Selecting an appropriate forestry extension model for the Zagros area in Iran through the AnalyticHierarchy Process (AHP)

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Abstract

As far as scientific and managerial activities are concerned, it has been always a major challenge to select one best among a number of choices. This important trend has, over the course of time, resulted in the emergence of a variety of effective techniques for selecting one item, from among many choices, as the best of all. Regarding the need for selecting the most appropriate approach to forestry extension in zagros area, we found it inevitable in our study to employ some specific techniques that would help us make the befitting decision.

This article is, accordingly, an attempt to show that how the analytical hierarchy process (AHP), as a multi-criteria decision-making techniques, can be effectively helpful in selecting on appropriate model for forestry extension.

Key words: *forestry extension, multi-criteria decision-making, paired comparison, analytical hierarchy process, hierarchical tree, and sensitivity analysis.*

Introduction

There is no doubt that one should follow specific methodologies to make rational decisions. This is particularly true when we deal with adopting stratified, accurate and comprehensive decisions associated with a control system. In order to solve a wide range of problems related to group decision - making processes, a variety of techniques, including Delphi, nominal group, brain- storming and many other methods have been developed. Each of these techniques, however, calls for a great amount of time and money; due to the complicated circumstance in which decisions are made. As a new innovative technique, however, Analytical Hierarchy Process (AHP) appeared to remove, to a great extent, the problems associated with traditional methodologies (Assad pour & Peykany, 2000)

Ghodsipour (2000) argues that AHP is one of the most comprehensive systems designed for multi-criteria decision - making processes. Initially introduced by Thomas L. Saaty in 1980, AHP is now widely used for both linear and non - linear planning processes. This technique not only would allow for problem formulation on a hierarchical basis, but also provides the chance to take into consideration various qualitative and quantitative criteria for the problem. In addition, it involves to different options in decision - making process and allows for sensitivity - analysis of both criteria and sub-criteria. Furthermore, it is based on paired comparison system, which facilitates judgments and calculations. And finally, as an outstanding advantage, it can show the decision's level of adaptability (compatibility)/non-adaptability (incompatibility).

Saaty (1990) holds that by simplifying and accelerating decision-making process, AHP serves to make effective decisions when complicated problems are dealt with. As a systematic methodology, AHP can disintegrate the component parts of an intricate unstructured problem into well-defined parts; so that one can easily understand that which variable has mostly influenced the outcomes of a situation.

Drake (1998) states that AHP involves paired comparisons. As a first step, decision - maker delineates the decision's overall hierarchy and then proceeds to identify various factors and alternatives that need to be involved in the decision. Later paired comparisons determine coefficient of factors and finally result in the factors assessment.

Saaty (1990) sates that AHP enables us to understand how a system and its surrounding environment are formed as interactive components. It then determines, through a mixture of measurement and classification, how much each component influences the whole system. This process organizes feelings, emotions and logics into a well-defined structure to be used for decision-making.

Saaty (1994) maintains that AHP is now largely used for both theoretical and practical purposes. In theoretical terms, a number of papers pertinent to AHP have been published in highly circulated printed media so far. For instance, a special bi-annual (six-monthly) magazine titled “AHP and Decision-Making" is printed in China. Also, "Japanese Research Operations Communication Society" has devoted a special issue to AHP. In addition to some 20 published books, many conferences on AHP have been already conducted all over the world. In practical terms also AHP technique has come to find widespread uses in diversified issues of decision-making.

In a general categorization, Saaty (1986) has divided hierarchy into two categories: structural and functional. In the former, the components/elements are generally linked physically. It means that complicated systems are founded on a group of major components according to specific structural-theoretical characteristics of size, shape, color, or age. In the latter, in contrast, the components are task-related to form a system. Functional hierarchy, thus, helps people direct a system towards a further productivity and a better implementation. In this research, accordingly, functional hierarchy has been employed.

Saaty (1980) and Drake (1998) believe that AHP can be delineated and performed through five major stages: 1)creating hierarchical tree, 2) pair – wise comparing of research criteria and options, 3) operations for computing data, 4) sensitivity analysis, and 5) level of non-adaptability (incompatibility)

Material and method

As required by the specific nature of this research, a particular model of decision tree has been employed for designing and selecting an appropriate community forestry model for Zagros Area. Branches of the tree are, indeed, occasional events or uncontrolled variables that each can be divided into other branches for decision-making. Finally, every branch, would lead to a given result, which in reality, by itself, realizes to some specific degree the decision's objective.

AHP has been, thus, used to achieve the intended objective. Also, AHP technique has been employed for selecting one alternative from among the intended

alternatives, and determining their "importance", "likelihood" , and "priority" or preference .It means that by using AHP technique we can well select and introduce , from among the existing forestry extension models, one that best fits the conditions and peculiarities of Zagros Area. This process consists of three parts: paired comparisons; combination, and sensitivity – analysis. The same pattern has been followed for selecting the most appropriate forestry extension system for the Area.

Figure1 shows hierarchical (decision) tree and the related criteria, sub-criteria, and options used for selecting an appropriate forestry extension model.

