Arrows show the relationships in the network and their direction shows the dependence. The dependence among clusters can be named external dependence and the internal dependence among elements of a cluster can be called circle dependence (Beccali M. *et al*., 2007; Dincer I. 2002; Szargut J. Morris D.R. Stewart F.R. *et al*., 1998). The network model used in this research is presented in Figure 2.

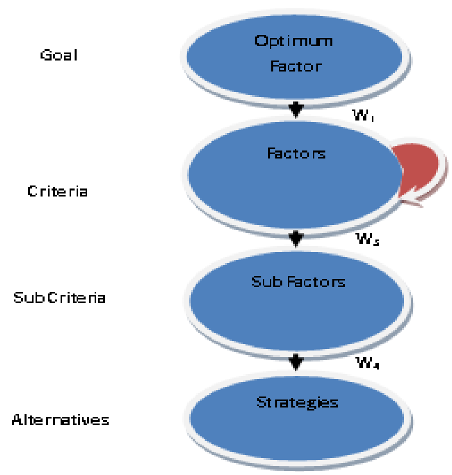

Fig. 2: Network model structure.

$$W= \begin{matrix} \text{Goal} \\ \text{Factors} \\ \text{Sub Factors} \\ \text{Alternative} \end{matrix} \quad \begin{bmatrix} 0 & 0 & 0 & 0 \\ w_{21} & 0 & 0 & 0 \\ 0 & W_{32} & 0 & 0 \\ 0 & 0 & W_{43} & I \end{bmatrix},$$

Where W21 is the vector of aim or goal effect on criterion, W32 is the matrix of criterion effect on sub-criterion, W43 is the matrix of sub-criterion effect on options and I is the single matrix. Figure 3 shows the factors' model network. The hierarchy in the network is depicted by the clusters' internal dependence without reflection.

The main steps of the method are as follows. The first step is locating the element factors, sub-factors and options. Then, according to the internal dependence relationship among the element factors, one determines the internal dependence, element factors' weights and strategic options' priority vectors, respectively, based on the sub-factors.

$$W = \begin{matrix} \text{Goal} \\ \text{Factors} \\ \text{Sub Factors} \\ \text{Alternative} \end{matrix} \begin{bmatrix} 0 & 0 & 0 & 0 \\ \mathbf{w}_1 & \mathbf{W}_2 & 0 & 0 \\ 0 & \mathbf{W}_3 & 0 & 0 \\ 0 & 0 & \mathbf{W}_4 & \mathbf{I} \end{bmatrix},$$

where w1 is the vector of goal or aim effect, for example, selecting the best strategy according to element factors, W2 is the element factors' internal dependence matrix, W3 is the effect matrix of element factors on each of the element sub-factors, W4 is the index of element sub-factors' effect on the strategic options. The matrix functions detail the algorithm steps. The proposed algorithm is derived as follows.

Step 1:
Determine the element sub-factors and strategic options according to sub-factors.

Step 2:
Establish the Triangular Fuzzy Numbers.

Step 3:
Assume that no dependencies among element factors exist, and then the importance degree of element factors is shown by the fuzzy scale.

Step 4:
Determine the element factors of the internally dependent matrix by the fuzzy scale, and consider other factors by schematic view and internal dependencies among them (W2 calculation).

Step 5:
Specify the internal dependencies' priorities, that is, calculate $w_{factors} = W_2 \times w_1$.

Step 6:
Specify the importance degree of element sub-factors using the fuzzy scale.

Step 7:
Specify the importance degree of sub-factors.

Step 8:
Specify the importance degree of strategic options, considering each sub-factor, on the fuzzy scale.

Step 9:
Calculate the final priority of strategic options derived from the internal relationships among element factors and Defuzzification its. $w_{alternatives} = W_4 \times w_{sub-factors(global)}$

Research Methodology:

It was decided to adopt a case study approach for this paper. It has been based on the descriptive Research. This descriptive type research has been carried out using the questionnaire as the research tool for gathering the required data. Data's gathering involved both reference material and a questionnaire survey. Sampling was simple random sampling and the data gathering instrument was the questionnaire. The author had already undertaken research in this field, which had stimulated the measurement tools and the theoretical framework used to analyze this case study, based on FANP Method.

