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New Challenges Facing Asian Agriculture under Globalisation

Volume II



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Effective Factors on Integrated Management of Basins: A Case Study of Iran

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Introduction

With the passage of time, the rapid growth of earth's population has caused more exploitation of the limited natural resources. This exploitation has been along with the gaining dominance on the resources

Man, as the main utiliser of the resources, has experienced many achievements and defeats. Unsuitable utilisation and inefficient exploitation of the resources have caused the destruction of a large part of them. Nonetheless, proper but excessive exploitation of the resources has deprived other people of the opportunity to utilize them. Because the geographical boundaries limit the extent of every country's natural resources, governments have to plan within a watershed framework for gaining watersheds sustainability, environment conservation and optimal utilization of the resources. Proper and optimal utilization of these god-given resources entails carrying out a type of planning based on the co-ordinated management of watersheds' whole resources. For example, mining should not result in the destruction of forests, ranges and environment; and conserving forests, ranges and environment should restrict mining in a manner that an occurrence of floods and heavy rainfalls should not destroy soil forest range and agricultural plants. Also soil conservation should not act as a preventive factor in the way forests and ranges are utilized. In fact watersheds are known as open systems, including all the environmental and human factors and that there is a balance among watersheds' components, whose disturbance would result in watersheds disorder. This fact that human beings as the main users of the systems are changing them makes the subject more sensitive.

The main hypothesis is that the effects of ecological, social, political, economic and infrastructure factors on the implementation of the integrated watershed management in the study area are the same.

The main hypothesis has several sub-hypotheses as follows:

1. The different ecological indexes equally affect the implementation of the integrated management.
2. The different social indexes affect the implementation of the integrated watershed management similarly.
3. The different political indexes impacts on the implementation of the integrated watershed management are the same.

4. The different economic indexes affect the implementation of the integrated watershed management alike.
5. The different infrastructure indexes influence the implementation of integrated watershed management to the same extent.

First, each of the five sub-hypotheses is analyzed and then the main hypothesis is tested, with regard to the above mentioned points and hypothesis. This study has been done for Kuteh district basins of Khash in S&B province.

Materials and Methods

This is a descriptive and field case study. Literature provides related information regarding the factors affecting the implementation of the integrated watershed management in Sistan and Baluchestan province (case of kuteh-khash). For determining the effects of various social, economic, political, ecologic and infrastructure factors on this type of management, experts (64 people) working in different local executive and planning offices in the region were consulted. A random sampling method was used for sampling government experts and the experts working in different indirectly involved executive departments.

Questionnaires were used for collecting the data using the LIKERT scale to determine the importance of each of the indexes. Using the SPSS software and applying the Wilcoxo non-parametric method, the experts' views were compared based on their scientific grades and organizational positions; and finally, by using the Kruskal-Wallis method, the sub-hypotheses and the main hypothesis were tested.

To test the first hypothesis, six different and important ecologic indexes were considered and the experts were asked to prioritize each of the indexes based on their importance. The results are shown in Table 53.1.

Table 53.1: The Frequency, Order and Score of the Different Ecologic Important Indexes Affecting the Implementation of the Integrated Watershed Management

Ecologic indexes	1	2	3	4	5	6	Score	Order
Soil	7	6	11	7	2	2	143	2
Land potential	2	3	5	9	6	10	96	5
Water resources	4	10	5	6	8	2	130	3
Rainfall rate	17	5	6	2	2	3	164	1
Topography	4	10	2	5	4	10	115	4
Vegetation cover	2	4	3	6	10	10	92	6

Based on the scores, rainfall index has the highest effect on the implementation of the integrated watershed management; and vegetation cover has the least effect. So based on the findings, this sub-hypothesis is not accepted.

To test the second sub-hypothesis, nine different and important social indexes were selected and the experts were asked to determine the importance of the effect of each of the indexes on the implementation of the integrated watershed management.

