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Notes

Water economic valuation of Solís Dam for agricultural use

Valoración económica del agua de la presa Solís para uso agrícola

Juan Trujillo-Murillo[1], ORCID: https://orcid.org/0000-0001-9962-9017

Arturo Perales-Salvador[2], ORCID: https://orcid.org/0000-0002-7225-4574

[1]Universidad Autónoma Chapingo, Texcoco, State of Mexico, Mexico, juan_trujillo1989@hotmail.com

[2]Universidad Autónoma Chapingo, Texcoco, State of Mexico, Mexico, adelin21@hotmail.com

Correspondence author: Juan Trujillo-Murillo, juan_trujillo1989@hotmail.com

Abstract

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The main objective of this research was to estimate the economic value of the water of the Solís Dam, ubicated in Acámbaro, Guanajuato, Mexico. The valuation method used was the contingent valuation, through the estimation of the willingness to pay (WTP), using applied surveys to agricultural producers who live near to the Solís Dam and use the water from it to irrigate their crops, and were considered the variables: price, income, education, perception and age. A total of 50 surveys were applied on December 2017. The data were analyzed and processed using a Logit binomial model whit the *N*-Logit software. The WTP estimated in the study area was $1/m^3. The most important variables were price and income; the average age was 36 years, and the education level were high school and university.

Keywords: WTP, Binomial Logit Model, contingent valuation.

Resumen

El objetivo principal de la investigación fue estimar el valor económico del agua de la presa Solís, ubicada en Acámbaro, Guanajuato, México. El método utilizado fue la valoración contingente, mediante la estimación de la disposición a pagar (DAP), a través de una encuesta aplicada a productores agrícolas que habitan en la zona aledaña a la presa Solís y que utilizan el agua de dicha presa para el riego de sus cultivos; se consideraron las variables precio, ingreso, educación, percepción y edad. Se aplicaron 50 cuestionarios para la encuesta, que se llevó a cabo en diciembre de 2017. Los datos se analizaron y procesaron usando un modelo binomial *Logi*, con el *software N-Logit*. La DAP estimada en el área de estudio fue de $1/m^3$. Las variables más importantes fueron precio e ingreso; la edad promedio de los encuestados fue de 36 años, y su escolaridad fue medio superior y superior.

Palabras clave: DAP, modelo *Logit*-binomial, valoración contingente.

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Introduction

The global water problem is due to multidimensional factors, which suggests that the possible solutions must contemplate a wide spectrum of actions aimed at guaranteeing a complete and effective solution. The increase in the water demand for food production decreases the availability of the liquid for its alternate uses, which makes it a scarce resource. In addition, the biofuels production leads to greater pressure on the resource. Thus, the agricultural sector uses approximately 70% of all freshwater withdrawals in the world, and more than 90% in most of the least developed countries (WWC, 2015).

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Therefore, the water problem as a productive resource is mainly in the primary sector (agriculture and livestock), this implies that efforts to solve it must focus on this sector, by improving the processes according to water optimization, including the use of better irrigation systems in agriculture. In Mexico the problem is similar, so in 2014 the 76.7% of the consumptive water was absorbed by the agricultural sector, 14.2% by the public sector and only 4.2% by the industrial sector (Semarnat, 2015).

The conditions and levels of water use in each country depend on the requirements of the products that are produced internally, so to analyze the situation of the water resource, the kind of the production in primary sector must be considered. In general, Mexico (in its primary sector) is a cereals, meat, milk and eggs producer which are the products with the highest demand for water during its production. Cereals, meat and milk are the products that need more water. Thus, 27% of the water goes to the cultivation of cereals, 22% to meat and 7% to milk. Within these products: 1 kg of beef requires 15,000 liters, 1 kg of chicken meat 6,000 liters, 1 kg of cereals 1,500 liters, 1 kg of citrus fruits 1000 liters and 1 kg of legumes and tubers 1000 liters (FAO, 2015).

