Prioritizing the Factors Affecting the Management of Cold Water Fish Farming
(Case Study: Qazvin Province)

Seyed Mohammad Shahroudi PhD

Faculty of industrial Engineering and Management, Shahrood University of Technology, Shahrood, Iran,
Mosavi.shams@gmail.com

Abstract: Today, fish farming and breeding is considered as one of the most significant sources of protein supply in the world so that we can observe the remarkable improvements in this field. Artificial methods of fish breeding began in China and dates back to 3000 years ago. However, though the precedence of breeding fish in a pool is long, the artificial reproduction is a new experience. The first step in artificial fertilization was taken by a German scientist named Ludwick Jacobi. Despite the long experience of fish farming in the world, in Iran, it has been started in 1972 by reproducing Acipenseridae and in 1959 by reproducing rainbow trout. Industrial and economical growth as well as the need for supplying food for the growing population and the higher quality of fish protein compared to that of other kinds of meat has caused an increasing interest in the fish and fishing in the seas and water resources and has made it an important source of attracting foreign currency. Iran should also take the same actions considering the current policies. Therefore, reproduction of cold water fish should be taken into consideration as one of the most significant issues in this regard and all kinds of facilities should be provided for its optimal application[3]. There is a high potential in national waters of Iran in this regard few of which are currently being used. One reason for this is the lack of technical knowledge and required experience in fish farms management. Most farmers who engage in this occupation have suffered losses or have not used the available facilities properly due to the lack of sufficient technical and scientific knowledge. Regarding the above-mentioned issues, this study aims to signify the effective factors in the production of cold water fish farms and prioritize them based on decision making methods of AHP[4].

Statement of the Problem:

Cold water fish farms have highly been operated and their production in the unit of area is remarkably higher than that of comparable farms in Iran. This indicates that the destination is not known to the managers of such farms. In other words, strategic purposes, ideals and, in some cases, operational purposes have been defined and considered. Currently, the organizations established for reproducing cold water fish do not know where to go. In case the managers of these farms know the factors effective in the operation of their farms and consider their preference and priority in their planning, they would have a much better function[5].

Factors which are considered effective in management of cold water fish farms are, on one hand, social, cultural, legal, technological, competitive, economical events and trends which can bring profit or loss for the farms in the future. On the other hand, management, marketing, operational activities are also among the factors affecting the management of fish farms.

These factors are generally borrowed from the studies carried out by others and the content of books and scientific articles but the question remains whether the same factors are effective in the farms of Qazvin Province or not. These factors are of different degrees of significance, hence this study signifies the general as well as particular factors which affect the cold water fish farm management in the Province of Qazvin through asking questions from the experts in fishery organization, professionals and farm owners of the province and then prioritizes them based on Analytical Hypothetic Process. Prioritizing the factors affecting the management of cold water fish farm management means considering the preference of one over another in the process of the operation, application of which brings about a better economical result. This issue results in gaining higher profits in return to the expenditure spent.

Significance of the Study

This study is significant and essential in several aspects. Some of these issues are explained below:

Allocation of Limited Resources

The global population has currently reached above 5 billion and considering the annual production of 4 billions of tons of food, the annual per capita portion would be 8 tons which means less than 2.2 kilograms a day and this would be possible only when a fair distribution is practiced worldwide which, of course, is not. 98% of the food is prepared

through agriculture and the remaining 2% from water resources. Farming lands are limited and include 3 to 5% of the earth; while 71% water-covered part of the earth is not properly used. Considering the existing limitations and the impossibility of the improvement of agricultural lands, man should think of supplying the food from water resources. One way, is to reproduce the fish and this needs a desirable appropriate management all over the world[6].

National Policymakers

Concerning the frequent recommendations of the physicians to consume fish frequently, the policy makers have set the expansion of fish production of different species at a national level and have issued various kinds of certificates and licenses in this regard. Gaining knowledge about the factors affecting the management of such farms helps the policymakers to plan much more appropriate and accurate plans so that the production would conform to the needs of society and this be done on time.

Fishery Organization of the Province

It is necessary for the Fishery organization of the province to know based on what parameters to evaluate the function of the farms and with what degree of significance to consider which factors as more determining. This research can help this organization in some respects.

Farm Owners of the Province

It is important for the farm owners of the province to know which factor is preferred in the management of the farms and results in a better functioning. Rather than the instances mentioned above, the following issues should also be taken into consideration in discussing the significance of the study.

Purposes of the Study

The main purpose of this study is to determine the priority of the effective factors in the management of cold water fish farms of the Province of Qazvin. This would be carried out through the following steps:

• Determining the primary factors;

• Determining the secondary factors;

• Prioritizing through Analytical Hierarchy Process (AHP)[6].

Other than the main purpose of the study which is to be achieved through this study there are other secondary purposes which result from this study. These purposes include:

- **Scholarly Purposes:** the result of this study can promote the knowledge of national and provincial policymakers as well as the farm owners; these results can also be applied in the next studies.

