International Journal of Agricultural Management and Development (IJAMAD)
Available online on: www.ijamad.com
ISSN: 2159-5852 (Print)
ISSN:2159-5860 (Online)

Investigation of Socio-Economic and Environmental Effects of Taleghan Dam Using Structural Equation Modeling

Vali Borimnejad [1] and Fatemeh Salimian[2]*

Received: 7 May 2014,
Accepted: 17 August 2014

Abstract

Today water supply issue in large cities seems to be a big problem. This becomes more important with population growth and urbanization extension. To cope with this problem lots of irrigation and drainage projects have been implemented and operated that subsequently many socio- economic and cultural effects have been brought to the areas . The objective of the present study is to survey the socio - economic and environmental effects of Taleghan dam to compare the two periods before and after the dam construction. The needed data have been gathered by use of a questionnaire and by interviewing 400 samples in the irrigation and drainage network's region of Taleghan Dam, and encoded questions and outcome data have been analyzed in spss and lisrel software. The results showed an economic development in the region, but some factors like, lack of trust, lack of economic advantages and deficiency of facilities, decrease villagers' willingness to invest. 63.3% of region's environmental pollution has been increased mainly by the tourists. Not only is there no increase in Water sources but also they have been decreased. 98% of individuals declared that the people were not questioned in construction projects. About the coefficient of dam's effect on region's socio- economic and environmental development, the villagers have declared that the dam construction had no positive effect on region's development.

Keywords:
Dam construction, Structural equations, Taleghan Dam

[1] *Associate Professor, Department of Agricultural Economics, Islamic Azad University, Karaj Branch, Karaj, Iran.*
[2] *MSc Student, Department of Agricultural Economics, Islamic Azad University, Karaj Branch, Karaj, Iran.*
** Corresponding author's email: vali_borimnejad@Kiau.ac.ir*

INTRODUCTION

The foot of the Zagros Mountains and the East Hills Farmers Mesopotamia were probably the first dam in the world. 6500 years ago the Sumerians, the plains between the Tigris and Euphrates brought under irrigation. The oldest dam, whose remains have been found, was built 3000 years BC. As with constructing the first pyramids, the Egyptian constructors built the "Alkafra" or "Pagams" dam at the bank of a seasonal river in Cairo. The Iranians learned how to use the surface and underground waters sooner than the others and they experienced the production increase with such irrigating methods.

The subterranean which is the most stable way in using the underground water, has been invented 3000 years BC in Iran. Collecting the rain water that simply apply the rain water of cold seasons to the hot seasons' cultivations, using very simple and stable methods, which is a sample of sustainable water supply, has been known since longtime ago in Iran. In all over the world more than 400000 km^2 have been used as a water reservoir. The widest land which has been used as a water reservoir is the 8500 km^2 delta behind the Akozomba dam, which contains 4 % of space of Ghana. The dams have 2 main functions, firstly, they save the water to compensate the volatility of rivers' flow and water and energy demand, and secondly, they increase the level of water in upstream so that in this way, they can deflect the water flow in a channel, or increase the hydraulic burden between the reservoir and the downstream. Building such this reservoir allows the dams to supply the required water in agriculture, industry and drinking water and also to control the floodwater, and it facilitates shipping in the river by regulating the water flow and by filling the river with water as soon as possible. As the other reasons of constructing a dam, the fishery and the entertaining purposes, like sailing, can be mentioned. The great dams mostly based on wide-spreading estimations, include about 1/3 of total crops harvest and 1/6 of total irrigated farms in whole world. The water reservoir of the dams for agricultural uses and generating energy, has been considered as a great wealth, that by using such this reservoir beside supplying the drinking and agricultural water, it makes it possible to generate hundreds megawatts of hydraulic energy. But despite lots of benefits and advantages in using the water which might be wasted, and its influence on human's life, ignoring the political issue in dam constructing may cause some disadvantages which are not easily compensable. Creating such this great wealth requires creating the lakes where so many human and village communities would be sunken in their banks. For instant, in Urmia city, constructing more than 40 dams in upstream has lead to the dehydration of Urmia lake and that expose the human and animal communities to a serious danger. The total amount of water in our planet, which is known as hydrosphere, is about 1360000 km^3, from which, 97.2 % is saline water and only 2.7 % is drinkable. And of this amount 2.14 % includes unavailable ices. The accessible amount is estimated about 12000 km^3 and of this amount a very low percentage can be used. And also the amount of underground waters is a little more than 8000 km^3 from which only 3/1000 is naturally renewed. The amount of the rainfall is 450000 km^3 annually that is justified with evaporation and of this amount only 110000 km^3 rains over the continents' lands. With the dry climates of countries like Iran, constructing the dams as an engineering way to control and regulate the flow to agricultural and drinking and other purposes, has become an interesting issue. And that's why the dam construction has got a historical background in Iran. The scientists have tried to save water and avoid water wasting by presenting some methods. Although the dam construction's history in the world, back to thousands years ago and the "Zolqarnein" dam in Iran is one of the oldest water reservoirs constructions in the world, but what is the impact of dam construction on the natural ecosystems in upstream and downstream and how this impact must be evaluated? The Taleghan project in order to achieve the national economic development goals and to optimally use the country's water resources' potential, and to use common usage of surface waters of Taleghan River in incorporation with Ziaran River, has being studied and designed since about 35 years ago. This project is considered as a multipurpose plan that has gained the below aims through constructing

