



## PRIORITIZATION OF VARIOUS COOPERATION INVESTMENT FIELDS IN HAMEDAN PROVINCE OF IRAN: AN AHP TECHNIQUE APPLICATION

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**ABSTRACT:** The purpose of the present study is to prioritize various investment fields of cooperation in Hamedan Province, Iran. The population of this research consists of experts, working for different cooperatives in Hamedan province, among which a panel of experts; including, 55 clear-sighted specialists are selected to fill the questionnaire. Gathered data are analyzed by Expert Option software applying Analytic Hierarchy Process (AHP) method, which is a flexible method that includes different targets and direct the manager to find the optimized ones. Results of analysis indicate that the most important condition for cooperative investment is "consistency with region's physical potentials". In addition; industry, agriculture and housing are three top fields of interest; while, carpet, services, transportation and providing needs of consumers and producers are least interested fields.

**Keywords:** Prioritization, Investment, Hamedan, Cooperation, AHP

### INTRODUCTION

Production increase in developing countries is crucial and inevitable, in order to strengthen economy and reduce dependency and elimination of current imbalances and needs lots of planning and also identifying potential facilities and resources. Increase in production capacity requires special attention to different economic fields, particularly cooperation, and increasing investments in this field seems to be critical. This target can be achieved by identifying facilities and limitations, resource allocation, proper evaluation of abilities, providing appropriate methods and finally planning and prioritizing future investments in countries [1].

Lack of investments, as an important production factor, is a huge barrier in developing countries[2] The first step to develop plans and economic policies is determination of advantages in major economic fields in order to optimize allocation of limited resources [3], because different economic sector has different comparative advantages and therefore different specialized positions [4] . So, it is necessary to recognize production capabilities and abilities in different fields and pay much attention to priority fields [5]. Considering importance of cooperation in global economy and its capability to produce added value and providing jobs, it is inevitable to develop cooperative bases and applying policies to help its growth. It is believed that empowering individuals by developing cooperative relationship is a very effective way in developing countries and will result economic growth and employment [6,7] Cooperation in Iran is one the three main economic sectors together with public and private sectors. It plays an important role in filling the gaps of structural & institutional parts, functional performance between public and private sectors, functional convergence and develops capacities to gain national sustainable development in economic, social, cultural, and infrastructural fields [8]. Unfortunately, activity of cooperation in Hamedan Province is not enough and does not have much effect in producing added value and employment. So, by paying attention to cooperative fields and applying right policies, we can help the authorities in one of their main concerns.

In order to prioritize industrial cooperative activities in Hamedan Province based on comparative and competitive advantages, in their research, Keyhani-e Fathi and Fathipour (2010) [9], prioritize different industrial fields of Hamedan Province by two digit ISIC codes based on their advantage rate. Hekmat & Rahmati (2009) [1] studied on investment prioritization in Iilam Province by considering criteria such as employment, revenue-generation, capital-intensive and labour-intensive. They concluded that priorities for investment in Iilam are: food and beverages, non-metallic minerals, basic steel products and agriculture. Shakeri and Salimi (2004) [10] prioritize investment fields and factors affecting on investment in Chabahaar free zone, by employing AHP mathematic method. With priority coefficient of 0.32, the results of their research indicate that lack of proper executive organizations and powerful executive management are the biggest problems in absorbing foreign investments. Falahati & Ahmadian (2010) [11] studied on investment prioritization in industrial fields of Kermanshah Province. This study provides regional economic concepts and techniques for industry structure of Kermanshah and also prioritize industrial investment fields in there.

Cooperation in Iran not only can be considered as a profitable activity but also can be a major aid for the government to reduce unemployment rate. Because of its special conditions, Hamedan Province has a special position; so, paying enough attention to cooperation; as well as, applying scientific management and proper investment, surely can provide jobs and increase income in this province. This study is about to investigate different investment fields in Hamedan by employing AHP technique and prioritize factors affecting on investment. Hopefully, the result of the present study work to optimize investment allocation in proper fields and increase production capacity and employment.

