

## **Analysis of the Utility of Economic Sectors in Achieving Agricultural Development: Applying an Analytic Hierarchy Process**

**M. NOORI<sup>1\*\*</sup> and M. NOORIPOOR<sup>1\*</sup>**

<sup>1</sup>Department of Rural Development Management, Yasouj University, Yasouj- I. R. Iran.

**Received 4 May 2014, Accepted 22 October, 2014, Available Online 3 March 2015**

**ABSTRACT-** According to article 44 of the I.R. of Iran Constitution, the Iranian economy consists of three sectors; the state, the cooperative, and the private sectors. The aim of this study was to present a hierarchy of criteria for selecting the best economic sector for agricultural development. Analytic Hierarchy Process (AHP) was used to calculate the relative importance of either criteria or their alternatives (economic sectors) with regard to the aggregate opinions of experts. Using a structured questionnaire, data were obtained from experts in economic sciences, social sciences, agricultural extension and rural development (n=25) and analyzed using Expert Choice software. Results indicated that entrepreneurship, employment and social justice were the most important criteria to consider when selecting the best economic sector. Moreover, the study demonstrated that based on the criteria, the cooperative sector was the best and the optimum choice. Nevertheless, the gap between cooperative and private sectors was small.

**Keywords:** Analytic Hierarchy Process (AHP), Economic Sectors, Iran

### **INTRODUCTION**

Over the past 150 years or so, two socio-economic systems have dominated the world: capitalism and communism. Capitalism is synonymous to individual ownership and private enterprise, and communism is synonymous to state ownership and public enterprise. A third model, sometimes called 'the third way' or the cooperative economy, has also been proposed which offers an alternative future that should potentially avoid the excesses and disasters of both capitalism and communism (20). Today, almost everywhere in Western Europe, Eastern Europe and the US, the 'third sector' co-exists

---

\* Ph.D. Student and Assistant Professor, respectively.

\*\* Corresponding Author

with private and public sectors. Terms such as social economy, third sector, solidarity economy or alternative economy, non-lucrative sector, non-profit sector, not-for-profit sector, voluntary sector, idealist sector, etc. are increasingly used as synonyms. In particular, the terms social economy, third sector and solidarity economy are often used interchangeably, thus overlooking the considerable differences in meaning in different countries, to which we intend to turn our attention. These differences frequently refer to the particular forms of ‘co-existence’ (such as relations of co-operation, dependency or control) of the private, public and third sectors in various countries, their regions and cities. According to (29), setting some order to these terms and the concepts and contexts to which they refer is necessary.

A simple analysis reveals that the three sectors are not interchangeable. The objectives pursued by the public, cooperative and private organizations are different, so, the private sector aims for profit, while the public sector seeks not only to obtain economic benefits, but also to obtain social benefits with the stated primary objective of ensuring public welfare (28). In other words, the private sector is essentially a business proposition by which the public purpose finds a subsidiary or peripheral position sometimes superseding business considerations. On the other hand, the public sector has greater public interest orientation against the logic of profit making and is built upon social values and welfare criteria (48).

The main difference between cooperatives and the state sector is that the former use a more democratic system of governance where there is no employer-employee relationship (5). Likewise, (24) examines the difference between cooperatives and other businesses in relation to three main groups of people responsible for bringing them into existence and keeping them in operation. The three groups are the persons who own them (the shareholders, the investors), the persons who control them (the effective decision makers) and the persons who use them (the customers). Accordingly, in typical capitalist businesses, especially large enterprise and multinational corporations, these three are separate and distinct groups. In small private businesses, the situation is generally much better because of the close connection between shareholders (investors) and control. In a small retail business, for example, the first two components are often identical. Nevertheless, users or customers are still a separate group. In a cooperative, all three come together to form a unity; those who own, those who control and those who use. The diagrams below give a picture of the cooperatives in comparison to other businesses.

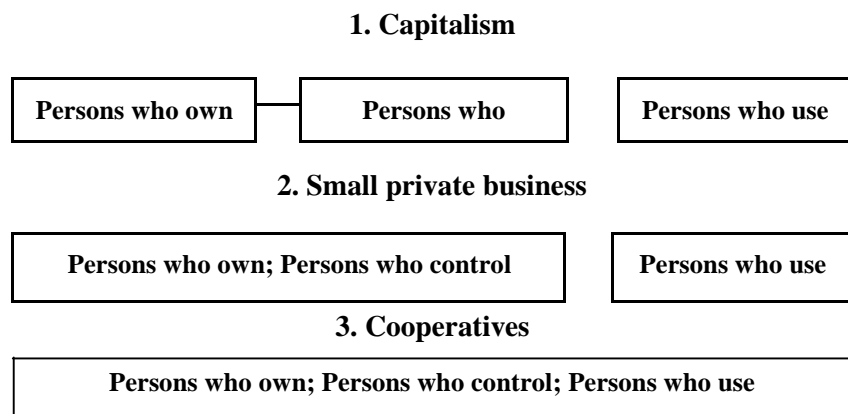


Fig. 1. The difference between cooperatives and other businesses (24)

The points of comparison also apply to public enterprise and cooperatives, though in a different way. In public enterprise, sometimes referred to as state capitalism, the components of ownership, control and use are separate and disjointed in contrast to cooperatives, where they are unified. In cooperatives, responsibility and accountability are direct while in public enterprise they are indirect and frequently difficult to trace (24).

According to article 44 of the I.R. of Iran Constitution, the Iranian economy consists of three sectors including state, cooperative, and the private sectors. It seems that the main purpose of supporting the cooperative sector was limiting the process of wealth accumulation in the hands of a small group, on the one hand and preventing the creation of a dominant public sector on the other. Thus, cooperatives seem to be the third choice between capitalism and socialism (5). However, the scope of each of these sectors, as well as the regulations and conditions governing their operation, is to be specified by law.

One of the biggest challenges of the Iranian economy is the size and ownership of the public sector, which controls roughly 80 per cent of the country's economic activity. To overcome this imbalance, the Iranian government started privatizing a number of enterprises managed by the government (21). Nevertheless, in order to increase rationalization and efficiency of the Iranian economy, there is a current emphasis on the transition to a market economy, including the encouragement of private sector development, privatization of state enterprises and cost recovery from beneficiaries (16). Thus, the issue that arises is the selection of the most preferred economic sector to bring off different economic needs as well as the optimal distribution and regulation of economic activities in achieving agricultural development in the conditions of Iran. These sectors are dealt with in more detail in the following sections.

### **A. Public (state) sector**

The public sector is generally viewed as being organized only through governmental institutions where services are delivered through a system of public administration.

