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Articles

Water management and environmental education as facilitators of sustainable tourism development in Valladolid, Yucatan

Gestión hídrica y educación ambiental como facilitadores del desarrollo turístico sustentable en Valladolid, Yucatán

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Abstract

With the information obtained from two companies of tourist turn whose main attraction is the recreational use of cenotes, analyzed the characteristics of uses, consumption, costs and legal requirements in environmental matters. In addition to this was conducted an experimental study of environmental education with the workers of enterprises, in the domains of knowledge, management and environmental awareness. The objective was to diagnose the water resource management and the level of environmental education, to make a proposal for improvement. The results obtained for the pilot study showed that the level of environmental education had a statistically significant difference between the scores obtained before and after the delivery of the workshop to the workers chosen at random. The workshop was established in accordance to the analysis of probabilities between each of the ratings of the level of environmental education which, as a result, were not the same and due to the fact that the greater percentage of employees was basic, the workshop will be provided from this level. The proposal to deploy in enterprises was to change its system of water storage in tanks or septic tanks by small biological treatment plants. Ultimately it was recommended that septic tanks together with an oxidative treatment. To make more efficient water consumption is recommended the use of energy-saving technology, all kinds of ads that motivate the water savings, public awareness campaigns for workers and establish environmental policies.

Keywords: Environmental education, management, water resource management, environmental awareness, environmental awareness.

Resumen

Con la información obtenida de dos empresas de giro turístico, cuyo principal atractivo es el uso recreativo de cenotes, se analizaron las características de usos, consumos, costos y requisitos legales en materia ambiental. Aunado a esto, se realizó un estudio experimental de educación ambiental con los trabajadores de las empresas en los dominios de conocimiento, gestión y conciencia ambiental. El objetivo fue diagnosticar la gestión del recurso hídrico y el nivel de educación ambiental para elaborar una propuesta de mejora. Los resultados obtenidos para el estudio experimental demostraron que el nivel de educación ambiental tuvo una diferencia estadística significativa entre las puntuaciones obtenidas antes y después de la impartición del taller a los trabajadores elegidos de manera aleatoria. El taller se estableció de acuerdo con el análisis de probabilidades entre cada una de las clasificaciones del nivel de educación ambiental que, como resultado, no fueron las mismas. Debido a que el mayor porcentaje de los empleados se ubicó en básico, el taller se impartió a partir de ese nivel. La propuesta a implementar en las empresas fue cambiar su sistema de almacenamiento de aguas en tanques o fosas sépticas por pequeñas plantas de tratamiento biológico. En última instancia, se recomendaron fosas sépticas, junto con un tratamiento oxidativo. Para hacer más eficiente el consumo de agua, se sugirió el uso de tecnología ahorradora, todo tipo de anuncios que motiven al ahorro de agua, campañas de concientización para los trabajadores y establecer políticas ambientales.

Palabras clave: educación ambiental, gestión, recurso hídrico, conciencia ambiental, conocimiento ambiental.

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Introduction

The karstic nature of the soil in the Yucatan peninsula allows water infiltration. It is for this reason that over thousands of years have originated sinkholes named "cenotes", formations of great natural beauty and suppliers of water resources from past generations. However, the characteristics of the soil and depth not only allow the uptake of water but also the easy percolation of contaminants. Thus, it is desirable to the enjoyment of moderate resources, resulting in the need to implement appropriate management methods in the field of water. Therefore, the tourism produces an economic impact invaluable that translates into benefits for the population, but it can also mean high resource consumption and physico-chemical alteration of the

same because it is an anthropogenic activity. Then, the proper management of the resource allows you to reduce environmental impacts.

In Valladolid Yucatan, located southeast of Mexico specifically in the middle of the State of Yucatan with the geographic coordinates of latitude: 20° 41' 22" N and longitude: 88°12'6" W; there are cenotes arranged in concession and assignment for recreational use. However, when it comes to these sites there is uncertainty about the quality of water, because of inadequate wastewater disposal, that is to say, willing without prior treatment is of great concern in the area.

For example, a tourist may prove to generate between 700 and 800 grams of trash per day. This gives a total of approximately 1.164 kg/day according to the Average visitors, with a monthly average of 34.920 kg of waste, a high energy expenditure and wastewater that can exceed 200 liters per tourist depending on load and hotel in Valladolid (Sefotur & UADY, 2013).

What demonstrates the relevance of the management and environmental education in the tourism sector. Therefore, the environmental education as a mitigation tool and this study was raised, recognizing the same, such as the systematic process to generate knowledge that form an awareness of change in individuals to achieve a consciousness in harmony with the environment, and thus contribute to the task of protecting the environment and prevent damage to ecosystems (Palos, 2005).

Thus, the current situation of tourism in environmental matters should be characterized and up-to-date information, for the purpose of presenting tools that will enable the sector, cover the legal requirements in environmental matters and be prepared before the rise of strategic projects that will detonate the sustainable regional development.

With this in view, the purpose of this study was to perform a diagnosis of the management of water resources and the level of environmental education, to make a proposal for improvement. In turn, it was possible to observe the concordance between the level of environmental education of workers and the environmental performance of companies.

This work presents the legal requirements in general should comply with the companies assessed in the tourism sector, as well as the consumption of water, costs and usage characteristics that describe them. Also, are presented as results the level of environmental awareness, environmental management and environmental awareness of workers. The latter of great importance because it focuses on understanding the environmental damage that is generated due to the improper disposal or waste management and improve attitudes toward sustainable development.

From the present project analyzed the water resource management to minimize the environmental impact, specifically in stops for tourists with cenotes for recreational use, which managed to establish viable environmental policies. The diagnosis also allowed to design an

environmental education workshop at a basic level, which was successfully conducted to workers.

The results of this research contributed to improve the level of environmental education found in the statistical results of the pilot study. The transcendental of the present draft is due to the fact that before there was no documented study in Valladolid on water management and its impact on the quality of the resource, for what is considered a project that can help the tourism sector involved to improve its environmental performance, contributing to the sustainability and especially for the improvement of public health.

Materials and methods

Type of research

In general, the investigation was of mixed approach addressing two aspects: diagnosis of water resource management and environmental education in two tourist businesses. With which it signed an agreement in which the companies undertook to facilitate the documentation

requested, to allow the application of instruments and delivery of environmental education workshop, all of the above subject to the commitment to maintain the confidentiality of the companies.

The project was carried out over a year, however, the field work and application of instruments had a duration of five months.

With regard to research to integrate a diagnosis of water management in the local tourism sector, it was assumed a qualitative approach due to the fact that explored the phenomenon of water management in depth, that is to say, assessed deficiencies through research instruments and an activity that simulated an environmental audit in order to propose solutions.

Once contextualized and interpreted the data collected, proposals were made for the proper management of water resources to minimize the volumes and the impact of the wastewater discharge. Therefore, the data collection was carried out in the natural scenery, in this case, the companies, which depended directly from individuals who were interviewed or provided the information. Thus, perform a qualitative study helped to know the context and the scene of the problem.

Part of this research focused on environmental education for businesses in the tourism sector presented a quantitative approach. In order to explain the correspondence to the quantitative nature it should be mentioned that a survey that integrated items that allowed to standardize and grouping the information which in turn would admit the data handling and results with numerical characteristics and statistics. The results were dependent on the characteristics of the workers,

therefore, subject to the variation of the activities of the personnel or tourist affluence, which resulted in a study with quantitative design.

Instruments

To perform an initial inquiry employment personal interviews in depth as a tool for obtaining of information applied to the general manager and head of maintenance companies. This instrument was applied with the objective to determine specific areas in which consumed the volumes of water, activities, staff and tourist affluence involved in the activities of use. After the interview of exploration, reformulated an instrument for characterization, classification and quantification of costs and volumes based on the working paper submitted by Viñuales, Fernandez, and González (2001). This instrument allowed the study to adapt to the company's activities, the restrictions of time, space and access. Because it is perfectly understandable that companies do not provide information indiscriminately and much less affecting their activities. Subsequently, the employment documentation, at this point the two stops provided confidential information that helped to structure the matrix of environmental legal requirements. These instruments made it possible to diagnose aspects of environmental management and legal firms.

To evaluate the environmental education, a survey that included items in three sections or categories which were knowledge, awareness and management in the environmental character, reformulated to a quantitative character unlike Palos (2010) but on the basis of the domains that it presents in his study on environmental education.

The items that were raised sought to determine the overall level of environmental education of workers, as well as its characteristics or demographic data. Information was obtained about: Age, gender, educational level and type of work in the company.

We used the Lickert scale, the above categories included ten questions with the same approach and, in turn, with five possible responses assigned to a numeric value (1= never; 2= almost never, sometimes; 3 = 4 = 5 = almost always and always or never; 5 = 4= almost never, sometimes; 3 = 2 = 1 = almost always and always) with respect to each question. In such a way that the respondent was able to select according to your criteria. The score for each category was 50 maximum and minimum 0. According to the value of the score obtained settled five levels: bad (< 20), insufficient (21 to 28), regular (29 to 36), good (37 to 44) to excellent (45 to 50). This type of questionnaire allowed for statistical analysis.