## MATERIAL AND METHODS

More than 5 decades has passed since providing first methods for prioritizing and introducing superior options in economic plans and designs. During these years, such methods were promoted so that calculations based on quantities changed toward calculations on qualities and from individual opinions toward group decision [3, 12]

Meanwhile, Analytic Hierarchy Process technique (AHP), considered by management scientists in early 80's, is a group deciding method for complicated environments. It was firstly introduced by Thomas L Saaty in 1980 [13]. This technique is used widely in decision making by administrators of industries, agriculture and services [14].

The base of this method is to form a hierarchical decision tree. First level in this tree indicates the goal of decision makers; mid-levels indicate criteria provided by planners to reach first-level goal and the last level indicates available options to reach the goal [15]

AHP process consists of six main stages; including, forming a hierarchical decision tree, benchmarking, data gathering, data calculation, and sensitivity analysis and inconsistency ratio [16], which are explained below:

### Forming a hierarchical decision tree

A hierarchical decision tree has three levels; level one includes target of study; level two includes basic criteria affecting on the target of study and third level includes important options arising from criteria categorization. The target of the present research is to prioritize different cooperative investment fields in Hamedan Province; second level includes basic criteria affecting on different cooperative fields and last level includes important options arising from categorized criteria (Figure 1).

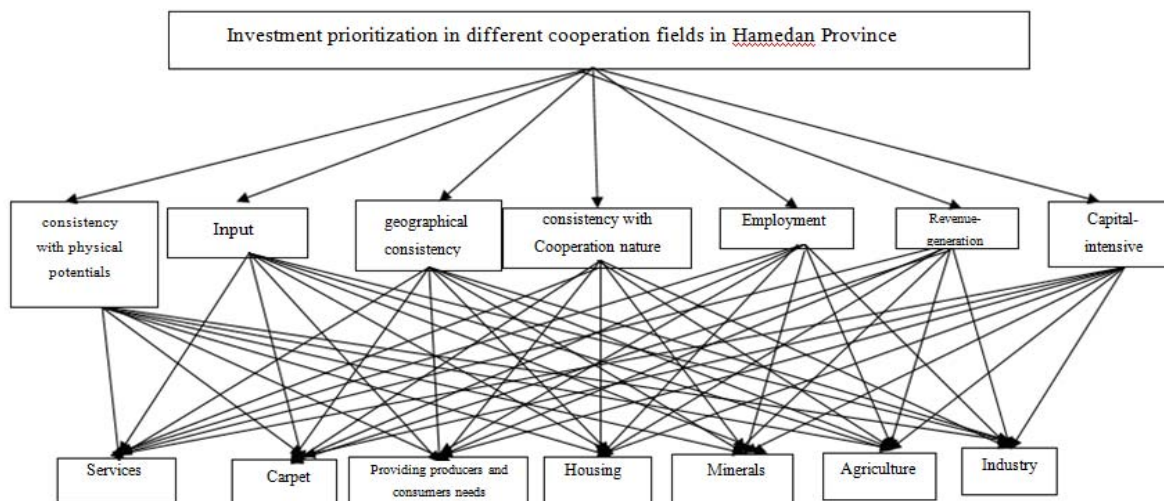


Figure 1: General structure of a hierarchical tree

### Benchmarking

The target of the present research is to prioritize different cooperative investment fields in Hamedan Province. In order to achieve the target, proper criteria and options are determined by economic professionals and experts, working on cooperation fields, and finally a complete set of criteria and options, related to the target, was defined. The options in this study consists of ten cooperative activities including agriculture, industry, services, construction, minerals, housing, hand-woven carpet, providing producer's needs, providing consumer's needs and transportation. Each pair of these fields was compared in the aspects of revenue-generation, employment, capital-intensive and consistency with cooperation nature, consistency with geographical condition of the region, achievement to markets providing needed inputs, consistency with physical potentials of the region. The fields were prioritized then.

### Data Gathering

After concepts, criteria and options of research are defined, next step would be preparation of proper tools to gather data. In the present research, data gathered by applying questionnaire, which was designed based on both criteria and options.

The questionnaire of this research is divided into two parts. In the first part, criteria affecting on investment in cooperative fields in Hamedan Province were compared in pairs. In the second part, options; which are different cooperation fields, were compared by pairs.