In Iran, the state sector is to include all large-scale and mother industries, foreign trade, major minerals, banking, insurance, power generation, dams and large-scale irrigation networks, radio and television, post, telegraph and telephone services, aviation, shipping, roads, railroads and the like, all of which to be publicly owned and administered by the State (5). Public organizations in Iran used to control about 80% of the Iranian economy. The growth of the public sector began after the Islamic revolution when many large industries were nationalized and private sector companies were confiscated and taken into government control (21).

### **B. Private sector**

The private sector comprises of all economic activities that trade with the capital of one or many private owners with the goal of making profits, usually organized through market transactions. In other words, the private sector consists of those activities concerned with construction, agriculture, animal husbandry, industry, trade, and services that supplement the economic activities of the state and cooperative sectors.

### **C. Cooperative sector**

The cooperative sector embraces all those organizations, large or small, which are not part of the state or part of the private profit sectors.

The Center for Cooperatives (7) also defined a cooperative as a private business organization owned and controlled by the people who use its products, supplies or services. Although cooperatives vary in type and membership size, they are all formed to meet specific objectives of members, and structured to adapt to the members' changing needs. Generally speaking, they are businesses voluntarily owned and controlled by their member patrons and operated for them and by them on a nonprofit or cost basis (47). In Iran, as an option to conduct business, the cooperative form of enterprise includes several domains such as agriculture, housing, credit, carpet, etc. In general, the cooperative sector includes cooperative companies and enterprises concerned with production and distribution in urban and rural areas.

Given this background, the aim of this study is to present a hierarchy of factors for selecting the best and most preferred economic sector regarding agricultural development in Iran. In addition, the study seeks to 1) to identify critical criteria for choosing the most appropriate economic sector and priorities and 2) to determine the most preferred economic sector for the Iranian economy.

## **MATERIALS AND METHODS**

A two-phase data collection approach including both qualitative and quantitative phases was adopted. In the qualitative phase, the Delphi method was used to explore and determine the criteria affecting the choice of an appropriate economic sector. This method is an iterative process involving a series of survey rounds with the same panel of 'experts'. Each round is informed from responses from preceding rounds. While the rounds can continue until consensus is approached or achieved, most Delphi processes involve three or four rounds (9, 12). Although the possibility of more than three rounds is offered, there is a need to balance time, cost and possible participant fatigue (19). There are no rules for selecting Delphi participants, except that the necessary experts and stakeholders are represented. Participants must also be willing to stay engaged through the end of the study (6). For the present study, we sought participants who were knowledgeable and willing to provide insight that would help us understand the economic sectors of Iran. Delphi participants were specialist experts of rural development and social and economic sciences at Yasouj University, Iran. This stage was executed in three rounds resulting in a complete list of criteria for selecting the optimal economic sector. Nine criteria were obtained from the Delphi technique in total, which we categorized in three groups as described below.

### **Economic Criteria**

- Investment opportunities: the opportunities that economic sectors can create for investment
- Increasing employment: the power and capacity of the economic sector to generate enough jobs to absorb new entrants to the labor market

-Entrepreneurship: increasing entrepreneurial interest, spirit and education in various fields

### **B. Social criteria**

-Empathy and social relations: vicarious emotional response to the perceived emotional experiences of others (27). In this study, empathy and social relations were counterpart and equivalent factors.

-Learning and training: Learning causes a change in a person's behavior, knowledge, or skill, this change is a relatively permanent change and is caused by prior experience (10).

-Social justice: the concepts of equality and equity in economic sectors were used as two significant components of social justice, which involved efforts to achieve greater equality in the living conditions of different social groups and classes.

-Improvement of social capital: the association networks, norms and trust that facilitate collective interactions for mutual economic and social benefits (33). In the present study, the concept of social capital derives from the quality of relationships among people within a particular group or community.

### **C. Managerial criteria**

-Systematic, independent and autonomous management: self-reliance and autonomy in governance and management as well as alluding to managerial skills that let managers perform their jobs effectively, especially conceptual, human, and technical skills.

-Evaluation and accountability: a systematic process for collecting, analyzing and interpreting information obtained from the three economic sectors of Iran aimed at investigating the number of objectives to be achieved. This process can lead to improvement in management levels, intensification of accountability and responsibility as well as renovation in allocated resources.

In a nutshell, according to the Delphi method, we hypothesize that to achieve agricultural development, the selection of the optimum economic sector (OES) is a function of the relative importance ranking of investment, employment, entrepreneurship, empathy, learning, social justice, social capital, management, and evaluation. That is:  $OES = f(I, Em, En, Emp, L, SJ, SC, M, Ev)$ .

In the quantitative phase of this study, a pre-structured questionnaire was used. As previously described, the Analytic Hierarchy Process (AHP) was employed to choose the best alternative (OES) based on the above introduced criteria. Thus, an AHP survey questionnaire was designed to collect decision makers' judgments about the relative importance/preference of the criteria and the alternatives.

Using the questionnaire, participants were asked to do a pair-wise comparison of criteria with regard to the ultimate goal (selecting OES) and also to do a pair-wise comparison of the alternatives with regard to each criterion. A rating scale from 1 to 9, as recommended by Saaty(34; 36), was used for the paired comparisons.

The research population of this phase was all Iranian university social science, economic science and agricultural extension and rural development specialists. A random sample of 10 universities was drawn from the population of 31 public universities in the centers of provinces of Iran using simple random sampling. From the selected universities, scholars from the above mentioned areas were selected purposefully. On the whole, 45 questionnaires were mailed or e-mailed to the experts, from which 25 were returned. The data were collected between October 2011 and

February 2012.

Each decision-maker made 63 pair-wise comparisons to complete their individual AHP model. Due to the individual nature of the responses, the common approach in AHP methodology is to obtain the aggregate comparison matrix computing geometric means of individual judgments (23). Thus, the individual responses to each question were combined based on geometric means to produce intergroup decisions representing separate decision making groups in each field of expertise. The data obtained through the questionnaire were then analyzed using the AHP software package Expert Choice, and local weights at each level of the hierarchy were produced. These were then combined using an additive value model to produce a set of global weights or priorities for the alternatives. Finally, a series of sensitivity analyses were performed to investigate the impact of changing the priority of the criteria on the economic sectors' ranking.

Expert Choice allows different sensitivity analyses, where the main differences are various graphical representations including dynamic, gradient, performance and two-dimensional analyses. The user has the option to graphically alter the weights of the decision criteria and see on the screen how the rankings of the alternatives will change (46). It should be stated that dynamic and performance sensitivity analyses were employed.