the Taleghan dam:

Control and regulation of river surface currents.

Water supply needed Qazvin

In order to achieve an optimum balance in the joint operation of surface water and groundwater Taleghan Qazvin

Provide drinking water for metropolitan Tehran

Use the hydroelectric potential of the dam and reservoir provides water transfer

The dam construction started on March 2001 and the impounding started on 16 January 2005. This dam transfer 298 million m^3 annually to the Qazvin field and supply 150 million m^3 of potable water of Taleghan (the Lar consulting engineers). The absence of participation of local communities and passive participation in water resources management, and also lack of local management themes and inefficient use of local communities in taking decisions, making decisions in the absence of beneficiaries and authorities and local decision makers in water and soil resources protection programs, has caused an inefficiency in state programs in protecting the natural resources. Such this negligence leads to a discouragement among villagers and farmers and the people who live in the bank of watersheds to the state projects, and lack of responsibility in preserving the natural resources and also a problem with local communities to accept natural resources projects who consider the government's strategies against their benefits. In order to study the environmental impact of dam constructing projects, the studies were fulfilled in 5 sections including: physical environment, biological environment, water resources, the contamination and dispersion of wildlife. At the time of dam construction, a village, some roads, several farms and fields and gardens were sunken whilst impounding the dam. In order to relate the upper villages to the central ones, several roads were built that consequently the farms and mountains were damaged or destroyed. Now the question is: was it worth to lose the resources by constructing the dam to achieve the goals of its operation? The impacts of dam construction on the region's economy were desirable or not? The value of lost resources was greater than the obtained facilities or not?

Hypotheses

There is a significant relationship between public participation and the rural development.

The local cooperation is effective in natural resources' protection.

The dam construction has lead to economic growth and consequently the people's satisfaction.

The dam construction has lead to prosperity in upstream fields.

There is a relationship between the needs of the project implementation progress.

Research purposes

Evaluating the economic impact of dam construction

Evaluating the social impact of dam construction

Evaluating the environmental impact of dam construction

Literature review

Falsafi Zade and Sabouhi Sabouni (2010), in their study determined the optimal exploitation of Kor river of Doroudzan dam. They applied a comprehensive economic- environmental model to study the irrigation and exploitation of surface waters in the plain around the Kor River, Doroudzan to Bakhtegan Lake. In this model economic, hydraulic and agricultural parts were considered. In economic part, the optimal allocation of water was investigated under 2 scenarios of presence and absence of regional water flow, using non-linear programming. The result of environmental simulated model in hydraulic part, were used as a preliminary data in economic part. In agricultural part, the real yield in wet, normal and dry years were determined by using the relationship between yield and the amount of irrigating water. The results showed that there is a difference between the quality of water, allocation due to wet, normal and dry years, with its optimal amount. A reason to such difference can be the lack of water market and price determining due to demand and supply. Using the model, the optimal cultivation model was determined to the region to preserve the surface water resources.