Thus, the production of biomass and food through the chlorophyll function requires large amounts of water to transform atmospheric CO2 into organic matter, through rainwater, surface or groundwater. The production of one kilogram of wheat requires a cubic meter of water and one of meat requires 15 m^3. The water needed to produce a good or service is what is usually called virtual water (Madurga, 2005).

In some states of the republic, there are serious problems regarding the use and availability of water, either because of its geographical location (the remoteness of the coasts, rivers and dams) or because of the costs that its use represents; mainly those that are located in the northeast, center and north of the country such as Baja California, Valle de México and the states with problems of high water pollution such as Guanajuato. In the case of the state of Guanajuato, most of its territorial extension is within the Lerma-Santiago-Pacífico region, which gives it a high availability of water compared to the country's average. However, there are problems that drastically reduce their real water availability, such as the fact that their annual average rainfall is below the national average and a high pollution of their rivers.

Precipitation levels are a problem with geographical and natural origins, so the possibility of action is reduced. However, the contamination of its water resources is an anthropogenic problem, so the society actions in order to decrease pollution is an important option. Beyond recovering contaminated water resources, it is urgent to optimize the resources that are still available for agriculture use and other economic sectors, under the premise that excessive use of the remaining resources can lead to a general shortage of water in the area.

The municipality of Acámbaro is geographically located in Guanajuato state, in Mexico. It is on 1,849 meters above sea level. The municipality is 173 km from the capital. Its ubication is on 100º 30′ 06″ and 101º 00′ 00″ west longitude and 19º 55′ 42″ and 20º 12′ 16″ north latitude. Acámbaro borders to the north with the municipalities of

Tarimoro and Jerécuaro, to the south with the state of Michoacán, to the east with Tarandacuao and to the west with Salvatierra (Saucedo, 2015).

There is in Acámbaro one of the most important dams in the country due to the producer's dependence on its water for the irrigation of their crops and other activities necessary for their subsistence (Figure 1).

Figure 1. Location of the Solís dam (Conagua, 2016).

Some questions derived from the problem detected are: How would the economic valuation of water in the Solís dam affect its rational use in the agricultural sector in the municipality of Acámbaro?, from this question derives the objective of generating a valuation Water economy in the area; also how would the research impact on the well-being or income of Acámbaro producers? And what optimization strategies could be implemented? From these questions emerges the secondary objective to propose water optimization policies, which leads to the following question regarding to what rates would be appropriate for the study areas? To answer that question will be used the willingness to pay for the use of water from the dam by farmers in the area; In general, these are the questions that guided this research.

The main objective of the research is to calculate the real value of water as a productive factor through contingent valuation, at the Solís Dam in Acámbaro Guanajuato. As well as, to propose strategies for optimizing water use in agricultural activities in Acámbaro, Guanajuato. In relation to the objectives, the presented hypothesis is that the current value of irrigation water would be below its real value, since only extraction and/or conduction costs are considered, and negative externalities are not considered. The second hypothesis is that, when its paid is below than real price, irrigation water is not being used optimally, so its future availability becomes more limited and uncertain.

Methodology

The water value for irrigation of agricultural crops in the study area was calculated using the Contingent Valuation Method where the result of the theoretical valuation was contrasted with the value assigned, that is, its market price. Field work, through surveys applied to agricultural producers who live in Acámbaro Guanajuato in the area near the Solís Dam and who use the water from said dam to irrigate their crops, was the main source of information for the collection of the necessary data for the application of the valuation method, considering that the surveyed producers use gravity irrigation when obtaining the water from the dam and that the main crops are corn, beans and sorghum.

The contingent valuation method is a hypothetical and direct method based on the information revealed by the economic agents involved who are surveyed when asked about the valuation of the environmental good. A fundamental element of this method is the questionnaire that collects information on the valuation of the environmental good (Novoa-Goicochea, 2011). From an economic perspective, the CVM is based on maximizing the utility of respondents, where the utility function of individuals is defined for market and non-market goods, configured by quantities, prices and other attributes (Aviles *et al*., 2010). The CVM allows to build a hypothetical market that simulates the transactions that occur in a real market to obtain the measures of welfare change; market in which individuals must express their maximum willingness to pay (WTP) for carrying out a certain policy or action (Del Ángel, Rebolledo, Villagómez & Zetina, 2009). The idea is to quantify the average WTP as an approximation of well-being that reflects user preferences. For this purpose, there are three types of formats: open format, auction format and referendum format, the referendum format being the most used in contingent valuation studies. The main feature of this format is that the individual is left alone with the problem of deciding whether he is willing to pay a certain amount for accessing the benefits of the environmental policy offered. In this event, all possible positions or proposals of the pollster are randomly distributed among respondents (Tudela, 2011).