### **Overview of AHP**

AHP is one of the most known methods of multi criteria decision making (MCDM) in different areas (39). In general, such methods require information about the relative importance of criteria, which is typically established by a set of preference weights (1). There are three main steps in utilizing a decision making technique involving the numerical analysis of a set of discrete alternatives: 1) determining the relevant criteria and alternatives, 2) attaching numerical measures to the relative importance (i.e., weights) of the criteria and to the impacts (i.e., the measures of performance) of the alternatives in terms of these criteria and 3) processing the numerical values to determine a ranking of each alternative (46).

The AHP is a theory of measurement through pair-wise comparisons and relies on the judgments of experts to derive priority scales (41). This method has been applied to solve unstructured problems in a variety of decision-making situations, ranging from simple personal decisions to more complex capital intensive decisions (49). In this method, decision-makers form a hierarchical decision tree and determine its indices and options. Then, they make pair-wise comparisons and determine the weight of each factor (criterion) in comparison with rival ones (35). In other words, the decision maker is required to provide judgments about the relative importance of each criterion and specify a preference for each decision alternative to each criterion. The output of the AHP is a prioritized ranking indicating the overall preference for each of the decision alternatives (38). In short, the basic steps involved in this methodology are as follows (50):

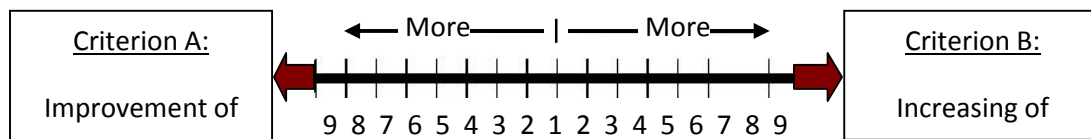
- 1) Setting up the hierarchy structure by breaking down the decision problem,
- 2) Collecting input data by pair-wise comparisons of the decision elements according to a given ratio scale,
- 3) Using the 'eigenvalue' to estimate the relative weights of the decision elements.
- 4) Aggregating the relative weights of decision elements to arrive at a set of ratings for the decision alternative.

The scale used for comparing the two qualitative measures was based on Saaty’s fundamental scale of absolute numbers (37, 41), presented in Table 1. This scale has been validated by a number of researchers for effectiveness in addition to theoretical comparisons with a large number of other scales (ibid).

There were two types of pair-wise comparisons; first, a comparison of criteria with respect to goal, and second, pair-wise comparisons of alternatives with respect to each criterion. These comparisons were shown in a matrix known as decision matrix. The resulting decision matrixes included a decision matrix for criteria comparisons and some decision matrixes for alternatives comparisons (30). Fig. 2 depicts an example of a pair-wise comparison between two criteria.

**Table 1. Saaty’s fundamental scale of absolute numbers (41)**

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgment slightly favor one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgment strongly favor one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favored very strongly over another; its dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
Reciprocals of above	If activity <i>i</i> has one of the above nonzero numbers assigned to it when compared with activity <i>j</i> , then <i>j</i> has the reciprocal value when compared with <i>i</i>	A logical assumption



**Fig. 2. Example of a pair-wise comparison between two criteria**

In the AHP procedure, the decision maker is required to make  $1/2n(n - 1)$  comparisons to establish the full set of pair-wise judgments for *n* criteria based on a

ratio scale. The choices are made from the integers between 1 and 9 and their reciprocals. The results of all pair-wise comparisons are then summarized and stored in an input matrix  $\mathbf{A} = [a_{ij}]$  which is a square matrix of dimension  $n$ . The element  $a_{ij}$  is the intensity of importance of criterion  $n_i$  compared to criterion  $n_j$ . It is reciprocally symmetric, i.e.  $a_{ij} = 1/a_{ji}$  (4; 8). In the same manner, the alternatives are compared in pairs to weigh their importance under each criterion. That is, for each pairing within each criterion the better alternative is awarded a score on a scale of 1 (equally good) to 9 (absolutely better), whilst the other alternative in the pairing is assigned a rating equal to the reciprocal of this value.

In the AHP method, a certain degree of consistency is necessary to get valid results. AHP measures the overall consistency of judgments by means of a “consistency ratio” (40). Since the judgments in each matrix are subjective, there is no guarantee for the pair-wise comparisons to be consistent with one another. In other words, three items, A, B, and C are consistent when A is preferred to B, B is preferred to C and A is preferred to C.

A consistency ratio (CR) is measured for each decision matrix. CR shows the precision of judgments when comparing criteria and alternatives. In other words, inconsistency ratio (IR) shows possible error(s) in judgments. Inconsistency ratio for each matrix should be less than 0.1, otherwise, the decision maker(s) should re-evaluate the judgments for the related matrix until the ratio is finally less than 0.1 (2, 31).

As priorities make sense only if derived from consistent or near consistent matrices, a consistency check must be applied. Saaty (34) has proposed a consistency index (CI), which is related to the eigenvalue method:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \tag{1}$$

where  $\lambda_{\max}$  = maximal eigenvalue

The consistency ratio, the ratio of CI and RI, is given by:

$$CR = \frac{CI}{RI} \tag{2}$$

where RI is the random index. If CR is less than 10%, then the matrix can be considered as having an acceptable consistency. Saaty (34) calculated the random indices shown in Table2.

**Table 2. Random indices from Saaty (1977)**

$n$	3	4	5	6	7	8	9	10
RI	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

Because pair-wise comparisons in the AHP are based on a ratio scale, judgment averages should be calculated using a geometric mean (35, 23). The average A for a set of judgments  $X_i$  is:



$$A = \sqrt[n]{\prod_{i=1}^n X_i} \quad (3)$$

In the next step, alternative scores are combined with criterion weights to produce an overall score for each alternative. The extent to which the alternatives satisfy the criteria is weighed according to the relative importance of the criteria. This is done by simple weighted summation. In brief, this step is to establish the composite or global priorities of the alternatives (37). The outcome of this step is the selected alternative.

The last stage of the decision process is sensitivity analysis, when the input data are slightly modified in order to observe the impact on the results. If ranking does not change, the results are said to be robust. Sensitivity analysis is best performed with an interactive graphical interface (18).

The AHP method was originally used for socioeconomic and political situations but has lately proved useful for judgmental decision making in other areas such as management, finance, resource allocation, planning, auditing, marketing, politics, architecture, health, logistics, ecology, farming, sport and law (15). Further applications, along with a good exposure of AHP, are given by Zahedi (50), Shim (42), Partovi et al. (32), Vargas (49), Triantaphyllou and Mann (45), Kumar and Vaidya (22), Ho (17), (26) and Sipahi and Timor (2010). In sum, AHP provides an easy method of making complex decisions using simple mathematics (11).

