Article

Agricultural competitiveness and efficient use of water in the Valley of San Quintín, Baja California, Mexico

Competitividad agrícola y uso eficiente del agua en el Valle de San Quintín, Baja California, México

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Abstract

This research presents the validation process for an instrument to measure water use efficiency and competitiveness variables for agricultural enterprises in Valle de San Quintin, Baja California, Mexico. Since the development of the instrument was based on reference desk

research, content validation was performed by applying the model by Lawshe, and modified by Tristán (2008). Later it assessed construct validation using an exploratory factor analysis and, lastly, the instrument's reliability was analyzed by determining the Cronbach's alpha coefficient.

Resumen

En este trabajo de investigación se presenta el proceso de validación del instrumento de medición para las variables uso eficiente del agua y competitividad en empresas agrícolas del Valle de San Quintín, Baja California, México. Desde la elaboración del instrumento con base en la investigación documental de referencia, se realizó la validez de contenido mediante la aplicación del modelo de Lawshe, modificado por Tristán (2008); después se llevó a cabo la validez de constructo mediante el análisis factorial exploratorio y al final se realizó el análisis de confiabilidad de instrumento mediante la determinación del coeficiente del alpha de Cronbach.

Introduction

Water was recognized as a common good by the Resolution of the General Assembly of the United Nations on July 28, 2010 (ONU, 2010), stating that "the right to drinking water and sanitation is a human right for all, to be effective and well-known, and also accompanied by a harmonization of the national and international rules necessary for its universal

application, water can not be limited to being a matter of political, technical and financial authorities: every woman and every man, regardless of their responsibilities, must participate in decisions, contribute to the protection and fair access of all to water, a common good of living beings"(ONU, 2010).

The United Nations (UN) considers the shortage of water to be one of the main challenges of the 21st century, which is affecting many societies around the world. The shortage of water is not only a natural phenomenon but it is also caused by human activities. There is enough drinking water on the planet to supply the 7,000 million people who inhabit it, but it is unevenly distributed, wasted, polluted, and managed unsustainably (ONU, 2014).

As of 2007 in Mexico, the water initiative by the National Water Commission recognizes that achieving the water balance required of surface and underground water bodies in the country in order to meet the demand of all users, including ecosystems, presents a great challenge. The 2013-2018 National Development Plan establishes a strategy to implement sustainable water management, making it possible for all Mexicans to have access to the resource, promoting sustainability without limiting development.

In Baja California, the 2014-2019 State Development Plan's (PED) strategic diagnosis recognizes the need to increase competitiveness as well as take advantage of the water resource and ensure efficiency in its distribution and consumption. In the State of Baja California, water is used as follows: agricultural (81.05%), urban public (11.37%), industry (2.47%), other uses (5.11%) (Conagua, 2013).

The San Quintín Valley is characterized as an important agricultural center for the production of vegetables, and in general those of high market value. Approximately 90% of the crops are exported, mainly to the United States. The valley is totally dependent on the aquifers for production, and it is currently experiencing an economic crisis in the administration of water resources due to the overexploitation of the aquifers and the little investment that there is in the creation of alternatives such as new aqueducts or desalination plants, leading farmers to look for technologies for the use of water (Pombo, 2014).

The problem of water scarcity affects the development of productive activities by agricultural enterprises, mainly in areas such as the San Quintín Valley, Baja California, where aquifers are overexploited and rainfall provides increasingly smaller amounts of water resources. This has forced entrepreneurs to look for alternatives that allow them to remain in the market and try to be competitive. So studying the impact of the efficient use of water resources on the competitiveness of

agricultural enterprises is of particular interest, first, because as a limited resource its use in the productive activities of companies in the region should be optimized and, secondly, in order to promote efficient water use systems that allow sustainable development in the San Quintín valley area.

The objective of this research work is to determine the validity of the content and construct of an instrument to measure the efficient use of water and the competitiveness of agricultural enterprises in the San Quintín valley, by using the Lawshe model (1975), modified by Tristán (2008), along with the opinion of seven experts on the validity of each one of the items that make up the instrument, and then to carry out the analysis of items, determine their correlation and calculate the Cronbach's Alpha for the reliability of the instrument.

Literary review

Baja California has scarce water resources, and the presence of continental aquatic systems —both lacustrine (lakes) and potamological (rivers, streams, springs, etc.)— is limited. Added to this is low rainfall, where under normal conditions rainfall varies from 200 to 300 mm per year in only a small portion of the state, while in the rest of the state it is significantly less, 50 mm per year.

Competitiveness of productive chains

In March 2008, FAO and SAGARPA presented a definition of the competitiveness of an agri-food chain production system, based on that conceived by Esterhuizen (2006), and Monke and Pearson (1989): The competitiveness of an agri-food production system can be defined as the capacity of said system —given its current technology, its inputs and products prices, and the interventions of national and international policies and programs (subsidies and taxes)— to achieve net gains greater than zero, a cost-benefit ratio (RBC) greater than 1, and to be equal or superior to that of other production systems that compete for the use of

the same factors of production (water, land, capital, labor) (Sagarpa-FAO, 2008).

According to Romo and Rivas (2012), competitiveness is related to productivity, so it is necessary to emphasize that a company can be productive and not be competitive, although for a company to be competitive it must be productive. This implies that competitiveness is a more complex concept and, for practical purposes, it can be said that productivity is one of its components.

As Sánchez and Avilés (2012) comment, competitiveness depends especially on the quality of the product and the price level. These two factors in principle are related to productivity, innovation and inflation. It follows from this approach that efforts should be concentrated on increasing productivity and incorporating and developing technology, which is not always achieved by reducing costs or devaluations.

Schwentesius and Gómez (1997) established that the analysis of production costs is one of the methods used to estimate the level of competitiveness between products from two or more regions. The studies that were prepared in preparation for the North American Free Trade Agreement were based, therefore, on this analysis. The results indicated that Mexico, in most cases, had higher costs than the United States of America.