For this study the endogenous variables were proposed based on scientific works of the same nature where it was found that the most representative variables in models that estimate WTP are income, educational level, perception and age. Some of these works, in the international sphere, are the one of Aguirre (2015) carried out in Chile, where it determined that the variables such as income, years of education, marital status, sex and knowledge of the subject affect the result of the research. In the case of the variable perception, Salazar (2001), in its study carried out in Spain on the WTP due to environmental improvements, it states that the previous information on the asset being valued influences through a positive relationship on the WTP. Similarly, Novoa-Goicochea (2011) evaluated the WTP by protected areas in Peru, obtaining that the most relevant variables are Price, Age, Income and Education. More recently regarding the water issue, Tudela (2017) evaluated the WTP for water treatment in Peru, concluding that there is a positive WTP of $ 4.30 per household, where the variables that most influence are the rate, the environmental problem, the Health, income and education. In the case of Mexico, recent studies on the application of the contingent valuation methodology have yielded results with positive WTP. An example is the investigation of Vázquez (2012) carried out in Veracruz, finding that 69% of the participants agreed to pay a premium for an improvement in the cultivation of agricultural products between

10% and 40% of price premium, where the most important variables are price, age, sex, educational level and income. Another is the case of Valdivia, García, López, Hernández and Rojano (2011), where the WTP is estimated for the conservation of the Axtla river located in San Luis Potosí and it is concluded that there is an average positive WTP of $ 57/month where the variables family income, education and pollution involvement. Another case is that of Medina (2014) where he states that consumer behavior is strongly affected by age and environmental concern. A strong case is that of Silva, Pérez and Návar (2010), where a positive WTP was obtained by 100% of the respondents.

Regarding the valuation of water in Mexico (Avilés *et al*., 2010), carried out in Baja California, it was determined that the levels of water availability have an inverse relationship with the WTP, where the most relevant variables are the rate, income , education and water availability. In this same sense, Sandoval *et al*. (2016) estimated the WTP for water consumption in the Iztapalapa delegation in Mexico City, obtaining an average for the WTP of $5 bimonthly where availability, quality and the price of water are the most representative variables, as well as socioeconomic variables such as age, education and sex. On the other hand, Del Ángel *et al*. (2009) carried out the valuation of the hydrological environmental service in the domestic sector of San Andrés Tuxtla in the state of Veracruz, obtaining a positive WTP associated with certain characteristics of the population like income, school price and age. Similarly, Jaramillo, Galindo, Bustamante and Cervantes (2013), generated an economic valuation of the water of the Tlapaneco River in the state of Guerrero obtaining a positive WTP where the monetary amount they would be willing to pay to improve the water quality of the river, the average was \$132.9, with minimum and maximum values of \$40 and \$300, a median of \$100 and a standard deviation of 65.7, where the most representative variables were age, sex, income, schooling and water price. From this perspective, utility, income, educational level, perception and age are the variables contemplated in the model. Considering utility as the dependent variable, the explanatory variables determine the level of well-being generated by the consumption of the evaluated good, in this case the water for irrigation from the Solís Dam.