## RESULTS AND DISCUSSION

### 4.1. Decision hierarchy model

As shown in Fig. 3, the hierarchy developed in this study consists of three levels. The top level represents the goal of selecting an economic sector. The last level includes three alternative economic sectors. The intermediate level represents the criteria. These criteria include three major economical, social and managerial categories. The economic criteria include entrepreneurship, increasing of employment opportunities and investment opportunities. The social criteria comprise social justice, social capital, learning and training, and empathy and social relations. The managerial criteria include systematic, independent and autonomous management and evaluation, accountability and responsibility of activities and programs.

### 4.2. Pair-wise comparisons

As mentioned, twenty five participants in three groups examined the criteria with respect to the overall goal (OES selection). Table 3 shows normalized weights and the rank for the nine criteria with the overall goal in each individual group and collectively as a whole.

The results of pair-wise comparisons of criteria by all respondents (three groups and collectively) are presented below.

**Economic sciences experts:** The results indicate that the criterion employment opportunities had the highest weight of 0.147, followed by entrepreneurship which had a

relative weight of 0.133 among economists (Table 3). In other words, the increase in employment opportunities and entrepreneurship was recognized and perceived as the most important criterion in selecting the appropriate economic sector. In addition, the creation or reinforcement of investment opportunities and social justice had the same weights of 0.119, whereas based on these groups of respondents' evaluation, empathy and social relations and evaluation and accountability had the least weights of 0.087. Table 3 indicates that the inconsistency ratio for the pair-wise comparisons in this group was 0.03, which is below the tolerable level of 0.1.

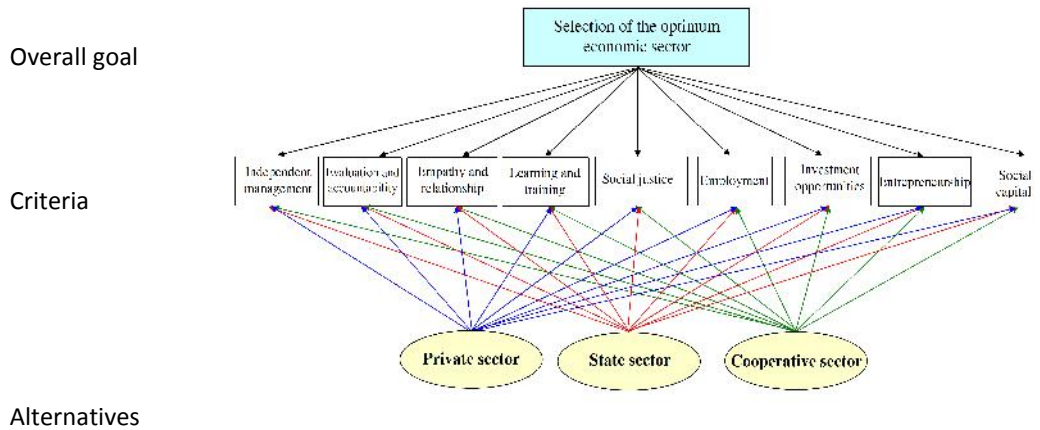


Fig. 3. Hierarchical model for OES selection

Table 3. Synthesized priorities and ranks for criteria

Criteria	Economic experts	Social experts	Agricultural extension & rural development experts	Overall groups
Social capital	0.109 (4)	0.090 (7)	0.107 (5)	0.109 (4)
Entrepreneurship	0.133 (2)	0.154 (2)	0.123 (4)	0.139 (1)
Investment opportunities	0.119 (3)	0.116 (4)	0.133 (3)	0.110 (3)
Employment opportunities	0.147 (1)	0.174 (1)	0.093 (6)	0.127 (2)
Social justice	0.119 (3)	0.125 (3)	0.145 (2)	0.127 (2)
Learning & training	0.107 (5)	0.092 (6)	0.063 (8)	0.087 (5)
Empathy & social relations	0.087 (7)	0.092 (6)	0.107 (5)	0.109 (4)
Evaluation & accountability	0.087 (7)	0.061 (8)	0.074 (7)	0.081 (6)
Independent management	0.093 (6)	0.097 (5)	0.156 (1)	0.109 (4)
Inconsistency ratio (I.R.)	0.03	0.02	0.02	0.02

Note: Figures in parentheses are ranks for criteria

**Social sciences experts:** The results demonstrated that the highest weight (0.174) belonged to increasing employment opportunities. Entrepreneurship was the second important factor with a weight of 0.154. Social justice was also found to be important with a weight of 0.125. The least important criterion with a weight of 0.061 was evaluation and accountability. The inconsistency ratio related to this pair-wise comparisons matrix was 0.02, which is less than the tolerable level of 0.1 (Table 3).

**Agricultural extension and rural development experts:** As observed, independent and autonomous management had an important role with a score of 0.156. Creation of social justice might have increased the popularity of this selected sector. Moreover, creation or reinforcement of investment opportunities finds an important place with a weight of 0.133. The inconsistency ratio related to their pair-wise comparisons (0.02) is less than 0.1 (Table 3).

The field of expertise of the respondents can explain the latter findings. For example, economic criteria were considered to be more important by economic experts than social and managerial criteria.

**Collective scores:** According to the aggregate judgments of different participants (all three groups), entrepreneurship ranked first with a weight score of 0.139, followed by increasing of employment opportunities and social justice, which had the same relative weights 0.127. These results signify that entrepreneurship, employment and social justice were the most important criteria to consider in the selection of the OES. Table 3 shows that the inconsistency ratio to collective pair-wise comparisons was 0.02, which is acceptable.

### **4.3. Comparisons of the different economic sectors with respect to the criteria**

After pair-wise comparisons for all criteria, the next step was making comparisons between economic sectors (state, private and cooperative) with respect to each criterion. The respondents' subjective judgment about the preference of one alternative over another with regard to the criteria was converted to a numerical value using a scale of 1-9 (Table 1).

#### **4.3.1. Synthesizing judgments**

Overall priorities for alternative sectors are given in Table 4. Note that they add up to 1. As Table 4 shows, the private sector is the highest ranking in the economic expert's assessment with the weight of 0.375, followed by the cooperative sector with the weight of 0.353. Nevertheless, the gap between private and cooperative sectors was very small. In contrast, agricultural extension and rural development experts expressed a higher priority for the cooperative sector with the weight of 0.408, followed by private and state sectors with weights 0.337 and 0.255, respectively.