When studying the competitiveness of productive chains, we highlight the influence of the use of limited resources such as water resources. With regard to efficient use of water, we should refer to studies conducted by Donald M. Tate who presents the principles in Table 1.

Table 1. Principles of efficient water use (Tate, 2014).

1	Water use efficiency includes any measure that reduces the amount per unit, that is used in a given activity, and that is consistent with the maintenance or improvement of water quality.
2	The use of water in most socio-economic activities can vary widely, depending on the interaction of many factors.
3	The amount of attention paid to the efficiency of water use is directly proportional to the prices charged for the service.
4	The rise in prices leads to an increase in attention to the characteristics of water use and, in the long term, to a more efficient use.

5	When water prices reflect all the social costs of developing supplies, incentives are created for the efficient and rational use of the resource, reflecting its value in production or in its various other uses.
6	The attitudes, tastes and preferences of the people originate important considerations to achieve an increase in the efficiency of water use.
7	Efficiency in the use of water is partly a response to the property rights that prevail in society. The more private property there is, the more water efficiency practices are used.
8	When resources are evaluated correctly in proportion to their contribution and productivity, there is an incentive, through the forces of supply and demand, to use those resources efficiently through the introduction of technological changes.
9	The quality and quantity of water are closely intertwined, so that actions aimed at increasing the efficiency of water use can have an impact on its quality, and viceversa.
10	The steps taken to improve the efficiency of water use should be formally evaluated by comparing them with the multiple existing criteria.

The principles for the efficient use of water allow highlighting that, as the main user of the resource, the agricultural sector must take actions that enable its optimal use and contribute to a collective benefit.

Method

Kind of investigation

Considering how the data was analyzed, the scope of the research is causal correlational, since the purpose is to show how the variables relate to a given phenomenon and to explain the phenomenon in our context (Hernández, Fernández, & Baptista, 2010). It seeks to explain how the

variable of efficient water use has a direct impact on the degree of competitiveness.

Research design

The research presents a non-experimental, cross-sectional or transverse design, with a correlational-causal analysis and a quantitative empirical approach (Grajales, 2004), since it is intended to objectively measure the variables involved and as accurately as possible.

Population and sample

With regard to the study population, it should be noted that the study unit is the agricultural companies in the San Quintin Valley, Baja California, Mexico. The population was determined according to the information provided by SAGARPA in the Rural Development Support Center (CADER), with a total of 97 agricultural companies. Once the population was determined, the sample was selected, which is a part of the population or universe to be studied (Gómez, 2006). To calculate the sample, a proportion of agricultural enterprises was considered, with a confidence level of 95% and 5% error, by applying the probabilistic method with a stratified sampling based on the size of the agricultural enterprises (micro, small companies, medium and large) as classified by the Ministry of Economy, according to the agreement establishing the stratification of micro, small and medium enterprises (SE, 2009).

Initial model of the measuring instrument

The instrument that was used to collect the data for the pilot test was developed in order to obtain specific information from the study group.

For the selection of some of the items in the instrument, the existence of some statistical data regarding the efficient use of water was reviewed. The instrument that was developed for the study consists of a data section with the characteristics of the agricultural companies and another section with 51 items related to the dimensions of the variables involved.

Characteristics of the measuring instrument

The data collection instrument developed by this research consists of 2 parts. One corresponds to sociodemographic characteristics (15 items) and the other consists of 48 items corresponding to the measurement instrument, with a Likert scale of five options, on Availability, Management, Performance, Irrigation Technology, Price-cost, Productivity and Technological Innovation, which are the dimensions of the efficient use of water and competitiveness variables. The response options range from totally disagreeing, disagreeing, neither agreeing nor disagreeing, agreeing and totally agreeing, assigning values from 1 as totally disagreement to 5 as totally agreeing.

Pilot test

The pilot test refers to the application of the questionnaire in a small sample of respondents to identify and eliminate possible problems. As a general rule, a questionnaire should not be used in a field survey without having been tested. The pilot test should be extensive, all aspects of the questionnaire should be tested, and the respondents should be similar to those that will be included in the actual survey in terms of characteristics, familiarity with the topic, behavioral attitudes and interest (Malhotra, 2004).

The pilot test was carried out with 13 agricultural companies in the study region, and with the data obtained. The database was developed using the Statistics for Social Sciences software (SPSS) version 21.0 for Windows.

Validity and reliability of the instrument

The content validity was assessed by applying the Lawshe model, supplemented by the experience and knowledge of seven experts in the area related to this case. The clarity and relevance of each item was evaluated by the experts. We determined the quantitative index of the content validity based on the model by Lawshe, modified by Tristán (2008), which considers the Content Validity Reason (CVR') with a value equal to or greater than 0.5823. Each expert was given the instrument along with the conceptual and operational definition of the variables involved. The results of the evaluation were collected and the data and information were processed with Microsoft Excel 2010 software. The Content Validity Index (CVI) was determined. In order to determine the reliability of the instrument, the questionnaire was analyzed using Cronbach's Alpha coefficient.

$$CVI = \frac{\sum_{i-1}^{M} CVR_i}{M}$$

Where,

CVRi = Ratio of Content Validity of the acceptable items according to the Lawshe criterion.

M = Total acceptable items of the test.

Collection of data

The primary data collection method was through the survey, through the preparation of a questionnaire-type instrument to be administered to selected agricultural companies in the San Quintín Valley, Baja California, Mexico. Data from secondary sources was obtained through statistics, communications, records, and publications, among others, from official sources, government agencies, and relevant related research. This information will provide support to achieve the expected objectives (Torres, 2014).

Results

Descriptive Analysis

The pilot test was conducted in 13 agricultural companies located in the study region and the main indicators of the sample are presented below.