The analysis of environmental education with quantitative approach was experimental in nature due to the fact that, starting from a diagnosis of the state of education of workers, have developed a workshop with the aim of address deficiencies

identified and finally determine the difference between the initial level and the subsequent to the delivery of the workshop in enterprises.

Reliability and validity of the instrument

The validity of the instrument according to the source (Palos, 2010). She was subjected to expert judgment, in the same way once reformulated the survey was submitted to trial. The tests or instruments to determine the level of environmental education, used for research purposes, must show the reliability. In this study, we used the analysis of Cronbach's Alpha, resulting in a value of 0.86, a coefficient of Alpha > 0.8, therefore, the criterion of reliability of the instrument is good. The minimum acceptable value of Cronbach's Alpha coefficient is 0.7 below that value the internal consistency of the scale used is low (Celina & Campo, 2005).

Procedures

To characterize the uses of water of the stops for tourists, once obtained the information through the preliminary survey, it was subsequently implemented the necessary adjustments and the characterization of the volumes and costs of water consumption.

Then, to have a diagnosis based on the methodology of environmental audits, in order to observe the water management in the tourism sector, there was a compilation of legislation in the field of water in the three areas, federal, state and municipal. Then, the information was categorized and proceeded to select the laws and regulations applicable to the stops for tourists. Once the process of discrimination and selection was formulated and structured the general checklist, which was applied in the whereabouts notice.

During the simulation of the audit the general manager in charge of the company provided the information or evidence to support compliance with environmental legislation in the field of water. On the basis of information collected and categorized the array of legal requirements whose importance is that it describes in a timely manner the heading or fraction corresponding to a standard, law or regulation for which if they should be the evidence.

Finally, to raise awareness with regard to the rational use of water and waste generation, the socialization of the information to companies that participated in the research project. To do this, working meetings were held in order to present the objectives and the procedures to follow in environmental education, because this activity was dependent on a direct interaction with the workers. To design the survey and determine

the level of environmental education and, in addition, to know the demographic characteristics of the workers.

Questions were structured with a focus on three categories applied in a random way. Then, it was proved the reliability of the instrument and proceeded to the elaboration of the final version. Of course, the training of the interviewer was paramount before application.

The analysis of the results allowed to describe the characteristics of the workers in the field of environmental education that affect the level of environmental performance.

The generation of descriptive parameters and established the relationship of probability of occurrence in the levels (bad, insufficient, regular, good and excellent) of the sections environmental awareness, environmental management and environmental awareness of companies.

It was subsequently designed the model of environmental education workshop for tourism enterprises in question and proceeded to a new evaluation of the environmental awareness of workers.

The environmental education workshop had a duration of three weeks with two sessions of two hours per week on average, according to the layout of the workers. During the workshop it was exposed using digital resources and didactic concepts such as the environment, pollution and environmental awareness. It was also explained and exemplified the classification of solid waste, recycling, energy savings, hazardous waste, labelling, legislation and management. Finally, recreational activities were implemented and table panel for exchange of views and

recommendations of the workers, highlighting the environmental implications of Valladolid. Subsequently, the design and implementation of analysis to the variables and set the parameters descriptive and inferential analysis comparative analysis of the before and after the workshop on environmental education. Processing the data obtained was carried out using SPSS version 24.

Results

Characterization of the use and consumption volumes

During the verification of the disposal of sanitary effluents of tourist whereabouts, it was noted that the whereabouts one has a storage tank that is emptied on a regular basis in the landfill in the city and the whereabouts two with septic tank (appointed numerically due to confidentiality).

The cleanup activities that are carried out in the whereabouts are: the washing of floors, dishes, cookware and bathrooms. In addition, daily cleaning is carried out tables and chairs for the comfort of the clients.

The tourist whereabouts one use well water for all its activities, the tourist hostel two consumes water provided by the potable water and sewerage system.

During the observation of the work activities in the cenotes, it was not detected the realization of specific actions for the prevention of pollution, not the reuse of volumes of water. However, subsequent to the verification tanks were placed in the bathrooms with lower volumes, in particular were changed from 9 to 6 liters of capacity. Thus, the willingness to collaborate was visible and indispensable for the implementation of the project and the implementation of remedial activities.

In the Yucatan Peninsula there are a large number of cenotes with tourist use. The perceptions, attitudes, expectations, and behaviors before the environmental circumstances, give shape to different uses and management (Moser, Navarro, Ratiu, & Weiss, 2010) of the cenotes. Therefore, the first stage of this study was dedicated to the diagnosis of consumption and water resource management, however, lack of awareness about what it means to water pollution for the health fosters an indiscriminate use of products in the cleanup activities in general. The results of the consumption of the two tourist whereabouts are presented in Figure 1 and Figure 2. In this way, the implementation of the instruments for the determination of volumes of consumption in the whereabouts with well water supply in Figure 1 showed that the average consumption of the bimonthly whereabouts is about 40.000 liters, taking into account that this is a fate which provides its services to a small number of people per day, consumption is moderate.

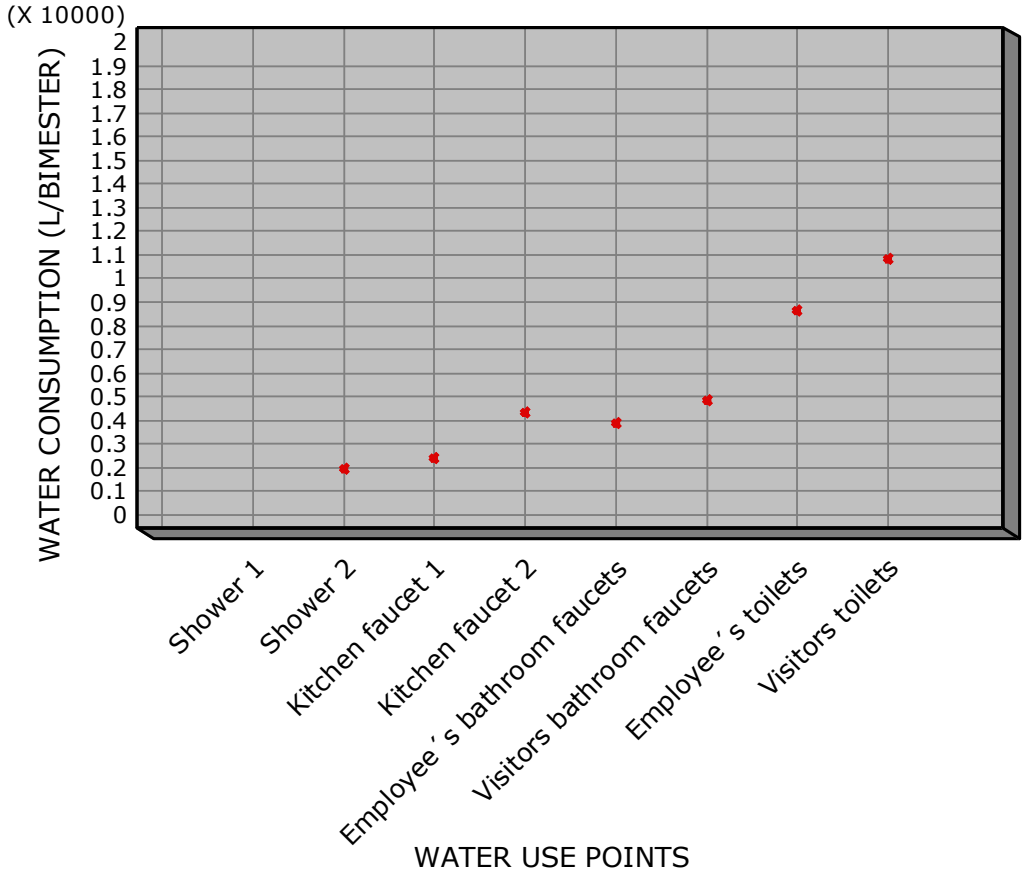

Figure 1. Dispersion of water consumption in the 1 tourist whereabouts with well water supply. Source: Own elaboration. Note: Shower 1 has a consumption of 120 000 L/Bimester.