In November 2007 a request for interviews and questionnaires was sent to a number of the strategic managers (60 persons, 40% Male and 60% Female, 65% over 15 year's experience) and strategic staff (60 persons, 35% Male and 65% Female, 65% over 20 year's experience). Prior to the interview and fill the questionnaire, the author explained the purpose of the research and made it clear that this information would be in the public domain, so any confidentiality concerns could be noted. The interview and questionnaire, from December 2009 to April 2010, lasted ten hours per week. The interview and questionnaire were semi-structured in nature, starting off with general questions on the Renewable energy systems to put the respondent at ease. To ensure internal validity the interview and questionnaire were transcribed and sent to strategic managers and staff for check that no commercially sensitive information had been included.

Case Study:

This section presents an illustration of the proposed approach summarized in the previous section. In the following case study, renewable systems factors analysis utilizing the FANP is performed on the Tehran Province. The proposed algorithm is as follows:

Step 1:

First, the issue is depicted as a hierarchical structure, which contains the strategic options and sub-factors for the next calculations using FANP. (See Figure 3) The goal is chosen at the first level of the FANP Model and the element factors are determined at the second level. The third level contains the sub-factors. Furthermore, 3 strategic options are given in the fourth level. The strategic options are as follows:

A-B: using the Sun and wind Renewable energies
A-C: Using the Sun Renewable and nonrenewable energies
B-C: Using the Wind Renewable and nonrenewable energies

