Volume 7, Issue 13 — July — December — 2021

ECORFAN

Journal- Republic of Nicaragua

ISSN-On line: 2414-8830

ECORFAN®

ECORFAN Journal-Republic of Nicaragua, Volume 7, Issue 13, December 2021, is a journal edited semestral by ECORFAN. First Avenue Southwest, San Sebastian area, León, Republic of Nicaragua. P. C. 21000. WEB: www.ecorfan.org/republicofnicaragua/, journal@ecorfan.org. Editor in Chief: ZAPATA-MONTES, Nery Javier, PhD. ISSN Online: 2414-8830. Responsible for the latest update of this number ECORFAN Computer Unit. ESCAMILLA-BOUCHÁN, Imelda, LUNA-SOTO, Vladimir, First Avenue Southwest, San Sebastian area, León, Republic of Nicaragua. P.C. 21000, last updated December 31, 2021.

ECORFAN Journal Republic of Nicaragua

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The works must be unpublished and refer to topics of agriculture-forest, pathology-sustainable, forest, management, horticulture, engineering and integrated water useand other topics related to Biotechnology and Agricultural Sciences.

Presentation of Content

In Volume seven, issue thirteen, as the first article we present, *Vinasse: current concepts, challenges and opportunities for the sustainability*, by FERRARESI-DE ARAUJO, José Geraldo & NIÑO-CASTILLO, Isaías Naú, with adscripction in the Universidade Estadual do Sao Paulo (UNESP) and Centro Universitario CIFE, as a second article we present, *Theoretical construction of sustainable social awareness in mexican organizations*, by OJEDA-GUTIÉRREZ, Maricela, MARTÍNEZ-TORRES, Rosa Elia and RIVERA-ACOSTA, Patricia, with adscripction in the Universidad Politécnica de San Luis Potosí and Instituto Tecnológico de San Luis Potosí, as third article we present, *Environmental impact of disposing of mouth covers, masks or respirators what alternatives do we have?*, by HERNÁNDEZ-RODRÍGUEZ, María Guadalupe, ORTEGA-CHÁVEZ, Laura Antonia, GALLEGOS-OROZCO, Carmen Angelina and CARO-ESCUDERO, Iveth Selene, with adscripction in the Instituto Tecnológico de Chihuahua II, as fourth article we present, *The productivity in the beekeeping sector of Comalcalco, Tabasco, for the design of an improvement proposal*, by PAYRÓ-GARCÍA, Génesis, MOREJON-SANCHEZ, Juana María, PAYRÓ–DE LA CRUZ, Emeterio and MONTEJO-ZAMUDIO, Manuela de Jesus, with adscripction in the Tecnológico Nacional de México, Campus Villahermosa and Tecnológico Nacional de México, Campus Zona Olmeca.

Content

Article **ECORFAN Journal-Republic of Nicaragua**
December 2021, Vol.7 No.13 1-9

Vinasse: current concepts, challenges and opportunities for the sustainability

Vinaza: conceptos actuales, cambios y oportunidades para la sostenibilidad

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DOI: 10.35429/EJRN.2021.13.7.1.9 Received July 10, 2021; Accepted December 30, 2021

Abstract

The objective was to highlight the historical documents that foresee the use and abuse of ethanol production (vinasse) in Brazil according to literature published in the period 1934-2020. The methodology used was documentary, the review and analysis of which brought with it the synthesis and perspectives of vinasse as well as its uses and abuses. Results: a) there are legal instruments in Brzil since 1934 whose goal is to care for the environment; b) about in 1978 was prohibited the direct dumping of stillage into bodies of water and c) in 2011 environmental guidelines were provided on this topic to achieve sustainability in the Brazilian space. Conclusions: 1) as can be seen in the cited literature, vinasse is one of the most impressive respurces for ethanol production; 2) Brazil is the second largest ethanol producer worldwide; 3) the use of stillage for cooling sugarcane fiekds, its organic content, chemical and biochemical oxygen demand rates are high and 4) the synergy between academics from universities, the government sector, civil society, companies in the productive chain of the sugar energy sector, among others, is important.

Vinasse, Sustainability, Brazil

Resumen

El objetivo fue resaltar los documentos históricos que preveen el uso y abuso de la producción de etanol (vinasse) en Brasil de acuerdo con literaura publicada entre 1934-2020. La metodología empleada fue documental cuya revisión y análisis trajo consigo la síntesis y perspectivas de la vinaza así como sus usos y abusos. Resultados: a) existen instrumentos legales en Brasil desde 1934 que tienen como meta el cuidado del medio ambiente; b) desde 1978 se prohibió el vertido directo de la vinaza en cuerpos de agua y c) en 2011 se proveieron las directrices ambientales en este tópico para el logro de la sustentabilidad en el espacio brasileño. Conclusiones: 1) como se aprecia en la literatura citada, la vinaza es uno de los recursos más impactantes de la producción de etanol; 2) Brasil es el segundo productor de etanol a nivel mundial; 3) el uso de la vinaza para la refrigeración de los campos de caña de azúcar, su contenido orgánico, índices de demanda química y bioquímica de oxigeno son altos. y 4) es importante la sinergia entre académicos de universidades, sector gubernamental, sociedad civil, empresas de la cadena productiva del sector energético azucarero, entre otros.

Vinaza, Sostenibilidad, Brasil

Citation: FERRARESI-DE ARAUJO, José Geraldo & NIÑO-CASTILLO, Isaías Naú. Vinasse: current concepts, challenges and opportunities for the sustainability. ECORFAN Journal-Republic of Nicaragua. 2021. 7-13:1-9.

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Introduction

It is estimated that biomass accounts for about 14 % of all world primary energy consumption (National Electric Energy Agency, 2005). For this index is higher than that of coal and similar to that of natural gas and electricity. In developing countries, this share rises to 34%, reaching 60% in Africa (Silva *et al*., 2005).

In Brazil, in 2014 sugarcane biomass accounted for 15.7% of the energy supply. Most of the energy from biomass is used in the production of ethanol. According to Union of the Sugarcane Industry (2014), the 2013/2014 harvest saw an increase of 3.68 billion liters in ethanol production, with the total reaching 25.04 billion liters versus 21.36 billion liters in the 2012/2013 harvest (Energy Research Company, 2014).