The study population is consisted of cooperation experts, working in different cooperative organizations in Hamedan Province, among which, 55 ones are picked as statistical sample. Data are gathered by questionnaire. Then, comparative tables were formed in AHP structure, and variable are compared based on the scale whose spectrum is from of same preference to infinite preference [17]. For this, Statistical samples were asked to value the options by marking in the preferred column. The middle column indicates indifference between the options. As Saaty suggested, the values of options indicates different grades of preference from weak to maximum possible [18].

Column I	Absolute	Very Strong	Strong	Weak	Equal	Weak	Strong	Very Strong	Absolute	Column II
Gi										Gj

Source: [18].

### Data Calculation

After questionnaires filled by experts, we faced to lots of ideas. Comparative tables should be combined in order to solve this problem. The AHP method is used to calculate the geometric mean (Equation1). Sameti, et al (2003) [19], Taghvaei and Ghaffar (2006) [20] and Roustaei and Teymouri (2009) [21] employed the geometric means to combine concluding in AHP technique.

$$\text{Equation (1): } a_{ij} = \left( \prod_{k=1}^n a_{ij}^{(k)} \right)^{\frac{1}{n}}$$

In this equation  $a_{ij}$  is the geometric mean of criterion  $a$ ,  $a$  is a measure which is compared to the options,  $ij$  are two options that are compared to each other,  $k$  is the code of the person who answered the questions and  $n$  is number of people who have compared the options [19].

After calculating the geometric mean, in order to identify the priority areas of investment, some mathematical operations were done in Expert Option software. Firstly, according to the targets, criteria were compared in pairs and the relative weight of each criterion was estimated according to the target as well. In the next step, options (different areas of cooperation) were compared in pairs (pair comparison) according to criteria and the relative weight of each option was calculated. After pairs compared and the relative weights of options and criteria calculated, it is essential to calculate the final weight of each option. For this, we the weights are combined and final answer is achieved.

### Sensitivity analysis

The sensitivity analysis is used to measure the options' sensitivity to the change of criteria's priority. Analytical Hierarchy Process (AHP) benefits from five different graphical sensitivity analysis methods in this measurement.

These methods include sensitivity analysis of performance, dynamic, gradient, and the two dimensional plan and differences. All these five methods show the graphical sensitivity of options and criterions and also their relationship with each other based on their characteristics and capabilities. This approach tends to focus on different aspects of options' relationship, criterions and their priorities [16].

**Inconsistency ratio determination**

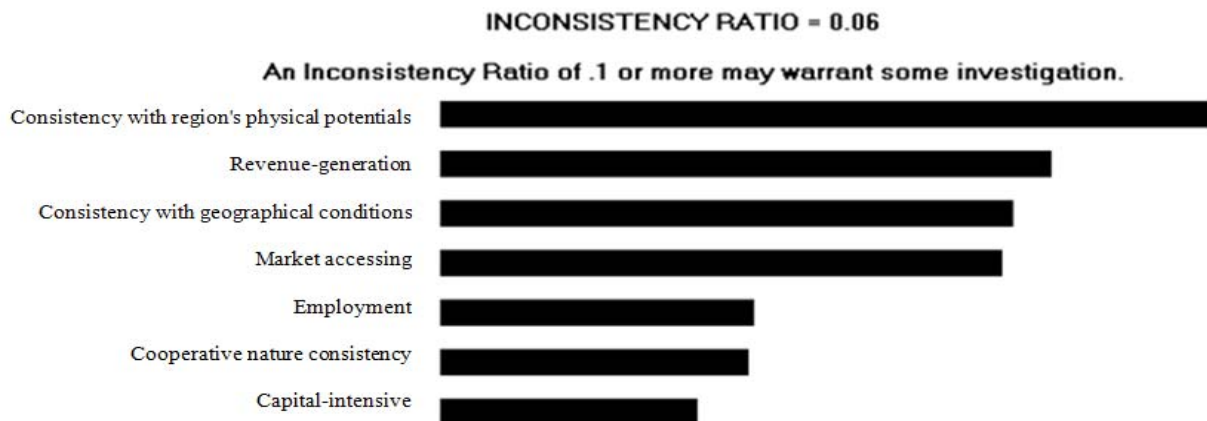
Inconsistency ratio is a mechanism to evaluate validity of answers acquired from respondents. This mechanism determines logical validity of responses [12], and indicates how trustworthy the results from fusion tables are [10]. Because inconsistency exists in real world and it may enters to the model. Zero inconsistency indicates full consistency and increase in that ratio means increased inconsistency in the model. An inconsistency ratio less than 0.1 is fairly acceptable, otherwise a review in process is essential [16]