Table 53.2: The Frequency of Each of the Indexes and the Importance of Their Effect on the Implementation of the Integrated Watershed Management

Social indexes	1	2	3	4	5	6	7	8	9	Score	order
Native knowledge	6	7	8	3	3	1	5	2	-	222	3
Ownership	5	2	2	3	8	5	6	2	2	177	5
Participation	10	11	2	7	-	1	-	3	1	245	1
Education	12	2	11	3	2	2	-	-	3	240	2
Ethnic diversity	-	2	2	2	2	5	6	9	7	115	9
Traditions and custom	-	2	1	1	10	4	8	4	5	132	6
Population growth rate	1	-	2	2	3	7	5	8	7	116	8
Literacy	1	7	5	10	3	4	1	3	1	201	4
Poverty	1	3	1	1	5	3	6	6	9	122	7

Among the different social indexes, the index participation with a score of 245 and the index ethnic diversity with a score of 115 are the most and least important indexes effecting the implementation of the integrated watershed management, respectively. So this sub-hypothesis is rejected.

Four different and important political indexes were assessed to test the third sub-hypothesis. The results are shown in Table 53.3. Of the different statements, the statement, “the existence of security in the basin” with a score of 165 has the highest importance; and “the expression the existence of an expediency approach to implementing the project” has the least importance and effect on the implementation of the integrated watershed management. So, this sub-hypothesis is rejected.

To test the fourth sub-hypothesis, nine different economic indexes were selected and the experts were asked to determine the importance of their effects on the implementation of the integrated watershed management. The results are presented in the Table 53.4.

Among the nine economic indexes, the index, “people participation in the implementation of the project” with a score of 246; and the index “the existence of mines” with a score of 71 have the highest and least effect on the implementation of the integrated watershed management respectively. So this hypothesis is rejected.

To test the *fifth sub-hypothesis*, 5 infrastructure indexes were specified and the experts were asked to determine the importance of each of the indexes in affecting the implementation of the integrated watershed management. The findings are given in Table 53.5.

Table 53.3: The Frequency of the Experts' View Points Regarding the Effects of Political Indexes on the Implementation of the Integrated Water Shed Management

Political indexes	High Agreement	Agreement	Neutral	Opposition	High Opposition	Score	Order
The existence of security in the basin affects the implementation of integrated watershed management	25	10	-	-	-	165	1
A lack of correspondence between the political and geographical divisions prevent the implementation of integrated watershed management	5	21	3	6	-	130	3
A lack of co-ordination between law enforcement and military offices and planning departments prevents the implementation of integrated watershed management	11	10	11	3	-	134	2
The existence of an expediency view point affects the implementation of integrated watershed management	3	20	8	4	-	127	4

Table 53.4: The Frequency of Each of the Indexes in Terms of Their Importance in Affecting the Implementation of the Integrated Watershed Management

Economic indexes	1	2	3	4	5	6	7	8	9	Score	Order
The agricultural lands' potential for development	2	2	1	6	6	5	6	2	5	154	5
The existence of processing industries	-	-	-	-	3	2	8	8	14	77	8
People participation in the implementation of the project	11	8	6	4	1	3	-	-	-	246	1
Job opportunities	1	8	8	7	4	1	3	1	2	208	3
Existence of mines	1	-	-	1	1	2	2	9	19	71	9
Ranges' potential for forage production	1	1	1	6	5	6	5	6	4	140	6
Using new technology	-	2	2	3	3	5	3	5	12	114	7
Existence of a unique management in the basin	17	1	4	1	4	2	1	2	3	232	2
Determining the ownership of the lands	1	5	4	2	3	7	7	1	5	160	4

Table 53.5: The Frequency of Each of the Infra-structure Indexes Affecting the Implementation of the Integrated Watershed Management Along with the Order and Score of Each Index

Infra-structure indexes	1	2	3	4	5	Score	Order
Villages' dispersion	5	5	1	10	14	82	4
Infra-structure services	16	12	2	2	3	141	1
Cultural and education services	11	10	8	2	4	127	2
Health services	-	3	3	17	12	67	5
Agricultural services	1	5	20	5	4	99	3

Among the different infra-structure indexes, the index infra-structure services with a score of 141 and the index health services with a score of 67 have the highest and least effect on the implementation of the integrated watershed management respectively. So this hypothesis is rejected.