These priorities may also be expressed in the ideal form by dividing each priority by the largest one (see Saaty, 2008). For instance, 0.400 for *cooperative sector* in accordance with the three group's collective view, as given in Table 4. The idea is to make this alternative the ideal one while others receive their proportionate value. One may then interpret the results to infer that a private sector is about 90% as

good as a cooperative sector and so on. Note that only one such idealized priority is shown in Table4.

**Table 4. Final results of AHP analysis (final preferences and rankings)**

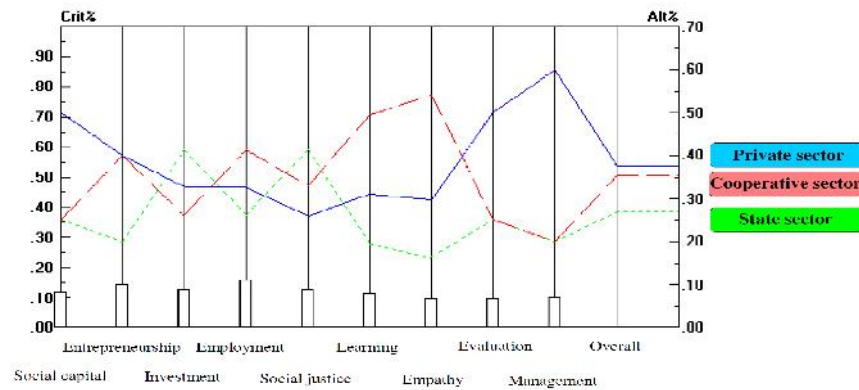
Alternatives	Economic experts	Social experts	Agricultural extension & rural development experts	Overall groups	
				Normalized priorities	Idealized priorities
State sector	0.272 (3)	0.186 (3)	0.255 (3)	0.237 (3)	0.592
Private sector	0.375 (1)	0.412 (1)	0.337 (2)	0.363 (2)	0.907
Cooperative sector	0.353 (2)	0.402 (2)	0.408 (1)	0.400 (1)	1.000
Inconsistency ratio (I.R.)	0.03	0.02	0.02	0.01	

Note: Figures in parentheses are priorities for the alternatives

### 4.3.2. Sensitivity analysis

#### Economic sciences experts

Fig. 4 illustrates the results of performance sensitivity analysis for economic sectors as perceived by economic experts. The private sector was perceived as a better alternative for achieving agricultural development in the conditions of Iran. The private, cooperative and state sectors have weights of 0.375, 0.353 and 0.272, respectively (Table4).



**Fig. 4. Performance sensitivity analysis of economic sectors as perceived by economic experts**

#### Social sciences experts

Fig.5 shows how an alternative was prioritized relative to other alternatives with respect to each criterion as well as collectively. In this study, the private sector had higher priority among experts of social sciences (Fig. 5). As indicated in Table 4, the private sector for social sciences experts had the first priority among other economic sectors with the weight of 0.412, followed by cooperative and state sectors with relative weights of 0.402 and 0.186, respectively. In other words, private and cooperative sectors performed very closely with priority weights of 0.412 and 0.402, respectively.

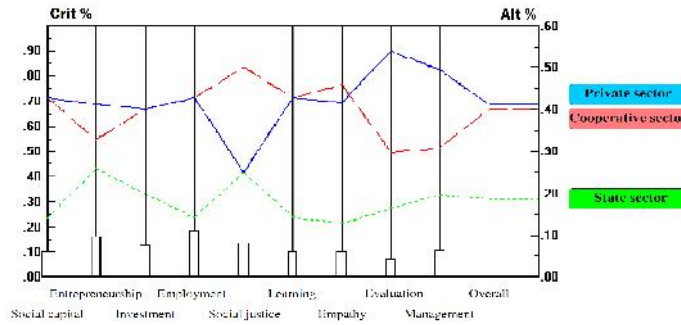


Fig. 5. Performance sensitivity analysis of economic sectors as perceived by social experts

### Agricultural Extension and Rural Development Experts

Fig. 6 represents the priorities of economic sectors in Iran from the point of view of agricultural extension and rural development experts. These specialists believed that the cooperative sector was the most preferable economic sector among the three alternatives, with an overall priority score of 0.408. Economic sectors were ranked according to their overall priorities as cooperative, private, and state sector, respectively, indicating the cooperative as the best economic sector.

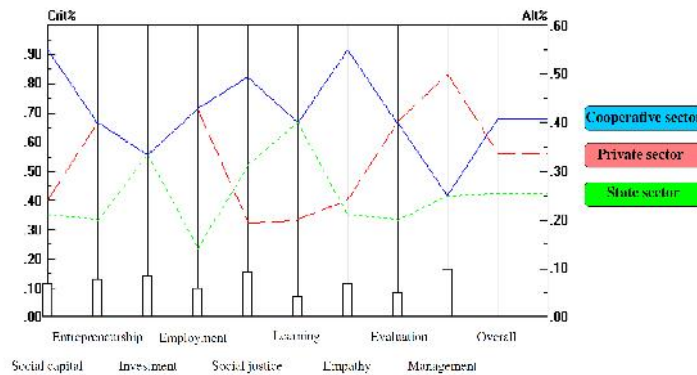


Fig. 6. Performance sensitivity analysis of economic sectors as perceived by agricultural extension and rural development experts

### Overall groups

As shown in Fig. 7, all participants evaluated the cooperative sector as the best economic sector for achieving agricultural development in the conditions of Iran. The cooperative sector had the weight of 0.400, followed by the private sector with the relative weight of 0.363. As indicated in Table 4, the state sector had the least weight in the Iranian economy. In sum, all decision makers in this study emphasized the capacity and position of cooperatives among other economic sectors of Iran. However, the results show that the importance of the cooperative sector in the Iranian economy is somehow remarkable.

In addition, dynamic sensitivity analyses were conducted to investigate the

impact of the criteria priority changes on the ranking of economic sectors. Dynamic sensitivity analysis is used to dynamically change the priorities of the criteria to determine how these changes affect the priorities of the alternative choices (41). We investigated the impact of changing the priority of nine criteria on overall results. The results of the sensitivity analyses indicated that the alternatives' ratings were not sensitive to changes (increase or decrease) in the importance of seven criteria out of the nine social capital, entrepreneurship, investment opportunities, employment opportunities, social justice, learning and training and empathy and social relations criteria. When we changed the importance of these seven criteria, the alternative ratings did not change for all priorities and the overall rank of the final outcome was preserved. In other words, when we decreased and increased the importance of these criteria, the results indicated that the cooperative sector was the best alternative for all priorities. For example, in the first scenario, when the importance of social capital was increased from 0.109 to 0.333, all three economic sectors maintained their rank.