Borimnejad (2006) studied the effective factors on technical efficiency of wheat cultivators in Qom province, using a combined model of stochastic frontier method and path analysis.

This article provides a method to estimate the technical efficiency level of wheat firms using stochastic frontier method and testing the effective managerial factors to this efficiency. The needed data were the cross-sectional data of 2004 and for 149 firms in Qom province. The results showed that the variables like: the farmer's ability to read and write, being or not being a member of a cooperative or company, participating or not participating in informal educational courses, have a significant effect on explaining the technical efficiency levels of the firms.

Mohammadi Golrang *et al.,* (2006), studied the economic evaluation of watershed activities done in dams' area, in order to determine and identify the economic and social effect and watershed activities done in Torbat Heydarieh city (Khorasan province), and also to learn the attitude and viewpoints of direct beneficiaries of performed activities toward the quality of watershed activities returns.

Bani asadi and Mohseni (1995) in their study, investigated the influence of Ab-Barik project of Bam on economic and social life of residents of this region. The fulfillment of this project caused an employment for many residents of the region. Also, with performing this project, the immigration has been decreased appreciably.

Lee *et al*. (2009) fulfilled a research due to the integrated watershed economy and reservoir management. The dynamic optimizing frameworks for the complete management of reservoirs and appropriate suggested policies have been used. Soil conservation, free level of reservoir's sediments, downstream water allocation and the water quality are the goals under control. Applying the model to the "Aswan" dam showed that the international cooperation is needed to common water resources managements.

Hearnshaw *et al.* (2010) studied the quality of eco systemic services by constructing dam and water reservoir and its changes. Eco systemic services affect all around directly or indirectly. Most of water projects are being evaluated by cost-benefit analysis. Most of such benefits in cost-benefit analysis are being ignored because of the shortage in supplying centers, limited information, or lack of awareness about eco systemic services. Revising the water projects can explicitly and appreciably measure the evaluation of such projects. Such these projects can provide some natural benefits (increasing in water flow, decreasing in water contamination costs as a result of the increase in water flow). The water reservoir projects can bring positive or negative outcomes to the environment. An increase in water flow can lead to a growth in fishery, an enhancement in natural regularity, water dilution as a result of reduction in pollution, and make the aquatic plants ecosystem healthier. Irrigation causes an increase in production in the fields under the plan, since the land has got a good soil and other environmental factors out the river. So, according to quantifying the eco systemic services, they managed to find an appropriate and calm place for fixing the barometers of Opihi-Opuha River.

MATERIALS AND METHODS

The theories usually lead us to know how some variables are related to each other. So, developing an equation system is often favorable, like a model which shows the whole casual relationships between the variables. For example, a research wants to know how a family background, access to education, and other variables that form the socio-economic situation, might affect the lifestyle. This is one of the earliest situation development models (Sewell 1983). In present research we aim to study and estimate the casual relationships between variables in 3 groups of social, economical and environmental, as quantitative variables. As a matter of fact, each variable has been made of several elements that each element affects the others. Using path analysis, the casual relationships can be measured, and also the amount and the quality of each factor's influence can be determined. Path analysis is an advanced statistical method which examines the casual relationships between two or more variables. This system is based on a linear equation system that has been used for the first time by Sewell Wright in 1930 in phylogenetic studies. This method has been adopted by the sociologists in 1960 and was used in 1970 to study the increase in frequency in ecological literatures. In ecological studies, path analysis has been used mainly to realize the difference between the powers which are embedded di-

rectly or indirectly in variables. In path analysis, mediated pathway can be examined (y is the mediated variable in pathway of (X←Y←Z). The pathway in path models indicates the researcher's hypotheses which can never be statistically tested. Pathway analysis is a subset of structural equation modeling (SEM) which was defined by Ullman that allows us to examine the relationships between two or more independent variables, either continuous or discrete. To evaluate the variables, they must be exactly observable, measurable and they must clearly show the characteristics of variable. Latent variable is a variable which is not clear or obvious and it is determined by measuring other variables, that such these variables are created and known according to the factors like analytic factors of other observations. The structural equation modeling is a combination of several regressions and analytical factors, but path analysis contains only measured variables.