- **Applicable Purposes:** the results of this study can be used in the following cases:

1. Future programs and plans at a national level by the Ministry of Construction Crusade and Fishery Management Organization;
2. Future provincial plans for the development of fish farms;
3. (By the farm owners) for the improvement of the products.

Research Questions:

This study deals with two questions:

Q1: What are the effective factors in the management of cold water fish farms in the Province of Qazvin?

Q2: Which level of preference can be given to different effective factors in the management of cold water fish farms of Qazvin Province?

Operational Definition of Key Terms:

Several terms have been applied in this study every one of which is defined in this section. The definitions of the key terms of the next chapters are provided in this section to have coherence in the definitions provided.

- Aquatic species farming: includes the farming of the living beings such as the fish, oyster, crustacean, and aquatic plants[7].

- Farming: is interfering in the process of reproduction and breeding of the aquatic species with the purpose of promoting the production including reservation, nutrition, protection against the hunters, etc. Every cold water fish farm consists of several pools, related installations and administrative establishments.

- Farm Management: if management is considered as the ability to utilize the resources in the best and the most profitable manner, then it can be specifically described about the farms. The farm management plans to help the activity of farming through its appropriate decisions for the purpose of maximizing the revenues according to the purposes of administer or the family (farm owners).

- Farming Plan: includes drafting the method or the structure of the organization and using the available resources for the considered farm. Taking action without having a plan means the decision makingin an accidental, haphazard manner.

- The factors of production are the four main factors including: land, labor, capital, management.

- Marketing of the products of aquatic species farming includes the result of the function of all acts of production and service of aquatic species farming from the beginning point to the delivery of the product to the consumer[8].

Statistical Community

The statistical community includes all individuals and objects, etc. which share at least one guild. The statistical community can be either limited or unlimited. With regard to the title of the study, it is evident that the researcher seeks to explore the

effective factors in the management of cold water fish farms in Qazvin Province based on the opinions of the experts. The experts of the statistical community include a limited community as follows:

-        The owners of cold water fish farms of Qazvin Province who, considering the requirements of receiving the license for establishing a fish farm can possess the qualifications required in this study to call them experts.

-        Specialists of the Fishery Organization of Qazvin Province who are qualified as specialized individuals in the area of issuing license, establishment, breeding and function of the fish farm. The individuals who are qualified based on these two clauses include 32 individuals whose judgments as technicians of the province in the scope of the study have been applied.

The qualifications of these individuals regarding individual specifications are as follows:

1.   22 , i.e. 68.75%, of the experts were among the specialists of the Fishery Organization of the province and 10 or 31.25% of them were among the managers or the experts of cold water fish farms of the province.
2.   Among the experts, 21 or 65.62% had a bachelor degree, 10 or 31.25% had a master degree and just one individual with the portion of 3.125% had a PhD degree. It should be added that the experts of the farms all had a bachelor degree and higher degrees belonged to the specialists from the Fishery Organization.
3.   15 persons, i.e. 48.87% of the experts, had 5-10 year record of service and 17, i.e. 53.125%, had served more than 10 years in the area of fish farms or Fishery Organization.
4.   All experts are male.

Statistical Sample:

Regarding the fact that AHP method[9] has been used in this study and the judgments of the experts are significant, this study sets to use the judgments of the experts of the statistical community instead of sampling, and related questionnaires have been completed by all experts. In other words, in this study instead of sampling, a census is used.

Domain of Study:

Spatial Domain of the study

This study has been performed within the boundaries of Qazvin Province including all fish farms and fishery management of the province. The Province of Qazvin with the climatic conditions mentioned before is on of the regions which are suitable for developing the farming of fish in Iran and has the privilege of easy access ways and other features which make it a suitable place for fish farming.

Temporal Domain of the Study

This study has been carried out within the years 2004-2005. All the activities of data collection and related analyses have been completed within 15 months.

Subject Domain of the Study

The subject of the study is to define and prioritize the effective elements in managing cold water fish farms in the province of Qazvin using AHP based on the judgments of the experts in the province.

Design of the Study:

Regarding the scientific classification of the studies, this study is of applied type. In definition, an applied research seeks to achieve a scientific destination and focuses on the prosperity and welfare of the public and the desirability of the activity. The findings of applied studies are to a high degree time- and space- dependent.

The method used in this study is a survey method. A survey includes the observation of the phenomena with the purpose of giving meaning to several aspects of the data collected. Surveys include two phases:

Close and careful observation of the parameters that are to be investigated in the society;

Collecting data and giving meaning to what has been observed.

In other words, a survey is a research process that is implemented to collect data on the subjects such as what a group of people know, what they think, or what they do. A survey has 3 objectives:

1.   Description – discovering the existing realities or what exists.
2.   Explanation – using terms in order to convey your purpose to the others.
3.   Discovering – investigation.