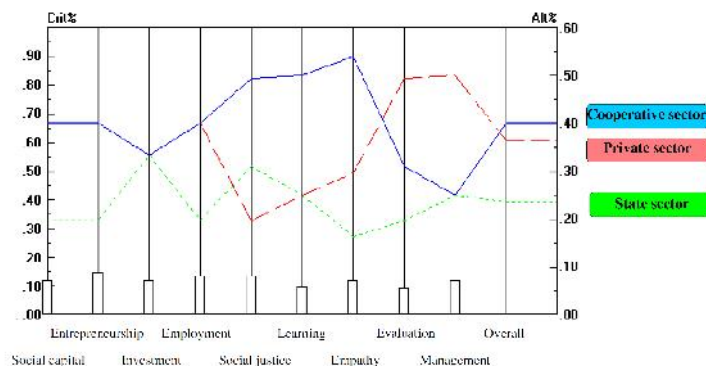


Fig. 7. Performance sensitivity analysis of economic sectors as perceived by overall participants

Furthermore, the results illustrated that the alternatives' ratings were a little sensitive to changes in the importance of managerial criteria i.e. evaluation and accountability as well as the independent and autonomous management. For example, in the second scenario, when the importance of evaluation and accountability increased from 0.081 to 0.260, the private sector became the best alternative, with an overall priority score of 0.386, while the overall priority of the cooperative sector decreased from 0.400 to 0.384. The state sector was still preserved as the third alternative, although its preference rating was decreased from 0.237 to 0.230, as shown in Table 5.

Similarly, in the third scenario, when the importance of independent management increased to 0.240, the private sector turned out to be the best. Nevertheless, private and cooperative sectors were very close with priority weights of 0.381 and 0.380, respectively. In general, the results of the sensitivity analyses demonstrated that only when the importance of evaluation and accountability and independent and autonomous management increased to 0.260 and 0.240, the final outcome changed and the private sector turned out to be the best. In another cases with all possible combinations, the cooperative sector was the best economic sector for achieving agricultural development in the Iranian context.

**Table 5. Summary of dynamic sensitivity analyses (relative importance of criteria and overall priority of alternatives)**

	First scenario	Second scenario	Third scenario	
<b>Criteria</b>	<b>Social capital</b>	<b>0.333</b>	<b>0.088</b>	<b>0.093</b>
	<b>Entrepreneurship</b>	<b>0.104</b>	<b>0.112</b>	<b>0.119</b>
	<b>Investment opportunities</b>	<b>0.082</b>	<b>0.089</b>	<b>0.094</b>
	<b>Employment opportunities</b>	<b>0.095</b>	<b>0.102</b>	<b>0.109</b>
	<b>Social justice</b>	<b>0.095</b>	<b>0.102</b>	<b>0.109</b>
	<b>Learning &amp; training</b>	<b>0.065</b>	<b>0.071</b>	<b>0.074</b>
	<b>Empathy &amp; social relations</b>	<b>0.082</b>	<b>0.088</b>	<b>0.093</b>
	<b>Evaluation &amp; accountability</b>	<b>0.062</b>	<b>0.260</b>	<b>0.069</b>
	<b>Independent management</b>	<b>0.082</b>	<b>0.088</b>	<b>0.240</b>
<b>Alternatives</b>	<b>State sector</b>	<b>0.227 (3)</b>	<b>0.230 (3)</b>	<b>0.239 (3)</b>
	<b>Private sector</b>	<b>0.373 (2)</b>	<b>0.386 (1)</b>	<b>0.381 (1)</b>
	<b>Cooperative sector</b>	<b>0.400 (1)</b>	<b>0.384 (2)</b>	<b>0.380 (2)</b>

**Note: only three possible combinations of the importance of criteria are presented in this table.**

## CONCLUSIONS

An AHP model was used to evaluate and select an optimum economic sector for agricultural development in the Iranian context. The model considers factors affecting the decision making process. These factors, i.e. entrepreneurship, employment, investment opportunities, social justice, social capital, learning and training, empathy and social relations, independent management and evaluation and accountability were determined using the Delphi method. The AHP provides a systematic method for comparison and weighting of these multiple criteria and alternatives by decision-makers, and requires setting the factors in a hierarchy that properly reflects the process of arriving at the selection of an OES. The computations were run using the specialized software Expert Choice. The AHP hierarchy design and evaluation allow the decision maker to readily determine the relative contribution of each factor to the final decision. To use the model, the users (decision maker) need to assess the relative weights they wish to assign to each factor. Thus, the decision reflects the decision maker's needs and preferences.

A closer look at Table 3 reveals that on the whole, the entrepreneurial spirit factor has a key role in the selection decision. Today entrepreneurship has become one of the most critical activities for the development of any economy. The reason for this importance is that the growth of entrepreneurial activities leads to the creation of opportunities for various sectors of the society (3).

The factors employment and social justice take the second major point, followed by investment opportunities. The least share is taken by evaluation and accountability.

In addition, this study showed that the cooperative sector was the best economic sector with an overall priority score of 0.400. In contrast, the state sector was the last choice for all decision makers.

Performing a sensitivity analysis, it was also found that when the order of

importance of the seven criteria changed in all possible combinations, the ranks of the alternatives remained stable in all cases, causing the cooperative sector to be the best economic sector for achieving agricultural development in the context of Iran. Only when the importance of evaluation and accountability as well as the independent management increased up to 0.260 and 0.240, the private sector became the best alternative.

According to Taimni (34), combating exploitation, reducing disparities, improving social conditions and gender sensitivity, and helping to create a more just society with pronounced concern for environmental protection and sustainable processes of development all tend to make a cooperative a preferred and more socially desirable form of organization.

Cooperatives are community-based, rooted in democracy, flexible, and have participatory involvement, which makes them well suited for economic development (13). The process of developing and sustaining a cooperative involves the processes of developing and promoting community spirit, identity and social organization as cooperatives play an increasingly important role worldwide in poverty reduction, facilitating job creation, economic growth and social development (14). Furthermore, with regard to economic and social development, cooperatives promote the “fullest participation of all people” and facilitate a more equitable distribution of the benefits of globalization. They contribute to sustainable human development and have an important role to play in combating social exclusion. Thus the promotion of cooperatives should be considered as one of the pillars of national and international economic and social development (25). Additionally, it should be considered that there are many different factors that can impact cooperatives (e.g., economic, political, and environmental changes). Moreover, as Iran is in the process of rapid economic development, Iranian government officials and policy makers need to consider the value of cooperatives as a viable organizational form and give greater attention to the importance of cooperatives in an Iranian context (31). In order to promote economic development in Iran, decision makers in the Iranian economy should consider entrepreneurship policy as it ranked highest among the criteria. The entrepreneurial and business nature of cooperatives’ activities ensures them as good prerequisites to national development.

