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Studying Effects of Consumed Fertilizer on Sustainable Rural Development by using AHP Method

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Abstract

Generally, sustainable development is regarded as a strategy for improving social and economic life of rural people. Increasing poverty and class discrimination in addition to ever-growing destruction of natural resources and cultural challenges is among fundamental problems at national and local level and is center of attention of policy makers in the field of development. This research is performed by descriptive-survey method with the purpose of studying effect of different fertilizers on sustainable rural development of Islamshahr city by using AHP method (Analytic Hierarchy Process). Results of research show that the Environmental, Managerial, Economic, Social and Institutional criterions with value of 0.353, 0.293, 0.175, 0.1, 0.081 are at first to fifth priority. In the sub-criterion section the Soil Protection, Correct Management of Opportunities and Limitations of Agriculture for Sustainable Agriculture, Correct Application of Chemical Fertilizers for Sustainable Agriculture, criterions with value of 0.184, 0.154 and 0.139 are at first to third level.

Keywords: Sustainable Development, Sustainability of Villages, Consumed Fertilizer, Islamshahr, AHP Method

Introduction

Rural development only means reversing process of development, planning and executing urban areas to rural areas and allocation of financial and economic benefits at national and local level. Rural development is part of national development that has value concept and its goal is ideological evolution and increasing abilities of rural society with the purpose of meeting financial and spiritual requirements with final goal of obtaining development and property (Yazdanpanah Abolmaleki and Salmanzadeh 2015). One of the programs that may have key role on rural development is attempt for obtaining sustainable agriculture i.e. optimum application of resources for maintaining the next generation. The most general definition of sustainable agriculture is to living all economic, social and ecologic aspects (Terror 2008). Nowadays in global scale many organizations, guilds unions and

associations were established in relation to this type of agriculture and they are mainly operating instead of concept of agriculture and doubtlessly based on definition of sustainable agriculture it is inferred that rural development and sustainable agriculture have close and direct relationship with each other. It is claimed that rural development specially based on sustainable agriculture is not impossible to reach and it is possible to obtain this goal through economic issues i.e. increasing production efficiency, increasing economic income for meeting the social goals of poor class of society and improving literacy standards of society (Namdar and Bozar Jomhouri 2015). Developing more sustainable agricultural ecosystem for improving foods leads to raising general broad concerns during recent years and the agricultural activities during recent years due to increasing application of different fertilizers is significantly increased. Thus, it is necessary for producing agricultural crops for limiting environmental effects, social and economic aspects of sustainable agriculture (Hosseinzadeh and Ghorbani 2011). In the field of sustainable agricultural and rural development, the most important issues is to finding solutions for improving the life of rural people and on order to perform this task, it is necessary to use from main amendments at agricultural and environmental policies. In the program of sustainable development, it is necessary to specially pay attention to villages; since, from one hand village is regarded as center of producing food and from the other hand poor and needy population are living in villages. In the field of sustainable agricultural development, the issue of agricultural inputs and fertilizers is very important due to economic, social and environmental aspects. Through correct selection of agricultural fertilizers, in addition to increasing water quality, reducing erosion, maintaining bio diversity that leads to maintaining environment, the efficiency and performance of agricultural products are very important from economic point of view. Moreover, through using some fertilizers inside of village, it leads to increasing job employments and paving the way through sustainable agriculture and finally rural sustainable development (Hosseinzadeh and Ghorbani 2011).

Goals of Research:

- Recognizing and prioritizing economic, social and environmental aspects of rural people of Islamshahr city in the way of obtaining sustainable rural development
- Weighting to criterions and sub-criterions selected for determining priorities and evaluating their importance
- Studying influence of consumed fertilizers on social aspects of rural people of Islamshahr in the way of sustainable rural development
- Studying influence of consumed fertilizers on economic aspects of rural people of Islamshahr in the way of sustainable rural development
- Studying influence of consumed fertilizers on environmental aspects of rural people of Islamshahr in the way of sustainable rural development

Research Background:

In the study of Davoudi Memar and et al 2013 and through studying and preparing plans for soil fertility by using advanced simulation software, it was determined that one of the main methods for protection of soil against excess consumption of chemical fertilizer is optimum application of fertilizers for prevention of pollution of underground waters. Results of this research show that based on simulated data and studying experts and field study, it is possible to recommended suitable fertilizer in the way of protecting water and soil resources, producing high quality organic crops that plays key role on reducing costs and saving time. Rafiei and et al 2013 performed a study in the way of determining effective structure on knowledge, attitude and skill of wheat farmers through changing their behavior in the way of optimization of consumption of chemical fertilizers by selecting correct educational and promotion methods for obtaining to goals of sustainable development in the way of reducing dangers of environmental pollutions in wheat. Results of this study showed that analyzing data in relation to prioritizing promotion variables by using change coefficient index shows that variables for using educational services of experts, attending at educational courses of planting wheat, using related books and journals to wheat are regarded as priority for improving professional behavior of wheat famers in the way of optimizing consumption of chemical fertilizers and the related priority is for skill of management of herbal nutrition by using change coefficient index including: Attempt for learning modern knowledge of planting wheat, prioritizing optimum management of wheat. Results of multi variable regression 0.68 shows that changes in behavior of wheat farmers is in the way of optimizing consumption of chemical fertilizers with promotion factor, social and economic factor, membership in association of farmers and level of water land. Mousavi 2014 in the way of studying effect of organic and nitrogen fertilizers on performance of onion gland for obtaining to sustainable development in Jirof city found out that the effect of organic and nitrogen fertilizers has significant different on performance of onion gland and this mutual effect shows significant difference between organic and nitrogen fertilizer on performance of onion gland. Moreover, the highest performance of edible inion gland is obtained from consumption of mixed fertilizer of poultry, cow and chemical nitrogen fertilizer. Research of Dubey, Suresh, Singh 2007 showed that using native bacteria is compatible with living condition and is more suitable for producing biologic fertilizers. Producing high quality foods that is product of biologic fertilizers not only leads to satisfaction of consumer; but also guarantees their health. Thus, it is concluded that only using biologic fertilizers not only supplies herbal requirements of plant but also improves quality of agricultural products and finally leads to heath of consumers and is regarded as solution for sustainable

development. Abbaspour, Mosler, Yang, Zhou 2010 in a study on farmers at North China found out that high education level of farmers prepares ability of better access to more suitable information about fertilizer and this issue makes farmers to benefit from higher level of knowledge about correct application of fertilizers and obtaining sustainability. Simon, Rausser, Pelow, Baylis 2008 in a study examined the method of maintaining environment on rural development in Europe and USA and concluded that through supporting from poor people, improving efficiency of workforce and focusing on agricultural sector, it is possible to observe that complete partnership of farmers is the main reason for growth of rural and unity of rural people. Whalen 2007 in a research studied the improvement of sustainable rural development through agriculture and results of study showed ever-growing negligence to agriculture from one hand and population growth for upgrading the life afford of rural people; thus, rural development is a strategy for improving social and economic condition of poor rural people and farmers play key role on reducing poverty.

Research Methodology:

This is applied research and in compliance with goal is regarded as descriptive-analytical research and the results are directly applicable for studying different type of consumed fertilizers on sustainable rural development. From viewpoint of controlling variables, it is concluded that research variables are measured without any intervention and manipulation; thus, this descriptive research. From viewpoint of data collection this is regarded as survey research and the statistical society of this research is 30 experts active in the field of agriculture management. In this study, it is benefit from mixed AHP technique for selecting best choice. Saati 2002 believes that 10 experts are enough for performing pairwise comparison and in compliance with importance of discussion and comments, it is concluded that questionnaire is divided between 30 experts including: Employees of department of agriculture and natural resources of Islamshahr city and also members of Islamshahr city council. In order to be sure of validity of questionnaire, it was confirmed by supervisor professor and experts. In order to be sure of reliability of test, it was benefit from pairwise comparison compatibility rate and this index is less than 0.1 and finally the reliability of questionnaire was confirmed. The continuation of process is as follows