The replacement of gasoline by ethanol plus the replacement of diesel oil by bagasse in the sugarcane industry prevented the emission of 33.2 million tons of CO_2 (Parsaee et. al., 2019). While a gasoline-only vehicle produces about 2.2 kg CO_2/liter, an equivalent vehicle powered exclusively by ethanol emits about 1.3 kg CO_2/liter, or 59% of gasoline vehicle emission therefore the vinasse was succesfully used as sources of nutrients for biohydrogen (Bittencourt *et al*., 2014).

However, with the increase in ethanol production, the production of residues such as straw, filter cake, bagasse, wastewater and vinasse are proportionally increased. Specifically with regard to vinasse, it is characterized as an effluent from distilleries with high polluting power, about one hundred times greater than that of domestic sewage. This is due to its richness in organic matter, low pH, high corrosivity, high levels of chemical oxygen demand (COD) and biochemical oxygen demand (BOD), high temperature at the end of the production process, and presents a high level of harm to the fauna and flora (Freire and Cortez, 2000 and Syaichurrozi *et al*., 2020).

The production of vinasse varies according to the different processes used in the production of ethanol. For each liter of ethanol, between 10 to 15 liters of vinasse are produced (Freire and Cortez, 2000). For every 1,000 t of processed cane, an average of 360 m^3 of vinasse is generated".

Considering the production of ethanol in Brazil, in the crop year 2013/2014, at around 25.04 billion liters, vinasse production was at least 250 billion liters (Szymanski, Balbinot and Nagel, 2010 and Belincanta, *et al*., 2016).

The literature on vinasse has been addressed mainly by the following researchers: Sheehan and Greenfield (1980), Willington and Marten (1982), Wilkie *et al*. (2000), Oliveira (2011) and Moares *et al*. (2015). The line of thought of these authors is convergent in the importance of the use of the waste, given organic matter content, as well as polluting capacity. Therefore, considering the high volume of vinasse production and its serious environmental impact, a review of the literature on vinasse, being the purpose of this study, is justified.

Methodology

The present investigation is exploratory, since it is characterized by a focus on the understanding of the facts (Lazarini, 1997). The exploratory research aims to provide a better understanding of the problem, in order to make it more explicit or to construct hypotheses and/or propositions. The vast majority of exploratory research involves a bibliographical survey and analysis of examples that stimulate understanding (Gil, 2007 and Meng, *et al*., 2020). Data collection was performed through a bibliographical survey in the search for information available in national and international publications (Fonseca, 2002).

For the construction of the theoretical framework, a bibliographic survey of articles was carried out in the databases of the Scientific Electronic Library Online; Web of Science; and theses and dissertations of the Integrated Library System of UNESP, UNICAMP and USP, using the keywords: vinasse, applications, and legislation on the subject.

Results

Vinasse is the sub product of the distillation of biomass for the production of ethanol, from sugar crops (beet and cane), starch crops (corn, wheat, rice and Manioc) and cellulosic material (crop residues, bagasse and wood). Vinasse stands out most in quantity and polluting capacity, being also known as stillage. This residue increases proportionally with the increase of ethanol production in the world (Moraes *et al*., 2015).

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The quantitative composition of vinasse varies according to the time, maturation index, soil type and the raw material used for ethanol production (Rodrigues *et al*., 2012). Vinasse is characterized as distillery effluent with high polluting and fertilizing value; its polluting power, about one hundred times greater than that of domestic sewage, derives from its richness from organic matter. It is defined as a light brown liquid which darkens due to oxidation resulting from the fermentation process, its pH ranges from 3.7 to 5.0, it has high corrosivity and BOD and COD index, with a high temperature at the end of the production process (Freire and Cortez, 2000). Due to its high organic matter content, it assists in the proliferation of vectors of diseases and in its decomposition generates strong odor (Rafaldini *et al*., 2006).

Vinasse as an effluent composed of 93% water and 7% solids; of these solids, about 75% are organic matter, formed of organic acids and, to a lesser extent, by cations such as K+, Ca+2 and Mg+2 and their alcoholic strength is not higher than 0.03 °GL (Araujo and Oliveira, 2020). Also, vinasse is the one with the highest pollutant content, with BOD varying from 20,000 to 35,000 mg/L, where the amount discharged by the mills varies from 10 to 16 liters of vinasse per liter of ethanol depending on the production conditions and leaves the distillation apparatus on average between 85 to 90 °C (Silva *et al*., 2007 and Kasak & Tor, 2020).

Regarding the composition of vinasse depends on factors such as: nature of the vinasse composition, fermentation system, type of yeast used, type of yeast treatment, additives used in fermentation, distillation apparatus, quality of the water used, the components used for disinfection, and the nature and composition of the raw material (Nogueira *et al*., 2015 and Nogueira & De Oliveira, 2020).

Second generation ethanol vinasse has a higher organic matter content than first generation ethanol vinasse. However, the ratio of BOD and COD is comparable for both types. In contrast, the content of nutrients and minerals, especially potassium, is considerably lower for second generation vinasse. Thus, the application of this liquid into the soil cannot be justified, unlike the case of first-generation vinasse from ethanol production (Moraes *et al*., 2015).

In general lines, the chemical composition of the vinasse from different origins is summarized in Table 1.

Raw Material	Production (L/L_{EtOH})	BOD (g/L)	COD (g/L)	N_{total}	P_{total}	K	SO_4^{2-}	pH
Molasses (beet)	11.6	44.90	91.10	3,569.00	163.00	10,030.00	3,030.00	5.35
Sugarcane juice	16.30	16.70	30.40	628.00	130.00	1,952.00	1,356.00	4.04
Molasses (cane)	14.00	39.00	84.90	1,229.00	187.00	5,124.00	3,478.00	4.46
Molasses (cane)	nd	25.8	48.00	820.00	480.00	nd	nd	nd
Cellulosic Material	11.10	27.60	61.30	2,787.00	28.00	39.00	651.00	5.35
Manioc	16.00	31.40	81.10	650.00	124.00	nd	nd	3,5
Corn	nd	26.9	64.50	755.00	1,170.00	nd	nd	3.65
Corn	nd	43.10	59.40	546.00	228.00	nd	299.00	nd
Saccharin sorghum	nd	46.00	79.9	800.00	100.00	nd	nd	4.5

Table 1 Physical-chemical characteristics of vinasse of different raw materials
Source: Wilkie, Riedesel and Owens (2000) and Menezes (1980); nd = no data available

By the late 1970s, increasing volumes of vinasse were being thrown into streams. The releases were of a seasonal nature, according to the ethanol production cycle, affecting self-regulation and self-reproduction of ecosystems (Corazza, 2006).