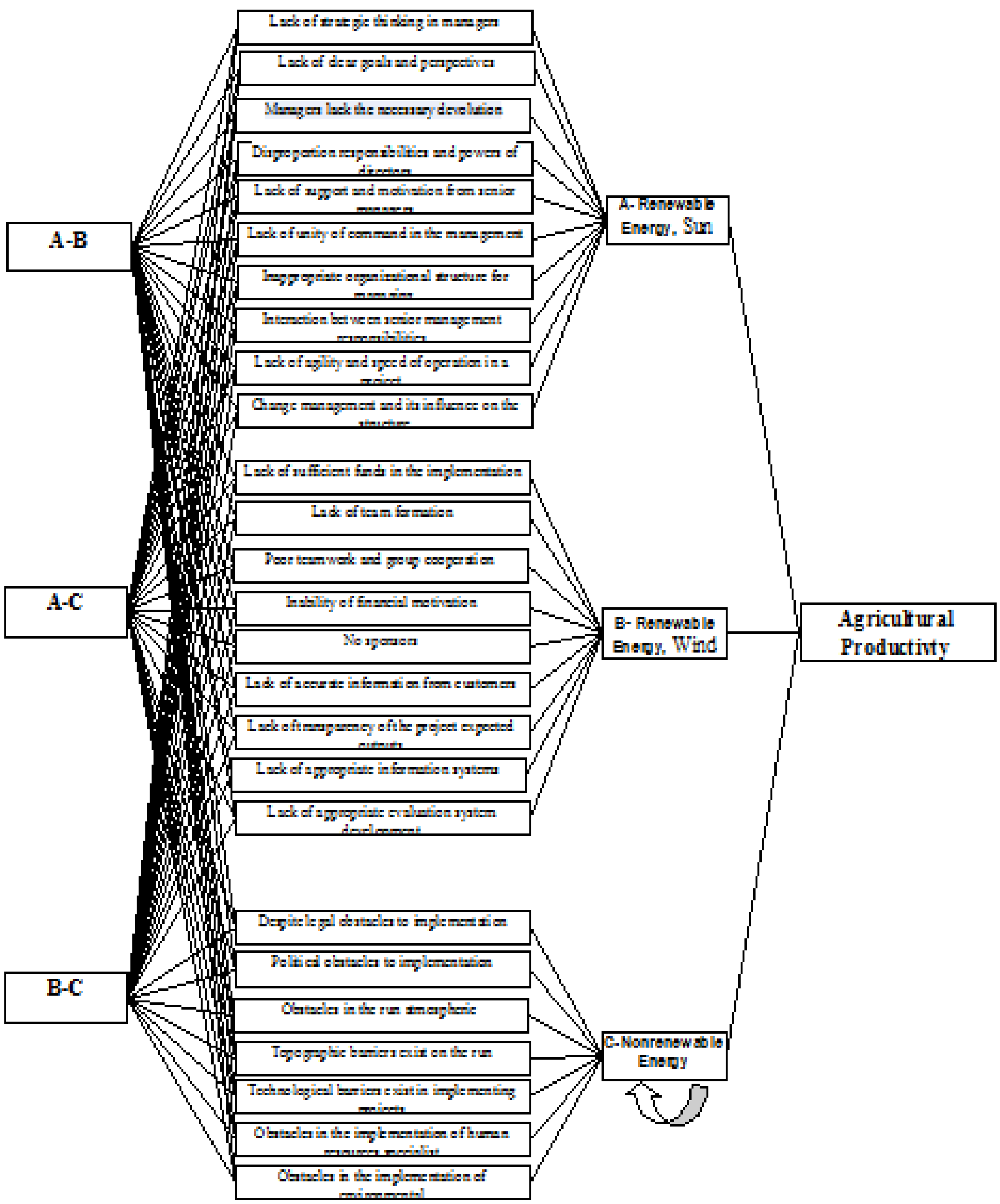

Fig. 3: strategies influencing on Agricultural Productivty.

Step 2:

Establish the Triangular Fuzzy Numbers. A triangular fuzzy number (TFN) is shown in Figure 4.

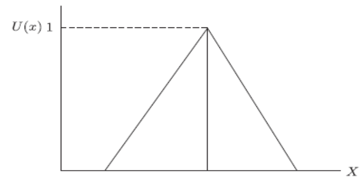

Fig. 4: Triangular Fuzzy Numbers.

Since each number in the pair-wise comparison matrix represents the subjective opinion of decision makers and is an ambiguous concept, fuzzy numbers work best to consolidate fragmented expert opinions. A TFN is denoted simply as (L, M, U). The parameters L, M and U, respectively, denote the smallest possible value, the most promising value and the largest possible value that describe a fuzzy event as shows in formulae (1) to (5). The triangular fuzzy numbers ˜uij are established as follows:

˜uij = (Lij ,Mij ,Uij), (1)

Lij ≤Mij ≤Uij and Lij ,Mij ,Uij ε[1/9, 9], (2)

Lij = min (Bijk), (3)

Mij = n√∏Bijk , (4)

and

Uij = max(Bijk), (5)

Where Bijk represents a judgment of expert k for the relative importance of two criteria Ci-Cj.

Step 2:

Assume that there is no dependency among the element factors. Determine the factors' pair comparison matrix using the numerical scale of 1 to 9. (See results in Table 2) All the pair comparisons are completed by a team of experts. The pair comparison matrix (Table 2) is analysed using Expert Choice software and the following special vector is obtained. In addition, a final inconsistency coefficient is shown at the end of the table.

$$W_1 = \begin{bmatrix} A \\ B \\ C \end{bmatrix} = \begin{bmatrix} .528 \\ .140 \\ .332 \end{bmatrix}$$

Table 1: Pair wise comparisons (independent status).

Weight	C	B	A	Factors
0.528	2	3	1	A
0.140	1/3	1		B
0.332	1			C

CR=0.03

Step 4:

The internal dependency among element factors is determined by comparing the effect of each factor on other factors. As mentioned in the preface, considering independence among the element factors is not always possible. Suitable and realistic results are obtained from the FANP technique and element analysis. An analysis of internal and external environment elements reveals the element factors' dependencies as shown in Figure 4. The results obtained from the special vectors are depicted in the last column of Tables 1 to 5. The internal dependency of the element matrix, based on the calculated relative importance weights, is shown by W2. While opportunities are only influenced by strengths, a pair comparison matrix cannot be formulated for the opportunities. Internal dependency of factors is defined in Figure 5.

Internal dependency matrix of factor A is defined in Table 2.