Relying on the definition of a survey, this study has first considered the numerous effective factors in the management of cold water fish farming in order to describe the present situation. When the factors were explored through field study or judgment of the experts, the analysis and prioritization was performed using an AHP method [9]. Therefore the research method in this study can be defined as a survey with a descriptive-analytical purpose. Since the exploration of the factors is of little effect, exploration can not be directly described as a purpose.

Concerning the direct definitions given about descriptive, analytic, and explorative research in the literature on research methodology, the present study can be described as a descriptive-analytic research.

Instrumentations

The instrumentations used in this study for collecting data were 4 questionnaires used in Analytical Hierarchy Process:

1. First questionnaire – this questionnaire includes one question in which the experts have been asked to present up to 10 major factors effective in the management of fish farms without giving them any priority.

2. Second questionnaire – the major effective factors were extracted from the first questionnaire and after assigning the factors which had the highest frequency in the judgments given by the experts, these factors were included in the second questionnaire and presented to the experts. In this questionnaire, the experts were asked to exclude from the provided list those factors they assumed as irrelevant and add to the list those factors they assumed the list lacks while they can be considered as effective factors. This questionnaire contained two questions.

3. Third questionnaire – after the extraction of the main effective factors from the questionnaire, in this questionnaire the experts were asked to present the secondary factors or parameters for each main factor, the experts had to present one parameter or more.

4. Fourth questionnaire – the next step was to draw a hierarchical tree for the problem based on the data collected from the third questionnaire. In the fourth questionnaire, the experts were asked to compare each factor or parameter with a higher factor as a pair. In every comparison made, the expert specified the preference they made between two parameters or factors.

Variables of the Study

The variables of the study are as follows: dependent variable, the management of cold water fish farms is the dependent variable; and independent variable, the factors effective in the management of cold water fish farms or the parameters of prioritization of the model .

The study mainly deals with qualitative variables; hence, in order to record them, we can take advantages of non-numerical methods and then convert them based on Saaty's scale. The scale used in this study is a rank-based or ordered scale of AHP model.

Validity and Reliability

Before using the instrument, its validity and the reliability should be established scientifically. The instrument is valid if it measures the quality it has been designed to measure. It is reliable if it measures consistently.

In order to explain the validity of the questionnaires, considering the following two issues would be sufficient:

• AHP questionnaires, in many works, have been used as a way of obtaining a hierarchical tree and are nearly accepted as the standard of this method by all researches of this field of study.

• These four questionnaires have been distributed only when they have been approved by some faculty members and their validity has been declared.

For the approval of the reliability of the questionnaires, the consistency of the components has been checked. In AHP, a consistency test has been systematically performed between the answers through the application of software; if the consistency rate of each table of pair comparisons is more than 0.1, it would be said that there is no consistency in the judgments and the comparisons should be repeated. Therefore, after each conclusion, the consistency rate is calculated by the software and presented below each result.

AHP Model of Research

Analytical Hierarchy Process (AHP) was first introduced and used by Professor Thomas Al Saaty (the Professor of Pitsburc University), and the first book on this issue was published by him in 1980. AHP is a method of decision making. It is used when the decision is to be made among several options or several qualitative and quantitative factors. Just as we can differentiate physical relations and measure them – for example meter for length and second for time – so abstract relations can be differentiated. Feelings and perceptions permit us to develop the relation between the elements of a problem and determine which element has the most influence on the desired solution[10].

In dealing with real and tangible subjects, such as repairing a car, the degree of the effect of a variable is understood through our faculties, for example hearing the voice of the defective function of the engine or seeing the leakage, etc.

The process of measuring the effect of the priorities is performed to solve the problems. Therefore, in order to determine the degree of the effect from various components of a system, some measurements should be exercised based on a criterion with its units such as gram, second, meter and dollar. However, these criteria limit the nature of the ideas that we can examine.

Social, political and other qualitative factors can not be evaluated in a rational and acceptable way in terms of physical measurement. (However, in dealing with such issues there is a method that enables us to measure intangible qualities as well.)

AHP or Analytical Hierarchy Process is an analytic approach that enables us to measure intangible and impalpable characteristics as well and overcome the problems of decision making.

AHP is a demonstrable and comprehensible method without the complexities of other methods of decision making.

AHP is a method which relies on the mathematic(6) knowledge which generally includes all the thoughts related to a problem. This method is constructed upon the experiences of the user and is completed and supported by the explanation and interpretation of the judgments so that finally a proper understanding and a comprehensive perspective to the problem would be achieved.

In AHP, after the definition of the significant and essential factors, the attempt is made to create a rational balance among various effective criteria and their influence on each other be understood before the final decision and through pair comparison.

In this paper attempt is made to present the components of AHP and the way of its application in a quite simplistic manner[10].