In Iran, cooperatives can provide locally needed services and employment, and can circulate money locally and contribute to a sense of community or social cohesion. In other words, they are specifically seen as significant tools for the creation of jobs and the mobilization of resources for income generation. Thus, cooperatives must play the role of a third force, an alternative and countervailing power to both private and government businesses. It is important to note, however, that forming a cooperative is not a guarantee for success. Cooperatives are subject to the same marketplace demands and planning requirements as any business, including careful market analysis, sound business planning, competent management, and adequate capital to start-up and grow.

No business enterprise in an economic system is completely independent and self-reliant. An ideal economy is one that has a good balance of public, cooperative and private sectors (24). Thus, cooperatives cannot be considered as exclusive economic systems but rather as one section of the total economy. They constantly operate in co-existence with other forms of business and sometimes in conjunction with them. However, the cooperative sector is an integral part of the economic structure of Iran and it is necessary for decision makers and lawmakers to believe in this system and consider the growth of the share of the cooperative sector in gross domestic and national outputs.



## REFERENCES

1. Alesheikh, A. A., M. J. Soltani, N. Nouri and M. Khalilzadeh. 2008. Land Assessment for flood spreading site selection using geospatial information system. *Int. J. Environ. Sci. Technol.* 5 (4): 455-462.
2. Asgarpoor, M. J. 2002. Multiple Criteria Decision Making. Tehran University Publication. Tehran, Iran. (In Farsi).
3. Azhar, A., A. Javaid, M. Rehman and A. Hyder. 2010. Entrepreneurship intentions among business students in Pakistan. *J. Bus. Sys. Gov. Ethics.* 5(2): 13-21.
4. Barzilai, J. 1997. Deriving weights from pairwise comparison matrices. *J. Operat. Res. Soc.* 48: 1226-1232.
5. Borimnejad, V. 2010. Rural credit cooperatives plans restructuring: case study Khorasan-e-Razavi Province, Iran. *International Conference on Business and Economics Research. Vol.1 (2011)*, IACSIT Press, Kuala Lumpur, Malaysia. 213-219.
6. Blinn, C.R., P. J. Jakes and M. Sakai. 2007. Forest landowner cooperatives in the United States: A local focus for engaging landowners. *J. Forest.* 105:245-251.
7. Center for Cooperatives. 2004. Working together for stronger cooperatives. University of Wisconsin, Madison, U.S.A.
8. Cox, M. A. A. 2007. Examining alternatives in the interval analytic hierarchy process using complete Enumeration. *Eur. J. Operat. Res.* 180 (2):957-962.
9. Critcher, C. and B. Gladstone. 1998. Utilizing the Delphi technique in policy discussion: a case study of a privatized utility in Britain. *Public Admin.* 76(3): 431-449.
10. Domjan, M. 2000. Learning: an overview. In A. E. Kazdin (*ed.*) *Encyclopedia of psychology*(vol.5), Oxford: Oxford University Press, 1-3.
11. Forman, E. and G. Selly. 2001. The Analytic Hierarchy Process- An Exposition. *Oper. Res.* 49(4): 469-486.
12. Garavalia, L. and M. Gredler, 2004. Teaching evaluation through modeling: using the Delphi technique to assess problems in academic programs. *Amer. Eval.* 25(3): 375-380.
13. Gertler, M. 2001. Rural cooperatives and sustainable development. Saskatoon SK: Centre for the study of cooperatives, University of Saskatchewan.
14. Gibson, R. 2005. The role of cooperatives in community economic development, RDI Working Paper # 2005-3.
15. Gupta, A., K. Singh and R. Verma. 2010. A critical study and comparison of manufacturing simulation. Soft wares using analytic hierarchy process. *J. Eng. Sci. Technol.* 5 (1): 108-129.
16. Hamdhaidari. S., H. Agahi and A. Papzan. 2008. Higher education during the Islamic government of Iran (1979-2004). *Int. J. Educ. Develop.* 28: 231-245.
17. Ho, W. 2008. Integrated analytic hierarchy process and its applications- A literature review. *Eur. J. Operat. Res.* 186(1): 211-228.

18. Ishizaka, A. and A. Labib. 2009. Analytic Hierarchy Process and Expert Choice: Benefits and Limitations. *OR Insight*. 22(4): 201–220.
19. Jones, J. M. G., C. F. B. Sanderson and N. A. Black. 1992. What will happen to the quality of care with fewer junior doctors? A Delphi study of consultant physicians' views. *J. Roy. Coll. Phys. Lond.* 26: 36-40.
20. Karlyle, J. 2005. A cooperative economy- What might it look like? Paper given at the Hobart conference: Community, Economy and the Environment: Exploring Tasmania's Future, 15 October 2005.
21. Khajehpour, B. 2000. Domestic political reforms and private sector activity in Iran. *Soc. Res.* 67(2): 577-609.
22. Kumar, S. and O.Vaidya. 2006. Analytic hierarchy process: An overview of applications. *Eur. J. Operat. Res.* 169 (1): 1-29.
23. Lai, V. S., B. K. Wong and W. Cheung 2002. Group decision making in a multiple criteria environment: A case using the AHP in software selection. *Eur. Operat. Res.* 137: 134-144.
24. Laidlaw, A. F. 1974. *The Cooperative Sector*, Columbia: University of Missouri.
25. Levin, M. 2002. The promotion of cooperatives, ILO cooperative branch. at [www.ica.coop/europe/ra2002/speech](http://www.ica.coop/europe/ra2002/speech)
26. Liberatore, M. and R. Nydick. 2008. The analytic hierarchy process in medical and health care decision making: A literature review. *Eur. J. Operat. Res.* 189(1): 194-207.
27. Mehrabian, A. and N. Epstein. 1972. A measure of emotional empathy. *J. Pers.* 40: 525-543.
28. Mihaiu, D. M., A. Opreana and M. P. Cristescu. 2010. Efficiency, effectiveness and performance of the public sector. *Roman. J. Econ. Forecast.* 4: 132-147.
29. Moulart, F. and O. Ailenei. 2005. Social economy, third sector and solidarity relations: A conceptual synthesis from history to present. *Urban Studies.* 42 (11): 2037-2053.
30. Nooripoor, M., M. Shahvali and K. Zarafshani 2008. Integration of communication media for horticultural sustainability: the application of multiple criteria decision making (MCDM). *Am. Eurasian J. Agric. Environ. Sci.* 3 (1): 137-147.
31. Noruzi, M. R. and J. H. Westover. 2010. Opportunities, challenges and employment relative advantages in the cooperative sector in Iran. *Manage. Sci. Eng.* 4(3): 95-99.
32. Partovi, F. Y., J. Burton and A. Banerjee. 1990. Application of analytical hierarchy process in operations management. *Int. J. Oper. Prod. Manage.* 10(3): 5-19.
33. Putnam, R. D. 1995. Bowling alone: America's declining social capital. *J. Democr.* 6(1): 65-78.
34. Saaty, T. L. 1977. A scaling method for priorities in hierarchical structures. *J. math. psychol.*, 15(3): 234-281.
35. Saaty, T. L. 1980. *The Analytic Hierarchy Process: planning, priority setting, resource allocation*. McGraw-Hill, Inc.