Figure 1 shows that 38.5% of the agricultural companies surveyed are located in the Col. Vicente Guerrero, 23.1% in San Quintín, 15.4% in Colonet and Camalú, and 7.7% in El Rosario. These zones belong to an area containing overexploited wells with saline intrusion problems (Conagua, 2013).
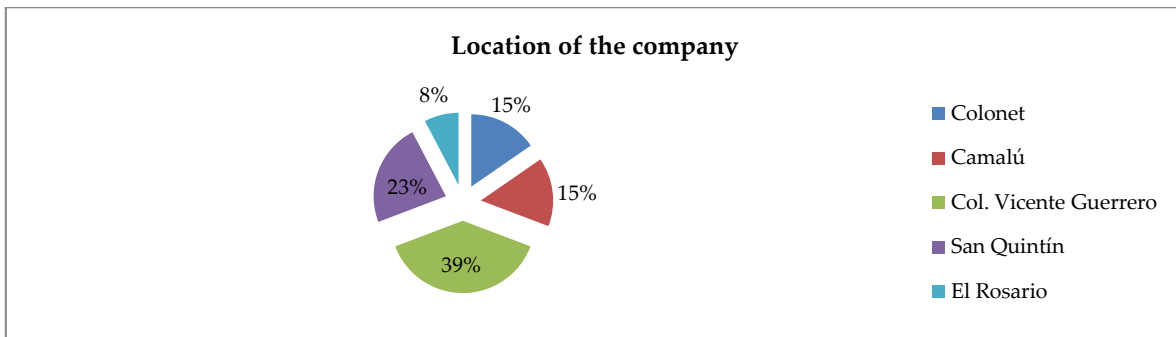

Figure 1. Location of the company. Source: Developed by the authors with data obtained by this study.

Figure 2 shows the companies surveyed based on the stratification of the companies by the Ministry of Economy (SE, 2009), with those that have 251 or more employees (38.5%) classified as large, those that have between 51 and 250 employees (38.5%) as medium, those with employees from 11 to 50 (15.4%) as small and the remaining (7.7%) with less than 10 employees as microenterprises.
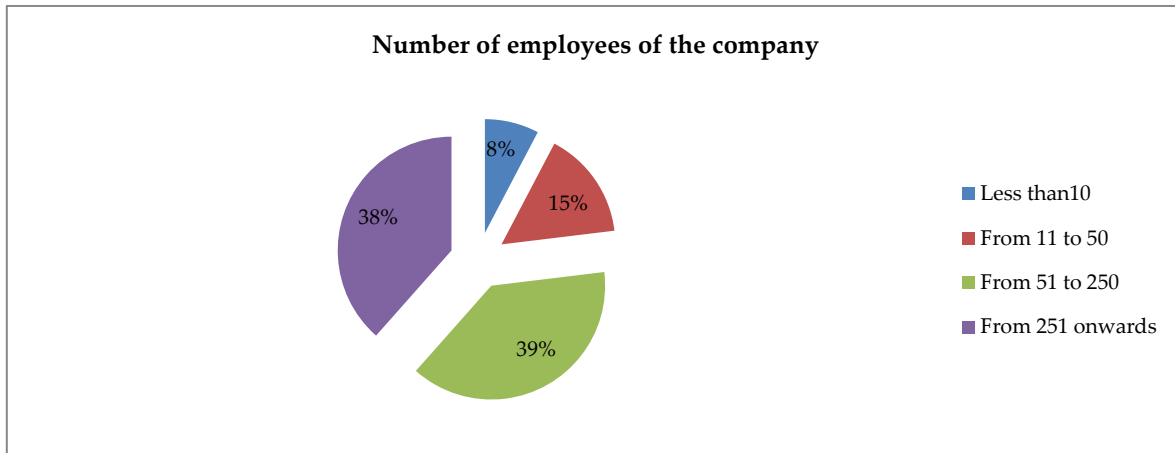
Figure 2. Number of employees in the companies. Source: Developed by the authors with data obtained by this study.

Figure 3 shows the main crop product in the companies surveyed: 53.8% produce strawberry, 15.4% tomato, 15.4% cucumber, 7.7% onions and the remaining 7.7% produce a different crop, in this case peas.

Figure 3. Main crop product. Source: Developed by the authors with data obtained by this study.

Figure 4 shows that 76.9% of the companies export their products, and participation in the national, regional and local markets is 7.7% each.

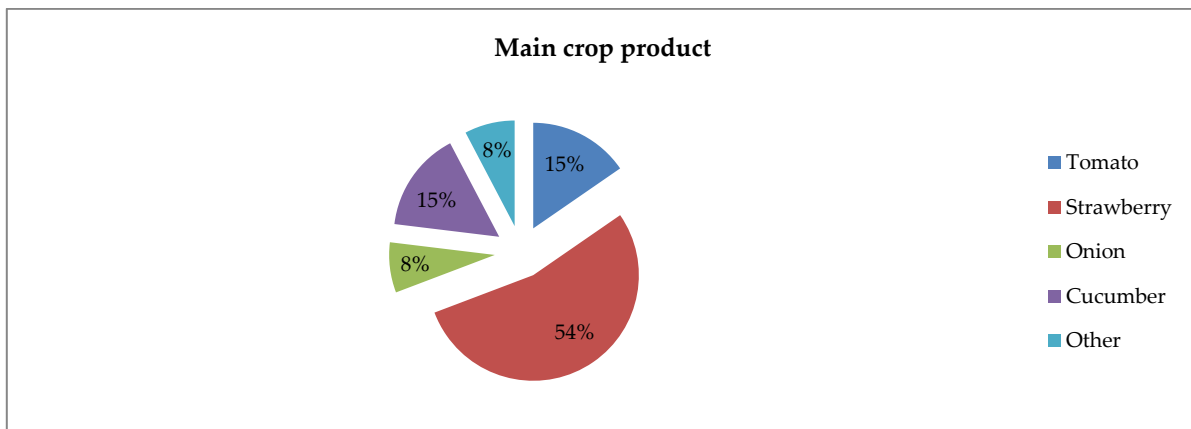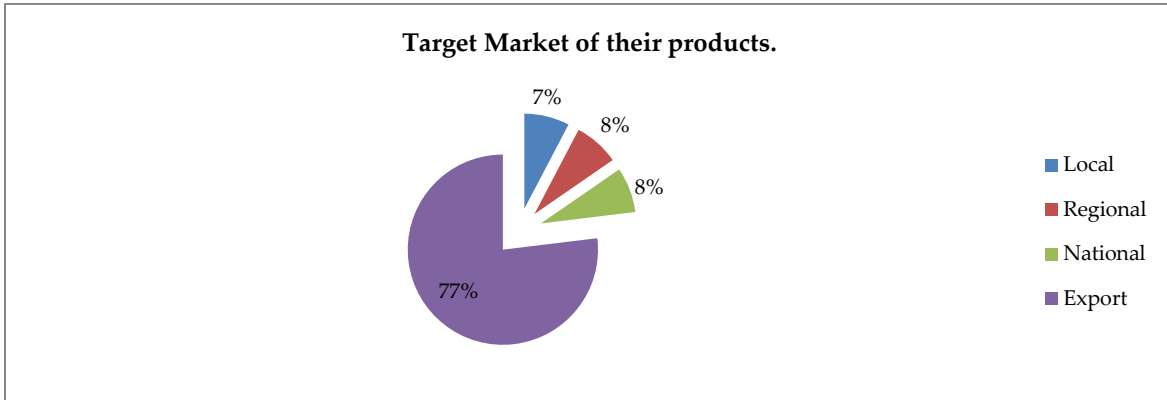**Figure 4**. Target Markets for products. Source: Developed by the authors with data obtained by this study.