Table 2: Internal dependency matrix of factor A.

WEIGHT	C	B	A
0.667	2	1	B
0.333	1		C

CR=0.00

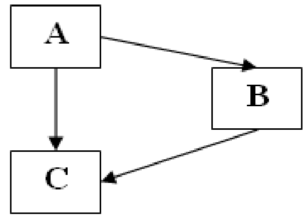

Fig. 5: Internal dependency of factors.

Internal dependency matrix of factor B is defined in Table 3.

Table 3: Internal dependency matrix of factor B.

WEIGHT	C	A	B
0.9	9	1	A
0.1	1		C

CR=0.00

Internal dependency matrix of factor B is defined in Table 4.

Table 4: Internal dependency matrix of factor C.

Weight	B	A	C
0.857	6	1	A
0.143	1		B

CR=0.00

$$W_2 = \begin{bmatrix} 1 & .9 & .857 \\ .667 & 1 & .143 \\ .133 & .1 & 1 \end{bmatrix}$$

Step 5:

Priorities for internal dependencies among the factors are calculated as follows:
The significant differences observed in the above results when compared with those in Table 1 are due to the lack of information about internal dependencies. Factor priority results including A, B, C have changed from 0.528 to 0.495, from 0.332 to 0.221, from 0.140 to 0.284

Step 6:

Local priorities of sub-factors are calculated using the pair comparisons matrix. The priority vector is defined. According the priorities, it defines vector of sub factors.

$$W_{sub-fdactors-A} = \begin{bmatrix} 0.218 \\ 0.192 \\ 0.151 \\ 0.133 \\ 0.108 \\ 0.095 \\ 0.062 \\ 0.031 \\ 0.008 \\ 0.002 \end{bmatrix}, \quad W_{sub-fdactors-B} = \begin{bmatrix} 0.297 \\ 0.196 \\ 0.148 \\ 0.137 \\ 0.117 \\ 0.082 \\ 0.023 \end{bmatrix}, \quad W_{sub-fdactors-C} = \begin{bmatrix} 0.207 \\ 0.175 \\ 0.135 \\ 0.126 \\ 0.108 \\ 0.096 \\ 0.076 \\ 0.044 \\ 0.033 \end{bmatrix}$$

Step 7:

General priorities of the element sub-factors are calculated by multiplying the internal dependency priorities, obtained in Step 4, by the local priorities of element sub-factors, obtained in Step 5. The results are depicted. Vector $W_{sub-factors(global)}$ which is obtained from the general priority amounts in the last column of table.

$$W_{sub-fdactors-GLOBAL} = \begin{bmatrix} 0.107 \\ 0.095 \\ 0.075 \\ 0.066 \\ 0.053 \\ 0.047 \\ 0.031 \\ 0.016 \\ 0.004 \\ 0.001 \\ 0.084 \\ 0.055 \\ 0.042 \\ 0.038 \\ 0.034 \\ 0.024 \\ 0.007 \\ 0.046 \\ 0.039 \\ 0.030 \\ 0.028 \\ 0.024 \\ 0.021 \\ 0.017 \\ 0.010 \\ 0.007 \end{bmatrix}$$

Step 8:

The degree of strategic options' importance is calculated from each element's sub-factor viewpoints. Special vectors are calculated from the analysis of this matrix and matrix W4.

$$W_4 = \left[\begin{array}{ccccc} 0.653 & 0.578 & 0.637 & 0.472 & 0.253 \\ 0.282 & 0.350 & 0.051 & 0.453 & 0.107 \\ 0.065 & 0.072 & 0.312 & 0.075 & 0.640 \end{array}\right.$$

$$\begin{array}{ccccccccc} 0.078 & 0.285 & 0.774 & 0.444 & 0.148 & 0.573 & 0.547 & 0.118 & 0.450 \\ 0.137 & 0.577 & 0.161 & 0.508 & 0.571 & 0.238 & 0.223 & 0.335 & 0.250 \\ 0.785 & 0.138 & 0.065 & 0.048 & 0.281 & 0.189 & 0.230 & 0.547 & 0.300 \end{array}$$