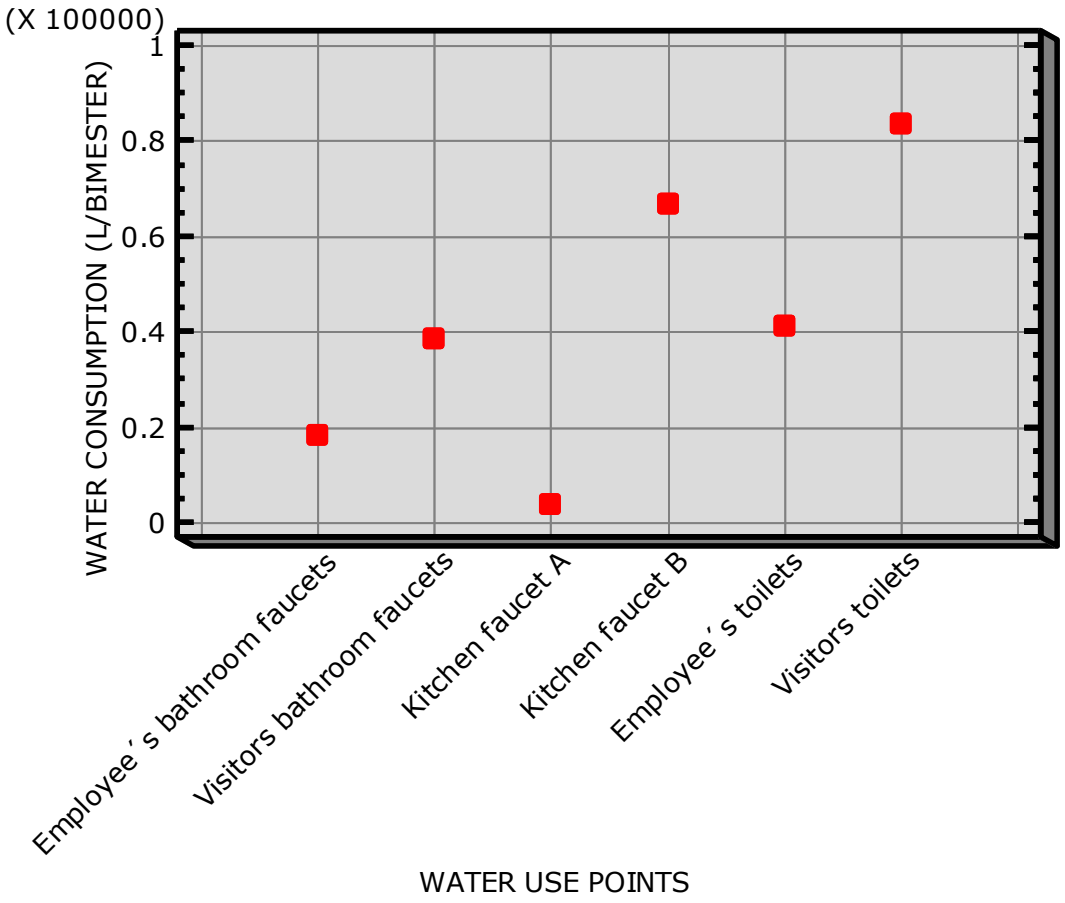

Figure 2. Dispersion of water consumption in 2 tourist whereabouts with drinking water. Source: Own elaboration.

In turn, the whereabouts with drinking water consumes around 245,000 liters per bimester distributed in eight points in using water as shown in Figure 2, detected for an influx of 100 people on average in the low season who come for recreational activities. The quantities of users of the services and volumes of water consumption served

as reference to inquire what system of disposal or treatment of water was more convenient.

For the whereabouts with well water supply with 40 000 liters of fuel the system of provision was the septic tank because it receives more than 10 to 15 people per day. In the whereabouts with drinking water is made the recommendation of the installation of a wastewater treatment plant, because the septic tank is not useful for more than 100 users who register by day.

The decrease in the costs of water consumption are a perfect reason for implementing reduction or reuse of water. In Figure 3 presents the bimonthly cost of six points of water use in the whereabouts with potable water supply system, for a total of $2 386.62 pesos the amount of bimonthly cost.

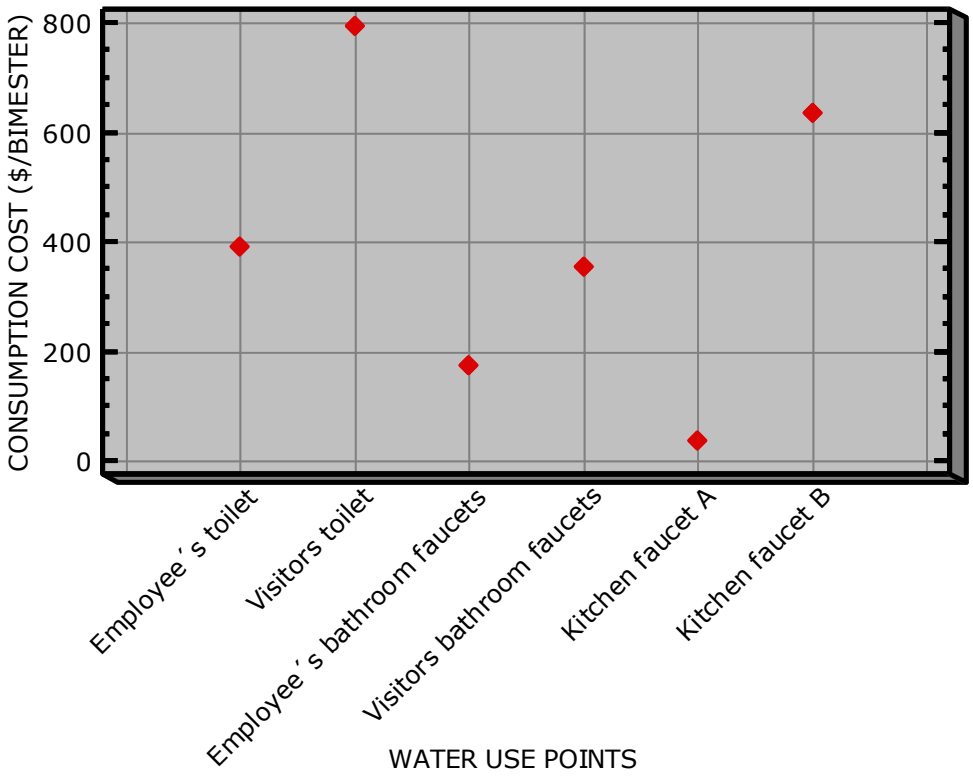

Figure 3. Dispersion of costs of 2 tourist whereabouts with potable water supply system. Source: Own elaboration.

In Figure 4 are the points of use of water for the whereabouts with well water supply, the cost of the majority is due to higher volumes to 12.000 liters consumed in the showers. Thus, the cost amounts to $3,254.54 pesos per quarter in low season. It should be noted that subsequent to the verification activities would be implemented activities of reuse and decrease in consumption, for example, the uptake

of the water of the showers and the swimming pool to bring them to storage tanks and reuse in the download of the toilets of the baths.

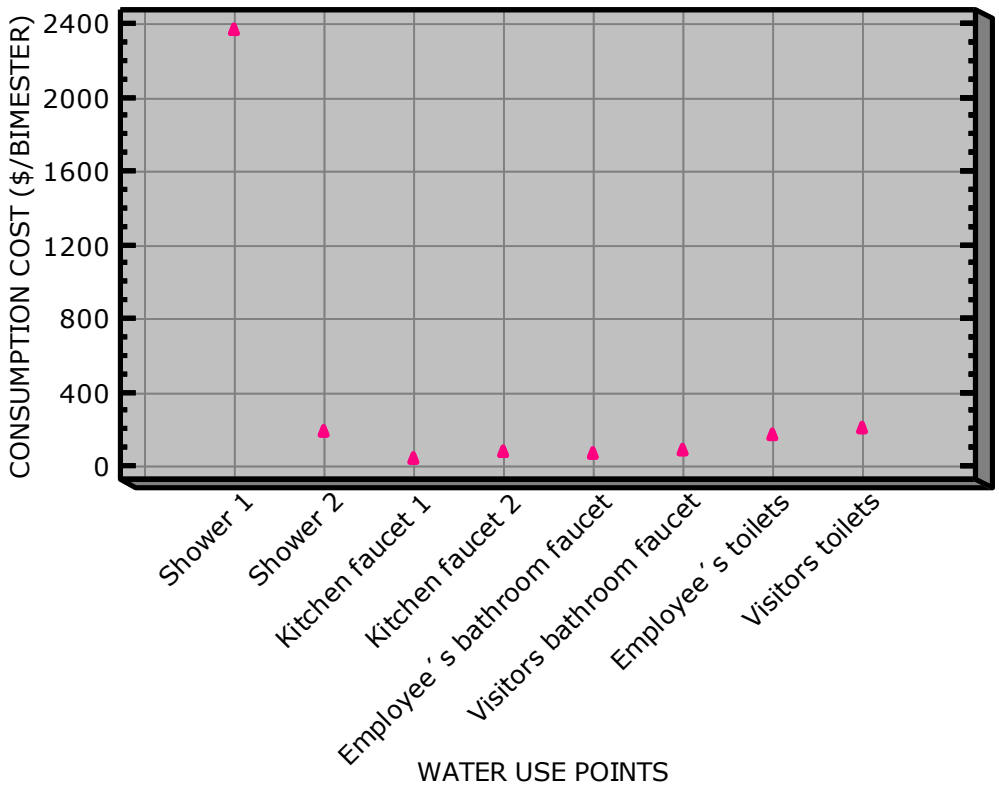

Figure 4. Dispersion of costs in 1 tourist whereabouts with well water supply. Source: Own elaboration.

Environmental education

The results are presented in two levels of analysis, descriptive and inferential, whereabouts the two with drinking water supply and whereabouts one with well water supply.

With regard to the descriptive analysis unfolds according to the domains or categories that were presented in the survey instrument.

With regard to the inferential analysis proceeded to make a comparative analysis of the previous and subsequent results with respect to each domain and in general.