Figure 5 shows that 92.3% of the companies use drip irrigation with irrigation tape and 7.7% use sprinkler irrigation. It is notable that most companies use drip irrigation, which is considered more efficient than sprinkler irrigation (Conagua, 2013).
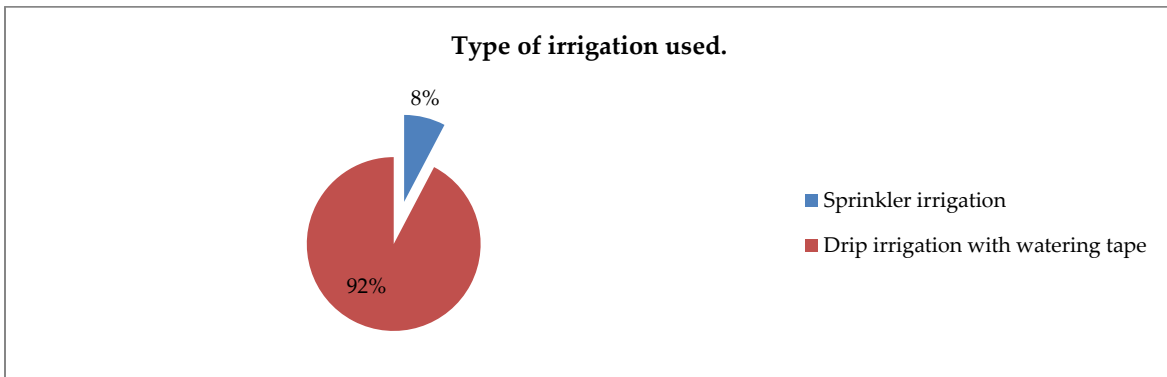
Figure 5. Type of irrigation used in the production process

Source: Developed by the authors with data obtained by this study.

Figure 6 shows that 46.2% of the companies surveyed do not produce under protected agricultural conditions, 30.8% produce with 61% or more of the cultivated area under protected agricultural conditions, 15.4% grow their products with up to 10% of the surface under protected agriculture and 7.7% report having an area of 41 to 50% under protected agricultural conditions. Producing under protected agriculture conditions increases the efficient use of water, optimizing the use of the resource in the productive process (Moreno, Aguilar, & Luévano, 2011).
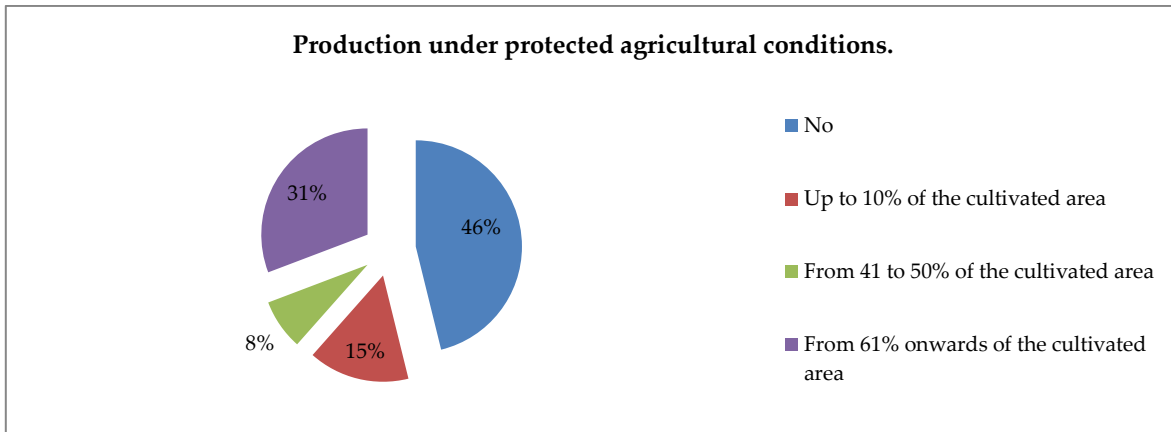
Figure 6. Production under protected agricultural conditions. Source: Developed by the authors with data obtained by this study.