**RESULTS AND DISCUSSION**

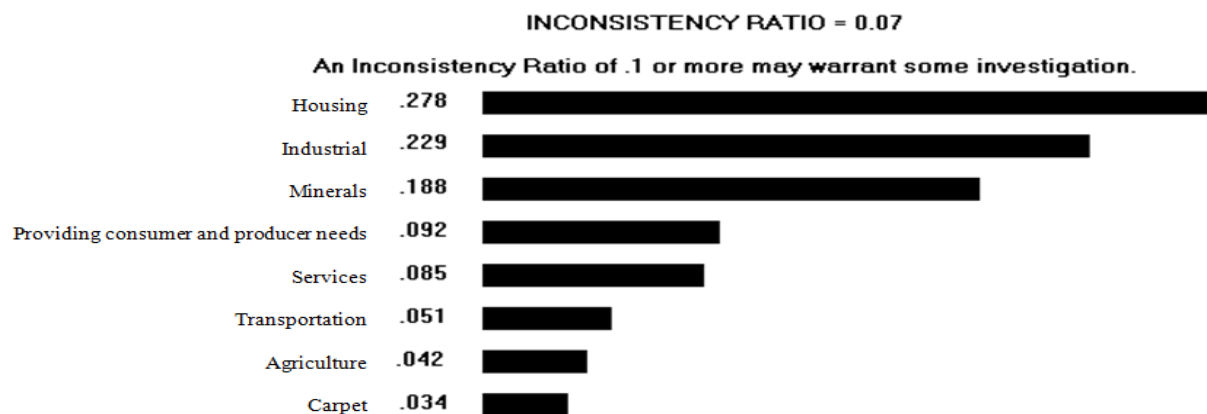
First, criteria affecting on cooperative investments are compared by pairs and then different options or fields of investments are compared by pairs, finally total weight of each option is calculated by integration and the final results are acquired.

**Comparison of criteria according to the target**

Comparing the results indicates that the following criteria are most important ones that affect cooperative investment in Hamedan: "consistency with region's physical potentials", "revenue-generation" and "consistency with geographical conditions" are three top priorities; while, "employment", "consistency with cooperation nature" and "capital-intensive" are least important options. Calculated inconsistency ratio is 0.06, which is acceptable (Fig-1).



**Fig 1: Pair comparison of criteria affecting on cooperative investments in Hamedan according to the target**



**Fig-2: Pair comparison of options according to revenue-generation criteria in Hamedan**

### Comparison of options according to the criteria

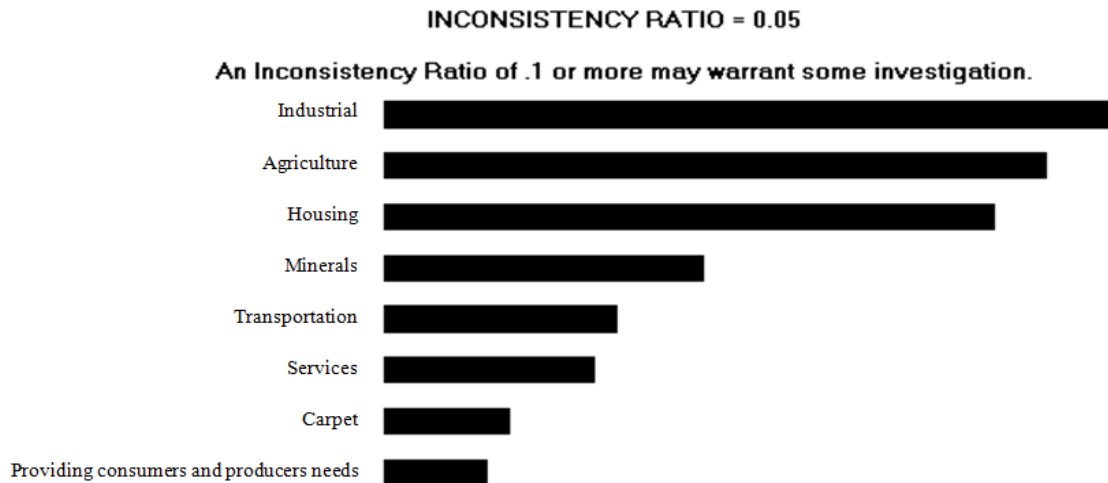
In this step, options; which are different cooperative investment fields, are compared according to the criteria.