Descriptive results prior to the environmental training

To perform the training was essential to diagnose earlier to companies in order to offer a workshop according to the characteristics of the workers. The results of the descriptive analyzes indicate that most of the elements that compose the scale, are characterized by a great variability distributed in five possible response options (1= never to 5= always). From the descriptive results we can highlight the following:

- There is a balanced distribution in the proportion of the age of the workers 18 to 22, 23 to 27, 28 to 32 and 38 or more (20% or more); with

the exception of the age range of 33 to 37 years, which had the lowest percentage (8%).

- The recruitment and presence of men and women is 52% and 48%, respectively, this is due to the fact that there are areas of opportunity for both.
- The 74% of workers have an educational level of middle school or high school that usually serve as cooks, waiters, technicians or assistants. The 20% that has a bachelor's degree level are found as receptionists or technicians. The 7% at primary level, the 37% and 36% secondary high school.
- In terms of marital status, half the number of workers are single. The 48% of workers they have assigned tasks varied according to the season and to the needs of companies; therefore, they are considered to be helpers.
- To the phrase "I have no knowledge of the substances and pollutants that are generated due to the activities of maintenance, cleaning, kitchen or service", the 49% of subjects is between the levels of never, almost never and at times. A high percentage of indifference to this circumstance.
- The 78 per cent claimed that as long as labora cares for resources such as water and light.
- The 65% of the workers in the companies always or almost always carry out activities for the care of the resources at home.
- A large majority of workers (67% between always, almost always and sometimes) leave connected appliances.

- The 52% always perceives garbage as he walks through the city. But, only 29 per cent are in favor of collaborate in campaigns or environmental conservation programs.
- Only 15% of workers are concerned about separating the garbage, while 61% never, almost never or sometimes the separate.
- The workers are conscious about the environmental damage due to the use of aerosols, however, the 15% always uses them.
- The 50% believes that the amount of waste generated is always a relevant topic due to its provision.
- Never, almost never, and sometimes a 76% responded to the statement "using recycled products". Among those who always and almost always gives a 24%.
- Never and almost never the 35% when they respond to "I have heard talks on environmental conservation".
- With regard to the attention to the news of environmental type in any medium of communication, the 38% see or hear news giving importance to those with environmental issues.
- The following variable refers to the everyday life of the talks on environmental issues, 82% never, almost never and sometimes hold talks with this topic. Contrary to the lack of interest in environmental issues a large percentage (68%) that recognize the importance of separating the garbage.

- 40% believe that recycling is to separate trash and 67% think that the government is responsible for regulating the environmental pollution in enterprises.
- In the statement "I believe that at work is perceived the importance of the handling of waste contaminants" the 42% never, or almost never sometimes considers it, while 58% almost always or always thinks about it. In the work the 62% of the workers never, almost never and sometimes notes that place graphical or textual preventive information to promote good use of water and energy. During working hours workers claim that always (42%) have assigned containers for waste generated while a 35% mentioned that are not designated specific containers, an assertion which is attributed to workers with greater knowledge of the separation of waste.
- The mission and vision of the company is a significant aspect for the identity of the company, however, about 50% of employees are not familiar with these.
- To the question to "What extent the company establishes objectives for environmental improvement?" For example, separation of garbage, actions to reduce or reuse, the majority declares that it does not observe regularly (66%).
- The 73% of workers between never and sometimes considers that studies on the effects of the discharge of sewage or waste.
- In the companies a fraction claims that are sometimes established environmental programs (23%), another that never sets (35%) and almost never (25%); while those who testify to the fact that the programs

are frequent are around 17%. But, the 45% claims to have never participated in programs or activities of environmental education.

In general, the results of the survey are presented per domain in Figure 5, Figure 6 and Figure 7. A small percentage (27%) has a good level of environmental awareness. For its part, a 37% is between bad and insufficient levels and for the perception of environmental management a low 15% is between good and excellent.

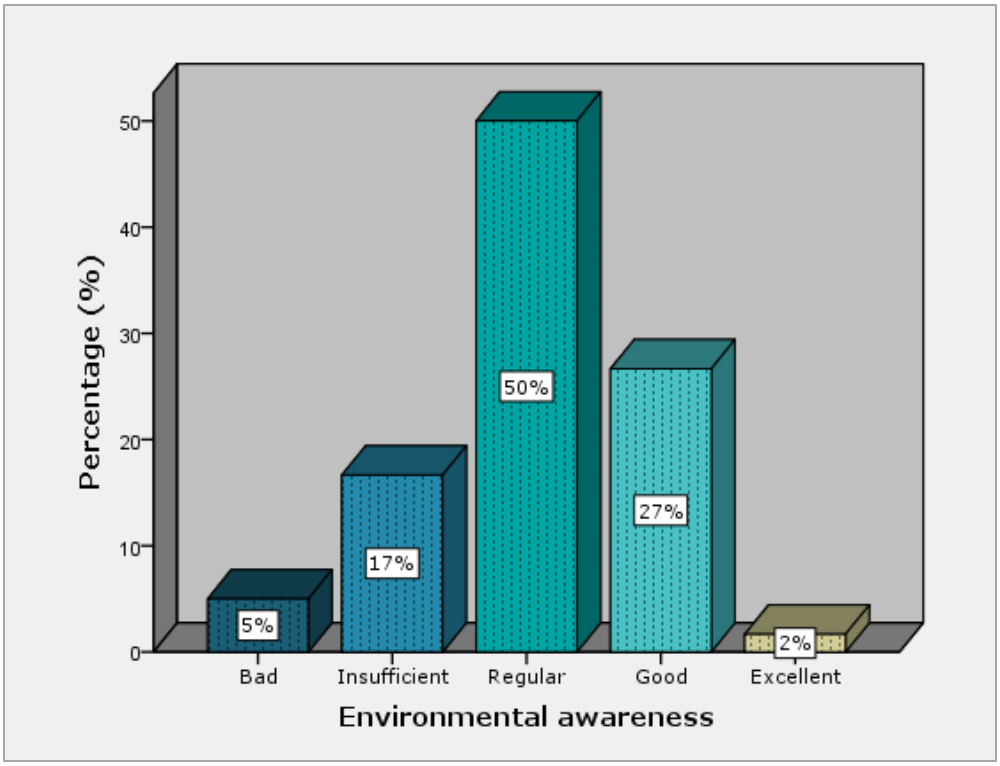

Figure 5. Level of environmental awareness. Source: Own elaboration.

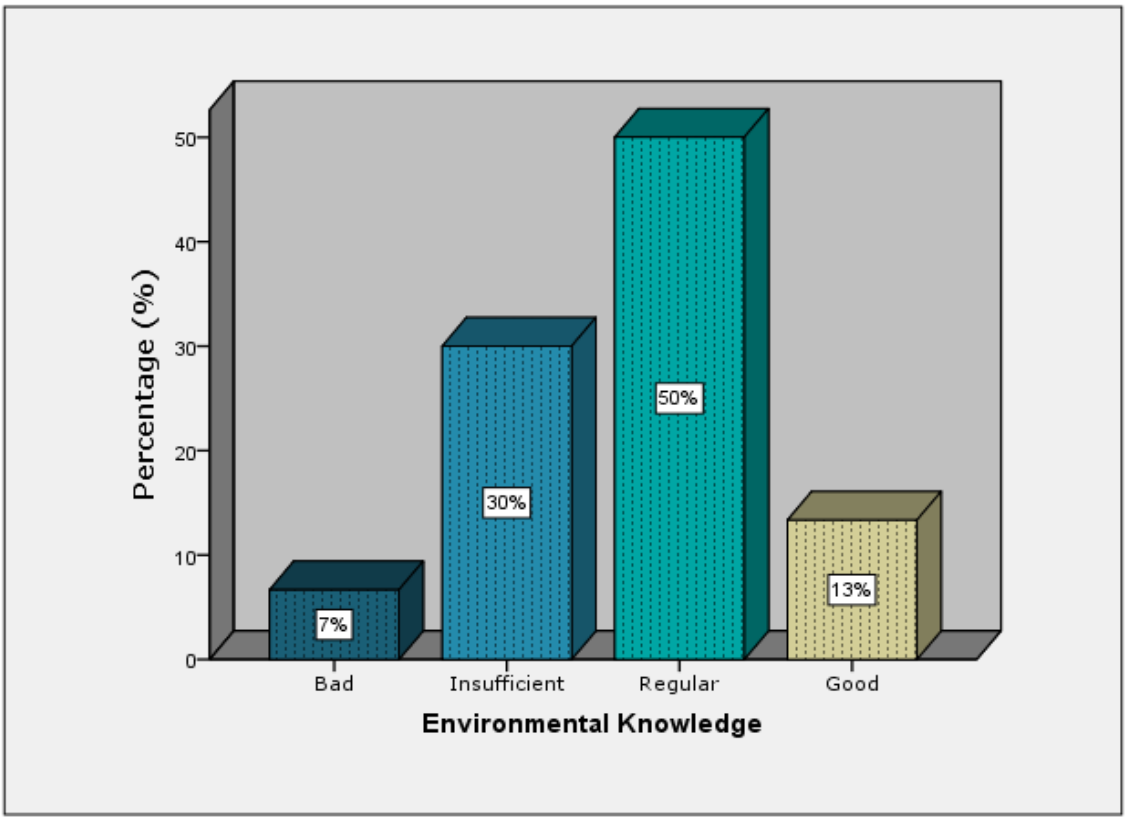

Figure 6. Level of environmental knowledge. Source: Own elaboration.