Figure 7 shows that 46.2% of the companies have tunnel-type greenhouses, 30.8% do not have greenhouses, 15.4% have chapel-type greenhouses and 7.7% asymmetric greenhouses. It is important to mention that companies that do not have greenhouses present an area of opportunity to improve the use of water resources in the production process (Conagua, 2013).
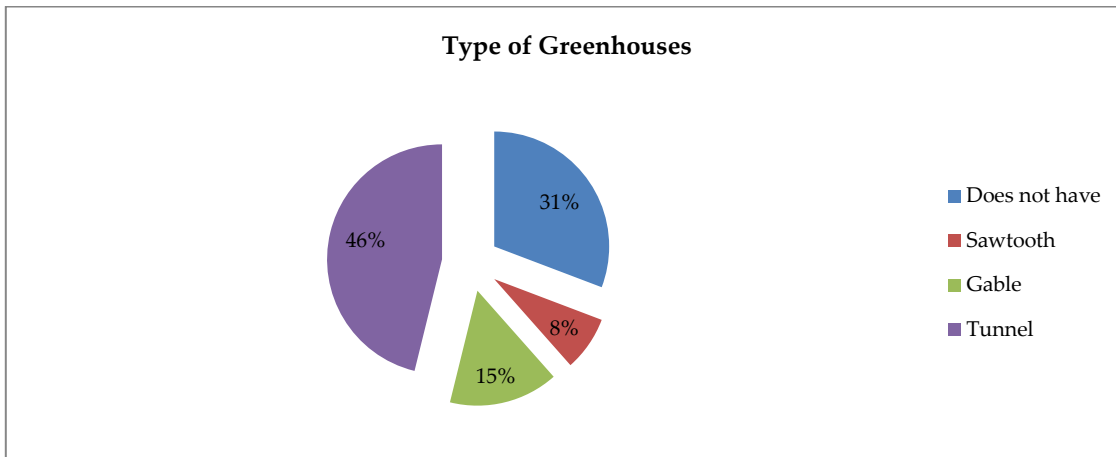
**Figure 7**. Type of greenhouses in the companies. Source: Developed by the authors with data obtained by this study.

Figure 8 shows that 53.8% of the companies do not have a desalination plant for their production, 23.1% have a large desalination plant, 15.4% have a small desalination plant and 7.7% have a medium desalination plant.
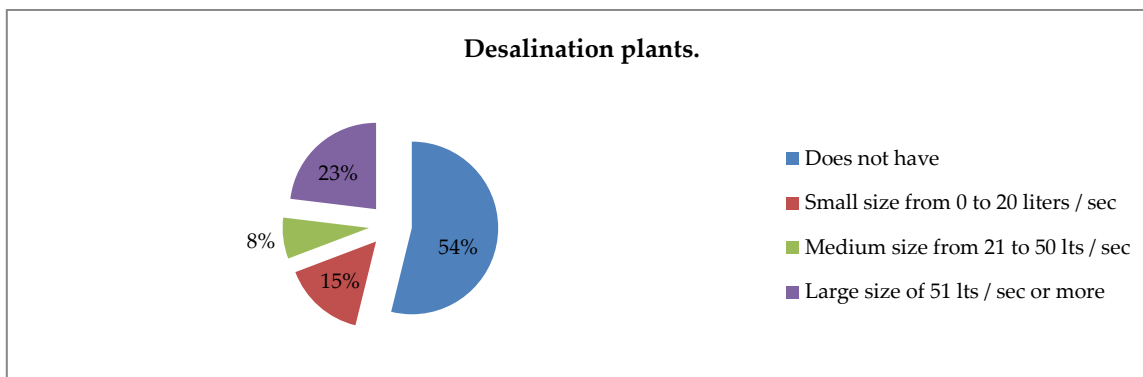
Figure 8. Desalination plants in agricultural enterprises. Source: Developed by the authors with data obtained by this study.

Content validity

Table 2 shows the results of the content validity ratio procedure according to the model by Lawshe and modified by Tristán (2008). This demonstrates that the global validity of the 51-item instrument is 83%. Most of the instrument items are acceptable, 3 items were eliminated for having values lower than the acceptable minimum of 0.5823, which were 2, 30 and 33, leaving an instrument with 48 validated items.

Table 2. Content Validity (Lawshe Model). Source: Developed by the authors with data obtained by this study.

Item	Essencial	Useful/not essential	Not important	CVR	CVR'
1	6	1		0.71	0.86
2	3	3	1	-0.14	**0.43**
3	5		2	0.43	0.71
4	7			1.00	1.00
5	6		1	0.71	0.86
6	5	2		0.43	0.71
7	5	2		0.43	0.71
8	6		1	0.71	0.86
9	6	1		0.71	0.86
10	6	1		0.71	0.86

11	5	2			0.43	0.71
12	6	1			0.71	0.86
13	5	2			0.43	0.71
14	7				1.00	1.00
15	6			1	0.71	0.86
16	6	1			0.71	0.86
17	7				1.00	1.00
18	7				1.00	1.00
19	7				1.00	1.00
20	6	1			0.71	0.86
21	7				1.00	1.00
22	7				1.00	1.00
23	7				1.00	1.00
24	6	1			0.71	0.86
25	5	1		1	0.43	0.71
26	6	1			0.71	0.86
27	5	2			0.43	0.71
28	6	1			0.71	0.86
29	5	2			0.43	0.71
30	4	3			0.14	**0.57**
31	5	2			0.43	0.71
32	5	1		1	0.43	0.71
33	4	2		1	0.14	**0.57**
34	5	2			0.43	0.71
35	5	2			0.43	0.71
36	5	2			0.43	0.71
37	5	2			0.43	0.71
38	6	1			0.71	0.86
39	6	1			0.71	0.86
40	7				1.00	1.00
41	6	1			0.71	0.86
42	7				1.00	1.00
43	7				1.00	1.00
44	5	2			0.43	0.71
45	6	1			0.71	0.86
46	7				1.00	1.00

47	6	1		0.71	0.86
48	7			1.00	1.00
49	5	1	1	0.43	0.71
50	6	1		0.71	0.86
51	7			1.00	1.00
SUM	297	50	10		
		CVI:		0.6639	0.8319
		CVI acceptable items:		1.0000	0.8512

The overall validity of the instrument (CVI) (Table 2), considering the opinion of seven experts in the area, is 83%, so the instrument is acceptable, eliminating items 2, 30 and 33 increased this to 85%, according to Tristán (2008).