#### Revenue-generation

Pair comparison of different fields of cooperative investment in Hamedan based on the revenue-generation, indicates that housing, industrial and mineral cooperatives are most profitable criteria; while, transportation, agriculture and carpet are least profitable ones. Calculated inconsistency ratio is 0.07, indicating that consistency of revenue-generation criterion with options is acceptable (Fig-2).

#### Employment

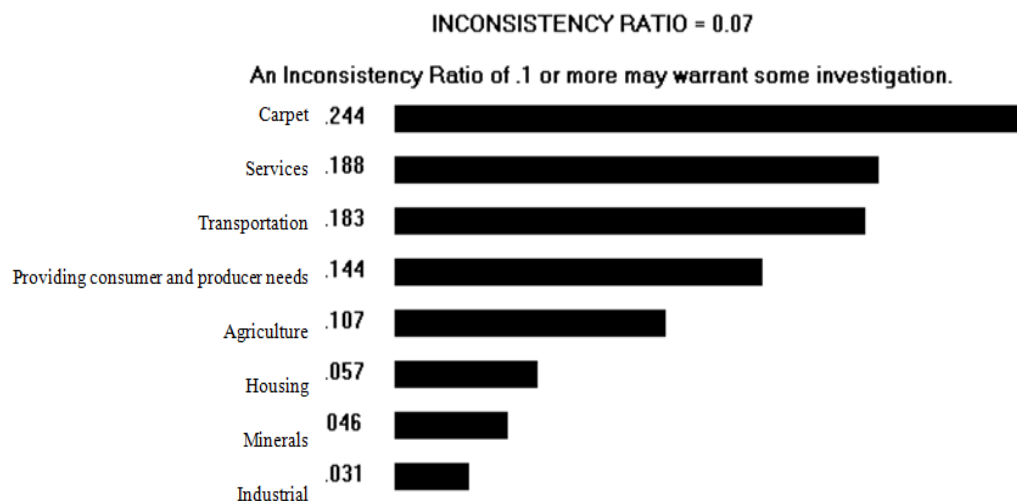
Pair comparison of different fields of cooperative investment in Hamedan based on the employment criteria indicates that, industrial, agriculture and housing cooperatives are most job providing ones; while, carpet and providing consumers' and producers' needs are last ones on the list. Calculated inconsistency ratio is 0.05, indicating that consistency of employment criterion with options is acceptable (Fig-3).



**Fig-3: Pair comparison of options according to employment criteria in Hamedan**

#### Capital-intensive

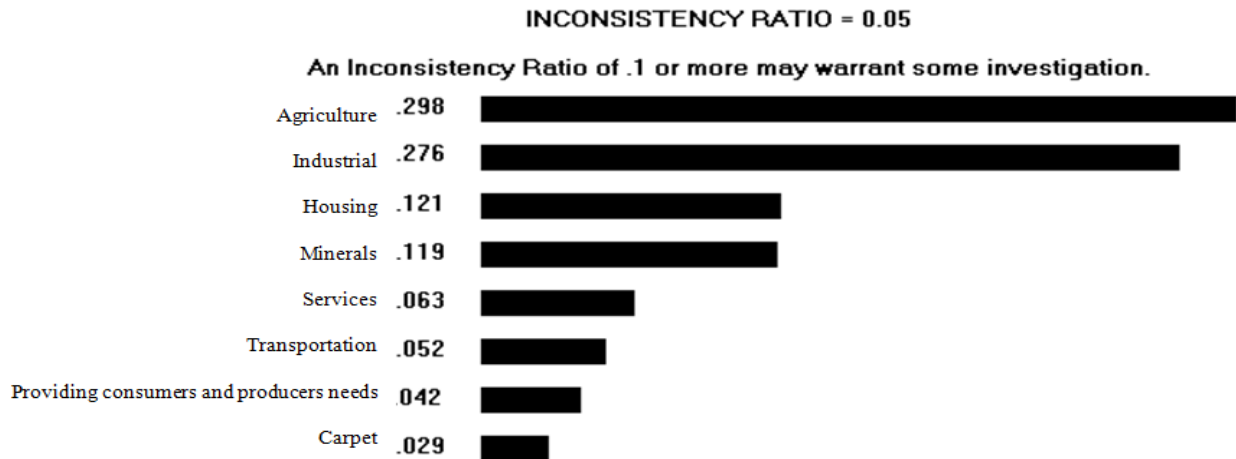
Pair comparison of different fields of cooperative investment in Hamedan based on capital-intensive criterion indicates that, cooperatives of carpet and services require less investment than other cooperatives; while, housing, minerals and industrial cooperatives require much more investment than others. Calculated inconsistency ratio is 0.07; indicating that consistency of investment criterion with options is acceptable (Fig-4).