RESULTS AND DISCUSSION

In this step the independent variables of covariance's matrix, are being generated and estimated. Ullman and Holy have discussed the advantages and limitations of mentioned estimation and have come to this conclusion that ML and GLS are usually used for data which have got a normal distribution and their coefficients and errors are independent. ADF are most used for the data which have got an abnormal distribution. This method is used for the samples with more than 2500 observations. Ullman has declared that the best estimators for the data of abnormal distributions and error terms dependency is ML method.

Maximum Likelihood:

$W=\Sigma^{-1}, pF_{ML}=log|\Sigma|-log|S|+tr(S\Sigma^{-1})-p$ (1)

In this equation $=\Sigma^{-1}$, and p indicates the number of observable variables.

Generalized Least Squares (GLS):

$$W \quad F_{GLS}=\frac{1}{2}tr[([S-\sum(\theta)]W^{-1})^2] \qquad (2)$$

That, *tr* shows the factor which is the sum of the elements in main diagonal matrix.

W^{-1} is the optimal weight which must be determined by researcher.

Asymmetric distribution Free (ADF):

$FADF=[S-\sigma(\Theta)],W^{-1}[S-\sigma(\Theta)]$ (3)

W in this function includes all of the elements which are derived from the highest statistical degree.

In order to study the internal stability of the questionnaire, Cronbach's Alpha coefficient was used.

$$\alpha=\frac{k}{k-1}(1-\frac{\sum s_i^2}{\sum s_{sum}^2}) \qquad (4)$$

K is the number of questions

S^2_i is the variance of i th question

S^2 *sum* is the sum of the values of question's variance and covariance matrix

Cronbach's alpha coefficient varies between zero and one, that zero means lack of internal stability of questions and one means complete internal stability of a set of questions related to a fundamental concept. The validity of the questionnaire was examined using the theories. The results of validity testing showed a Cronbach's alpha coefficient of 0.906 which means a high validity of the questionnaire. Collecting information was fulfilled in supplementary phase through questionnaire and the questionnaires were sorted based on Likert scale.

Data distribution testing:

To perform the statistical methods and evaluating the appropriate statistics and a rational inference about research's hypotheses, the most important thing is to select a suitable method to the research. In that case being aware of data distribution is very important. In this case if the data are quantitative or ordinal we use Kolmogorov-Smirnov test and for two stages nominal data we use binominal test and for the data with more than two stages we use Chi-square test for compliance of distribution. Now according to the table, looking at the number corresponding to Sig., if the number is less than the target P, which is usually P=0.05, then we have an abnormal distribution, but if it is equal to P or more than that, then we have a normal distribution. In testing the ordinal data according to Kolmogorov and Shapiro test, we have got an abnormal distribution. It is the same for the

nominal data and the distribution is abnormal. So, the method which was used in this study is maximum likelihood.