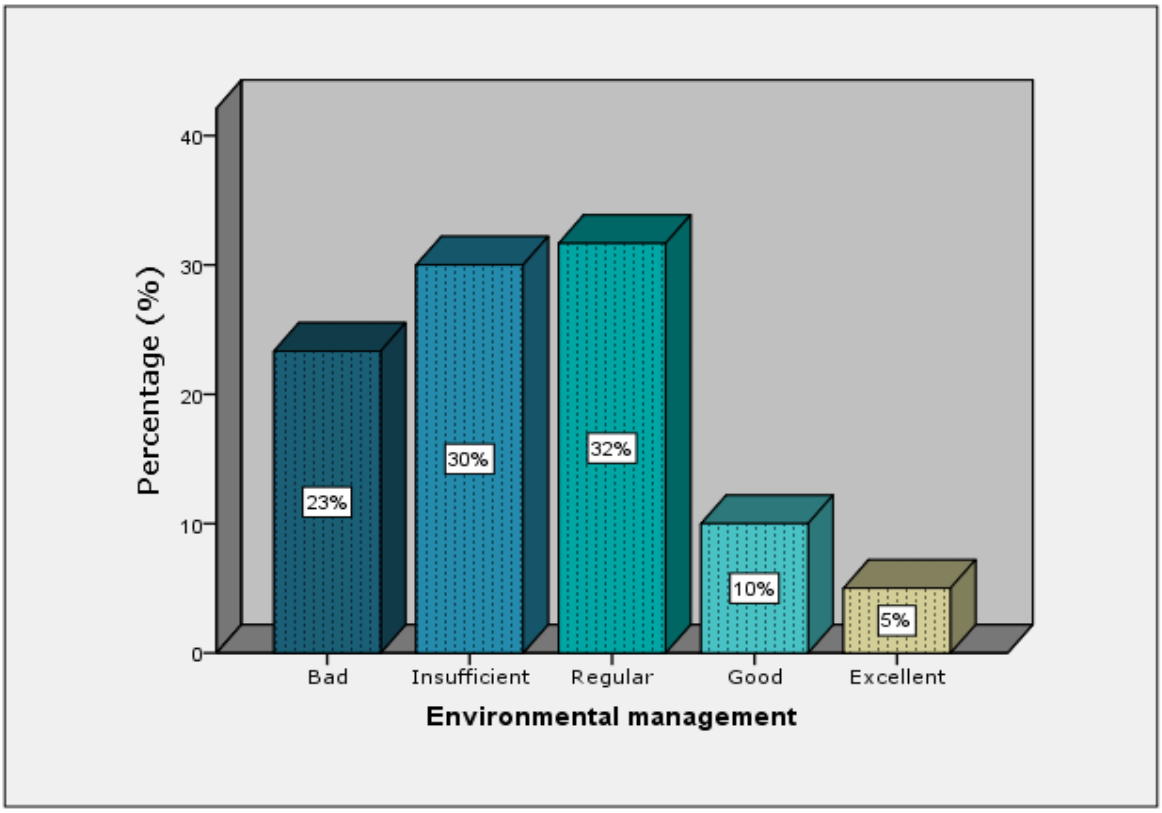

Figure 7. Level of Perception of Environmental Management. Source: Own elaboration.

Descriptive results after the environmental education workshops

Once the environmental education workshop, we proceeded to evaluate a random sample of firms' workers. The most relevant results of the survey are presented below:

- The proportion of the age of the workers 18 to 22, 23 to 27, 28 to 32 and 38 or more was found among the 19% and 26%; the age range of 33 to 37 years, was significantly lower with a 3%.
- Of the total number of workers surveyed 52% are women and 48% are men. Of these, 52% are married and 48% are single.
- The 13% of respondents reported having undergraduate studies and are found as receptionists or maintenance personnel. The 10% at primary level, the 39% and 39% secondary high school.
- The occupations of the workers are receptionist (16%), cleaning staff (3%), maintenance (6%), cook (29%) and Chef (16%), 29 per cent are helpers.
- To the phrase "I have no knowledge of the substances and pollutants that are generated due to the activities of maintenance, cleaning, kitchen or service", the 35% of subjects is between the levels of never, almost never and at times. This percentage represents a difference of 14% with the first survey. Also, it is possible to emphasize that the level of almost always and always accounted for 64%.
- The 78% of workers always or almost always strives to save resources such as electric power and water during their labor activities. But in the home is greater than the percentage who reports to perform actions for the care of electrical energy and water with an 87%.

- Most of the workshop realized from the environmental damage due to the use of aerosols, however, 19% reported that the use of necessity.
- Never and almost never the 9% to 35% difference of the preceding the workshop when they respond to "I have heard and I am interested in talks for the conservation of the environment".
- Of the 67% initially between always, almost always and sometimes leaves connected appliances was reduced to 51%.
- The 80% always perceives garbage while walking through the city and 33% expressed interest to collaborate in campaigns or environmental conservation programs.
- Never, almost never, and sometimes a 45% responded to the statement "Using recycled products" among those who always and almost always gives a 55%.
- The 32% of workers are concerned with separate waste including at home, but the 45% continues to manifest than ever, almost never or sometimes the separate.
- The 74% understands that the provision of garbage is a relevant issue due to their involvement.
- With regard to the attention to the news of environmental type in any medium of communication, the 61% always and almost always seen or heard news giving importance to those with environmental issues.
- To the affirmation "Periodically keep conversations about environmental issues", 80% never, almost never and sometimes hold talks with this topic. But when they have the knowledge of any situation with regard to

contamination by hazardous wastes, recognize the importance of separating the garbage (77% provided almost always).

- For the 23% recognizes the type of packaging materials (plastic, cardboard, paper) by purchasing products and take it into account in their provision.
- To the variable on recycle is to separate trash on 32% said they never and the same percentage forever.
- The 52% believes that the responsibility to regulate the environmental pollution generated by companies is the government.
- In accordance with the statement "I believe that at work is perceived the importance of the handling of waste contaminants".
- The 45% never, or almost never sometimes considers it, while 55% almost always or always considers it. In the same way, the 58% of workers never, almost never and sometimes notes that place graphical or textual preventive information to promote good use of water and energy. They also observed that in the place of work (42%) have spaces and/or containers allocated for waste generated while a 35% mentioned that are not designated specific containers according to an efficient system of separation of waste.
- To the question to "What extent the company establishes objectives for environmental improvement? For example, separation of garbage, actions to reduce or reuse", a significant fraction of the 52% do not observe environmental improvements.

- Close to 13% of employees think that they are not familiar with the mission and vision of the company, but the 50% stated to have knowledge of and these have observed that are found in the facilities.
- A 29% unknown the environmental programs of the company. But the same percentage is aware of the programs.
- In the companies a fraction ensures that according to their perception of the law the company always complies with environmental legislation (13%), other than ever before (13%) and almost never (16%) while those who testify to the fact that the programs are frequent are around 26%. But the 32% Not sure because they are familiar with the information.

The results are seen in Figure 8, Figure 9 and Figure 10 that present the general level for each domain after the implementation of the environmental education workshop.

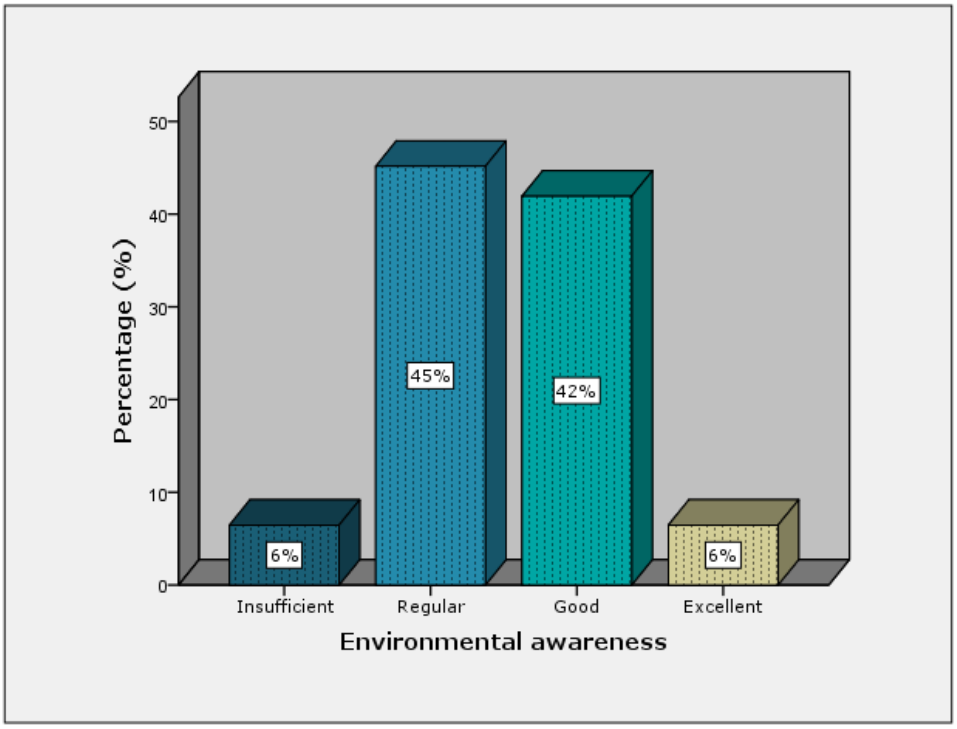

Figure 8. Level of environmental awareness. Source: Own elaboration.