**Fig-4: Pair comparison of options according to capital-intensive criteria in Hamedan**

**Consistency with cooperative nature**

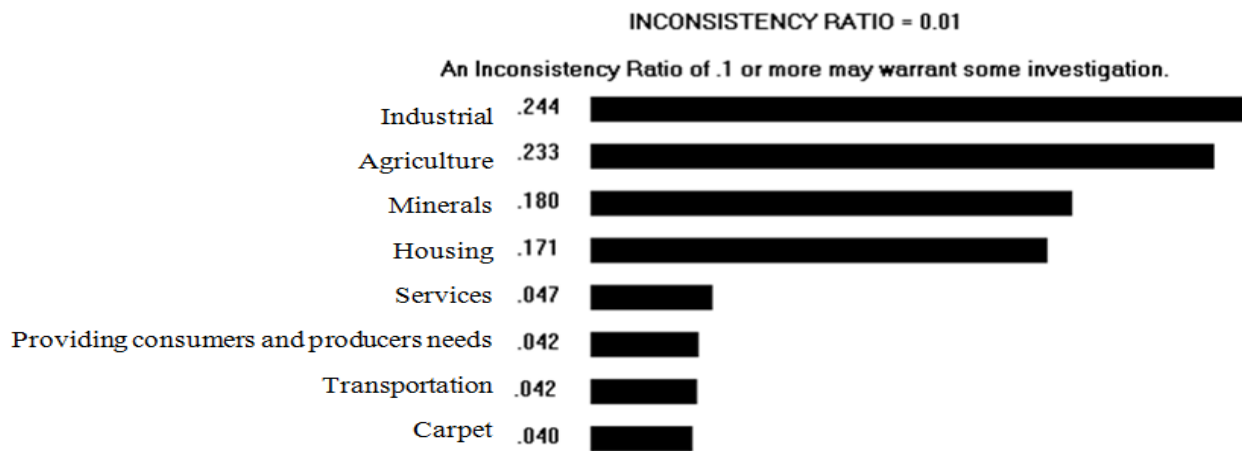
Diagram 5 shows the results for comparing different fields of cooperative investment's consistency with cooperative nature. It indicates that agriculture and industry are most consistent fields; while, providing needs of consumers and producers are least consistent cooperatives. Calculated inconsistency ratio was 0.05; indicating that consistency of cooperative nature with options is acceptable (Fig-5).



**Fig-5: Pair comparison of options according to cooperative nature consistency criteria in Hamedan**

**Consistency with geographical conditions**

As shown in diagram 6, most consistent fields in cooperative investment in Hamedan based on geographical conditions are industrial and agricultural cooperatives. Fields involving services and need providing and also transportation and carpet are inconsistent. Mineral and housing fields are fairly consistent. Calculated inconsistency ratio is 0.01; which, indicates that Consistency with geographical conditions with options is acceptable (Fig-6).