The Advantages of AHP

-        Being simple and applicable;
-        Compiling and systematizing the very mental process of decision making and as a result, facilitating a proper and accurate judgment;
-        Flexibility with regard to different problems and in various grounds;
-        Creating appropriate environment and conditions for the improvement of the definitions and supervision through discussion in a decision making group (combining, analysis and adjusting the contradictions among them);
-        The possibility of analyzing the sensitivity of the results and examination with low costs;
-        Doing the numerical calculations and specifying the priority of the options and alternatives based on numerical values (a method for measuring qualitative values in the form of figures);
-        The access of the manager to the data related to the evaluation standards and determining the percentage of the confidence in the data and information obtained by the decision maker (by a fixed rate or comprehensiveness) and the weight of each of the criteria as a side advantage of the method. Hence, AHP consists of the principles which include:

1. Designing a Hierarchy
    The description of a complicated problem, about which the decision should be made as a hierarchy for which it's better to use a tree called the tree of decision making and is a graphic description of the problem and is composed of three levels.

2. Determining the Priorities
    Pair comparison of the factors in order to determine the relative significance of the factors in each level of the hierarchy.

3.   Calculating the Results

Combining and integrating the comparisons made for the purpose of a general evaluation of the decision; in short, in this method, the decision maker or the decision making group assigns a goal and when the goal is specified as the subject of the decision making, various options or alternatives which are significant in the process of decision making are listed and then various criteria are compared in pairs among the options, after that based on a series of mathematic rules such as normalization we can determine the priority of the choice.

The Defects of AHP

This method applies too many mathematical operations and hence great care is needed to be made in the application of this method. Moreover, too many phases should be carried out for the performance of the operations; however, the application of the software has removed these defects as well.

Applicable Example of AHP Model (Finding the location for chain store)

Imagine that we are going to select a location among three alternatives of A, B and C in order to establish a store. Four criteria of culture of the people, income, population, and residential area are involved. The solution of this problem can be explained through the following steps:
- building a hierarchy;
- estimating the weight;
- system consistency.
The first step is to provide a graphic presentation of the problem in which the objective, criteria and the alternatives are illustrated.

Estimating the weight

In AHP, the elements of each level are compared with their counterpart elements in the higher level in a binary Format and their weight is calculated; such weights are called relative weight. Then, through combining the relative weights, the final weight which is called the absolute weight, is determined for each alternative.

First, the locations are separately compared regarding culture, income, population, residential area and easy communication and the weight of each is specified regarding these criteria.

In such comparisons, the decision makers would use verbal judgments. These judgments are transformed into quantitative amounts from 1 to 9 which are presented in the following table:

A. Now, the locations regarding culture are compared and their values regarding this criterion are estimated. Imagine that the decision maker selects the preference of A to B between equal and moderately preferred, and then the value of the judgment is 2. However, if the preference of location A to location C is between very strongly preferred and extremely

preferred, then the numerical value of this judgment would be 8; and if the preference of B to C is between strong and very strong, the value would be 6. This judgment can be shown as illustrated in table 2.

- In comparison of pairs, the preference of each element to itself equals one.
- If the preference of A to B equals 2, the preference of B to A would be ½.

B. The weight of each alternative of pair comparison matrix is estimated through approximate methods

First step: the values of each column are added.

Second step: Each element in the pair comparison matrix is divided to the total of its column so that the pair comparison matrix would be normalized.

Third step: The estimation of the average of the elements of each row.

Hence, observe that regarding culture, location A (with the preference of 0.593) is the best location. Moreover, based on the estimations made above, the locations are now compared regarding income, population and the residential area and their weight are estimated regarding these criteria. When all these calculations have been carried out for locations A, B and C, based on an arithmetic mean method, the results of the calculations are presented in table.

The results of the above table can be explained in the following way: Location A is the best regarding culture, income, population and residential area; however, for example location B might be the best regarding income, and location C might be the best regarding population. The final decision should be made when the weight of each criterion is determined.

After calculating the weight of the locations in relation to all constraints, the weight of the criteria should be determined; in other words the portion of eachh one of the criteria in specifying the best location should be determined. To do this, the criteria should be compared in pairs. The results are presented in table 8. The weight of the criteria is estimated through arithmetical average method which is displayed in the following way:

Culture: 0.355
Income: 0.359
Population: 0.169
Residential area: 0.117

As can be observed, the criterion of income possesses the largest weight.

C) The estimation of the final weight of the locations

Now that the weight of the criteria is estimated with regard to the objective and the weight of the locations is estimated with regard to the criteria, it's the time

for the way of combining these weights to be explained for the estimation of the final weight.

The following table displays the weight of the locations with regard to the criteria which have previously been calculated and would be briefly explained in the following way.

Then, regarding the relative weights estimated, the final weight for each alternative would be obtained in the following way.

Final weight of location A = $(0.355*0.593)$ + $(0.395*0.702)$ + $(0.169*0.740)$ + $(0.117*0.629)$ = 0.660

Final weight of location B = $(0.355*0.341)$ + $(0.359*0213)$ + $(0.169*0.113)$ + $(0.117*0.629)$ = 0.289

Final weight of location C = $(0.355*0.066)$ + $(0.395*0.085)$ + $(0.169*0.147)$ + $(0.117*0.629)$ = 0.151

Therefore the preference of the locations would be as follows: As can be observed, location A is the best choice.