Regarding the specific features of AHP technique, people with tertiary educational levels have been selected from among the

beneficiaries in the selected provinces. Accordingly, 9, 26, and 15 individuals were selected respectively from Kurdistan, Eilam and Fars provinces. Group AHP technique has been used for identifying the appropriate forestry extension model for Zagros Area.

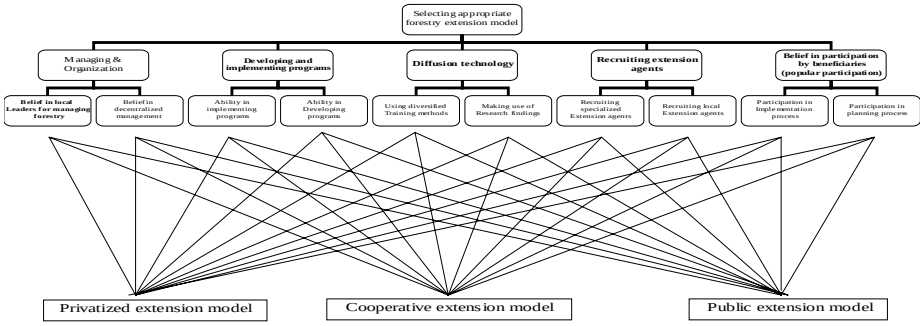

Figure 1: Hierarchical (decision) tree for selecting an appropriate forestry extension model

Results

Our hierarchical tree in this study consists of four levels:

1. **Objective**: selecting an appropriate forestry extension model.
2. **Criteria**:
   - 2.1 Belief in popular (beneficiaries) participation in forestry activities;
   - 2.2 Ability in recruiting extension agents;
   - 2.3 Making use of diffusion technology;
   - 2.4 Ability in developing and implementing extension programs;
   - 2.5 Managing and organizing.

3. **Sub-criteria**:
   3.1 Beneficiaries' participation in planning process;
   3.2 Beneficiaries' participation in implementation process;
   3.3 Ability in recruiting local extension agents;
   3.4 Ability in recruiting specialized extension agents;
   3.5 Making use of research findings;
   3.6 Using diversified training methods;
   3.7 Ability in developing extension programs;
   3.8 Ability in implementing extension programs;
   3.9 Belief in decentralized extension management;
   3.10 Belief in the role of local leaders in managing forests.
4. **Options**: these include three extension systems or models; namely public extension, cooperative extension; and privatized extension.

A matrix-wise comparison of the criteria is presented in table1. Stars show "priority" and "reversed importance" of the criteria.

Table1: comparison of the criteria through AHP

criteria	recruiting extension agents	technology	program	management
participation	1.7*	1.6*	1.7*	1.7*
recruiting extension agents		1.3*	1.0	1.2
technology			1.2*	1.0
program				1.2

Findings of paired comparisons show that the criterion "belief in popular participation in forestry activities" has lower importance than other criteria involved. And in contrast, the criterion "recruiting extension agents" has greater importance than other criteria, namely" belief in popular participation in forestry activities, "making use of diffusion technology" and "managing & organizing". Meanwhile, this criterion is equal with "developing and implementing extension programs" in terms of priority level. Also, "making use of diffusion technology" and "managing & organizing" stand at the same level of importance.

Table2 shows the weight (value) for each item obtained through paired comparisons of criteria, sub-criteria and the related options.

Table2: a comparison of criteria, sub-criteria, the related options, and the calculated weights

criteria	Calculated weights	Sub-criteria	Calculated weights	Calculated weights of options		
				Public extension	Cooperative extension	Privatized extension
Belief in popular participation	.131	Participation in planning	.543	.427	.386	.188
		Participation in implementation	.457	.201	.625	.174
Ability in recruiting extension agents	.238	Recruiting local extension agents	.785	.199	.535	.265
		Recruiting specialized extension agents	.242	.653	.182	.165
Making use of diffusion technology	.196	Making use of research findings	.457	.469	.261	.270
		Using diversified training methods	.543	.400	.294	.306
Ability in developing and implementing extension programs	.233	Ability in developing extension programs	.673	.466	.299	.233
		Ability in implementing extension programs	.327	.233	.598	.169
Managing & organizing	.203	Belief in decentralized extension management	.543	.256	.425	.381
		Belief in (the role of) local leaders in management	.457	.265	.439	.297

As show in table2, priority weights (value) assigned to two criteria, i.e. “ability in recruiting extension agents” and “ability in developing and implementing extension programs” are greater than the weights of other items. It also indicates that sub-criteria “participation in planning”, “recruiting local extension agents”,” using diversified training methods” , “ability in developing extension program” , and “belief in decentralized extension management” have, respectively, greater importance than “participation in implementation” , “recruiting specialized extension agents” , “making use of research findings” , “ability in implementing extension programs” , and “belief in the role of local leaders in management ” . As far as appropriate option for each sub-criterion is concerned, “privatized extension” option has been, by no means, selected as an appropriate model. Whereas the other two options, i.e. “cooperative extension”, and “public extension”, have been each recognized as appropriate model with respect to the for five sub-criteria.