The impacts of the application of vinasse vary according to its chemical composition, volume and the periodicity of application. The high concentration of vinasse in soil and groundwater can lead to a high concentration of metals such as magnesium, aluminum, and iron, and also chloride and organic matter (Araujo *et al*., 2020).

Biorremediation is a technique for cleaning floors contaminated in a very practical way since use the same microorganisms that live in the ground and the subsoil (Irurbe, 2011 and Dias, *et al*., 2020).

In channels of vinasse flow, the contamination of the water table can reach 91.7%, thus making the groundwater polluted. Once contaminated, the chances of reversal are small. For the author, vinasse presents a high level of harm to large aquatic animals, it drives away the Brazilian coastal marine fauna in the physiological phenomenon of spawning, and destroys microflora, microfauna, submerged and floating aquatic plants (Ludovice, 1997).

The indiscriminate application of vinasse into the soil intensifies salinization, metal leaching, greenhouse gas emissions and contamination of groundwater.

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The situation is more complex in the case of second generation ethanol vinasse and alcoholic beverage pentoses, for which there are no environmental standards, and cannot be used as fertilizer in sugarcane crops, unlike first generation ethanol vinasse (Moraes *et al*., 2015). Considering that in the 2013/2014 harvest Brazil produced, around 25.04 billion liters of ethanol, the production of vinasse in this harvest was at least 250 billion liters, a very worrying volume (Union of the Sugarcane Industry, 2014).

However, the inadequate and indiscriminate disposal of vinasse in soil, rivers, lakes and aquifers has received attention in Brazil since the 1930s, due to the environmental problems associated with this practice (Environmental Company of the State of São Paulo, 2006). Therefore, a series of legal frameworks have been constructed with the objective of minimizing and even eliminating the indiscriminate disposal of vinasse in soil, rivers, lakes and aquifers, and the main of which in Brazil and the world are highlighted below. Table 2 presents the legislation on effluent and vinasse disposal in Brazil.

Legislation/Standard	Content
Decree 8468/76:	Approved the regulation of Law 997/76 and its regulation on the "Prevention and Control of Environmental Pollution", referring to the discharge into watercourses was restricted in the State of São Paulo (SÃO PAULO, 1976)
Standard P4.331-Resolution CONAMA 430/11:	Deals with the conditions and standards for the discharge of effluents; complements and alters Resolution No. 357 of March 17, 2005, of the National Council for the Environment CONAMA (BRAZIL, 2011)
Standard CETESB P.4321 Vinasse	Criteria and Procedures for Application into Agricultural Soil, to establish the criteria and procedures for the storage, transportation and application of vinasse, generated by the sugar-alcohol activity in sugarcane processing, in the soil of the State of São Paulo. Addresses the limits of the application of vinasse, according to the following parameters (CETESB, 2006).

Table 2 Legislation and rules on effluent and vinasse disposal in Brazil
Source: Adapted from Decree 8468/76, Standard P4.331 –Resolution CONAMA 430/11 and Standard CETESB P.4321 Vinasse

Point out from a history perspective, the main legal instruments referring to water protection and vinasse discharge.

– Water Code (Decree 24.643 of July 10, 1934), which, among other things, safeguards water bodies against the disposal of pollutants;

– Law on environmental crimes (Law 9605, of February 12, 1998) in articles 33 and 54, indicates the penalties that will be imposed on offenders when the occurrence of death of animals due to the emission of effluents into the waters and in the occurrence of water pollution respectively, in which case the offenders receive imprisonment from one to three years or a fine, or both, cumulatively, for violation of article 33 and one to five years of imprisonment in violation of article 54;

– Decree of the Ministry of the Interior n. 323 of November 29, 1978, which states that from the 1979/1980 harvest, the direct or indirect discharge of vinasse into any water body by the alcohol distilleries installed or to be installed in the country is prohibited;

– Decree of the Ministry of the Interior n. 158 of November 3, 1980, which addresses its discharge into water bodies and on distillery effluents from sugar mills; Resolution of the CNRH Number 15 of 01/06/2001, which gives the guidelines for the integrated management of surface, underground and meteoric waters;

– Law Number 7 960, dated 21/12/89, which provides for temporary detention for the crime of drinking water poisoning, among others;

– Decree-Law Number 1413, dated 14/08/75, which provides for the control of environmental pollution caused by industrial activities;

– Decree of the Ministry of the Interior Number 124, dated 20/08/80, which lays down standards for the prevention of water pollution, for the localization of potentially polluing industries, constructions or structures, and for protection devices.

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– Resolution of CONAMA Number 430, dated May 13, 2011, which provides for the classification of water bodies and environmental guidelines for their classification, and also establishes the conditions and standards for effluent releases and other measures. In accordance with § 4º, it establishes the conditions for effluent discharge, and in § 5º, which regulates effluent discharge standards, which are: I –pH between 5 to 9; II – temperature: less than 40°C, where the temperature variation of the receiving body must not exceed 3°C in the mixing zone; III –sedimentable materials: up to 1 mL L-1 in a one hour test in an Imhoff cone. For discharge in lakes and ponds, whose circulation velocity is practically zero, sedimentable materials should be virtually absent; IV –discharge system with a maximum flow rate of up to ½ times the average flow of the daily activity period of the pollutant, except in cases permitted by the competent authority: I – oils and greases; II –mineral oils: up to 20 mg L-1; III –vegetable oils and animal fats: up to 50 mg L-1 and VI –absence of floating materials.

– The World Health Organization also created recommendations for wastewater reuse, the main one being:

– Guidelines for the Safe Use of Wastewater, Excreta and Greywater-Volume II-Wastewater Use in Agriculture: which presents a number of considerations regarding the use of wastewater in agriculture, seeking to benefit human health and the environment (WHO, 2006 and Kazak & Tor, 2020).