Analysis of the items

The item analysis was done by conducting a correlation analysis and determining its effect on the Cronbach Alpha coefficient, eliminating items that did not meet the 0.30 requirement to be acceptable.

In Table 3, the majority of the items have correlation indexes above 0.3, considered acceptable. The items that have values lower than this reference are numbers 1, 2, 3, 4, which correspond to water availability, 5, 6, 9, 11, 12, which correspond to water management, 13 which corresponds to performance, 16 and 19 which correspond to irrigation technology, and 26 and 27 which correspond to prices and costs. However, when eliminating the effects from the instrument they do not result in a significant increase in the Cronbach's alpha, remaining at the same level of reliability. And since the information that could be collected for the items is useful they would not be eliminated.

Items 2 and 16 have a negative correlation, nevertheless, their effect on the level of reliability when eliminated is minimal, and since the information gathered is of importance to the research, it was decided to keep the items in the instrument.

Table 3. Analysis of the items. Source: Own elaboration based on data in SPSS.

	Item	Mean	Variance	Correlation Index	Cronbach's Alpha if the Item were deleted
1	D01 Your water source has been sufficient for production in your company	180.08	832.410	**.149**	.915
2	D02 The availability of water in your company has been decreasing to the point of affecting your production	179.38	854.756	**-.183**	.917
3	D03 Expectations of decreased water availability may continue to affect their production	179.31	840.564	**.073**	.915
4	D04 The volume of water needed for production can be reduced by efficiently using water	179.77	843.859	**.002**	.916
5	G05 The way in which water is distributed in the San Quintín Valley is adequate for production	180.46	842.769	**.010**	.916
6	G06 Water management in the San Quintín Valley has allowed the conservation of its soils and plants	180.38	840.090	**.058**	.916
7	G07 The storage of water in your company is carried out through reservoirs to ensure availability in production	179.08	800.410	.678	.910
8	G08 The use of water in production can be improved by making efficient use of water	178.92	828.410	.589	.913
9	G09 The quality of water that you obtain first hand needs to be improved for production	179.54	824.769	**.275**	.914
10	G10 The use of a desalination plant in your company allows efficient use of water	179.54	797.769	.378	.914
11	G11 The cost of water extraction in the company has been increasing due to the decrease in availability	179.46	840.603	**.040**	.916
12	G12 The water used in the production decreases making efficient use of water	180.00	840.333	**.019**	.918
13	R13 The production per hectare increases in the company making an efficient use of water	179.46	834.269	**.170**	.915
14	R14 The efficient use of water reduces its evaporation and prevents production leaks	179.31	825.897	.333	.913

15	R15 Water filtration in the company's production is controlled to improve the absorption in the plant	179.31	827.731	.335	.913
16	TR16 The irrigation system in the company is suitable for production	178.85	850.808	**-.179**	.916
17	TR17 The irrigation system in the company can be modified to improve the efficiency in the use of water	179.77	804.192	.429	.912
18	TR18 The company has mesh-shades for its production that improve the efficiency in the use of water in production	180.85	793.974	.448	.912
19	TR19 The company has greenhouses for its production	180.77	824.359	**.150**	.917
20	TR20 The greenhouses of the company allow to improve the efficiency in the use of water in production	180.15	788.808	.387	.914
21	TR21 The company produces under protected agriculture increasing efficiency in the use of water	180.00	798.667	.464	.912
22	TR22 The production in protected agriculture allows to increase the production per hectare of the company	179.31	793.231	.712	.910
23	PC23 The sales prices of your company's production increase due to water scarcity	180.77	782.692	.596	.910
24	PC24 The efficient use of water in production in your company increases the selling price	181.08	785.244	.527	.911
25	PC25 The efficient use of water in your company allows you to reduce production costs	179.54	820.436	.339	.913
26	PC26 The efficient use of water in your company allows you to save on production inputs	180.08	827.910	**.179**	.915
27	PC27 The cost of transporting water in production increases due to the decrease in availability in your company	180.38	824.923	**.200**	.915
28	PC28 The cost of transporting water decreases with the efficient use of water in your company	180.69	800.897	.538	.911
29	PC29 The cost of conserving water for production in your company decreases with the efficient use of water	180.31	813.231	.362	.913
30	PC30 The efficient use of water improves the packaging process of production in your company	180.23	786.192	.670	.910

31	PC31 With the compliance of safety rules in your company have increased sales	180.46	773.769	.733	.909
32	PC32 Compliance with the safety rules allow to improve the efficiency in the use of water in your company	180.69	791.397	.585	.911
33	PC33 Complying with the safety rules in your company, on the management of crop residues increases the efficient use of water	181.08	797.244	.557	.911
34	PC34 The efficient use of water in your company allows you to reduce the hidden costs of damage to soil and groundwater	180.15	793.808	.554	.911
35	P35 With the efficient use of water in the company, production per hectare increases	179.00	817.667	.721	.912
36	P36 The production process in the company improves with the efficient use of water	179.15	817.808	.597	.912
37	P37 By efficiently using water in production, the expected yield is increased	178.85	827.974	.664	.913
38	P38 In the company the duration of the production process is improved by efficiently using the water	179.54	793.936	.602	.911
39	P39 In production, the use of inputs is increased with the efficient use of water, allowing savings in costs	179.23	829.192	.342	.913
40	P40 In the productive process the efficient use of water allows to increase the inventory of quality production	180.08	768.244	.828	.908
41	P41 The increase in production per hectare has allowed it to remain in the market	179.77	771.359	.760	.908
42	IT42 The irrigation systems installed in the company have been adapted to increase the efficiency in the use of water, and ensure to remain in the market	179.08	835.577	.303	.914
43	IT43 It is necessary to invest in irrigation systems that increase the efficiency of water use in the company, which allows it to be more competitive	179.08	794.577	.773	.910
44	IT44 Investment in greenhouses could improve their situation in relation to their competitors	179.62	784.423	.680	.910

45	IT45 With an adequate source of financing, it could invest in the installation of infrastructure to efficiently use water and improve its competitiveness	179.31	787.897	.896	.909
46	IT46 Considers that production under protected agricultural conditions would improve the competitiveness of your company	179.62	785.423	.668	.910
47	IT47 The company could increase its competitiveness if it had a desalination plant for an efficient use of water in production	179.46	792.603	.667	.910
48	IT48 The technological innovation in the production of the company is a determining factor to improve competitiveness	179.00	821.833	.511	.912

Reliability analysis

The general Cronbach's Alpha presented in Table 4 is 0.91 for the 48 items, which is considered an acceptable level since it is greater than 0.7. The 13 agricultural companies surveyed (100%) were included for its determination.