CONCLUSION

The data mentioned on the arrows connecting the latent variable to the observed one, are the factor loadings. The factor loadings between 0.3 and 0.6 explain a good estimation and the factor loading between 0.6 and 1.00 explain the best estimations. In fact, the more is the factor loading and the closer it is to 1, the better the observed variable will explain the independent variable. All of the estimated coefficients of economic variables are able to explain the latent variables by the observed ones. The negative sign of a coefficient shows a negative and inverse relationship, which we are going to analyze them. The variable of willingness to invest in the village has got a statistics about -5.10, and as it was mentioned above, the negative sign shows an inverse relationship between the latent variable and the observed variable. In this case, due to the questions answered by people, 0.75 % of people have willingness to invest in the village, but some factors like, lack of trust, lack of economic advantages, and deficiency of facilities, caused a less attempt of villagers in that case. The cultivated area and the crops and fruit yield were the other economic variables were considered in this study. Most of the lands in the region are being used by small holders so, they are being used to satisfy the individual's needs, and so, economic production with a high yield is very limited in the region. In this part, we are going to analyze the coefficients of environmental variables. 46.8% of villagers declared that the climate changed and the humidity increased in the region, however this variable is not known as an appropriate variable to describe the latent variable of environment. 62.8% and 63.3% of people agreed with this idea that the environmental damages and contaminations have been increased in the region, but such these damages are because of the tourists and not the dam construction, so such these damages can be considered as the outcome of dam construction. Another factor which was considered was the increase in water resources for irrigation, but since several years ago the water resources have been declined. 64% of villagers were against this concept that the agricultural water has been increased. However this variable was not known as an appropriate variable to explain the environmental latent variable. In the case of destroying the local plants, about 44% of population disagreed, 33% almost agreed, and 31% agreed with this hypothesis. According to the table the statistics of this coefficient is negative, as a reason, it can be said that the majority of population, were against this hypothesis. It is the same for the animal residential in the region. As it is shown in the table the estimated coefficient of the variables like, age, housing status, immigration to other cities, the quality of public participation in dam construction, the influence of dam on region's development, are the variables which can well explain the social latent variable which has got a positive and significant relationship with the latent variable. 50% of people are older than 55 years old and they are farmers and whose educational level is less than diploma. About 98% of people claimed that they are not investigated in constructing projects. The results of path analysis method, confirm such this claim. And the negative sign indicated the absence of investigation of local people. Regarding to the rural activities before and after dam construction it can be said that the rural main activities before dam construction were, farming 44%, husbandry 27%, after dam construction they faced a decrease about 20% and 5% for farming and husbandry respectively. In that case the villagers said that their activities have been stopped because of dam construction. As a reason it can be said that while constructing the dam, lots of farms and gardens were sunken and consequently their activities have been stopped. About the husbandry activities it can be said that regarding to the grasslands who supplied the livestock's feed, after dam construction they have been sunken, and it got more difficult than before to supply the livestock's feed and that caused stopping their activities. From 13.5% of livestock farmers, 20% have declared this subject. It must of course be mentioned that even before dam construction, because of the mountainous characteristics of the region, the feed supplying was difficult. But after dam construction this issue has been enhanced. The estimated

coefficient of path analysis confirms that issue. About the variable of dam construction effect on economic, social, environmental development of the region, 34.4% of villagers declared that the dam construction had no positive effect on region's development. 14.3% of villagers have participated in dam construction and 85.8% of them have not. As it is shown in the table the estimated coefficient confirm well this subject. The estimated coefficients due to the reason "why have you participated in dam construction?" are zero and negative, that according to people's opinions it can be analyzed that most participation has been in land transfer and they are not satisfied with it, because most of the lands have been transferred compulsorily. The negative sign confirms such this dissatisfaction of land transferring and the value of zero indicates the very low percentage of people's participation in this subject. About the variable of "why haven't you participated in dam construction?" the estimated coefficient is about 0.01, the positive sign confirms the alignment between the observed variable and the latent variable. This estimated coefficient is small, due to people's feedback it might be analyzed in that way that about 50% of people said that they have not been asked to take part in dam construction. About the variable of villagers' participation in dam construction, 187 persons or in other words, 46.8% of villagers have not taken part in dam construction. The positive sign of this variable has no contradiction with the variable of "why haven't you participated in dam construction? This will confirm the previous issue that, neither the people aimed to take part in dam construction, nor did the authorities want them to do so. One of dam construction's outcomes in each region is job creation, but in constructing this dam no native labor was asked to take part and no employment has been created to the local people. In fact, all of these subjects are effective in people's dissatisfaction. In the topic of social variables the general attitude of villagers was asked and the estimated coefficient of path analysis is about -0.04. in this case about 45% of people declared that the environmental damages of dam construction were too high to be compensated and the negative sign shows such this dissatisfaction. In order to study the amount of development and to show the positive or negative changes of dam construction, the creating index method has been used. So, we considered an index to each question, thus, the indices above the value 3, are the appropriate indicators of development. The index of each variable is shown in the table.