– In the United States, the Environment Protection Agency has established standards for wastewater reuse:

– Guidelines for Water Reuse: which also provides for the reuse of wastewater in order to obtain benefits to human health and the environment (USEPA, 2004).

Despite all, the legal framework regarding the adequate use of vinasse in Brazil with regard to São Paulo Decree Law Number 8.468, September 8, 1976, it can be, considered superficial because it's prescribed only according to its potassium content. However, its potential associated environmental impacts weren't considered (Moares *et al*., 2015 and Aragao, *et al*., 2020).

However, the normative instruments and published legislation aim not only to mitigate the disposal of vinasse in soil and water bodies, but also to encourage new applications for this residue, with the assumption of promoting economic and social development in its reuse in consonance with environmental preservation. Simultaneously with the construction of these legal instruments, researchers have focused on finding uses and treatments for vinasse (Silva & Gallo, 2021). According to Sheehan and Greenfield (1980), Willington and Marten (1982), Cortez *et al*. (1992), Oliveira (2011), Moares *et al*. (2015), based on technologies available for the reuse of vinasse, alternatives are listed in consonance with sustainable development, where the main products and processes from vinasse and their respective advantages and disadvantages are summarized in table 3.

Process/Final product	Advantages	Disadvantages
Anaerobic Biodigestion	Production of electrical energy; Reduction in BOD; Effluent is a fertilizer	High cost; High technology
Fertirrigation	Low cost; Easy to adopt	Unknown long term effects; High logistic cost
Anaerosis	Reduction in BOD (70 to 90% in the first process) and up to 99% in the second.	Need of construction, maintenance and monitoring of large tanks or lagoon for the treatment.
Construction	Significant advances regarding the resistance of the material. Potential for vinasse discharge reduction	Limited to constructions near the place of vinasse origin. High logistic cost
Biodiesel	Produce lipids with higher added value for biodiesel production	In research phase
Animal feed	Cheap method; Easy to adopt	Not sufficiently researched.
Yeasts	Reduction of vinasse discharge	High production process cost

Table 3 Potential use of vinasse: advantages and disadvantages. *Source: Adapted from Sheehan and Greenfield (1980), Willington and Marten (1982), Cortez, Magalhães and Happi (1992), Salomon (2007), Oliveira (2011), Moares, Zaiat and Bonomi (2015).*

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In this case, of caring for the environment, the literature shoes a scenario characterized by many difficulties, for the construction and execution of a project that achieves sustainability through, ecological biofuel such as bioethanol with genuinely national capital (Vieira et al., 2018).

Conclusions

As reported in the literature cited in the theoretical reference of this article, vinasse is one of the most impacting residues of ethanol production, due to its polluting capacity as well as to the volume of its production, and with Brazil, being the second largest producer of ethanol in the world this volume is even more disturbing.

Although vinasse is to use for fertirrigation of sugarcane fields, its organic content, chemical and biochemical oxygen demand indexes are high, posing a potential risk for soil and water pollution with groundwater, rivers, streams, lakes (Ortíz, *et al*., 2017) and aquifers being significant (Niño-Gutiérrez & Saldaña, 2012).

Given this reality, the government, both at federal and state levels, has developed a series of legal frameworks with the objective of restricting or even eliminating the indiscriminate dumping of vinasse, whether in soil or in water bodies. However, this is not enough if there is no real inspection, punishment and, above all, incentive for the use of vinasse for other purposes, with positive economic, social and environmental externalities.

However, it is this same substantial volume of organic content that gives vinasse the potential to be used for generating electric energy from anaerobic biodigesters. From the studies performed by researchers such as Sheehan and Greenfield (1980), Willington and Marten (1982), Oliveira (2011), Moares et al. (2015), the potential use of vinasse for anaerobic biodigestion, fertirrigation, anaerosis, and construction, as well as for the production of biodiesel, animal feed and yeast, has been shown.

However, there are no governmental incentive policies, no incentive for biogas or bioelectricy production at energy auctions in the regulated contracting environment, no financing of research and development of industrial scale biodigestors to produce electricity, and all of the other byproducts originating from vinasse (Parasee, *et al*., 2019).

Therefore, there is a need for synergy between universities, research centers, development agencies, development banks, multilateral institutions, companies in the sugar energy sector production chain, non-governmental organizations, executive and legislative branches, both at the federal level and in the state spheres, to work together to curb the disposal of vinasse in disagreement with the law and, at the same time, encourage its reuse in line with the economic, environmental and social dimensions of sustainability.

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ISSN-On line: 2414-8830

Article **ECORFAN Journal-Republic of Nicaragua**
December 2021, Vol.7 No.13 10-20

Theoretical construction of sustainable social awareness in mexican organizations

La construcción teórica de la conciencia social sustentable en las organizaciones mexicanas

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DOI: 10.35429/EJRN.2021.13.7.10.20 Received July 15, 2021; Accepted December 30, 2021

Abstract

This article gives an account of the qualitative research process under the Grounded Theory strategy to generate a substantive theoretical construct called Sustainable Social Culture from instrumental records product of an immersion in the field in four industrial units (Martínez, 2020). The first findings raised questions that led to delving into the way in which industrial workers exercise agency and reflexivity in terms of sustainability. This theoretical construct rests on the Sociology of Organizations, Organizational Culture and Environmental Management that contribute to integrating categorical dimensions for their subsequent theorization and conceptual integration whose consistency, internal logic and validity are evidenced.

Sustainable Social Awareness, Environmental Management Culture, Agency, and Reflexivity

Resumen

Este artículo da cuenta del proceso de investigación cualitativa bajo la estrategia de Teoría Fundamentada para generar un constructo teórico sustantivo denominado Cultura Social Sustentable a partir de registros instrumentales producto de una inmersión al campo en cuatro unidades industriales (Martínez, 2020). Los primeros hallazgos motivaron interrogantes que llevaron a profundizar sobre la manera en que los trabajadores industriales ejercen capacidad de agencia y reflexividad en términos de sustentabilidad. Este constructo teórico descansa en la Sociología de las Organizaciones, la Cultura Organizacional y de Gestión Ambiental que contribuyen a integrar dimensiones categoriales para su posterior teorización e integración conceptual cuya consistencia, lógica interna y validez se evidencian.