Data Analysis and Interpretation of Research Tests

Research Question:

What are the effective factors in the management of cold water fish farms in the Province of Qazvin?

In order to find the answer to this question, three first questionnaires of this research were designed and the data were collected using these questionnaires.

In questionnaire (1) the specialists (the experts in research) were asked to signify the ten major factors effective in management of cold water fish farms in the Province of Qazvin. After collecting the questionnaires and extracting the factors indicated in it, the following results were obtained.

After the collection of the data of questionnaire (1), questionnaire (2) was designed and distributed. In this questionnaire, ten major factors about which there was a high degree of agreement, was presented to the experts and asked to write in the first column the factors which are essential but are not included among these ten factor, and in the second column exclude those factors which are redundant from among the factors presented by the researcher.

The data collected from questionnaire (2) were extracted and the results are as follows in table 12.

Regarding the judgments of the experts in questionnaire (2), 14 percent alteration was observed in the factors in comparison to questionnaire (1).

In questionnaire (3) the results obtained from questionnaires (1) and (2) were presented to the experts and they were asked to signify the sub-parameters related to each factor (major parameter)

which were classified in three groups. The results of the completion of questionnaire (3) by the experts are demonstrated in the following tables.

Research Question 2:

What is the priority of the effective factors in the management of cold water fish farms of the Province of Qazvin?

When the questions were distributed and the answers to questionnaires (1), (2) and (3) were gathered, questionnaire 4 (the last one) was compiled based on the data collected from three previous questionnaires and then were delivered to the experts to be completed.

In order to answer the questionnaires of the last questionnaire based on AHP method, the experts needed to be informed about the basic issues, then the questionnaire which included:

- The diagram of hierarchical tree of decision making;
- Questionnaire with Saaty spectrum.

Was distributed and completed by the experts.

The data collected from the questionnaire was entered in the file of Expert Choice Software the results obtained from the analysis of the data in the format of AHP group decision making, in which a geometric mean relation was used, are demonstrated in the following tables.

When the estimations were made, the weights of the major parameters were compared with the purpose and the result was as is presented in table 16.

Results

Efficient attention to the management of cold water fish farms can result in changes and new directions in the industry of aquatic species farming. This study seeks to specify and prioritize the effective factors in the management of cold water fish farms in the province of Qazvin. After the determination of these factors and the designing of the related hierarchy, the results obtained from prioritizations were as follows:

1. First, three major factors of economic(5) factors, technical-engineering factors and management factors were compared with each other and then they were prioritized. The result of this prioritization was as follows:
- Management factors at the first level of priority;
- Technical-engineering factors at the second level of priority;
- Economical factors at the third level of priority.

This means that management factors with the significance ratio of 47% are to be considered as the most significant effective factors in the management of fish farms. Technical factors with 39% and economical ones with 14% come next. It should be noted that based on the opinions of the experts,

focusing on management factors are more significant or in other words, in order to come to a higher degree of exploitation and a better production, the role of management factors should be taken into consideration in all phases of production.

2. Parameters or the secondary factors related to economical factors included: marketing, access to the regional power supply, the facilities of local investment, economic access to skilled manpower and the transportation facilities. Based on the judgments of the experts the levels of priority were classified as follows:
- First level of priority is given to local facilities of investment;
- Second level of priority is given to the transportation facilities;
- Third level of priority to the access to the regional power supply;
- Fourth level of priority to economical access to skilled manpower;
- Fifth level of priority to marketing.

It should also be mentioned that the three first priorities possess 70% of significance and the two last factors only possess 21% of significance.

3. Among three factors of secondary position considering the major factor of technical-engineering nature it was observed that:
- Design and construction of the pools with 42% significance were at the first level of priority;
- Location with 33% at the second priority;
- Safety and emergency with 25% at third level of priority.

This indicates that in several phases of construction to exploitation of cold water fish farming the highest attention should be directed toward design and structure of the pools. This factor can also be classified into five secondary factors which can be prioritized in the following way (the prioritization of third level of parameters):

➢ Constructing a diverting dam with the significance ratio of 29%;

➢ Observing the gradient of the pool with the significance ratio of 24%;

➢ Appropriate deposit cleaner with the significance ratio of 20%;

➢ Protection wall with the significance ratio of 15%;

➢ Appropriate concrete canal with significance ratio of 12%.

Location is in the next level of significance. It is with 8 secondary factors which can be prioritized as follows:

➢ Estimating the critical discharge of the upper regions;

➢ Appropriate temperature of water in the place of establishment;
➢ The length of the period of muddiness in the place of establishment;
➢ Distance from the market;
➢ Distance from the farms of upper regions;
➢ Distance from the access road;
➢ Observing the side distance from river;
➢ Distance from the food supplies.