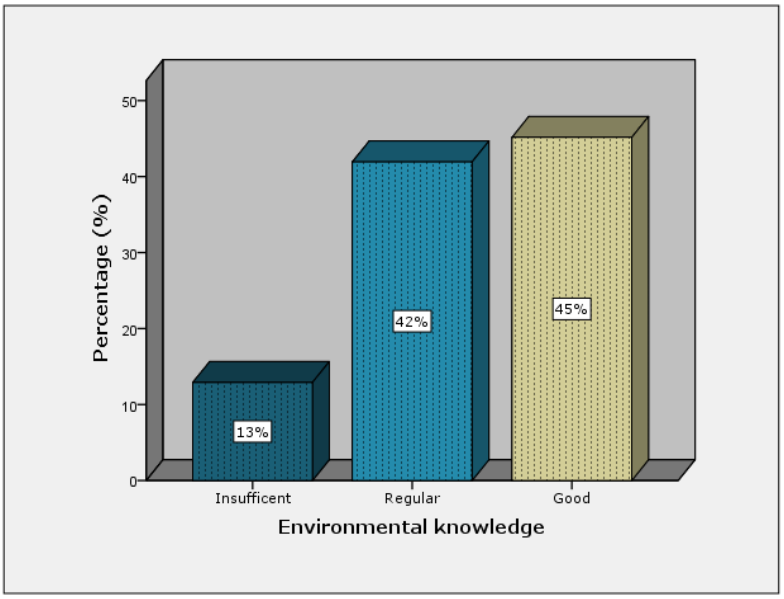

Figure 9. Level of environmental knowledge. Source: Own elaboration.

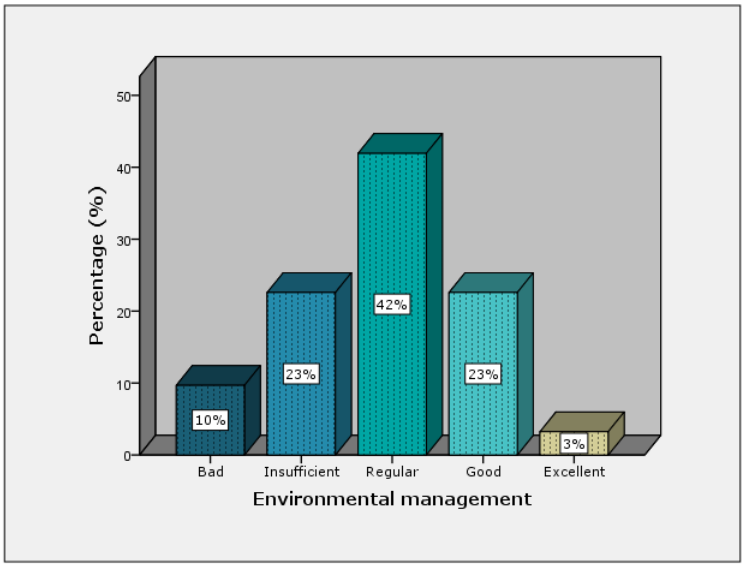

Figure 10. Level of Perception of Environmental Management. Source: Own elaboration.

After the pilot activity, with respect to the level of environmental awareness results were recorded in four categories, the category Good had an increase of the 27% to 42%; and excellent increased of the 2% to 6%.

For environmental awareness the percentage of Good increase in a 33% and a 13% in Management. The level of knowledge also had a tendency to increase in the categories good and regular, which had approximately 45% each, while the perception of management adopted a distribution of campaign, the category of bad showed a tendency to decrease in half and decreased by 7% insufficient.

Analysis of the effectiveness of the environmental education workshops

Taking as an evaluation instrument the survey, it was essential to establish whether there was difference in the proportion of response of the domains. For this, determined if the response options, for example, to environmental knowledge presented the same frequency in each one of the classifications (bad, insufficient, regular, good and excellent). That is, if the odds of each classification or did not statistical differences. This is inferred with a significance level of 0.05 for environmental awareness

had a value of X^2 of 45,500 which can be seen in Table 1 and for the probability of $P < 0.05$ the critical value is 7 815, then 45.500 is located in the area of rejection. This means that at least one of the percentages or proportions of each classification is different from the others.

Table 1. Of chi- square statistical.

Test statistical			
X^2	**Environmental awareness**	**Environmental management**	**Environmental awareness**
Chi-square	45.500[a]	17.167[a]	47.500[a]
Degrees of freedom (gl)	4	4	4
Asymptotic Significance.	0.000	0.002	0.000
A. 0 boxes (0.0%) have been waiting for lower frequencies that 5. The minimum frequency of expected check box is 12.0. Source: Own elaboration.			

Therefore, the people polled are not evenly distributed in each of the classifications for environmental awareness. Thus, for environmental awareness once you have determined that the percentages of the classifications of response are different we can argue that the regular level is the one that occurs with greater influence in the distribution of data.

For environmental awareness was obtained a value of X^2 of 17.167 with the significance level of 0.05 and 4 degrees of freedom and the value of the table chi square is similarly 9.488. To compare the value obtained with the critical value it is possible to affirm that it rejects the null hypothesis that establishes the equality of proportions between the classifications.

Then the answers do not present the same frequency, the classification that presents greater frequency is regular. From this, one understands that it is the difference between the frequency response for the classifications for example of knowledge good and regular, so that companies generally have a regular level.

For environmental management the critical value is also exceeded by the calculated. Then it is possible to reject the hypothesis of equality by 95%, the answers of respondents do not occur with the same frequency in each of the classifications, in such a way that there are so many employees with a good level of knowledge in environmental management. Those who have a poor level or insufficient. According to this analysis the proposed workshop for workers of the companies was introductory character since the results of the level of environmental education are mostly insufficient or regular. In addition, the level of dominant studies was secondary, a workshop was raised at a basic level.

Once the first survey to determine the level of environmental education in the whereabouts, was designed and conducted the workshop. For the comparative analysis of the results before and after the

environmental education workshop was conducted in which a student's *t* - test.

In general, the assumptions to determine differences between the level of education before and after the workshop are: H0, there is no statistically significant difference between the level of environmental education, before and after the workshop; H1: there is a significant difference between the level of environmental education, before and after the workshop.

In Table 2 it can be seen that the resulting value t is 2.47, according to 89 degrees of freedom, we find the critical values for the distribution with an alpha of 0.05 we have a value of 1.98. Therefore, to note that the value of 2.47 is greater than the critical value rejects the null hypothesis and it is accepted that there is a difference in the level of environmental awareness, before and after the workshop.

Table 2. Student's *t* test for the comparison of the category environmental awareness.

Student's t- Test	T-test for equality of means						
	T	Degrees of freedom	Significance (bilateral)	Mean Difference	Tip Error. the difference	95% confidence interval for the difference	
						Less than	Greater Than

Categories	They have assumed equal variances	2.47	89	.015	2.86720	1.16050	-5.17310	-.56131
	Does not have assumed equal variances	2.56	67.66	.012	2.86720	1.11590	-5.09414	-.64027
Source: Own elaboration.								

For environmental awareness in Table 3 we observe the value obtained 4.95 with an alpha of 0.05 to 89 degrees of freedom the critical value is 1 987. Therefore, a difference in environmental awareness category before and after the implementation of the workshop.

Table 3. Student's t test for the category of environmental awareness.

	T-test for equality of means					
	T	**Degrees of freedom**	**Significance (Bilateral)**	**Mean Difference**	**Tip Error. the**	**95% confidence interval for the difference**

Student's t- Test						difference	Less than	Greater Than
Amounts	They have assumed equal variances	4.95	89	.000	5.8371	1.1789	8.79	3,494
	Does not have assumed equal variances	5.04	63.99	.000	5.8371	1.1568	8.148	3,525
Source: Own elaboration.								

In Table 4 for the category of environmental management we observe the value of 1.853 with an alpha of 0.05 to 89 degrees of freedom compared to the value 1 987, it is assumed that there is no significant difference in the level of knowledge in the category before and after the workshop.

Table 4. Student's t test for the category of environmental management.

Student's t- Test		T-test for equality of means						
		T	Degrees of freedom	Significance (Bilateral)	Mean Difference	Tip Error. the difference	95% confidence interval for the difference	
							Less than	Greater Than
Amounts	They have assumed equal variances	1,853	89	.067	3.59	1.942	7.459	.260
	Does not have assumed equal variances	2,027	77,165	.046	3.59	1.775	7135	-.063

Source: Own elaboration.

In general, according to the results of comparison in Figure 11 it can be seen that the environmental education workshop had positive effect on the results obtained when applying for the second time in the level of environmental education per domain.