Conciencia Social Sustentable, Cultura de Gestión Ambiental, Agencia y Reflexividad

Citation: OJEDA-GUTIÉRREZ, Maricela, MARTÍNEZ-TORRES, Rosa Elia and RIVERA-ACOSTA, Patricia. Theoretical construction of sustainable social awareness in mexican organizations. ECORFAN Journal-Republic of Nicaragua. 2021. 7-13:10-20.

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Introduction

The World Commission for the Environment and Development (1987) defines sustainability as the one that promotes both the fulfillment of current needs, and the guarantee for the good use of resources for the future generations. To achieve this task, social organizations and institutions must become aware of the problems that humanity faces in environmental terms to seek strategies in scientific and technological contributions, and with it, move towards a new organizational culture that is sustainable. However, this persistence embodied in the 2030 Agenda for the management of public policies in favor of the sustainability, as well as its execution guidelines have not reached yet the requirements needed to positively impact the organizational culture of economic units of the industrial sector.

On the other hand, a constant restructuration is perceived in some branches of the industrial category in two senses: by the regulations of all kinds that require changes in processes, procedures as well as in the behavior of workers, and by technological changes that require better practices. Some examples can be found in the mining-metallurgical industry, where it is observed that since the last decade of the last century, it has been gradually adjusting its organizational and procedural strategies to meet the international and national regulations, whose central approach is focused on Sustainable Development.

A specific case was the result of the application of a Management Model for Sustainability (Martínez, 2020) whose main goal was to establish the level of compliance with the current legislation known as the Environmental Impact Manifesto—EIM—(SEMARNAT, 2020) and the alignment with the environmental objectives of the 2030 Agenda that were managed by four mining units located in central-north, central-south and a Ag-Au-Zn-Pb mineralization trend of the Mexican Republic. During the three years of immersion in these units, different data collection instruments were applied, and their results generated new question related to Organizational Culture, opening a gap of opportunities to deepen them.

When analyzing the Organizational Culture of these units, a significant discrepancy was found among the management priorities established as a strategic plan by the senior management as opposed to the daily work carried out by middle managers and operator in terms of sustainability. It was an unexpected finding in the research carried out in the field, which highlights that some mining workers, although they demonstrate knowledge regarding the functions, obligations and tasks established by the management and these are consistent, in most cases, towards the sustainability, its environmental reflexivity is not clearly expressed when carrying out its work.

The sociological notion of reflexivity (Giddens, 2006) takes a preponderant role in this study due to the recognition of the conceptual transition in favor of the environment that is occurring in many industries in general and has had an important impact also in the mining sector particularly. The agency capacity is perceived from the environmental reflexivity on the impact of actions in past, present and future events, which directly affects the decisions that individuals must consciously transform the environment in which they participate at work. Nonetheless, the scope of the study carried out between 2018 and 2020 did not consider a specifically designed way to evaluate the levels of awareness towards sustainability that workers in this sector managed.

This led to create new questions: first, about the meaning that workers give to environmental management and the environmental impact of their industrial actions; second, about the recognition of the impact that their actions have on the environment; third, about the degree of choice that worker have regarding their work in environmental matters.

These questions guided the research path towards the field of organizational sociology as a basic theory that allows to inquire into what is called Environmental Management Culture, to determine the degree to which industrial workers have appropriated the sustainability in their work actions.

ISSN-On line: 2414-8830

Hence, the general objective of this research is to explain the conformation of the Sustainable Social Awareness that industrial workers handle based on four sustainable principles that the 2030 Agenda handles and that are aligned with the current legislation in Mexico on environmental matters. Understanding that Sustainable Social Awareness is one of the necessary indicators to understand more precisely the Environmental Management Culture that is occurring in industrial environments.

Taking as the hypothesis that, as part of the Environmental Management Culture within companies, workers consolidate a Sustainable Social Awareness based on the meaning they give to the environmental management and that their industrial practice corresponds to the degree of choice they have on the impact of their actions.

Once the reasons that have led us to delve into the meanings and sustainable industrial practices of industrial workers are defined, this document is organized in five fundamental parts: the first gives an account of the theoretical principles that support the theoretical construct of Grounded Theory. Second, it will be possible to find the methodological design to give way to the third and fourth part of the document that discusses the results of the axial, open and selective codes, which contribute to the substantive theoretical construct of Sustainable Social Awareness. This document ends with some reflections and bibliographic references as sections five and six, respectively.

Theoretical bases

To answer the initial questions, a literature review was essential to identify an opportunity gap in the preliminary findings obtained through a field immersion. In the following sections, some of the postulates on the Sociology of Organizations, Organizational Culture, Environmental Management, Agency capacity and reflexivity are briefly exposed.

Sociology of organizations

From the perspective of the Sociology of Organizations, this document adheres to the conceptual definition with the greatest scientific acceptance that indicates that organizations are complex social systems, independent and interrelated with other systems.

From the complexity, the sociological explanation is that it is about open and closed organizational systems insofar as they are concerned with relationships both within the organization and in its environment, where there are adjustments and adaptations that affect the way in which it is carried out, in regards of technology, structure, process, efficiency, among other things (Scott, 2005).

Although the sociology of organizations contemplates elements of evolution in organizational models, the approach that is desired to be highlighted is its role for the understanding of individuals withing companies. As some authors point out, “individuality versus structure” (Lucas, García & Llano, 2014); this individuality is highlighted to show their role and how their influence transforms workspaces due to the knowledge applied in technology, science, and innovation at the service of production, but also due to changing beliefs, ideologies and meanings about work and its role within organizations, especially when it comes to issues related to Sustainability.

Therefore, the focus of interest of the sociology of organizations is centered on studying the structures, processes, conflicts, and meanings that occur within the context of industrial organizations, on one side, but also considering the social processes that occur within them. The aim of organizational sociology is to obtain a more complete vision of organizational life through a more global explanation of both the problems and the opportunities for action that arise in this industrial context. Lucas, García and Llano (2014) argue that within organizations there are contradictions between daily tasks and official norms, and these deviations mean problems worth studying, such as the case at hand.