36. Saaty, T. L. 1986. Axiomatic foundation of the analytic hierarchy process. *Manage. Sci.* 32, 841–855.
37. Saaty, T. L. 1990. How to make a decision: The analytic hierarchy process. *Eur. J. Operat. Res.* 48: 9-26
38. Saaty, T. L. 1994. How to make a decision: The analytic hierarchy process. *Interf.* 24: 19-43.
39. Saaty, T. L. 1995. Transport Planning With Multiple Criteria: The analytic hierarchy process applications and progress review. *J. Adv. Transport.* 29(1): 81-126.
40. Saaty, T. L. 2001. Decision making in complex environments: the analytic network process for decision making with dependence and feedback, RWS Publications, USA.
41. Saaty, T. L. 2008. Decision making with the analytic hierarchy process. *Int. J. Serv. Sci.* 1(1): 83-98.
42. Shim, J. P. 1989. Bibliography Research on the Analytic Hierarchy Process (AHP), *Socio. Econ. Plan. Sci.* 23:161-167.
43. Sipahi, S. and M. Timor. 2010. The Analytic Hierarchy Process and Analytic Network Process: an overview of applications. *Manage. Decision*48(5):775-808.
44. Taimni, K. K. 1997. Cooperatives in the new environments: A study of the role of the registrar of cooperative societies in selected countries in Asia, Rome: FAOUN
45. Triantaphyllou, E. and S. H. Mann. 1995. Using the analytic hierarchy process for decision making in Engineering Application: Some Challenges. *Int. J. Ind. Eng.-: Appl. P.* 2(1): 35-44.
46. Triantaphyllou, E. and A. Sanchez. 1997. A sensitivity analysis approach for some deterministic multi criteria decision making methods. *Decision Sci.* 28 (1): 151-194.
47. UWCC. 2002. Cooperatives, University of Wisconsin Centre for Cooperative, at [www.uwcc.com](http://www.uwcc.com)
48. Vaidyanathan, S. and V. Sundar. 2011. The role of public sector enterprises in rural development and social welfare. *Int. J. Manag. Public Sector Inf. Comm. Technol.* 2(1): 23-33.
49. Vargas L. G. 1990. An overview of the analytic hierarchy process and its application. *Eur. J. Operat. Res.* 48: 2-8.
50. Zahedi, F. 1986. The analytic hierarchy process: a survey of the method and its applications. *Interf.* 16(4): 96-108.

## تحلیل مطلوبیت بخش‌های اقتصادی در نیل به توسعه کشاورزی: کاربرد تحلیل سلسله مراتبی

مرتضی نو<sup>\*\*۱</sup> و مهد<sup>\*۱</sup>

<sup>۱</sup>گروه مدیریت توسعه روستایی، دانشکده کشاورزی، دانشگاه یاسوج، یاسوج، ج.ا. ایران

**چکیده-** استفاده کارآمد از آب آبیاری برای گیاهان زراعی تابستانه به دلیل عدم وقوع بارش در تابستان باید به طور جدی مورد بررسی قرار گیرد. این تحقیق کارایی مصرف آب را از طریق بررسی عامل بهره وری آب برای گیاهان زراعی تابستانه غالب در منطقه مورد مطالعه (ذرت و برنج) با در نظر گرفتن سناریوهای مختلف مدیریت آب در مزرعه تحت شرایط مختلف آب و هوایی مورد ملاحظه قرار داد. نتایج این تحقیق نشان داد که در اکثر موارد حداکثر بهره وری آب در سناریو آبیاری کامل اتفاق نمی افتد. با افزایش بازده کاربرد آب در مزرعه، بهره وری آب افزایش یافت و حداکثر بهره وری آب در کسر کاهش آب بالاتری رخ داد. برای ذرت در روش هایی از برنامه بندی کم آبیاری که در آنها در مرحله گلدهی آبیاری کامل انجام شده بود کاهش بیشتر آب از نظر اقتصادی قابل قبول بود. برای برنج با افزایش بازده کاربرد آب و کسر کاهش آب، بهره وری آب افزایش یافت و کم آبیاری در مراحل مختلف رشد از نظر اقتصادی توجیه پذیر بود. با در نظر گرفتن قیمت واقعی آب، نسبت بهره وری اقتصادی آب تا حد زیادی کاهش یافت به طوری که برای داشتن درآمد خالص مثبت در سیستم آبیاری سطحی باید بازده کاربرد آب در مزرعه افزایش می یافت و از اعمال کسرهای زیاد کاهش آب (بیشتر از ۰/۴) اجتناب می شد. در سیستم آبیاری بارانی، با افزایش بازده کاربرد آب در مزرعه نسبت بهره وری اقتصادی آب افزایش یافت و اعمال کسرهای کاهش آب بیشتر از ۰/۲ (۰/۲ تا ۰/۶ برای ذرت) قابل قبول بود. اعمال آبیاری قطره ای برای ذرت فقط برای کسرهای کاهش آب کمتر از ۰/۲ پذیرفتنی بود که با کاهش بازده کاربرد آب در مزرعه، کسرهای کاهش آب ۰/۲ تا ۰/۴ نیز از نظر اقتصادی توجیه پذیر بود.

واژه های کلیدی: ایران، بخش‌های اقتصادی، تحلیل سلسله مراتبی

---

\*به ترتیب دانشجوی دکتری و استادیار

\*\*مکاتبه کننده