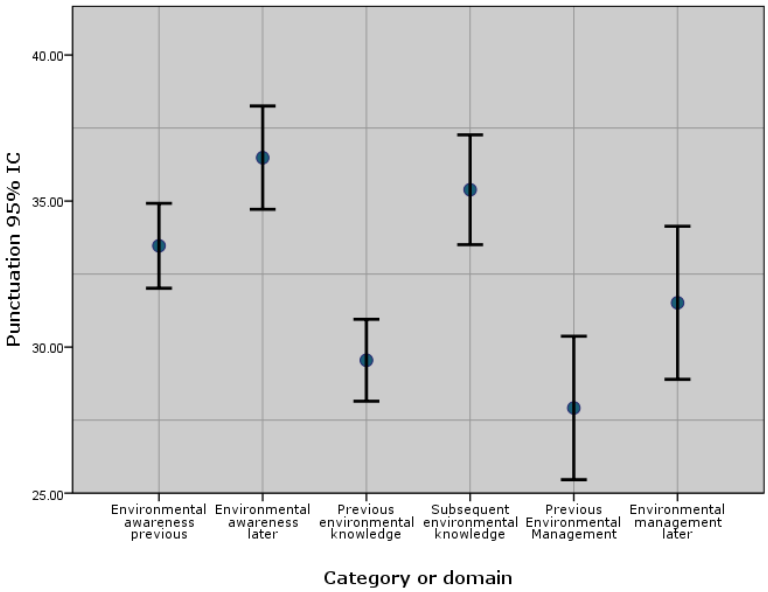

Figure 11. Level of average environmental education before and after the environmental education workshop by domain. Source: Own elaboration.

Visibly to highlight the difference in the level of environmental education in Figure 12 presents a comparison chart of the total average obtained. As you can see there was a positive impact because the Group subsequent to the implementation of the environmental education workshop has a score much higher than the previous group.

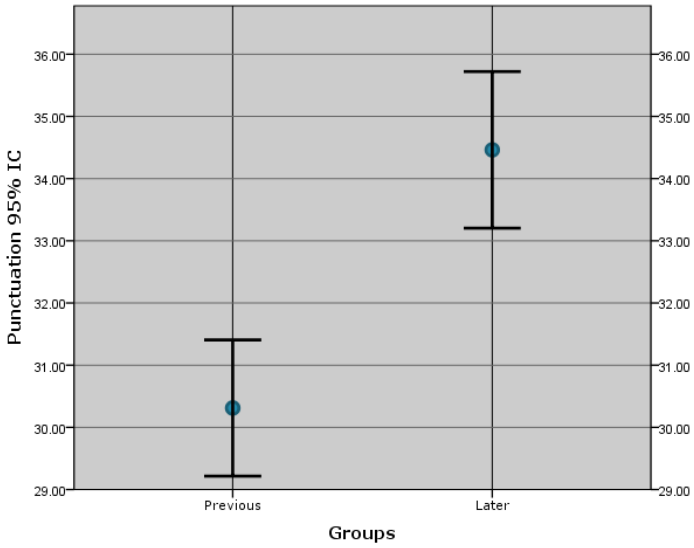

Figure 12. Level of average environmental education before and after the workshop on environmental education. Source: Own elaboration.

Legal requirements

The regulation of the disposal of effluents by companies requires more attention, priority is to make it clear to the companies the requirements that must be met in order to respect the legal framework in the field of water, as presented in the array of legal requirements (Table 5), most of which are not met.

Table 5. Legal requirements on water.

Standard, LAW, REGULATION	Heading or fraction thereof	Description	The Field	Compliance
"Law of National Waters"	Title VII CHAPTER I Article 88 BIS II fraction II	Article 88 bis. Natural persons or legal entities that carry out wastewater discharges to receiving bodies referred to in the present Law, shall: II. Treat wastewater prior to its discharge into receiving bodies, when necessary to comply with the provisions of the discharge permit and in the Mexican Official Standards;	Water	Yes
"Law of National Waters"	Title VII. Chapter I. Art.88 BIS. Fraction I.	Article 88 bis. Natural persons or legal entities that carry out wastewater discharges to receiving bodies referred to in the present Law, shall: I. Count with the permission of discharge of wastewater mentioned in the previous article;	Water	No

"Law of National Waters"	Title VII. Chapter I. Art.88 BIS. Fraction III.	Article 88 bis. Natural persons or legal entities that carry out wastewater discharges to receiving bodies referred to in the present Law, shall: III. Cover, where appropriate, federal law by the use or exploitation of national property as receiving bodies of wastewater discharges.	Water	No
"Law of National Waters"	Title VII. Chapter I. Art.88 BIS. Fraction IV.	Article 88 bis. Natural persons or legal entities that carry out wastewater discharges to receiving bodies referred to in the present Law, shall: IV. Install and maintain in good condition, measuring devices and access for sampling necessary in the determination of concentrations of the parameters in download permissions.	Water	No

"Law of National Waters"	Title VII. Chapter I. Art.88 BIS. Fraction V.	Article 88 bis. Natural persons or legal entities that carry out wastewater discharges to receiving bodies referred to in the present Law, shall: V. Make the knowledge of "The Water Authority" contaminants in the wastewater generated by cause of the industrial process, or the service that you are operating, and that were not considered in the terms and conditions of download laid down.	Water	No
"Law of National Waters"	Title VII. Chapter I. Art.88 BIS. Paragraph VIII.	Article 88 bis. Natural persons or legal entities that carry out wastewater discharges to receiving bodies referred to in the present Law, shall: VIII. Retain at least five years of the registration of the monitoring information.	Water	No

"Law of National Waters"	Title VII. Chapter I. Art.88 BIS. Fraction XI .b.	Article 88 bis. Natural persons or legal entities that carry out wastewater discharges to receiving bodies referred to in the present Law, shall: XI. allow staff of "The Water Authority" or "the Office", in accordance with its respective powers, the realization of: B. Reading and checking the operation of the gauges or other devices of measurement;	Water	Yes
Official Mexican Norm "NOM"	NOM-001-SEMARNAT.	NOM-001-SEMARNAT: Which establishes the maximum Permissible levels of contaminants for wastewater discharges into National waters and published in the Official Journal of the Federation 06 January 1997.	Water	No
Official Mexican Norm "NOM"	NOM-002-SEMARNAT -1996.	NOM-002-SEMARNAT- 1996, which establishes the maximum permissible levels of contaminants for wastewater discharges to Urban or municipal wastewater collection systems, published in the Official Journal Of the Federation on 03 June 1998	Water	No

Official Mexican Norm "NOM"	Mexican Standard NMX-AA-42-1987	Mexican Standard NMX-AA-42-1987 water quality - Determination of the most probable number (NMP) of total coliforms , fecal coliforms (thermo tolerant) and presumptive *Escherichia coli*	Water	No
Regulation of the law for protection of the environment of the State of Yucatan.	Sixth Title. Chapter I. Art 196.	Article 196. Domestic wastewater treated by septic tanks, shall be discharged to fields of absorption or irrigation, whose depth is between three and four meters above the water table of the place. When this is not possible, the waters shall be subject to any other method of treatment with similar efficiency to the systems described.	Water	No
Regulation of the law for protection of the environment	Title VI CHAPTER I Article 200	Article 200. The working capacity of the septic tanks shall be determined in accordance with the number of users.	Water	No

Source: own elaboration on the basis of information collected from the interior.

Discussion

Tourism is an important factor in the development of the economies of various nations. However, it is possible to ask, What Is the tourism a blessing or a curse?, a fair deal or a trick misleading?, Is the tourism one response to the problem of development of planned economies, or your good planning and economic organization make tourism a benefit only business? (Apostolopoulos, 1995). In various aspects of the development of cities, the expansion of tourism has both positive and negative aspects, in the social, economic and environmental. In particular, the environmental impacts are considered as inversely effects, proportional to the development of tourism. Therefore, the more environmental impacts affect a tourist zone lower likelihood of concurrency and consequently lower incomes. At this point it is not intended to address the issue according to a specific approach as the defense or adaptation to tourism. But, the current situation of tourism in environmental matters should be characterized, for the purpose of presenting tools that allow the tourist sector cover the legal requirements in environmental matters. In this perspective allows us to mitigate impacts and formulate tourism businesses with environmental awareness. Trends in Tourism research focus mostly to aspects such as: Eco-tourism, rural tourism, massification of ecotourism, impacts, gastronomy, sustainable development, among others (Castillo & Lozano, 2006). But, to speak of sustainable tourism also directs us to aspects such as environmental education. As well, environmental education refers to the need to inform people about the characteristics of the environment in which they operate and the effect they have on the environment (Sarukan, 2016). The United Nations

environmental education is geared to sustainability. In Mexico the Secretariat of Environment and Natural Resources (Semarnat), offers different strategies to strengthen environmental education and support the legislation by means of the General Law of Ecological Equilibrium and Environmental Protection (LEEGEPA) (Akerberg & Gonzalez, 2016). Then, it is the responsibility of citizens and businesses know the aspects related to environmental legislation. Therefore, the purpose of environmental education is to prevent environmental damage, in this project specifically during the development of tourist areas with cenotes as attractive.