Step 1: Pairwise comparison of variables

Upon recognizing criterions and by using comment of experts we performed pairwise comparison of each criterions. When element i is mixed j one of the aforesaid number is allocated to it and in comparison with i and j element, is reverse amount is allocated (xij= 1/xij). In the way of pairwise comparison matrix in row with j column is compared; then the entire elements of main diameter of this matrix show number one and also any amount before main diameter equals to reverse amount upper diameter (Momeni 2008)

Step 2: Calculating geometrical average of rows of matrix for pairwise comparison

Eczol and Saati 1983 introduced method of using geometrical average as the best method for mixing pairwise comparison; thus, we take geometrical average from date of each row

Step 3: Calculating specific vector and determining weights of criterions

The obtained weights in step 2 is not normal and the term normal weight means that sum of weights equals to one. Thus, the geometrical average is divided into sum of elements of geometrical middle column and the new column consists of normal weight of each criterion that is called as specific vector and the final weight of each criterion is column of specific vector

Introducing Expert Choice Software:

Expert Choice software is an assistant software for making multi-criterion decisions based on AHP and this mathematical process is a theory that was founded by Thomas L. Saaty at University of Pennsylvania. Moreover, AHP is a powerful and comprehensive method for simplifying decision making by empirical date and oral judgments. Expert Choice software has unique method for pairwise comparison for obtaining priorities that is more valuable than other methods

Findings:

Determining Relative Value of Criterions and Sub-Criterions

Through studying and reviewing subject literature and published article, the effect of different consumed fertilizer on sustainable rural development, the effective indices were recognized and according to extracted indices and by using AHP method, we calculate the related indices and sub-indices. In this chapter, the collected data and tables were analyzed and upon performing calculation at Excel software, the results with tables, pairwise comparison matrixes and related figures are offered

Studying priority of criterions in comparison to goal

Through studying resources and records of research and also theoretical fundamentals that was offered in previous chapter, following 5 criterions were extracted and compared with each other including: Social, economic, environmental, managerial and institutional and the average pairwise of these criterions is offered in table 1

Table 1. Average pairwise comparison of criterions based on goal

Criterion i	Average Priorities	Criterion j
Social	0.79	Economic
Social	0.29	Environmental
Social	0.25	Managerial
Social	1.14	Institutional
Economic	0.38	Environmental
Economic	0.69	Managerial
Economic	3.17	Institutional
Environmental	1.26	Managerial
Environmental	3.42	Institutional
Managerial	3.42	Institutional

Pairwise comparison matrix of criterions in compliance with goal

Upon determining average criterions and by using pairwise comparison matrix, the extracted criterions from theoretical fundamentals of research including: Social, economic, environmental, managerial, institutional were compared on pairwise basis and its results is offered as follows

Table 2. Pairwise comparison matrix of criterions in compliance with goal

IR= 0.02	Social	Economic	Environmental	Managerial	Institutional
Social	1	0.79	0.29	0.25	1.14
Economic	1.28	1	0.38	0.69	3.17
Environmental	3.445	2.63	1	0.26	3.42
Managerial	4	1.45	3.85	1	3.42
Institutional	0.88	0.32	0.29	0.29	1

Upon inputting date at Expert Choice software, the weight of criterions in compliance with goal of figure 1 is offered as follows:

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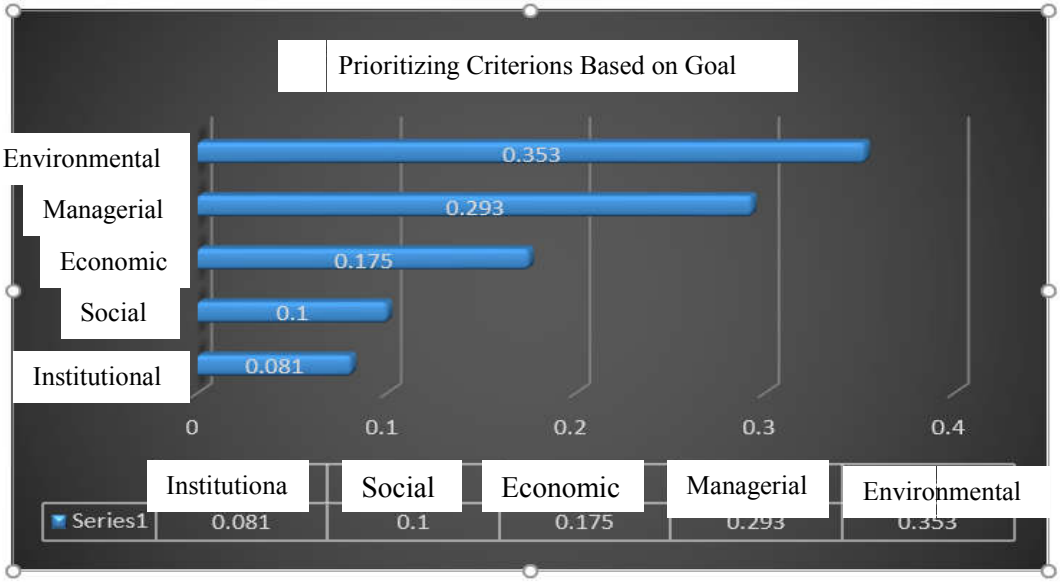