Results and Discussion

Comparative Analysis

The responses from interviews regarding all the five indexes i.e. ecological, social, political, economical, and infrastructural related to proposed hypothesis are compared in term of their organization and scientific degree and the result and illustrations are given as below:

Ecologic Indexes

Comparing the answers in terms of organization and scientific degree:

H: there is a consensus among the respondents from those working in jihad-sazandagi organization and its related offices and the answers working in other departments regarding the ecologic indexes.

H: there is a consensus among the graduate and post-graduate respondents on the ecologic indexes.

For comparing the experts' views on their organizations and scientific degrees (indeed they belong to two independent groups) the Wilcoxon sum ordinal test was applied. The results are shown in Table 53.6. At a significance level of 5 per cent there is no significant difference between the two groups' view points (those working in jihad-sazandagi and those working in other departments) regarding the ecological indexes.

For comparing the answers in terms of scientific degrees the wilcox on sum ordinal test was used and the results are shown in Table 53.6. Regarding the hypothesis the graduates and post-graduates' view points are identical. The figures obtained indicate that Z values are significant at level of 5 per cent and are accepted, except for the topographic index. The same method has been used for comparing the expert's viewpoints regarding the other hypotheses and the results are shown in Tables 53.7–53.10.

Table 53.6: The Results Obtained by the Application of the Wilcoxon Test Regarding the Ecologic Indexes in Term of Organization and Scientific Degree

Ecologic indexes	Z Value in Terms of Organisation	Z Value in Terms of Scientific Degree
Soil	-0/3	0/27
Land potential	-0/25	0/017
Water resources	0/004	0/82
Rainfall rate	0/48	-0/41
Topography	-0/34	-2/22
Vegetation cover	-0/59	-0/1

Social Index

Comparing the answers in terms of their organization and scientific degree:
H: there is a consensus among those working in jihad-sazandagi organization and its subordinate offices and those working in other organizations regarding the social indexes.
H: among the graduates and post-graduates' view points regarding the social indexes there is a consensus.

Table 53.7: Wilcoxon Test's Results Regarding the Social Indexes in Terms of Organisation and Scientific Degree

Social Indexes	Z Value in Terms of Organisation	Z Value in Terms of Scientific Degree
Native knowledge	-0/2	0/27
Ownership	-2/43	0/26
Participation	0/32	-0/97
Education	1/83	-0/94
Ethnic diversity	-0/05	-0/1
Traditions and custom	-0/036	0/2
Population growth rate	0/018	-1/16
Literacy	0/09	-1/35
Poverty	0/94	0/89

Political Index

Comparing the answers in terms of their organization and scientific degree:
H: there is a consensus among those working in jihad-sazandagi organization and its subordinate offices and those working in other organizations regarding the political indexes.
H: among the graduates and post-graduates' view points regarding the political indexes there is a consensus.

Table 53.8: Wilcoxon Test's Results Regarding the Political Indexes in Terms of Organisation and Scientific Degree

Political indexes	Z Value in Terms of Organisation	Z Value in Terms of Scientific Degree
The existence of security in the basin affects the implementation of the integrated watershed management	0/09	-0/17
A lack of correspondence between the political and geographical divisions prevent the implementation of integrated watershed management	0/11	2/22
A lack of co-ordination between law enforcement and military offices and planning departments prevents the implementation of integrated watershed management	-1/03	-0/05
The existence of an expediency view point affects the implementation of integrated watershed management	-0/96	0/75

Economic Index

Comparing the answers in terms of their organization and scientific degree:

H: there is a consensus among those working in jihad-sazandagi organization and its subordinate offices and those working in other organizations regarding the economic indexes.

H: among the graduates and post-graduates' view points regarding the economic indexes there is a consensus.

Table 53.9: Wilcoxon Test's Results Regarding the Economic Indexes in Terms of Organisation and Scientific Degree

Economic Indexes	Z Value in Terms of Organisation	Z Value in Terms of Scientific Degree
The agricultural lands' potential for development	0/75	0/69
The existence of processing industries	-0/99	0/94
People participation in the implementation of the project	0/04	-1/08
Job opportunities	-0/5	-1/31
Existence of mines	-0/2	0/46
Ranges' potential for forage production	1/2	-0/72
Using new technology	1/08	-1/6
Existence of a unique management in the basin	-0/43	1/13
Determining the ownership of the lands	-0/23	0/44

Infra-structure Index

Comparing the answers in terms of their organization and scientific degree:
H: there is a consensus among those working in jihad-sazandagi organization and its subordinate offices and those working in other organizations regarding the Infra-structure indexes.