It is certain that organizations—factories, companies— are complex and changing systems by their very nature, but also by the influence of other systems with which they interact. However, it is possible to observe in its sociological analysis some variables that are maintained over time in terms of their description but not in their involvement in industrial processes. Such analytical variables worth mentioning have been exposed in the sociological literature (Tilly, 2001; Scott, 2005) regularly:

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Actors: are people who play several roles within organizations, its analysis is directed to their cooperation in the workplace; some topics of sociological interest are related to identity, beliefs, and symbolic configurations, among others.

Relationships: they are about human interaction, and its analysis goes in the sense of communication patterns and networks, teamwork, and even labor conflicts, among other topics.

Activities: related to the functions that are carried out, the daily tasks and obligations or in specific situations; its analysis is directly related to the effectiveness, efficiency, productivity and profitability of companies.

Legal and regulatory criteria: the aspects of property, contracts, control rights, and regulatory applications are addressed; its analysis is on the border of the "should be" of the companies and their members.

However, there are other analytic variables that seem to emerge and consolidate as a fertile field for its sociological study, from which the conception of the organization as a relational system stands out. According to Scott (2005), there is a growing number of sociological studies that adopt the relational approach because they start from the premise that organizations are inseparable from the transactional contexts in which they are embedded and that they derive their meaning and identity from the roles they play in these encounters. This author points out that the relational sociological approach is carried out on the organizational structure that is continuously being "created and recreated" since the actors are "constructing and reconstructing" the intentions in descriptions and, therefore, their own identities and those of others (Scott, 2001). It is from this sociological perspective that this research is supported to verify the ideological changes that are occurring in the Mexican mining-metallurgical industry referring to its environmental practices; that is why it is an emerging sociological focus, it has theoretical and methodological relevance.

Organizational Culture

Most authors (Chiavenato, 2007; Robbins and Judge, 2013) agree by pointing out that from the moment an individual joins an organization, they become part of it and, therefore, will have to assimilate its culture. It is a daily interaction where prevailing attitudes, underlying presuppositions, aspirations, and relevant issues are part of the organization's culture.

According to Robbins and Judge, (2013), organizational culture is characterized by: establishing differences between one organization and another as it helps define borders; transmit the feeling of identity among the members; generate collective commitment; increase the stability of the social system through unity; serve as a mechanism that gives meaning and control, that guides and shapes the attitudes and behavior of employees.

In favor of perpetuating the organizational culture, many organizations seek that their members, that is, their workers, possess values essentially consistent with the values proclaimed by each company, hence, from the selection, hiring, permanence to the promotion of their personnel, they are influenced by decision makers. Another factor to maintain the organizational culture is the effect that the top management prints as norms that filter through the organization whose manifestations range from the ideology about work and its social, economic, and in our case, environmental repercussions, to the establishment of objectives, goals and strategies, benefit systems, uniforms, among other things. The third and last factor is socialization, understanding this as the formation of social networks whose influence is directly related to what is considered accepted or rejected in terms of socio-labor practices, generating a sort of "metamorphosis" in each worker who will inevitably align themselves to the prevailing organizational culture (Robbins and Judge, 2013).

The literature specialized on the subject indicates that the organizational culture is intangible, deep, and rooted in people, however it is possible to measure its effects and consequences once the different strata in which it is composed are known. Chiavenato (2007) compares it with an iceberg to provide an explanation of the different strata that compose it:

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Superficial stratum: built of physical and concrete formal aspects such as organizational structure, jobs, organizational objectives, strategies, technology, organizational practices, personnel policies and guidelines, work methods and procedures, productivity, and financial measures.

Deep stratum: made up of informal aspects, whose invisible, hidden, affective, emotional components are oriented towards the social and psychological aspects of its members, such as patterns of influence and power, perceptions and attitudes of people, feelings, and group norms, values and expectations, patterns and formal interactions and affective relationships (Chiavenato, 2007: 85).

Following Luthans (2002) of the most significant components of the organization culture are:

a. Regularity in the observed behaviors: characterized by the fact that its participants have a common language, their own vocabulary, and rituals related to behaviors.

b. Norms: whose behavior patterns include guidelines for doing things.

c. Predominant values: shared form top management and permeated through the behavior of its members.

d. Philosophy: through policies that reinforce beliefs about aspects related to processes and dealing with people.

e. Rules: understood as the established guidelines and related to behavior within the organization.

f. Organizational climate: as the feeling transmitted by the work environment on which the interaction, treatment of others, attention to clients and suppliers, among other things, intervene (Luthans, 2002).

Environmental Management

Adding to the global scientific consensus, environmental management is the set of actions and strategies aimed at organizing activities that influence the environment, thereby obtaining life quality and warnings to problems in the environment to protect the environment.

It is recognized in this construct the existence of dimensions and factors that intervene to achieve or stop the adequate balance between economic and population growth on one side and the rational use of resources and the protection and conservation of the environment.

Talking about Environmental Management refers us to a broad context of international relations and international cooperation programs whose impulse and insistence on creating regulations in favor of the environment is transferred to governments, institutions, organizations and, to a lesser extent, to people around the world. Especially in the Latin American and Caribbean region where a diversity of territories, populations, economies, ecosystems, and visions coexist to address critical environmental issues.

The roots of Environmental Management have their foundations from the United Nations Conference on Human Environment and the United Nations Conference on Environment and Development (UNCED, 1972, 1987 and 1992) from which a renewed vision towards the conservation and rational use of resources that persist to this day and consequently a higher priority in the state agendas that would put into operation national legislation and policies focused on the environment (Rodríguez-Becerra and Espinoza, 2002).

Multilateral agreements between neighboring countries to protect ecosystems were immediate, as the slogan was clear: to improve environmental quality through determined management. However, the world would see an accelerated deterioration in natural resources and the environment, evident in deforestation, desertification, and the pollution of the oceans (Rodríguez-Becerra and Espinoza, 2002). The result: a new international call to establish the World Commission on Environment and Development (WCED, 1987) from which the term Sustainable Development arises, understood as a goal of the highest political level to which all nations should address to alleviate said environmental deterioration of the last few years.