RMSEA index

As it was mentioned before, so many indices can be used in model fitting. One of the most important indices is RMSEA index. Due to the importance of this index, right after evaluating the factor loading, this index it is shown below the graph. According to the results, the RMSEA index is about 0.086. Since the value is less than 0.1, so the model fitness is desirable.

Suggestions

According to the investigations, in general the outcomes of dam construction are: the region has developed economically and this development is obviously observable along the region. The region's environment has been damaged both because of dam construction and the tourists.

A considerable economic development is seen in the region but the issue is that despite such this economic development the people don't desire to invest because of lack of trust, deficiency of facilities and etc. So it is suggested to the region with such potential, be provided by necessary capacities to investment including: improving the facilities, increasing the villagers trust in the region, in order to not to lose the investment's opportunities.

Besides supplying the drinking water to Teheran and irrigation water to Qazvin fields, paying more attention to the problems of local people in supplying the agricultural and drinking water, is suggested.

According to the capacity of region it is suggested to plant the trees with high yield, and to construct the infrastructures facilities like the roads, and to decrease the transportation costs and to take the right policies which can lead to region's development and removing the problems like income deficiency, and increasing the production of fishery and gardening and farming.

Creating processing industries in the region is

suggested to increase the production and the value added in order to job creation.

Making a suitable context is suggested in order to achieve the sustainability and preserving the present and the future value of natural resources.

To supply the more income to the farmers, trying to identifying, introducing and promoting the suitable cultivars due to the regions situations and not to use the inappropriate and weak cultivars in the region, is suggested.

Creating capacities is suggested to attract more tourists and using the income caused by tourists in civil development and village buildings.

It is suggested to Increase the leisure facilities and to supply the target market of agricultural and husbandry's products which is effective in increasing the villagers' income and in decreasing the immigration to other cities in order to find jobs and income.

It is suggested to attract the villagers, and to create the facilities and to provide the credits in gardening and husbandry (industrial or semi-industrial), and to take the right policies to attract the young labors and to apply them in generating businesses in order to prevent their immigration to other cities.

REFERENCES

1- Applied Economics Association. (2009). AAEA & ACCI Joint Annual Meeting, Milwaukee, Wisconsin, July 26-29.

2- Azizi Khalkheili, T., & Zamani, GH. (2010). Factors affecting farmers' participation in irrigation management: Application of Path Analysis, Journal of Economics and Agricultural Development, Agricultural Science and Technology, 24: 83-90.

3- Bart, J., & Earnest, SL. (1998). Relative importance of male and territory quality in pairing succes of male rock ptarmigan. Behavioral Ecology and Sociobiology 45: 355-359.

4- Bodaghpour, S., & Jadidi, A. (2008). Environmental impacts resulting from the construction of Mijran dams, fourth national congress on civil engineering, Tehran University.

5- Borimnejad, V. (2006) .Factors affecting the technical efficiency of wheat farmers in Qom (a mixture of stochastic frontier model and path analysis), and development Agricultural Economics, 53: 23-39.

6- FalsafiZadeh, N., & Sabohi Saboni, M. (2010). Determine the optimal harvest of peripheral run off water from Kor river basin, dam Dorovdzan. Journal of Economics and Agricultural Development (Agricultural Science and Technology), 24: 415 – 424.

7- Haji Rahimi, M., & Torkamani, J. (2003). Investigation role of agriculture in economic growth model using path analysis, and Development Agricultural Economics, 41 - 42: 71-83.

8- Hearnshaw, E., Cullen, R., & Hughey, K. (2010). Ecosystem services review of water projects, Australian Agricultural and Resource Economics Society Annual Conference.