H: among the graduates and post-graduates' view points regarding the Infra-structure indexes there is a consensus.

Table 53.10: Wilcoxon Test's Results Regarding the Infra-structure Indexes in Terms of Organisation and Scientific Degree

Infra-structure Indexes	Z Value in Terms of Organisation	Z Value in Terms of Scientific Degree
Villages' dispersion	-0/52	-0/05
Infra-structure services	-0/59	1/13
Cultural and education services	0/23	-1/54
Health services	1/37	-1/45
Agricultural services	-1/5	-0/23

Inferential Analysis

H: the different ecologic indexes affect the implementation of the integrated watershed management equally.

Kruskal-Wallis test was used for the inferential analysis of the first sub-hypothesis. This test is used for testing the equality of some means (more than two hypotheses) for original data. Each sample should be at least five in this method and the samples are integrated and graded. Then the sum of the grades of each sample (index) is obtained as follows:

$$H=12(R^21/n1+R^22/n2+...)/(N+1)-3(N+1) \tag{1}$$

It is compared with the value of $\chi^2_{\kappa-1, \alpha} \Rightarrow RH$.

And if it is greater than $\chi^2_{\kappa-1, \alpha}$ then the hypothesis H. (the equality of the means) is rejected.

$$H > \chi^2_{\kappa-1, \alpha} \Rightarrow RH.$$

N= number of observations

After integrating and grading the samples by using formula 1, the result obtained is:

$H = 35/92$. Since $\chi^2_{5, 5\text{ per cent}} = 11/07$ this hypothesis is rejected, because the value of H is greater than $\chi^2_{5, 5\text{ per cent}}$. So at a confidence level of 95 per cent, we can claim that the effects of the different ecologic indexes on the implementation of the integrated watershed management are not the same and their effects vary. The result confirms the descriptive method applied.

$H =$ the different social indexes affect the implementation of the integrated watershed management to the same extent.

Using formula (1) for the 9 indices and after integrating and grading the data, the result was $H = 97/7$ while the value $\chi^2_{8, 5\text{ per cent}}$ obtained was 15/507. So this hypothesis is rejected. $H =$ the different political indexes affect the implementation of the integrated watershed management equally.

Using the Kruskal-Wallis method this hypothesis was tested with the result:

$H = 36/42$. Also the following result was obtained: $\chi^2_{3, 5\text{ per cent}} = 7/815$.

So, this hypothesis is rejected, because H is greater than the value 7/815.

$H =$ the different economic indexes affect the implementation of the integrated watershed management equally.

For testing this hypothesis, the Kruskal-Wallis method was used too. H was calculated at 137/55 and $\chi^2_{8, 5\text{ per cent}}$ is 15/507. So, the hypothesis is rejected.

$H =$ the different infra-structure indexes affect the implementation of the integrated watershed management equally and to the same extent. The value is 51 and $\chi^2_{4, 5\text{ per cent}}$ is equal to 9/488. So this hypothesis is rejected.

Discussion

By using the descriptive and inferential method, it became evident that the indexes of each of the different ecological, social, political, economic and infrastructural factors that affect the implementation of the integrated watershed management varies and the degree of their influence is different. To test the main hypothesis that the different ecological, social, political, economic and infrastructure factors affect the implementation of the integrated watershed management, Kruskal-Wallis method was used. The number of those agreeing with the different indexes of each factor was obtained and then the Kruskal-Wallis method was used to test. Table 53.11 shows the values of each factor.