Figure 1. Weight of criterions in compliance with goal

This figure that is result of comment of experts show that environmental factor with weight of 0.353 has the highest importance and managerial factor, economic factor, social factor and institutional factor with weight of 0.293, 0.175, 01, 0.081 are at second to fifth chapter

Studying priority of sub-criterions based on Social criterion

Upon studying the status of goal and determining average priorities for each of the variables, some subsidiary sub-variables are defined that is originated from theoretical fundamentals of research and is related to goals and hypothesis. Upon inputting data at Expert Choice software, the sub-criterion weights are offered based on criterion of Social according to the following figure.

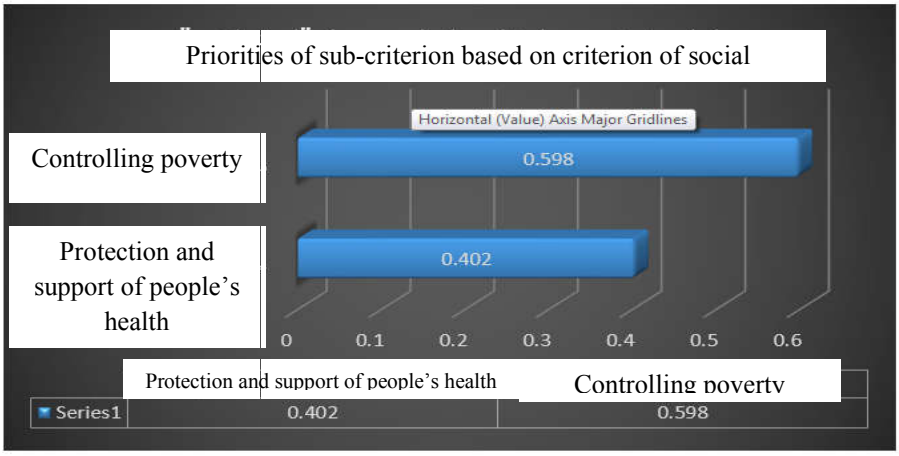

Figure 2. Weights of sub-criterion based on criterion of Social

As it is observed, the sub-criterion of Controlling Poverty with weight of 0.598 is at first rank and protection and support of people's health is at second rank with value of 0.402

Studying propriety of sub-criterion of Economic

For better and more exact studying the economic criterion, 3 sub-criterions as financial support of agriculture, sustainable agriculture and developing rural spaces and control of desert greening and drought. Upon entering date at Expert Choice software, the sub-criterion of Economic is obtained as shown in figure 3