If the user agrees to pay an amount of money P to maintain the proposed stage, it must be met that: $V1(Q = 1, Y - P; S) - V0(Q = 0, Y; S) > e_0 - e_1$. Where the terms e_0 and e_1 independent and identically distributed random variables. The utility change experienced by the user will be equal to the difference between the final utility function minus the initial one; To access the utility in the final situation defined by the proposed stage, a certain amount of money proposed by the interviewer must be paid. Simplifying the notation: $\Delta V = V1(Q = 1, Y - P; S) - V0\,(Q = 0, Y; S)\, y\, h = e_0 - e_1$. The answer of the YES/NO respondent is a random variable. Therefore, the probability of a positive response from the user is given by the following expression: : $Prob(SI) = Prob(h \leq \Delta V) = F(\Delta V)$. Where F is the cumulative distribution function of h. By choosing a distribution for h, and properly specifying V, the parameters of the difference indicated by ΔV can be estimated with information on the amount of payment required of individuals, the answers to the binary question and information about the socioeconomic characteristics of the respondents (Tudela, 2011).

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Based on the current methodology used in recent studies such as Trujillo, Hernández and Martínez (2019), the explanatory model of the research is presented as a binary choice model, where the probability that the WTP is positive depends on the value of explanatory variables:

$$Prob\ (SI) = \alpha 0 + \beta\,(\text{price}) + \alpha 1\,(\text{income}) + \alpha 2\,(\text{age}) + \alpha 3\,(\text{perception}) + \alpha 4\,(\text{education}) + \varepsilon\text{t}$$

Where the variable *Prob* (YES), represents the probability of a positive WTP, in this case the willingness to pay for the use of water from the Solís Dam. The price variable expresses the simulated price for the use of water. The income variable refers to monthly family income. Education is determined by the highest academic degree the respondent has. Finally, the perception variable contemplates the knowledge of the water situation in the region. Thus, the individual WTP for the use of water from the Solís Dam depends on the proposed price, its level of income, its level of education and age. In this investigation, the valuation method used was the contingent valuation through surveys applied considering the variables Income, Education, Perception and Age. The main objective of the method is to establish a price that represents the value of the good in question through the amounts expressed by the respondents, considering that if the market of the good existed the price that they would be willing to pay would be the market price of the well (Trujillo *et al*., 2019).

The questionnaire used to collect information through the application of the contingent valuation method consists of four sections; The first section deals with the recognition of the good under study and the relationship of the respondent with that good, the second section investigates the perception of the respondent about the use of the good in question, the third seeks to obtain the willingness to pay (or be compensated) for the use of the good and the final section is about the socioeconomic characteristics of the respondent.

The first section, called recognition questions, explores the respondent's knowledge about the object of study. The respondent is questioned about the amount of water he uses to irrigate his crops, the origin of that water, the costs of water in the area and the availability of water for irrigation in the region. An attempt is made to inquire into his opinion regarding the correct use of water, that is to avoid waste, and its degree of concern in the subject.

The second section called perception questions focuses on the use of water in the production process by the respondent.

The third section proposes different rates to be paid for the use of the Solís Dam water to produce agricultural crops.

Finally, the socio-economic variables of the respondents are explored, such as the level of income, education, sex, marital status and age, to relate them to their WTP. The survey format carried out is set out in Annex 1.

Based on the answers obtained in each block, a relationship is established between the willingness to pay expressed by the respondents and their socioeconomic attributes. Using a Logit-Binomial model, an average value of WTP is estimated by water users. The statistical procedure performed to carry out the calculations and estimates of the values corresponding to all the variables that are incorporated in the model or that intervene in some way in it, is oriented to extrapolate the responses of the population sample to the total population . Under this consideration it is necessary to consider the level of error not only methodological but also statistical when interpreting the results. A total of 50 surveys were applied in December 2017, under a simple random sampling scheme with infinite population. The data were analyzed and processed using a Logit binomial model with the N-Logit software.

Results and discussion

A binomial code was used to record the level of studies of the respondent and was recorded considering the numbering 1 = Primary; 2 = Secondary; 3 = High school; 4 = University; 5 = Postgraduate. The income level was recorded using the income ranges: 1 = < $4 000; 2 = $4 000-$8 000; 3 = $8 000-$12 000; 4 = $12 000-$ 18 000; 5 = $18 000-$25 000; 6 = > $25 000. The upper limits of each income level were considered as part of the following stratum. The age variable was

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recorded as an ascending linear variable (18, 19, 20, 21,...). The categorization of the variables by strata was recorded using a numerical code which is presented through Table 1.