$$\begin{array}{ccccccc} 0.578 & 0.637 & 0.472 & 0.253 & 0.078 & 0.285 & 0.774 \\ 0.350 & 0.051 & 0.453 & 0.107 & 0.137 & 0.577 & 0.161 \\ 0.072 & 0.312 & 0.075 & 0.640 & 0.785 & 0.138 & 0.065 \end{array}$$

$$\left.\begin{array}{ccccc} 0.444 & 0.148 & 0.573 & 0.547 & 0.118 \\ 0.508 & 0.571 & 0.238 & 0.223 & 0.335 \\ 0.048 & 0.281 & 0.189 & 0.230 & 0.547 \end{array}\right]$$

Step 9:

Finally, the general priorities of strategic options are calculated considering the internal dependencies of element factors, as follows:

$$w_{alternatives} = \begin{bmatrix} A-B \\ A-C \\ B-C \end{bmatrix} = W_4 * w_{sub-factors(global)} = \begin{bmatrix} 0.456 \\ 0.269 \\ 0.275 \end{bmatrix}$$

The results of FANP analysis show that the most important strategy for renewable energy system is strategy A-B or using the Sun and wind Renewable energies whose score is 0.456.

RESULTS AND DISCUSSION

This study faced many challenges in its model validation test. The first is that the FANP model's factors are not naturally quantitative. FANP is a technique for solving multi-criteria decision making by using the dependence among quantitative and qualitative factors. However, it is not always possible to apply numerical and quantitative amounts to elements in decision making. It is also that for each calculation, different amounts resulted. This may be due to the different viewpoints among the experts who evaluated the matrix. Thus, it seems impossible to obtain similar amounts based on the data obtained from different studies. These limitations are exacerbated by the nature of decision making. It is natural that in different circumstances, there are different priorities. It should be noted that the existent differences among the pair comparison amounts, which are due to the differences in expert viewpoints, are not sufficient reason for rejecting the proposed model's validity in FANP discussions (Chung, Lee and Pearn 2005; Expert Choice 2000; Ngai 2003). Another problem is that the validity of this model has not been tested using the latest data and that is because those data are available only to special managers. The comparison matrix which is the input for the proposed model was composed under definite conditions; hence, results may differ due to the pair comparison matrix's composition in different time periods (Saaty 1980). This model may be improved as the factors and sub-factors keep changing. Each management team should apply these strategies to the model according to the strategic factors in play. Second, the amount of dependence among factors and sub-factors may vary based on the management type. For example, in The Tehran Provice, only the dependence among important element factors is evaluated. The inconsistent ratio resulting from the pair comparison matrix also conorganizations this model. The inconsistent ratio or CR is based on the inconsistency index and Random index. Inconsistency index or CI can be obtained through the following formula:

$$CI = (\lambda_{\max} - n)/(n-1)$$

where $\lambda_{\max}$ is the highest special amount and n is the matrix dimension. Inconsistency ratio (CR) is composed of two parameters: inconsistency index (CI) and Random index (RI). The relationship between RI and n is as follows: RI = 1.98 * [(n – 2) / n]

where 1.75 is the ratio of average amount of all numbers for n=3 till n=15, each having been multiplied by (n-2)/n. The calculated amount for the inconsistency ratio in FANP should not be less than 0.1. The inconsistency ratio of the pair comparison matrix is calculated using Expert Choice. All inconsistency ratio amounts are less than 0.1. The proposed model is the first of its kind and is hence considered unique.

The results were re-rating of the managers who confirmed that 69.44 percent, and it suggest for reliability. Validity of the model is used the Cronbach alpha value was 78.35 percent, which indicates validity of the model.

Conclusion:

We have defined and classified the effective factors of non-renewable and Renewable energy systemes and analysed them using FANP, it presents the best energy systems influence on productivity improvement in the agricutltral section. Consequent to this analysis, we have presented strategies for improving Renewable energy systemes, which were verified and validated in a case study of the Tehran Province.

One possible follow-up is the comparison of the proposed method with other models, such as neuro-fuzzy methods.

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