9- Holy, RH. Structural Equation Modeling. SAGE Publications, Inc. Thousand Oaks, CA. 1995.

10- Jaffari Eskandari M. (2011). Determine the causal relationship of science and technology development in the private sector industrial processes using path analysis, Journal - Science and Technology Policy Research, 4: 41-51.

11- Kalantari, KH., & Ebrahimi, M. (2005). Factors affecting the absorption of tea to Irrigation Associations case study: city clones, Journal of Agricultural Science, 36(5), 1273-1282.

12- Kelloway, EK. (1998). Using LISREL for structural equation modeling. Sage publications, inc. thousand oaks, CA.

13- Yoon, L., Yoon, T., & Shah, F. (1987). Economics of integrated watershed and reservoir management agricultural.

14- Loehlin, Jc. (2010). Latent variables of model. Lawrence erlbaum associates, inc. Hillsdale, NJ.

15- Ross, C., & Hearn shaw, E. The sustainability and Cost-Effectiveness of water storage projects on canterbury rivers: The Opihi river case, New Zealand Agricultural and Resource Economics Society Inc.

16- Tompkins, J. (2011). Evaluating the sustainability of impounded river systems and the cost-effectiveness of Dam projects: An ecosystem services approach, 55th Annual AARES national conference.

17- Ullman, JB. (1996). Structural equation modeling (In using multivariate statistics, third edition, B.G. tabachnik and L.S. fidel, Eds.)

18- Yavari, GH., Khalili, M., & Mirkiaiee, H. (2006). Social and economic effects of national projects Hablehrud PRA method village branch pilot city (village case study Behvard).