Table 1. Response registration code.

Code	Education	Price ($/m^3)	Income ($)	Age*	Perception**	WTP
1	Primary	0.5	< 4 000	18	Broad	YES
2	Secondary	1.0	4 000 - 8 000	19	Moderate	NO
3	High school	1.5	8 000 - 12 000	20	Low	
4	University	2.0	12 000 - 18 000	21	Null	
5	Postgraduate	2.5	> 18 000	…		

*The age variable by its nature includes a range of 18 to 90.

**Knowledge of the subject

The endogenous variables of the model required to be expressed in numerical terms in order to be entered and analyzed in the data processing software. The categories of each variable were expressed through strata, generally 5, responding to the values contained in each variable and the number of possible answers in the questionnaire. The results of this procedure are shown in Table 2.

Table 2. Descriptive statistics.

Variable	**Mean**	**Dev. Est.**	**Minimum**	**Máximum**	**Cases**
Age	36.361	14.501	17	74	50
Education	4.055	1.607	1	5	50
Income	2.5	1.855	1	6	50

The 93% of the agricultural producers of Acámbaro who were surveyed were men and the remaining 7% were women, which is partially predictable since currently in the country the stratum of the population employed in the primary sector is mainly composed of male individuals. Due to the nature of the research, the sex variable is not very representative, however, it was included due to the results in other investigations where the WTP applied to water issues such as that (Flores, González, & De los Santos, 2010), where 42% of those involved were women and 58% men. These data can be seen graphically in Figure 2.

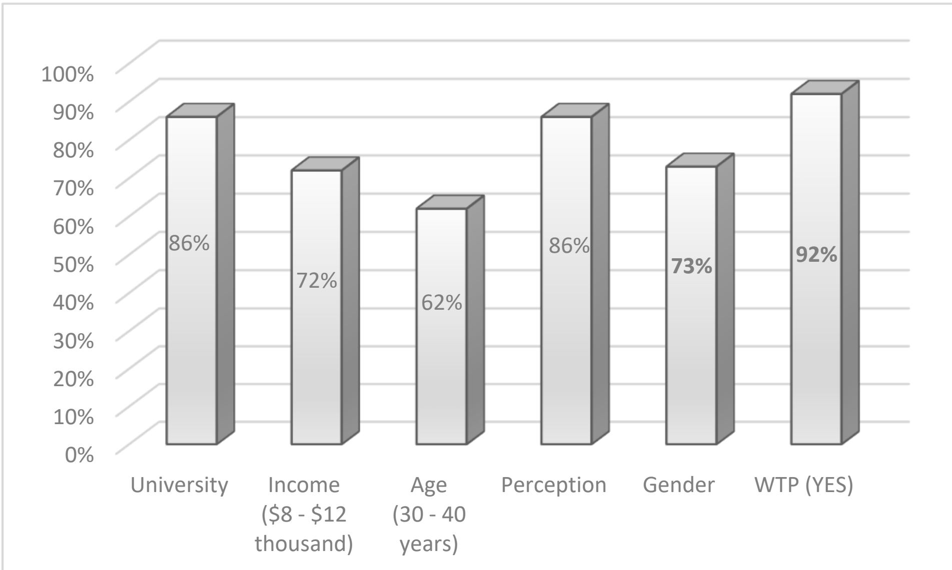

Figure 2. Average values of the variables. Own elaboration.

The average age of the respondents was 37 years, this shows that the individuals that make up the subsector of agriculture in the studied area are young adults unlike the national average, this is very close to the result obtained by Flores *et al*. (2010) where an average age of 36 years was obtained, as was the case of Del Ángel *et al*. (2009) with an age range of 26-35 years. The average level of education of the respondents was Preparatory, this result presents a general approximation of the educational level of the farmers in the study area, which should be taken into account when implementing policies oriented to the sector in the sense of the form and means to reach the target population. This result regarding the level of studies is like that obtained in the work of Flores et al. (2010) where most of the respondents had studies of upper and upper

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middle level. Finally, the average monthly income of the respondents was \$8000 to \$12 000, this is simply explained by the levels of costs and productivity in the plots related to the average rural prices at which the product is bought from the farmers in the area. Works such as Flores *et al*. (2010) reported an average income of \$11,000; Avilés *et al*. (2010) obtained an average income of \$8 000 and in turn; Del Ángel et al. (2009), an average income of \$7 000. The results of the coefficients for the model are expressed in Table 3.