Table 4. Reliability analysis. Source: Developed by authors based on data in SPSS.

Agricultural Companies	Number	Percentage
Valid	13	100.0
Cronbach Alpha		.914335
Number of items		48

Construct validity by Factorial Analysis

Construct validity assesses the degree to which the instrument reflects the theory of the phenomenon or concept it measures. The validity of the construction of the instrument ensures that the measures resulting from the responses to the questionnaire can be considered and used as a measure of the phenomenon that we want to measure. The most frequently used calculation methods are factor analysis and a multimethod matrix (Arribas, 2004).

In this investigation, the construct validity was assessed after the content validity was determined by the experts. The instrument's dimensions were determined through the exploratory factorial analysis by means of the SPSS software, using the principal components extraction technique and the orthogonal rotation method (Varimax), resulting in the determination of four factors that explain 75.69% of the variance. The internal consistency of the scale was also analyzed for each of the factors determining the Cronbach's Alpha coefficients (Table 5).

Determination of the number of factors to rotate

Table 5 shows the explained variance of the factors in order to determine the best factorial solution for the instrument. In this case it was determined that four factors explain 75.686% of the variance, which is considered adequate for the investigation since this exceeds the minimal acceptable percentage of 60%.

Table 5. Explained variance. Source: Developed by authors based on data.

Components	Initial Eigenvalues			Sums of Factor Extraction			Sums of Factors Rotation		
	Total	% Variance	% Accumulated	Total	% Variance	% Accumulated	Total	% Variance	% Accumulated
1	13.357	35.149	35.149	13.357	35.149	35.149	8.196	21.568	21.568
2	6.289	16.550	51.700	6.289	16.550	51.700	7.553	19.876	41.444
3	5.389	14.181	65.880	5.389	14.181	65.880	6.891	18.135	59.579
4	3.726	9.805	75.686	3.726	9.805	75.686	6.121	16.107	75.686
5	2.787	7.335	83.021						

6	1.939	5.103	88.124						
7	1.640	4.315	92.439						
8	.916	2.410	94.850						
9	.822	2.163	97.013						
10	.594	1.562	98.575						
11	.541	1.425	100.000						

Sedimentation graph

The sedimentation graph is a method for extracting factors, where the sum of the eigenvalues is equal to the explained variance. The purpose is to identify the values whose associated eigenvalue is large enough to be considered.

Figure 9 shows the sedimentation graph with the eigenvalues associated with the efficient water use and competitiveness variables for the agricultural enterprises in the San Quintín Valley, Baja California, Mexico.
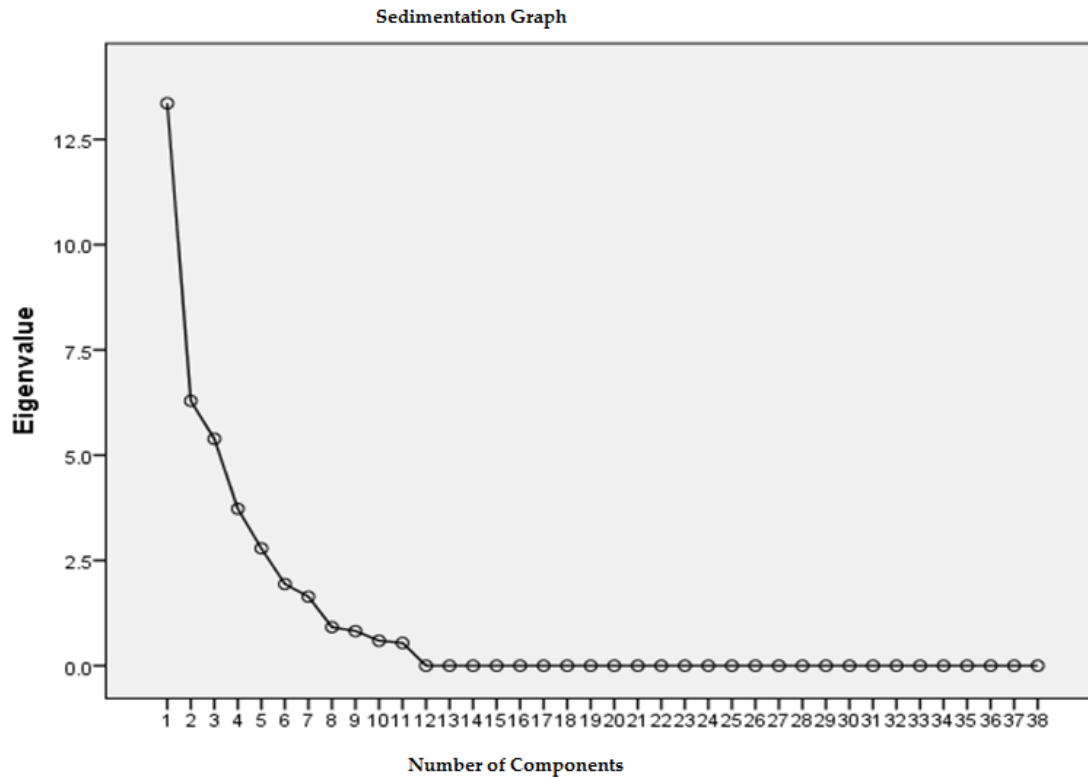
Figure 9. Sedimentation graph of the determined factors. Source:
Developed by the authors based on data.