The factor of safety and emergency is placed at the third level with 5 secondary factors which can be prioritized as follows:
➢ Reflective pumps;
➢ Pumping wells;
➢ Ventilating pumps;
➢ Alarm systems of the interruption of water flow;
➢ Emergency power supply;

4. There are 9 secondary factors regarding the major factor of management which can be prioritized as follows:
➢ Specialty and experience;
➢ Training courses;
➢ Considering weather reports;
➢ Using guide-tables;
➢ Observing hygienic and quarantine issues;
➢ Observing the weight of release;
➢ Using modern methods of improving the production in the unit of area;
  The numbers of times of separation;
➢ Recording the conditions of the farm during the period of farming.

5. After the prioritization of secondary factors with regard to each major factor, the final phase of prioritization was carried out. This phase included the prioritization of each one of the 32 secondary factors with regard to other factors. The priorities are as follows:
If the priorities of factors are observed as determined above, we can claim that the farm would be productive and its management would be efficient.

Other Results of the Study

In addition to what was directly obtained from the analyses, some other issues are concluded during the study which can not be assumed as the direct implications of the findings of the research and are mainly considered as implicit results of the study:
• Water is a gift of God, and reserving water and preventing it from being wasted is one of the issues that have frequently been focused. In modern management of farms, the fact that water is non-renewal has been taken into great consideration. It is necessary for us to take this fact into consideration in our country.
• The manager should not merely care about marketing to the purchasing phase; he/she should also attempt to encourage the consumption of fish regarding new findings about the significant role of the aquatic species in nutrition, for example stressing the content of Omega 3 in fish.
• Modern methods of farming in enclosed waters should also be taken into consideration and the management methods other nations should be used and defined as models of application.

Two groups of suggestions are presented in this paper; the first group is derived from the results of this study and the second group is derived from the personal studies and experiences of the researcher.

Suggestions Derived from the Study

• The managers of the Fishery Organization of the Province and the officials of cold water fish farms should take the prioritization of the factors in consideration in the management of general affairs and improvement of their farms in order to have productive farms.
• The officials of the farms should plan their activities based on the priority of each secondary factor and its role in programming the establishment, production and utilization, and maintenance.
• Before issuing the license for the establishment of new farm, the provided prioritization can be observed.
• In examining the conditions of each farm for the improvement of the management, the status of each factor that is to be changed should be taken into consideration.

Suggestions of the Researcher

Here, in addition to the suggestions derived from this study, there are some other suggestions made by the researcher which are not directly resulted from the present study but can be regarded as the implications of the study:
• It is suggested that other factors be taken into consideration beside and parallel to the management factors but with a different degree of significance, so that it would be possible to have a productive farm and plan for the optimization of the management of farm affairs.
• It is suggested that the man power who are to be employed in the farm be qualified enough to help the management of farm affairs in a proper manner.

- It is suggested that the future developments of the farms in the province be managed according to the prioritization offered so that exploitation of the resources be directed toward optimization.
- Allocating the credits of the province to cold water fish farms based on the prioritization suggested here as the criteria of evaluation of farm conditions with different levels of significance.

Suggestions for Further Research

Regarding the limitations faced in the accomplishment of this study it is suggested that the following subjects be studied by other researchers:

- Investigation of the effective factors in warm water fish farming in the province of Qazvin;
- Comparative study of management of cold water fish farms in different provinces;
- Determination of the level of significance of the effective factors in the management of cold water fish farms in the province of Qazvin compare with other factors;
- Investigation and accomplishment of 5S in the cold water fish farms of the province of Qazvin;
- Investigation of the results of the application of this prioritization in the improvement of the quality of products.

Limitations of the Study

Here the limitations faced by the researcher in the process of this study are presented.