**Fig-6: Pair comparison of options according to geographical consistency criteria in Hamedan**

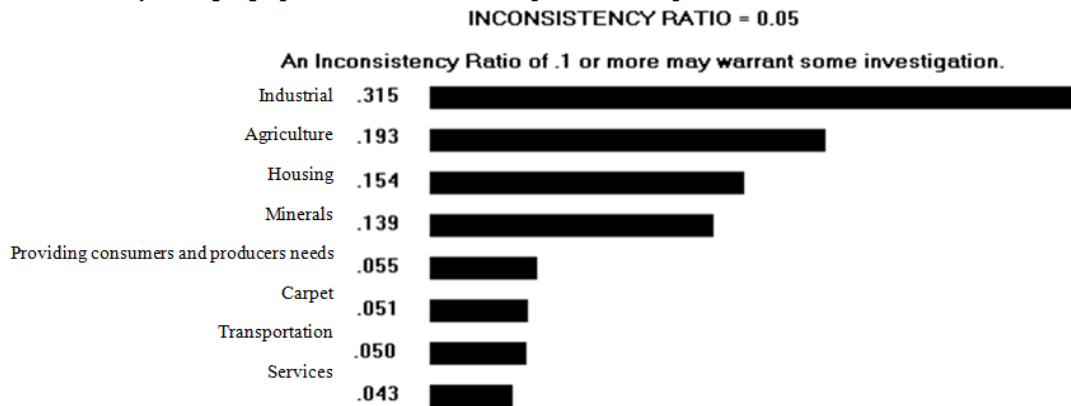
**Input market access**

Pair comparison of different fields of cooperative investment in Hamedan based on input market access criteria indicates that, industry and agriculture cooperatives are best fields based on their market accessing. Accessing market for housing and mineral fields is also fairly good. Fields involving need providing, carpet, services and transportation are not good based on their market accessing. Calculated inconsistency ratio was 0.05; which, indicates that Consistency with geographical conditions with options is acceptable (Fig-7).

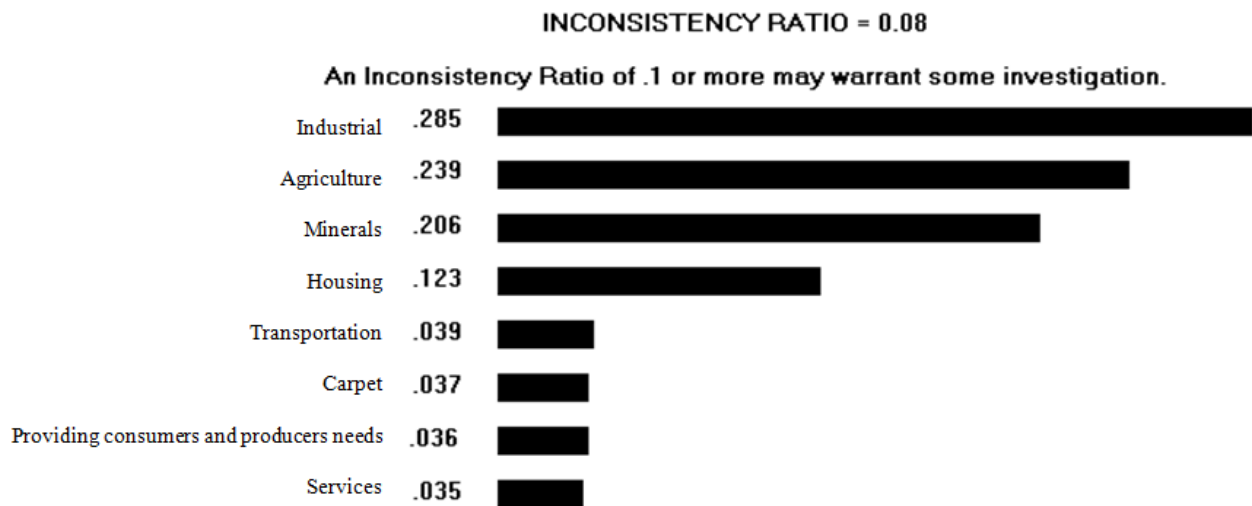
**Consistency with region's physical potentials**

As demonstrated in diagram 8, most consistent fields in cooperative investment in Hamedan based on the physical potentials are industrial and agricultural cooperatives.