Extraction of factors

The extraction of factors was done using the extraction method in the
main components analysis and the rotation method used was that of
Kaiser's Varimax in the SPSS System.

Table 6. Matrix of the rotated components.

Ítems	Factors			
	1	**2**	**3**	**4**
17 The irrigation system in the company can be modified to improve the efficiency in the use of water	.956			
37 By efficiently using water in production, the expected yield is increased	.939			

36 The production process in the company improves with the efficient use of water	.821		
38 In the company, the duration of the production process is improved by efficiently using water	.792		
35 With the efficient use of water in the company, production per hectare increases	.744		
14 The efficient use of water reduces evaporation and prevents production leaks	.695		
30 Efficient water use improves the packaging process of production in your company	.691		
42 The irrigation systems installed in the company have been adapted to increase the efficiency in the use of water, and to ensure that they remain in the market	.640		
44 Investment in greenhouses could improve their situation in relation to their competitors		.781	
46 It considers that the production under conditions of protected agriculture, would improve the competitiveness of your company		.780	
47 The company could increase its competitiveness if it had a desalination plant for an efficient use of water in production		.778	
48 Technological innovation in the production of the company is a determining factor to improve competitiveness		.756	
07 The storage of water in your company is done through reservoirs to ensure availability in production		.755	
43 It is necessary to invest in irrigation systems that increase the efficiency of water use in the company, which allows it to be more competitive		.736	
09 The quality of water that you get first hand needs to be improved for production		.683	
22 The production in protected agriculture allows to increase the production per hectare of the company		.658	
45 With an adequate financing source, it could invest in the installation of infrastructure to efficiently use water and improve its competitiveness		.657	
32 Compliance with safety regulations allows improving the efficiency of water use in your company		.616	
15 Water filtration in the company's production is controlled to improve the absorption in the plant		.572	
08 The use of water in production can be improved by making efficient use of water		.535	
11 The cost of extracting water from the company has been increasing due to the decrease in availability		.502	
27 The cost of transporting water in production increases due to the decrease in availability in your company			.862	

34 The efficient use of water in your company allows you to reduce the hidden costs of damage to soil and groundwater		.839	
28 The cost of transporting water decreases with the efficient use of water in your company		.816	
29 The cost of conserving water for production in your company decreases with the efficient use of water		.753	
26 The efficient use of water in your company allows you to save on production inputs		.749	
31 With the fulfillment of safety rules in your company, sales have increased		.718	
06 Water management in the San Quintín Valley has allowed the conservation of its soils and plants		.715	
40 In the productive process the efficient use of water allows to increase the inventory of quality production		.648	
41 The increase in production per hectare has allowed it to remain in the market		.647	
25 The efficient use of water in your company allows you to reduce production costs		.628	
20 The greenhouses of the company allow to improve the efficiency in the use of water in production			.867
19 The company has greenhouses for its production			.862
24 The efficient use of water in production in your company increases the selling price			.774
10 The use of a desalination plant in your company allows efficient use of water			.770
18 The company has mesh-shades for its production that improve the efficiency in the use of water in production			.768
23 The sales prices of your company's production increase due to water scarcity			.733
21 The company produces under protected agriculture increasing efficiency in the use of water			.629
Extraction Method: Analysis of Main Components Rotation Method: Varimax with Kaiser			

Determination of the internal consistency of the scale

Table 7 shows the coefficients determined by the extraction method corresponding to the principal components analysis of the competitiveness variables. The items that did not meet the correlation

requirements were eliminated and a final instrument with 38 items was obtained, with a global Cronbach alpha of 0.926.

Table 7. Internal Consistency of the Scale. Source: Developed by the authors with data obtained from the database in SPSS.

Competitiveness Variables	Cronbach´s Alpha	Number of Items
Productivity and yield per hectare	0.898	8
Technological Innovation and Management.	0.925	13
Prices and costs	0.917	10
Irrigation technology	0.907	7
Total	0.926	38

Discussion

The objective of this research was to determine the validity of the content and construct of an instrument to measure the efficient use of water by the agricultural enterprises in the San Quintín valley and their competitiveness. The psychometric characteristics of the measuring instrument were studied in relation to the efficient use of water and the competitiveness variables for agricultural enterprises in the San Quintín Valley, Baja California, Mexico.

The necessary tests were carried out to determine the content validity of the initial instrument as proposed by the Lawshe model, modified by Tristán (2008), regarding the efficient use of water and the competitiveness of the agricultural enterprises in the San Quintín Valley, Baja California, Mexico, based on the opinion of the experts. The results obtained reflect diverse points of view, their valuation was assigned to each one of the proposed items, and only 3 of the 48 proposed items obtained did not comply with the minimum acceptable value of 0.5823.

The construct validity was performed with an item analysis, for which the correlation index of each of the proposed items was determined. The global Cronbach alpha coefficient of the 48-item instrument was 0.914. The items that did not meet the minimum requirements of 0.300 were

eliminated, leaving 44 for the reliability test. The determination of the internal consistency of the scale was then made by means of the extraction of the main components and the Varimax orthogonal rotation method, 4 main components were obtained and 38 items were left in the final instrument, with an overall Cronbach alpha coefficient of 0.926, considered reliable according to Hernández, Fernández and Baptista (2010).

Conclusions

The contribution of this work to generate a data collection instrument to measure efficient water use by agricultural enterprises and their competitiveness can be considered a valuable product since it is difficult to obtain the efficient use of water variable and its relationship with competitiveness from the specialized literature, because the subject has not been investigated in-depth and no research has been done on similar topics at the local, national and international levels.

The importance of carrying out this work lies in the application of instruments having adequate content validity and construct validity for research regarding the efficient use of water as a factor in the competitiveness of agricultural companies in San Quintín, Baja California, Mexico. The methodology applied provides useful tools for the collection of data from primary sources, which can provide the expected results.

Therefore, this work contributes to the effort by many economic and social actors to solve the problem of the allocation and use of water resources, which would improve the living conditions of society and contribute to the millennium development objectives, which consider access to water as one of the basic and fundamental human rights for existence.

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