Table 3. Proposed model for WTP.

Variable	Coefficient	Dev. Est.	*P* (IZI > *z*)	Mean of *X*
Constant	-0.459	2.562	0.800	
Price	-0.0406	0.192	0.658	1.500
Age	0.058	0.026	0.061	36.361
Education	0.319	0.282	0.500	4.055
Income	-0.06	0.247	0.761	2.500

The results of the coefficients are generally presented as expected based on the theory. In the case of the price variable, there is an inverse relationship between the price of water and the availability to pay an extra amount for the resource, in this sense a price below the real value of water leads to a greater willingness to pay for water. The age variable shows a positive relationship between the respondents' years of life and their willingness to pay for access to water to irrigate their land. Although there is no standard deviation of the average age considerable enough to extrapolate results since most respondents were around the middle ages. The level of education in contingent assessment studies always shows a positive relationship with respect to the WTP, this is explained by the level of social and economic awareness that represents the academic preparation and civic education that is promoted in schools. The partial effects of the model variables on the WTP in terms of probability are presented in Table 4.

Table 4. Binary choice model predictions.

Real value	**Predicted values**		**Real total**
	0	1	
0	(1.4%)*	(18.1%)	(19.4%)
1	0 (0%)	(80.6%)**	(80.6%)
Total	(1.4%)	(98.6%)	(100%)

** Correct negative predictions = total 0s correctly predicted * Correct positive predictions = total 1s correctly predicted.

The inaccurate aspect of opinion surveys and their relationship with the values obtained with the methodology is presented more clearly analyzing the degree of predictability of the proposed model. The model presents 1.4% of correct negative predictions, that only 1% of the agricultural producers surveyed who were expected not to be willing to pay, were not willing to pay. On the other hand, 80% of the agricultural producers surveyed who, based on the model, were expected to be willing to pay, in fact, were. In this investigation a high level of prediction was obtained. The total of correct predictions by the model is 81% and 19% errors in the model predictions. The prediction level of the model for the set of variables is acceptable. The estimated WTP at the Solís Dam located in Acámbaro, Guanajuato was $\$1/m^3$ (Table 5).

Table 5. Descriptive statistics of the WTP.

Variable	Average	Standard Dev.	Minimum	Maximum	Cases
WTP	0.999	0.010	0.5	1.5	50

There is a willingness to pay an average of $\$1/m^3$. That is, agricultural producers who use the water from the dam to irrigate their crops are willing to pay $1 over the price they currently pay per cubic meter of water. This represents the prediction of the hypotheses raised where the agricultural producers surveyed present a positive WTP, suggesting that the current value of water is below its real value, which determines the optimization of its use, this in accordance with what was found with Aviles *et al*. (2010) in the La Paz Baja California aquifer, as with Valdivia *et al*. (2011) on the Axtla River in San Luis Potosí, and Sandoval *et al*. (2016) in Iztapalapa, Mexico City.

Conclusions

The percentage of respondents who revealed a positive WTP was higher than those who said they were not willing to pay an additional amount for the use of water from the Solís Dam, a positive WTP for water use is consistent with the results of the investigations existing on the subject. In this sense, the real value of water is below its real value, which concludes that an irrational use of the resource is being made. This question meets the primary objective of the investigation and in turn answers the question posed at the beginning of which arises such an objective regarding why the economic valuation of water in the Solís dam would have an impact on its rational use in the agricultural sector in the municipality of Acámbaro? Since the valuation exposes the irrational consumption of water and allows to propose strategies combined with routes of action to rationalize its use oriented to optimize the administration of the resource.