a) Dispersion of the farms around the province and the difficulty of contacting their managers;
b) Non-cooperation of some of the experts of the Fishery Organization and farm owners;
c) Lack of sufficient literature on the management of fish farms;
d) The problems the experts had in completion of the questionnaires especially questionnaire (4) which required high degrees of skill and proficiency;
e) Based on the analysis made, the factors have not been totally independent from each other and some degrees of dependence exist among them. In order to adjust this problem all respondents were informed and asked to fill in the questionnaires bearing such dependences in mind. This can not totally exclude the negative influence of the dependence between the priorities; however, it can cover them to a significant degree. This limitation can be observed in several articles and many authors assume the aforementioned solution as the most effective approach with regard to issues with limited numbers experts available.
f) The error resulted from the act of making the figures of geometric mean round may affect the results achieved from the software. In this study, the figures are rounded to 3 decimal places.
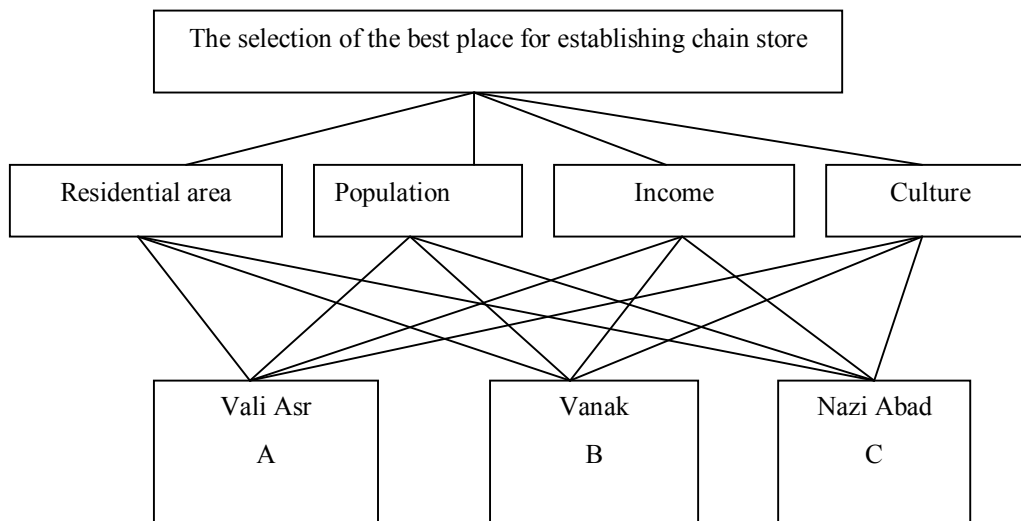

Fig 1. The hierarchy of the selection of a location for chain store

Table 1. The value of the preferences for pair comparisons

Degree of significance	Definition	Description
1	Equally preferred	Both activities play an equal role in achieving the desired destination
2	Moderately preferred	The experience and the judgment support one of the activities to some degree
5	Strongly preferred	The experience and the judgment strongly support one of the activities
7	Very strongly preferred	One of the activities is focused much more than other activities and its prevalence is evident in practice
9	Extremely preferred	Evident preference of one activity over another; the highest possible order is verified
2,4,6,8	For the states where the degree of significance is between the above-mentioned values	The preferences within the above-mentioned intervals

Table 2. Comparison of locations

Culture	Location A	Location B	Location C
Location A	1	2	8
Location B	½	1	6
Location C	1/8	1/6	1

Table 3. Comparison of locations

Culture	Location A	Location B	Location C
Location A	1	2	8
Location B	½	1	6
Location C	1/8	1/6	1
Total of each column	13/8	19/6	15

Table 4. Comparison of locations

Culture	Location A	Location B	Location C
Location A	8/13	12/19	8/15
Location B	4/13	6/19	6/15
Location C	1/13	1/19	1/15

Table 5. Comparison of locations

Culture	Location A	Location B	Location C	The average of the row
Location A	0.615	0.632	0.533	0.593
Location B	0.308	0.316	0.316	0.341
Location C	0.077	0.053	0.053	0.066
Total	1.000	1.000	1.000	1.000

Table 6. Comparison of Culture, Income, Population and Residential area

	Culture	Income	Population	Residential area
Location A	0.593	0.702	0.740	0.629
Location B	0.341	0.213	0.113	0.250
Location C	0.066	0.085	0.147	0.121

Table 7. Comparison of Culture, Income, Population and Residential area

	Culture	Income	Population	Residential area	Average of each line
Culture	0.414	0.321	0.284	1.400	0.355
Income	0.414	0.321	0.636	0.067	0.359
Population	0.104	0.036	0.070	0.466	0.169
Residential area	0.068	0.322	0.010	0.067	0.117
Total of each line	1.000	1.000	1.000	1.000	----

Table 8. Comparison of Culture, Income, Population and Residential area

	Culture	Income	Population	Residential area
Location A	0.593	0.702	0.740	0.629
Location B	0.341	0.213	0.113	0.250
Location C	0.066	0.085	0.147	0.121

Table 9. preference of the locations

Final weight	Location	Preference
0.660	A	1
0.289	B	2
0.151	C	3

Table 10. results

Rank	Factor	Frequency of the responses
1	Management of the farm	23
2	Training courses	19
3	Location	18
4	Estimating the food change index	18
5	Design and construction of pools	17
6	Technical and engineering factors	15
7	The number of times of separation	12
8	Taking economic factors into consideration	12
9	Safety and emergency	10
10	Using modern methods of production development in the unit of area	8

Table 11. the result of questionnaire (2)

The judgments of the experts		Factor	Rank	Factor
Non-effective	Effective			
		Management of the farm	1	
		Training courses	2	**Existing factors**
		Location	3	
		Estimating the food change index	4	
		Design and construction of pools	5	
		Technical and engineering factors	6	
		The number of times of separation	7	
		Taking economic factors into consideration	8	
		Safety and emergency	9	