So, what has been observed is that the use of the tourist areas, it is almost always through concessions. In the case of Valladolid, the tourist flow is given in some hotels, tourist whereabouts, restaurants and little shops. In this way, Valladolid, despite having a rich architecture that combines traditional, indigenous, colonial, popular and spaces of environmental value, becomes a point of Step (Sefotur & UADY, 2013). However, the emerging characteristics of tourism development, and the limited number of formal enterprises (without taking into account the cooperatives that manage large number of cenotes) allow you to work with programs to mitigate environmental pollution according to the characteristics, for example, of a hotel.

On the other hand, it was interesting to note that the people who manage a tourist whereabouts perceive the contamination and the vulnerability of the aquifer in different ways. Thus, the perceptions, attitudes, expectations, and behaviors before the environmental circumstances, will give shape to different uses and management (Moser,

Navarro, Ratiu & Weiss, 2010). Because of this the study focused in the diagnosis of the handling and consumption of the water resource, to then make a awareness activity.

As well, tourism enterprises tend to facilitate environmental education courses only to its employees, leaving aside for the guests. This can be seen in some studies, for example, in Iran, where it has measured the environmental performance of hotels and found that approximately 80% of the hotels trains its employees in the field of environmental awareness, but only 43% does it with your customers (Aminian, 2012). In such a way that was presented as a proposal the visual resources to publicize both workers and visitors the environmental policies of the companies.

During the awareness activity was undeniable to perceive the economic benefits generated by tourism for the area of work. However, it was also noted that the tourism causes a large increase in water demand and in areas with permeable character is predictable the contamination of the groundwater, in general there are no specialised treatment, since the waters are sent to sinks. Because of this, the main concern is sewage. This problem is evident, for example, Nava (2015) Conducted a study in which was characterized the degree of contamination in the cenotes Skull, Sacbe and Eden, which are found in the Yucatan; and it was observed contamination by phosphates and organic matter; finding that the levels of fecal coliforms were beyond the limits allowed by the NOM-245-SSA1-2010; that establishes the health requirements and maximum contaminant levels in swimming pools (Segob, 2010). This occurs because the companies or stops for

tourists do not have treatment, and if these are defective or may not cover the treatment of volumes of wastewater generated, especially in high season. During the implementation of the checklists it was noted that a company had septic tank and another with a storage tank; the last commanded their wastewater to a dumpster to avoid overflow. What leads to recognize the imperative that companies deploy efficient treatment systems to prevent the infiltration of wastewater into the groundwater.

The septic tank is an airtight container designed and built to receive waste water, separate the solids from liquids, provide a limited digestion to organic matter on hold, store the solids and allow the fluid clarified to be downloaded for later treatment and disposal (Collado, 1992). The water that comes out of the septic tank contains between 60 and 70% less organic matter in which he entered and still require treatment (Quintal, 1992). Then, this mechanism of treatment is recommended for the whereabouts tourist attraction that had little tourist affluence due to the sector to which he was going. The company that offers a restaurant service, visit the cenote and sale of souvenirs, according to the observation in the field, receives at least 100 visitors per day. In such a way that for this last to first instance recommended the remodeling of the storage tank segmenting in stages to sedimentation, and then install a small aerobic plant. Even when the septic tank for this amount of users is at the limit of application. The Official Mexican Norm NOM-006-CNA-1997, septic tanks, manufactured homes, specifications and test methods, offers relevant information on methods and working capacity, depending on the number of users (Segob & Conagua, 1999).

As to the whereabouts that offer these generate large volumes of discharge for which the retention times in the tanks for treatment, would not allow the degradation of organic matter and neither is it possible to establish greater dimensions for a pit which works with a mechanical system. Therefore, it is necessary to install small biological treatment plants. According to the volumes issued recommended an aerobic biological treatment with extended aeration. There are authors who state that the septic tanks should not be a system of choice for the disposal of effluents in Yucatan (Nava, 2015), Due to the high permeability of the soil. However, the maintenance and the addition of an oxidation system allows the elimination of microbiological agents.

With regard to the environmental aspects of the National Water Commission has issued rules governing water pollution that comes from all branches of industry. These have served to establish some specifications and limits on contaminants in Mexico. For example, the NOM-001-SEMARNAT-1996 (Segob, 1996) Establishes the maximum permissible levels of contaminants for wastewater discharges to national waters and properties, however, only one company demonstrated conduct studies of the parameters of the effluents How are solid, pH and chemical. The regulation of the disposal of effluents by companies requires more attention from government. The NOM-127- SSA1-1994 (Segob & Salud, 2019), sets the permissible limits of quality and the treatments in drinking water for human use and consumption that must comply with the systems of public and private supply or any person or entity that circulate in Mexico. The treatment of drinking water to ensure the quality supplied to the population is fundamental, but it is also proper disposal of wastewater.

Today, the water in Yucatan is drinking with a single chemical method: chlorination.

The tertiary treatment of water by chlorination presents limitations, though with this method eliminates pathogens that could cause diseases. Then, taking into consideration that the effluents do not receive proper treatment and infiltrate the aquifer that at the same time it houses the volumes of supply increasingly polluted with chemicals, pharmaceuticals and wastewater treatment; it was priority with the scope and limitations of this project to make it clear to the companies the requirements that must be met in order to respect the legal framework in the field of water.

To make more efficient water consumption is recommended the use of energy-saving technology, all kinds of ads or resources that motivate the reduction in consumption, public awareness campaigns for workers and establish company policies regarding care of the resource. In addition, make changes to the facilities for reuse, for example, instead of disposing of swimming pool water once the months of use place a pumping system to storage tanks to bring them to the toilets.

As well, during the diagnosis, a company replaced toilet tanks to reduce the consumption of 9 to 6 liters per flush. These were some of the practices implemented during the subsequent environmental education workshop which was determined by means of the survey for the category of good in awareness, knowledge and perception of the management had an increase of 15, 33 and 13%, respectively.

Therefore, the proportionality of increase in the categories of excellent and good we could indicate that the level of environmental

awareness and knowledge after the workshop was influenced by the new knowledge gained.

Although it is recognized the limitations of a survey to measure the environmental awareness, because it is a very subjective variable and it is assumed that the results only represent the companies assessed, also referred to the usefulness of the environmental education workshops for awareness raising.

In such a way that it is very likely that workers, to be focused on these environmental issues, now recognize local problems. For example, in a study on the behavior and environmental awareness in tourism enterprises, carried out in the Middle East, positive changes have been detected in small enterprises, influenced by the new policies for tourism development, in aspects of energy savings, water conservation, responsible waste management, improvements in practices and training (Min, 2011).

For this as a first step, it should be considered that to make the solutions more attractive to hoteliers, it is recommended to present them as an investment, and accompanied by the benefits conferred by providing environmental education and consequent increase in environmental awareness, such as the demonstration of cost savings and resources, as well as access to the prestige that provide environmental certifications and standards of environmental management, compliance with environmental law, and to encourage tourists demand for green practices or use eco-innovations of production processes and reduction of waste, in order to make a significant change in their behavior, then this

must be known to the tourism sector attended and conduct studies Complementary, to adapt and implement other methodologies for assessing the sustainability in the tourism industry just like the SWOT analysis.

Therefore, it is very likely that environmental education workshops to educate workers on the effects of tourism, its ecological footprint and the role they play, in implementing good practices, to mitigate the environmental impact.

Conclusions

This research was able to diagnose the water resource management in companies with tourist character, since it generated lists of nonconformities from the instruments and arrays of legal requirements for tourism enterprises participants, in the field of water and wastewater.

During much of the period of implementation of the project had no contact with the personnel working in the company and talked with the representatives for bonding and to be able to bring to fully implement the study.

Despite the fact that there are multiple requirements that must cover the companies to cover the aspects related to the legislation on water, we can say that there was no knowledge of which, for example, the permit application for discharge of wastewater. However, the company was committed to carry out in the short and medium term measures necessary for not submitting in a future non-conformances.

The knowledge of the volumes of water and related costs according to their activities will establish the activities for which you can save or edit with green technology systems for example in the taps and with respect to the water treatment. Ultimately it is recommended that septic tanks together with an oxidative treatment and for the cenote Zaci with major tourist it is recommended that a biological treatment system in a small active sludge plant.

All the employees were in accordance with the conservation and care of the water resource through the regulation of activities, have a positive attitude. Therefore, we must establish the steps to cover the procedures or requirements that establish the secretariats and presented in this project.

During the study it was determined that it has limited knowledge of activities involved in caring for the environment, so that was raised an environmental education activity that was implemented with success.

The results obtained in the surveys and workshops we can say that there is an equitable proportion between men and women employed in the company.

The predominant educational level is the child and the civil status equal to the frequency presents married and unmarried.

Environmental awareness and environmental awareness do not present an equitable distribution according to the number of people in the different classifications, according to the first survey the majority was found in the insufficient level or on a regular basis. In such a way that the projected workshops included basic aspects according to the following characteristics: with regard to the post of workers, with regard to the interference of the workers in the environmental aspects, level obtained who threw a basic environmental education workshop, the development of a training workshop with practical aspects.

Then to impart the workshop workers significantly improved their score in the surveys and showed greater interest in environmental issues raised during the activities.

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