A combination of results reveals that the weights for the three above-mentioned systems are as follows:

1- Cooperative extension model = 39.8% (first option)

2- Public extension model = 34.6% (second option)

3- Privatized extension model = 25.5% (third option)

Figure 2 indicates to what extent the options are sensitive to a change in criteria priorities. As shown, cooperative extension model is recognized "the most appropriate" as compared to the other two options.

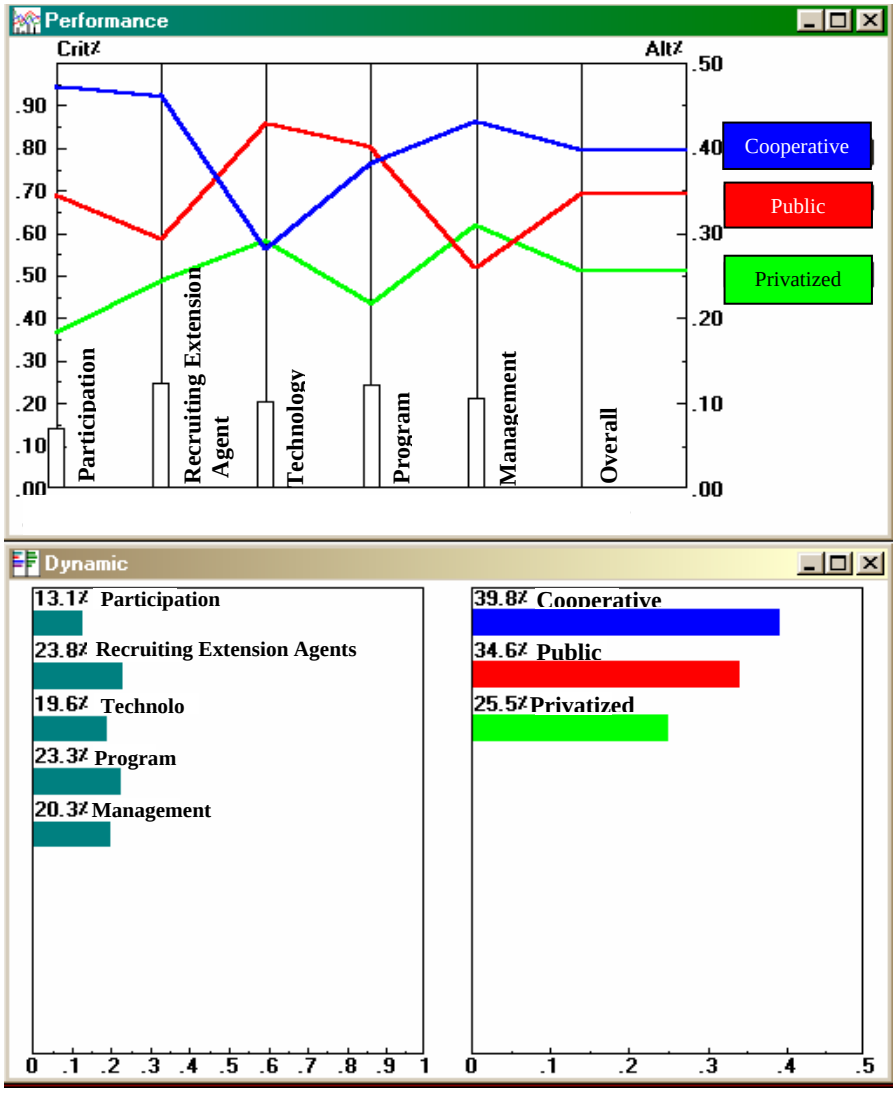

Figure 2: Sensitivity analysis for selecting an appropriate forestry extension model

Conclusion and discussion

Sustainability of forests in Zagros Area depends, to a large extent, on both adherence to proven forestry practices and participation by forest – dwellers (beneficiaries). In order to preserve, restore and develop these forests, a variety of forest resources management plans (projects) have been designed and carried out in the Area since 1996. Followed naturally by establishment of the related cooperatives, these activities have come to introduce community forestry as an efficient approach to forest management. Focusing on community forestry in Zagros Area calls for several mechanisms that need to be taken into consideration: beneficiary – centered attitude, public supports, adequate research efforts, systematic participation, legal requirements, an integrated extension network, etc…

Also, mechanisms such as utilitizing local resources, using local leaders for community management, allocating adequate financial resources and credits as low-rate loans, and the like , need to be delivered greater attention if an optimized management for forestry extension is to be achieved.

AHP technique, as employed in this research, reveals that present situations fail to regard privatized extension model as an appropriate one for Zagros Area. Beneficiaries have selected cooperative extension system as the most appropriate one. However, it has no tangible difference with public extension system as the second preferred option. A combination of both latter systems is, accordingly, recommended to be selected as the appropriate model.

As suggested by criteria for selecting an appropriate model, the Government, as controller and provider of credit needs, and cooperatives, as implementing agents, can together contribute to further realization of community forestry extension objectives in Zagros Area.

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