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Particularly in Latin America, the Ecobíos International Conference (CDMAALC, 1990) would establish its own agenda to achieve Sustainable Development, whose proposal focuses on economic growth, social justice and the environment and implies social cohesion, the recognition that natural resources are limited and that the environmental capacity must also include waste management (UN, 1993).

To achieve this effort, 17 Sustainable Development Goals, described in the 2030 Agenda, are established, and the achievement of which implies determined and specific actions; that is, an operation to obtain financing for remediation in case of environmental impact, the inclusion of human habits in favor of the environment, the creation of services and opportunities, as well as more efficient production and operation processes (Naredo, 1996).

In order to reach this goal, strategic planning refers us to Sustainability, which refers to the regulation of public and social policies to use natural resources more efficiently in order to satisfy the current needs of human beings, but without compromising the resources of future generations (Naredo, 1999).

The Sustainable Environmental Management is, for this research work, the set of strategies and operational methods to effectively carry out concrete actions to use natural resources to achieve a profitable and beneficial position in environmental terms in the short, medium, and long term. This definition permeates the Organizational Culture described in previous paragraphs due to its direct interference in the industrial organizations that are the discussion of this study.

Agency capacity and reflexivity

With the plan of explaining from sociology the way in which individuals are conformed as social and historically conformed beings, it is necessary to refer to two emerging concepts: human agency and reflexivity. Both concepts are theoretically supported by the proposal of Giddens (2006) who explains that within the constitution of society, the human being is part of an interrelation between the social structure that gives cohesion and belonging to a group or community; and it is in this interrelation that both the social structure affects the decisions and actions of the individual and vice versa.

Giddens (2006) establishes that human action is a competence that each person has in order to do things and, therefore, the ability to influence the behaviors of other actors. As part of these competencies, the ability to transform circumstances and contexts becomes crucial. Giddens defines this phenomenon of action as human agency and the individual becomes an agent that acts, influences, and allows the influence of other people, other events within the social structures to which the person belongs.

But human agency is not complete without the second concept: reflexivity, that encompasses both the awareness of social actions and the awareness of the practice of their decisions. Then, for the agent to be able to exercise a power, it must be understood that the conditions in which the agent acts, have objectives and intentions based on which the behavior can be guided, and of course, expectations in relation to others, and the results of such actions will be set.

According to this author, the social structures in which the agents are immersed and that influence their performance are the political system of the nation-state that corresponds to the geographical place where they live, the system of social reproduction that constantly exchanges new social evaluations, that leads to the reformulation of the human worldview and therefore, a transformation that configures a new social order.

For this present case, these two concepts contribute to deepen into how the Culture of Environmental Management becomes a reference that involves the agency and reflexivity capacity as means to transform industrial spaces in favor of the environment.

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Methodological design

Within the wide range of qualitative research methods that exist to explain the conformation of Sustainable Social Awareness that workers handle because of their Agency capacity and reflexivity in terms of Environmental Management, the Grounded Theory has been chosen, as the ideal qualitative research method. Following Creswell (2005), Strauss and Corbin (2002), the Grounded Theory provides a broader, deeper, and more comprehensive sense of understanding, since it allows the representation of the complexity of a phenomenon paying attention to the social processes that take place in natural environments, avoiding preconceived conceptual frameworks. So far, it has been found that the specialized literature on Sociology of Organizations, Organizational Culture and Environmental Management, cannot fully explain the phenomenon that has been identified as a study problem for this research, hence, this methodological selection.

Therefore, the research design that was carried out to answer the research question is through Grounded Theory of a systematic type (Creswell, 2005; Strauss and Corbin, 2002), understanding that it is the search for a substantive theory that adheres to the formal theory of Environmental Management as a scientific contribution by:

– Paying attention to what people say and do, avoiding stereotypical ways of thinking about the phenomenon.

– Focusing on the data without taking anything for granted by stimulating the inductive process.

– Formulating interim questions and answers that lead to categories with innovative properties and dimensions.

– Offering alternative meanings to the phenomena.

Observing the obtention of a substantive theoretical construct, this research design allows the conceptual ordering and its subsequent theorization through the meanings that industrial workers give to their work practice with a Sustainable Environmental Management approach. Therefore, the sample units are organized as follows:

– Records of the participant observation and checklists made during the employment of the Management Model for Sustainability (Martinez, 2020) in the years 2018, 2019 and 2020.

– Records of in-depth interviews conducted with industrial workers —managers, middle managers, and operators —during the immersion in units of the mining-metallurgical sector located in the Au-Ag-Pb-Zn metallic trend in the years 2018, 2019 and 2020.

– Records of in-depth interview conducted with experts in Environmental Management in the last semester of 2020 and the first quarter of 2021.

Stage 1. Codification and classification of the findings made during the implementation of the Management Model for Sustainability (Martínez, 2020). This stage includes an analytical process called open codification to identify key concepts in participant observation records, checklists, and in-depth interviews from "in vivo codes" (Glaser and Strauss, 1967) that lead to classification and categorization in regarding relationships, properties, and dimensions.

Stage 2. Axial and selective codification that comes up from the previous stage from which the categories and subcategories were obtained as inputs to begin to formulate the first explanatory approximations about the phenomenon. This stage includes a preliminary theoretical integration process that occurs thanks to the immersion in the records of interviews with experts and their triangulation with the previous stage.

Stage 3. Formulation of the theoretical-explanatory model where it is possible to identify the conceptual affinity that emerges from the empirical data. This stage includes the formulation of the central category that includes the conceptual idea under which all the elements of the interpretive categories generated during the previous stage will be grouped. Said conceptual integration represents an abstract expression that will have consistency, internal logic, and construct validity.

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Results

The following sections give an account of the methodological process and thereby explain the conformation of Sustainable Social Awareness as an indicator of the Environmental Management Culture that takes place in Mexican industrial organizations.

Theoretical substantive construct: Sustainable Social Awareness

The Grounded Theory methodological strategy first led us to identify the regularities, discrepancies and relationships in the data collection records. With this first approach that goes through codification, classification, up to the exhaustive selection of primary and secondary categories, it was possible to formulate a central category that would trigger a preliminary theoretical integration.

This preliminary theoretical integration that contained some categorical dimensions favored its contrast with the sociological theories of Sociology of Organizations, Organizational Culture and Environmental Management, finding a link in general but that did not answer our initial questions to reformulate new ones.