		Using modern methods of production development in the unit of area	10	
Frequency: 9	Marketing	1	**Factors added**
Frequency: 7	Proper access	2	
Frequency: 5	The facilities of regional investment	3	
Frequency: 5	Obtaining the deposits	4	
Frequency: 4	Water discharge	5	

Table 12. the result of first group of parameters from questionnaire (3)

Major factor (parameter)	Sub-parameters	The frequency of the judgment of the experts
Economical factors	Marketing	14
	Access to the regional electricity power supply	17
	The facilities of regional investment	11
	Economical availability to the skilled manpower	18
	Transportation facilities	19

Table13. the result of the second group of sub-parameters from the major technical-engineering parameters of questionnaire

Frequency	Sub-parameter	Factor
16	Construction of the diverting dam	**Design and structure of the pools**
18	Having an appropriate concrete canal	
15	Having proper deposit cleaning	
22	Observing the gradient of the bottom of the pools and height and the relation of the length to width	
19	Having the protective wall	
27	To have pumping wells	**Security and emergency considerations**
28	To have emergency power supply	
31	To have reflective pumps	
30	To have ventilation pumps	
27	To have alarm systems for the interruption of water flow	
18	Observing the side distance from the river	**Mechanical**
29	Estimation of the critical discharge for upper regions	
26	The length of the muddiness in the establishment location	
22	Having a proper temperature in the establishment	

17	Distance from that access road	
20	Distance from the market	
19	Distance from food supplies	
22	Distance from the farms of the upper regions	

Table14 – The result of the third group of sub-parameters from questionnaire (3)

Frequency	Sub-parameter	Major factor (parameter)
17	Specialty and experience	**Management**
18	Training courses	
22	Using guide-tables	
29	Observing hygienic and quarantine principles	
31	Observing the releasing weight	
30	The numbers of times of separation	
29	Considering weather reports	
18	Using modern methods for the improvement of production in the unit of area	
15	Recording the details about the farm in the farming period	

Table 15. The geometrical mean of pair comparison of the first level

	Management	Economical	Technical and engineering
Management	1	4.615	
Economical		1	4.764
Technical and engineering	3.681		1

Table 16. the result of prioritization

Priority	Normalized weight	Main parameters
1	0.47	Management factors
3	0.14	Economical factors
2	0.39	Technical and engineering

Table 17. Priority of The effective factor in farm management

Priority	The effective factor in farm management
1	Local facilities of investment
2	Construction of deviational dam
3	Reflective pumps
4	Observation of the gradient of the bottom of the pool
5	Transportation facilities
6	Estimation of critical parameter of the upper region
7	Pumping wells
8	Access to the regional power supply
9	Specialty and experience
10	Appropriate water temperature in the location
11	Appropriate deposit cleaner
12	Ventilating pumps
13	Training courses
14	The length of the period of muddiness in the location
15	Alarming systems for the interruption in the flow of water
16	Considering the weather report
17	Protection wall
18	Economical access to skilled manpower
19	Emergency power supply
20	Appropriate concrete canal

21	Distance from market
22	Application of guide-tables
23	Observation of hygienic and quarantine issues
24	Distance from the farms of the upper region
25	Marketing
26	Observation of the weight of release
27	Distance from access road
28	Application of modern methods for the improvement of production in the unit of area
29	Observation of the side distance from the river
30	Numbers of times of separation
31	Distance from food supplies
32	Recording the farm conditions during the period of farming

REFERENCES

1- Qodsipoor, Hasan.2007. Analytical Hierarchy Process. University amirkabir Publishing Company. Tehran, Iran. ISBN: 964-463-056-4 .

2- Asgharpoor, Javad.2006. Analytical Hierarchy Process. Publishing Company Tehran IRAN, Tehran.

3- Salhi, Hasan. 2000. Economic Aquatic species farming. Journal of Shelat Tehran. Iran, 22(3):55.

4- Azis. I.J, 1996 "Reciting trade conflicts using analutic hierar Proceeding of the Fourth International Symp Analytic Hierarchy Process, simon Frasier U C., Canada, July 12-15, pp. 397-408.

5- Karami, Alireza. 1997. Reproduction of cold water fish.shelat Tehran.

6- Azis, Iwan. J., 1990 "Analytic Hierarchy Process in the Benefit Cc Post- evaluation of the Trans-Sumatra Highwa Journal of Operational Research, 48/1, 38-48.

7- Azis, Iwan. J., 1994 "Decentralization form the Regional Perspect AHP", Proceedings of the 3rd International S Analytic Hierarchy Process, Washington, DC.

8- Hooshang, Darabi. 1997. Recognition of Analytical Hierarchy Process. Journal of Tadber, 15(2): 140.

9- Frahane, Rezza. 2003. Reproduction of Cipenseridae in System. Nagshmehr iran Publishing Company. Tehran, Iran.

10- Karami, Alireza. 1997. Reproduction of Cold Water Fish. Journal of Shelat Tehran. Iran, 19(2):25.