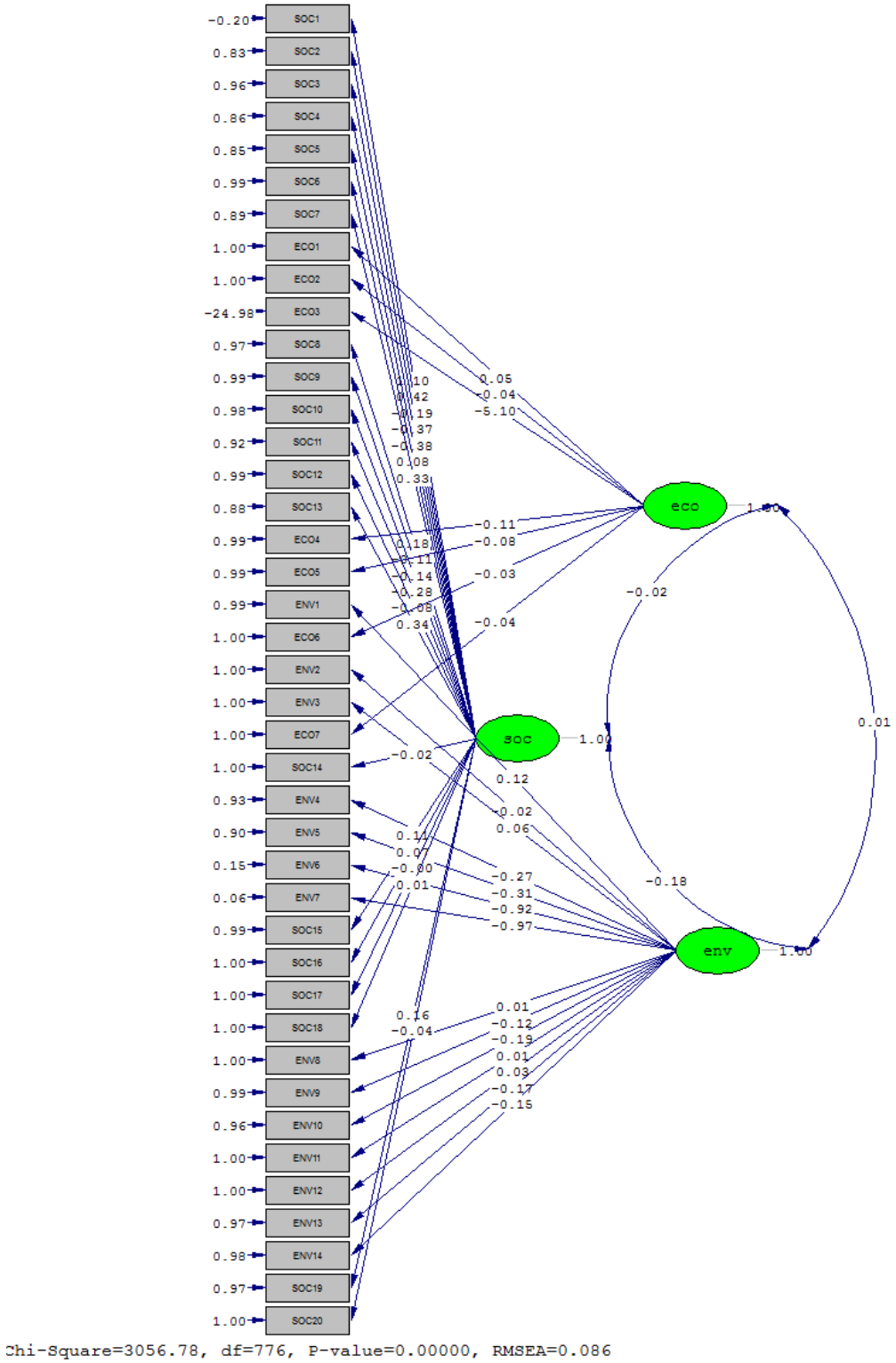
Appendices

Table 1: Indicators of environmental variables and sample size estimation

Variable	Estimated parameters	Results
Climate Change	4.06	Since the estimate of the index is greater than can be said about the climate change hypothesis is correct.
Environmental damage	4.30	Since the estimate of the index is greater than can be said about the hypothesis was correct environmental damage is imported.
Environmental pollution	4.2	Since the estimate of the index is greater than can be said of environmental pollution based on hypothesis were accurate.
Increasing water	1.6	Since the estimate of the index is smaller than can be said about the hypothesis of water resources have not increased due to the construction of dams and water resources have not increased.
Dispersal of animal species	3.2	Since the estimate of the index is greater than can be said about the dispersal of animal species hypothesis is correct. Because the index is lower than the estimate of assumptions regarding the dispersal of species of birds can be said is not correct.
Dispersal of bird species	2.7	Since the estimate of the index is smaller than can be said concerning the loss of plant species hypothesis is not correct.
The loss of plant species	2.7	Since the estimate of the index is smaller than can be said about the hypothesis of socio - economic development - it is not proper environmental dam has not had a positive impact on regional development.
Socio - economic development - environmental	2.4	

Table 2: Tests for determining the distribution of normal and abnormal kolmograph ordinal variables.

Shapiro-Wilk			Shapiro-Wilk			
p-value	df	Statistic	p-value	df	Statistic	
0.000	389	0.785	.000	389	0.265	Climate change
0.000	389	0.649	.000	389	0.358	Environmental damage
0.000	389	0.651	.000	389	0.364	Environmental pollution
0.000	389	0.655	.000	389	0.378	Water resources have increased
0.000	389	0.899	.000	389	0.173	Animal species scattered
0.000	389	0.893	.000	389	0.151	Species of birds scattered
0.000	389	0.884	.000	389	0.156	Native plant species have disappeared


SOC1
SOC2
SOC3
SOC4
SOC5
SOC6
SOC7
ECO1
ECO2
ECO3
SOC8
SOC9
SOC10
SOC11
SOC12
SOC13
ECO4
ECO5
ENV1
ECO6
ENV2
ENV3
ECO7
SOC14
ENV4
ENV5
ENV6
ENV7
SOC15
SOC16
SOC17
SOC18
ENV8
ENV9
ENV10
ENV11
ENV12
ENV13
ENV14
SOC19
SOC20
eco
soc
env
1.00
0.01
-0.02
-0.18
Chi-Square=3056.78, df=776, P-value=0.00000, RMSEA=0.086