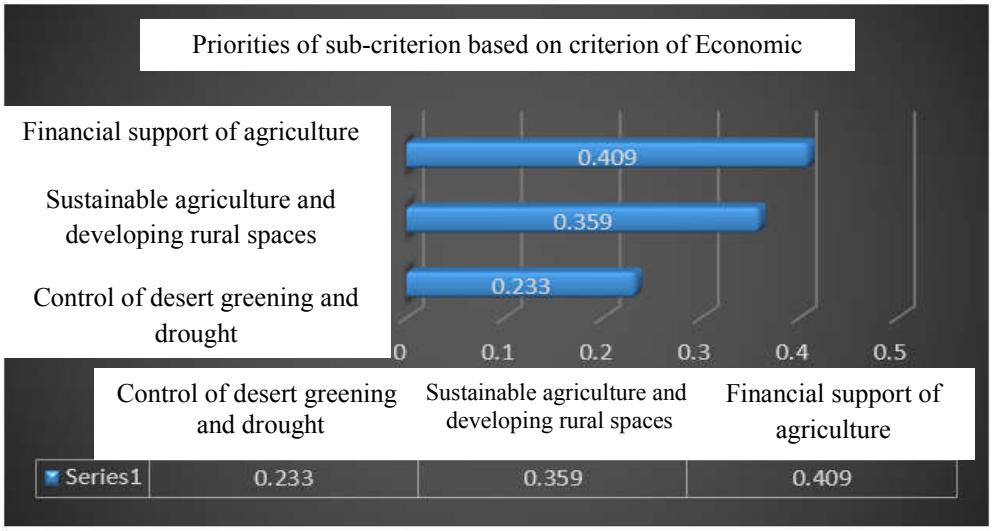

Figure 3. Weights of sub-criterion based on Economic

Figure 3 shows that the index of financial support of agriculture with weight of 0.409 is at first rank and the index of Sustainable agriculture and developing rural spaces, Control of desert greening and drought with value of 0.359 and 0.233 are at next ranks

Studying priority of sub-criterion of Environmental

With the goal of more exact studying of environmental issue, the following 3 sub-criterions are determined as follows: Protection and operation of water resources, soil protection and reducing dangers due to environmental pollution

Upon inputting data at Expert Choice software, the sub-criterions based on Environmental according to figure 4 is obtained as follows:

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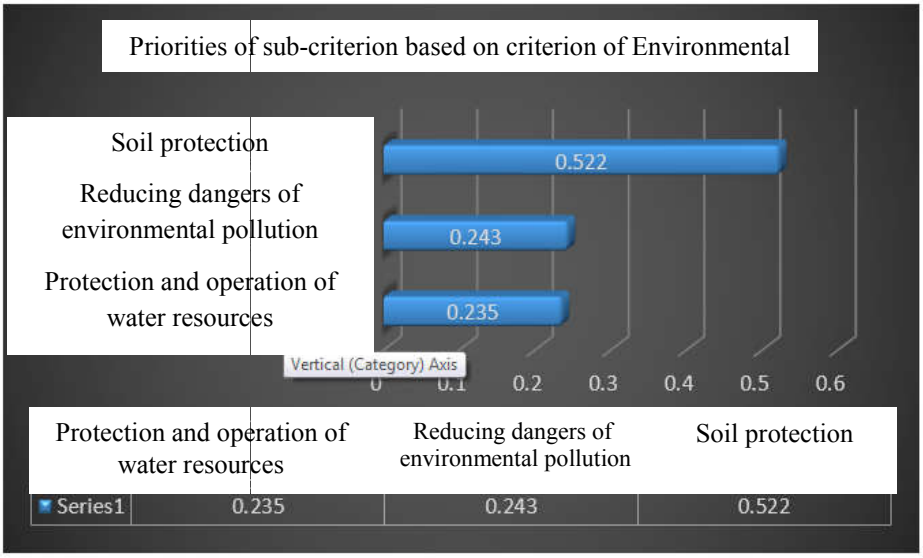

Figure 4. Weights of sub-criterion based on Environmental

According to figure 4, the index of Soil protection, Reducing dangers of environmental pollution, Operation of water resources with weights of 0.522, 0.243 and 0.235 are at first to third rank

Calculating final weights of criterions and sub-criterions and their prioritization

According to Thomas L. Saaty, we have collected the comment of experts and through calculating geometrical average and comment of experts entered at Expert Choice software, the final stage of calculating weight of criterions, relative weight of sub-criterions, final weight of sub-criterion is offered in table 3. The final weight of each sub-criterion is obtained from multiple relative weight of sub-criterion at weight of criterion in the same cluster.