Table 53.11: The Frequency of the Answerers in Order of Priority
(their view points regarding each of the indexes)

Index type	The sum total of those agreeing with each of the indexes' effect the implementation of the integrated watershed management								
	1	2	3	4	5	6	7	8	9
Ecological	36	38	32	35	32	37	-	-	-
Social	36	36	34	32	36	32	37	37	35
Political	44	61	22	13	-	-	-	-	-
Economic	35	36	36	37	33	35	36	36	27
Infra-structure	33	35	34	36	37	-	-	-	-

First, all data on the five factors were combined and rated and then by using the statistical method of Kruskal-Wallis equality of the rate with which each of the above-mentioned factors influencing the implementation of the integrated watershed management is tested.

H = the ecological, social, political, economic and infra-structural factors affect the implementation of the integrated watershed management equally. H was calculated at 0/352. $\chi^2_{4,5}$ per cent is equal to 9/488. It is noted that the condition $H > \chi^2_{k-1}, \alpha \Rightarrow RH$. is not established. So H. could not be rejected. This indicates the rate of the effects of the different ecological, social, political, economic and infra-structural at a level of 5 per cent are equal. In order to get more control and confidence, the Kruskal-Wallis method was also applied and similar results were obtained.

Table 53.12: The Results of Testing the Research Hypotheses

Hypothesis title	H value	χ^2_{k-1}, α	The condition
The different ecological indexes affect the implementation of the integrated watershed management equally	35/92	11/071	There is
The different social indexes affect the implementation of the integrated watershed management equally	97/7	15/51	There is
The different political indexes affect the implementation of the integrated watershed management equally	36/42	7/82	There is
The different economic indexes affect the implementation of the integrated watershed management equally	137/55	16/2	There is
The different infra-structure indexes affect the implementation of the integrated watershed management equally	51	9/49	There is
The different ecological, social, political, economic and infra-structure indexes affect the implementation of the integrated watershed management equally	0/352	9/49	There is not

Conclusions

1. The ecological, social, political, economic and infra-structural factors at a significance level of 5 per cent affect the implementation of the integrated watershed management equally.
2. The indexes of the different ecological, social, political, economic and infrastructural factors affect the implementation of the integrated watershed management variably. Of the 32 indexes studied, the indexes of security and the existence of mines had the highest and least effect respectively.
3. Between the view points of those working in jihad-sazandagi organization and its subordinate offices and those working in other organizations there was a consensus regarding the effect of ecological, social (except for ownership), political, economic and infra-structural indexes on the implementation of the integrated watershed management.
4. Between the view points of the graduates and post-graduates regarding the degree of the effect of ecological (except for topography) social, political (except for the existence of co-ordination among the law enforcement and military units and the departments involved in planning), economic and infra-structure indexes, there is no difference.
5. The different ecological indexes affect the implementation of the integrated watershed management variably. Studies show that the indexes rainfall rate, soil, water resources, and topography exert the highest effects on the implementation of the integrated watershed management, followed by the indexes the lands' capability and vegetation cover respectively.
6. The different social indexes affect the implementation of the integrated watershed management variably. The findings indicate that of the 9 indexes defined, the indexes participation, native knowledge, literacy and ownership have the highest effect on the implementation of the integrated watershed management, followed by the indexes traditions and custom, poverty, population growth rate and ethnic diversity respectively.
7. The different political indexes affect the implementation of the integrated watershed management variably. The results show that the effects of each of the 4 expressions are considerable.
8. The different economic indexes affect the implementation of the integrated watershed management variably. The findings show that of the 10 indexes studied the indexes participation, the existence of a unique management, existence of water resources, job opportunities, land ownership and the potential for developing the agricultural lands have the highest effect on the implementation of the integrated watershed management, respectively followed by the existence of processing industries and of mines having the least effects respectively.
9. The different infrastructural indexes affect the implementation of the integrated watershed management variably. The studies indicate that of the 5 indexes defined the indexes infra-structure service, educational and cultural services and agricultural services exert the highest influence on the implementation of the integrated watershed management and the indexes villages' dispersion and health services have the least effects respectively.

Finally, it can be noted that although all the factors do not equally affect the implementation of integrated watershed management (IWM), every index up to some level may influence the integrated management of basins area. Therefore, it is recommended and necessary that government, for the purpose of water conservation and reforms at basins area of S&B province should give attention and importance to various effective factors based on their priority and influence level, which have been discussed and determined in the context of the present research work.

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