The fields involving services and need providing had least consistency. Calculated inconsistency ratio was 0.08, which means that consistency of region's physical potentials with options is acceptable (Fig-8).



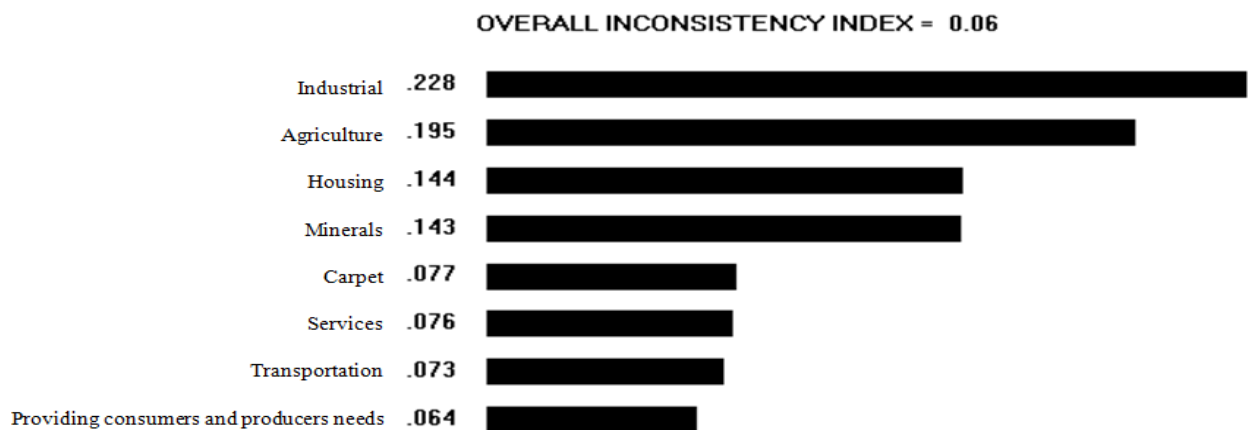
**Fig-7: Pair comparison of options according to market access criteria in Hamedan**



**Fig-8: Pair comparison of options according to physical potentials criteria in Hamedan**

**Final option results made by integration**

The analysis performed by cooperative experts in Hamedan indicates that "industrial" and "agricultural" fields had a high priority among suggested fields. On the other hand, fields involving "carpet", "services", transportation" and "provision of consumers and producers needs", are in next ranks with slight difference. Moreover, "housing" and "mineral" fields are fairly appropriate. Calculated inconsistency ratio is 0.06; indicating that consistency of options with criteria and targets is acceptable. (Fig-9).



**Fig-9: Final investment priority options in Hamedan based on criteria and targets**

## CONCLUSION AND RECOMMENDATIONS

Housing and carpet cooperatives are respectively the most and the least profitable ones in terms of "revenue-generation".

Industrial cooperative and "providing needs of consumers and producers" cooperative are respectively in the best and the worst rank in terms of employment.

Carpet cooperative's investment is the lowest with a significant difference compared to others and is in the best rank in this case.

Agricultural and industrial cooperatives are the most consistent ones with the nature of cooperation and there are significant differences when compared to other areas.

In geographical conditions, the most consistent cooperative fields are industrial and agricultural cooperatives.

Markets which are needed for industrial and agricultural cooperatives had the best conditions possible in Hamedan province rather than other areas.

The industrial field has the most consistent cooperatives with physical potentials of Hamedan province.

The evaluation of determinant criteria of capital-intensive in different cooperative areas of Hamedan province evidences that the most and the least important criteria for investment are respectively "consistency to the nature of cooperation" and "capital-intensive". Hence it is suggested that planners pay special attention to the cooperative which are more consistent to the nature of cooperation. According to the research results industrial and agricultural cooperatives are the most consistent ones to the nature of cooperation. On the other hand, the integrated results of different experts opinions from different areas of cooperation in Hamedan province evince that among the investigated areas, industrial and agricultural cooperatives have the most potential for investment and in this case, "providing the needs of consumers and producers" cooperative has the worst position. Hence, according to the conditions of Hamedan province it is suggested that necessary investments be done in these two areas (industrial and agricultural) that complement each other and less investment be done towards the "providing consumers' and producers' needs" cooperatives.

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