Table 3. Relative and partial weights of criterions, sub-criterions and their priority

Criterion	Sub-Criterion	Weight of Sub-Criterion at Cluster	Final Weight of Criterion	Rank
Social	Control of poverty	0.598	0.060	8
	Protection and support of people's health	0.402	0.040	11
Economic	Financial support of agriculture	0.409	0.072	6
	Sustainable agriculture and developing rural spaces	0.359	0.063	7
	Control of desert greening and drought	0.233	0.41	10
	Protection and operation of water resources	0.235	0.083	5
	Soil protection	0.522	0.184	1
	Reducing danger of environmental pollution	0.243	0.086	4
Managerial	Correct management of opportunities and limitations of agriculture for sustainable agricultural development	0.524	0.154	2
	Correct application of chemical fertilizers for obtaining sustainable agriculture	0.476	0.139	3
Institutional	Lack of using successful experience of other countries	0.465	0.038	12
	Being uninformed about problems of sustainability and require to education	0.535	0.043	9

As it is obvious in table 3, the criterions of Environmental, Managerial, Economic, Social and Institutional with weight of 0.353, 0.293, 0.175, 0.1 and 0.081 are at first to fifth rank and in the section of sub-criterions, Soil protection, Correct management of opportunities and limitations of agriculture for developing sustainable agricultural development, Correct application of chemical fertilizers for agricultural sustainability have significant importance and have weight of 0.184, 0.154 and 0.139.

Conclusion:

First of all through studying several related books and articles for effect of consumed fertilizers on sustainable rural development, we have recognized effective factors by using questionnaire and then by using AHP method we prioritized and weighted main criterions. Then, the relative weights of each sub-criterion was determined and the priority of each sub-criterion was determined in its own cluster and finally, through calculating the weight of main criterion to relative weight of sub-criterion, the final weight of criterion is obtained. Upon calculating all final weights, the priorities of sub-criterions are determined. 5 criterions as Social, Economic, Environmental, Managerial and Institutional were selected as aspects influencing on relationship of consumed fertilizer in the way of sustainable development of Islamshahr city. The criterions including: Environmental, Managerial, Economic, Social, Institutional with weight of 0.353, 0.293, 0.175, 0.1, 0.081 were at first to fifth rank. In Social criterion, the issue of

controlling poverty with eight of 0.598 and in criterion of Economic the issue of Financial support of agricultural sector with weight of 0.409 and in the criterion of Environmental the issue of Soil protection with value of 0.522 were the first and most important criterions on this cluster. According to the results of research, it is determined that social poverty is related to lack of application of developing agriculture in Islamshahr city and this issue depends on status of education; thus, it is recommended to improve educational system, amending educational system for promoting awareness and information of rural people at Islamshahr city. The result of this research is compatible with the result of Bowler 2010, Bozarhomhouri and Namdar 2011 that refers to cumulative obtaining goals of welfare, life afford, eliminating poverty, having suitable life, increasing range of benefit of future generation from natural resources in rural areas, ability of rural associations for meeting material and spiritual requirements and effective control on forces forming the current residence system of growth and development. Using unsuitable chemical fertilizers in addition to running the agricultural crops and threatening the human health, leads to eliminating conditions of suitable soil and also removing sustainable rural balance. Thus, it is recommended to make considerations for consuming fertilizers agricultural sector and prevent from using unhealthy chemical fertilizers. The result of this research is compatible with result of research of Mohammadi et al 2015 that refers to crop rotation, using green fertilizer, organic and farm animal fertilizer, biologic control, fallow, mechanical operation for maintaining fertility of soil and preparing foods for vegetables and preparing pesticide. According to size and great importance of environmental costs, these costs are negligence by managers; since, the offered information in this field, are generally incomplete, ambiguous and irrelevant. Thus, it is recommended that by using sustainable development approach to revise on equipping organization for better analysis of traditional methods in relation to consumed fertilizer in the way of sustainable development of Islamshahr city and to amend this system for processing the information related to environmental costs and submitting the suitable report to managers.

Recommendations:

- In order to calculate weights and prioritizing criterions and sub-criterions, it is possible to benefit from TOPSIS, ELECTRE and PROMETHEE method

- Whereas human judgments have fuzzy nature, using fuzzy numbers is more recommended for using final numbers

- Using logic and gray numbers for making decision instead of final numbers

- To consider other villages, cities and area of Iran and comparing their results

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