The second objective of the research, which talks about proposing strategies for optimizing water use in agricultural activities in the study area, is met through the answer to the questions posed that address the problem related to how would the research impact in the welfare or income of the producers of Acámbaro? And what optimization strategies could be implemented? In addition to what rates would be appropriate for the study areas? To answer the first question, the fact that optimal use of water would reduce costs and increase profits in production systems is resumed, since non-optimal use leads to a decrease in the maximum well-being that producers could achieve, in other words, use it optimally considering its real value would increase the well-being of all the economic agents involved, which answers the first question.

To answer the second and third questions, the fact that, meeting the main objective of the study, it was found that the estimated WTP in the study area was $1/m^3, thus, based on these results, it is proposed to establish a fixed fee that ranges between $1 and 2/m^3 extra to the current cost of water, for the use of the Solís Dam water for agricultural use. From this perspective, considering that the WTP in general was positive, it implies that the majority of respondents see it as a necessity to make a more rational use of water, in this sense an optimization proposal is to implement irrigation systems, for example, the drip irrigation, considering that there is already a disposition to optimize its use.

Another proposal to consider is the awareness and education regarding the means and ways for the correct use of water, this follows from the fact that the education variable showed to have a positive and statistically significant relationship in relation to the WTP, so it has a predisposition to environmental concern. These strategies allow us to fulfill the second general objective of the research and answer the questions generated by the problems addressed in this study.

Considering the high percentage of male respondents, with respect to those involved in the female sex, it is not possible to establish a conclusive relationship between WTP and sex, since any statement in this regard would be affected by a considerable sample mistake. The relationship of the WTP with respect to the variables used was determined. In the case of the variables income, age and educational level, a positive relationship was obtained. In other words, as the individual has a higher income, they are more willing to pay for the use of water, just as if the agricultural producer surveyed is older, their willingness to pay increases and the higher their level of education It will be your willingness to pay.

In the case of price, the relationship is negative, as expected, if the price increases, the agricultural producers surveyed will be less willing to pay. Although this result is a good indicator, the limitations of the study should be considered, since finally these results show a subjective aspect, in the sense that it is an opinion, therefore, the need to deepen the study is considered relevant to determine among other aspects: the actual costs of water supply, if these correspond to what users pay, if there are losses in resource management. It is also relevant to know the environmental impacts generated by the supply. On the other hand, we must evaluate the social aspect and consider the relevance of the food supply, regardless of the costs of using water.

Annexes

Annex 1. Questionnaire for contingent valuation

Block 1. Recognition questions

1. Do you know the Solís Dam?
2. Do you know where the water used to irrigate your crops comes from?
3. Do you know how much (m^3) of water you use in your crops?
4. Do you know the cost of water (m^3) for irrigation in the region?
5. Do you know the availability of water for irrigation in the region?

Block 2. Perception questions

6. Do you consider that there is enough availability of water for irrigation in the area?

7. Do you think the amount of water you use is high or low?

8. Do you use water properly, that is, only the necessary one?

9. Does water count as an input in the production of your crops?

10. What is the quality of water you use in your crops?

11. Could you afford your production without using the water from the Solís Dam?

Block 3. Willingness to pay

12. Taking the above into account, would you be willing to pay a representative amount for the use of the Solís Dam water?

a) Yes_____ (Go to 14) b) No_____ (Go to 13 and then at 16)

13. What is the main reason why you would not be willing to pay?

14. How much would you be willing to pay per m^3 of water?

15. What is the main reason why you would be willing to pay?

Block 4. Socio-economic data

16. Gender: Male_________ Female__________

17. Age: _____________

18. Marital status: Single_______ Married_______

19. Level of studies:

o Primary

o Secondary

o High School

o Bachelor or Postgraduate

o Other (specify) _________

20. Currently what is your main employment situation?

a) Free professional

b) Professor

c) Merchant

d) Employee

e) Farmer

f) Student

g) Housewife

h) Other (specify)

21. What is your family's average monthly income?

Option	Monthly family income
A	Less than $2000
B	From $2000 to $6000
C	From $6000 to $8000
D	From $8,000 to $10,000
E	More than $10,000

22. Number of members in the family?

23. What type of crop does it produce?

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