As a result, a substantive theoretical construct called Sustainable Social Culture is obtained, that takes as its foundation the sociological contributions of structural and organizational theories to first understand that Social Consciousness is a complex term that is transformed over time as a product of circumstances of matter that occur in societies but also with ideological representations that influence individual and group actions.

According to sociology, the Social Awareness has the following features: a) *It is psychic,* it comes from the internal experience of a person, before the social world; b) *it is immanent,* it derives from an individual intern process to act in front of others; c) *It is irreducible* to the individual conscience, since both are implied or superimposed; d) *It is intermittent,* since it is exercised under certain events, by virtue of the circumstances that affect the group; and finally e) *It is versatile,* there are as many social consciences as unified groups (Orgaz, 2016).

However, the Social Awareness handled by industrial workers, the reason for this research, in addition to encompassing the above, adds two features that deserve attention: f) reflexivity, as the individual who realizes the social bond in which he is immersed and therefore their actions respond to: g) the agency capacity exercised as a volitional process that positively or negatively impacts the group or collective to which it belongs but also has consequences in the immediate and mediate environment where it operates.

These two characteristic features—Agency capacity and reflexivity—are consolidated as the motor of action so that the agent consciously reacts to the stimuli of the environment that are in the order of the social pressures exerted in the society of which it is a part, but also as ideological elements of an Organizational Culture that prints values, guidelines and forms of behavior. It is in this process of social reconstruction that Social Consciousness is being configured and strengthened through the different experiences that are had on matters that are of peculiar importance at the individual, group, community, national, and even global level.

These external influences related to the conservation of the environment and the environmental impact caused by man, reflected in various documents, and disseminated through international public policies (2030 Agenda), national legislation (SEMARNAT, 2002), but also through planning strategic with a sustainable vision of different organizations that permeate through the Organizational Culture in their employees, are shaping what we call Sustainable Social Awareness.

Therefore, our substantive theoretical contribution called Sustainable Social Awareness is an active process that begins individually through observations on the impact that is exerted on the environment but is consolidated collectively when responding to actions related to the environmental impact, social responsibility, ecological aspects and commitment to future generations.

This Sustainable Social Awareness takes place in industrial spaces and arises as an ideological and participatory expression with a view to addressing the pressing environmental issue from the labor practice.

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It is sheltered by the Culture of Environmental Management generated at the highest levels of political decision, but its precepts go down until it reaches individuals through organizations that install environmental policies either due to legal pressure, or environmental conviction, resulting in staff with agency capacity who choose to act in favor of or stay out of the environment through reflexivity. Therefore, Sustainable Social Awareness becomes a qualitative indicator that directly affects the Culture of Environmental Management within Organizations.

Category dimensions of Sustainable Social Awareness

The culture of Environmental Management within organization is a complex phenomenon where elements of different nature converge. Among these, the substantive construct that we present called Sustainable Social Awareness stands out as a new vision of the world that requires certain behaviors derived from reflexivity on the impact of individual and collective actions, but also the agency's capacity to carry out strategies for preservation of resources for future generations.

It was through the Grounded Theory that some categorical dimensions were identified, that nourish Sustainable Social Awareness and that allow establishing levels and even ranges for their individual, work and professional volitional exercise for their subsequent measurement system that will be the product of a new contribution. to the field of knowledge and its practical application in industry.

Through the explanation of records related to the guidelines of the 2030 Agenda and the national regulations in force in Mexico (SEMARNAT, 2030) it was found that Sustainable Social Awareness can be ordered in the following categorical dimensions:

Dimension one: *Conscience of environmental impact,* related to the Sustainable Principle of Industry, Innovation and Infrastructure: it refers to the agency capacity that is reflexively exercised to identify, measure and / or mitigate the environmental impact; observation of the physical aspect of the environment; preventive-corrective maintenance to mitigate landscape damage as well as the observation and execution of international guidelines in relation to environmental policy represented by the modernization and reconversion of industries through the practical exercise of their knowledge with a Sustainable perspective and the adoption of technologies and clean processes.

Dimension two: *Social responsibility awareness* referred to the Sustainability principle, sustainable cities, and communities: it is recognized as the observance for the development and progress of communities surrounding the industrial center; migration control; the promotion of trades and educational resources with a sustainable vision; the promotion of access, transportation, urbanization, and protection of the cultural and natural heritage; the management of economic, social and environmental support.

Dimension three: *Resource preservation awareness for future generations* adhered to the Sustainable Principle of Responsible Production and Consumption: it is made up of the monitoring of operational processes that people follow within organizations; the observance of extraction systems, metallurgical processes with areas for improvement; the use on energy and water; upgrading or acquiring clean technology equipment; the management of budget items; the use of reagents; the treatment of liabilities and the calculation of reserves; the management and efficient use of natural resources and waste.

Dimension no. four: *ecologic awareness* linked to the Sustainability Principle: life of the terrestrial ecosystems: articulated through the reduction of degradation, devastation by extraction, deposit of liabilities; image and landscape evaluation; the observance of the parameters established in the environmental legislation (LGEEyPA, 2018) and the Environmental Impact Manifesto (MIA-SEMARNAT, 2002) that are evaluated and concentrated at this level.

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The following illustration is a schematic representation of the interrelation that exists among the composing dimensions of the Sustainability Social Culture.

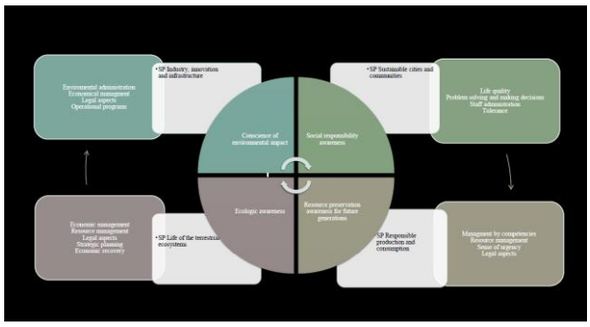

Figure 1 Configuration of category dimensions of Sustainable Social Awareness
Source: *Own elaboration*

As it is noted, the presented dimensions function as constituent elements of Sustainable Social Awareness that are interrelated, generating a conceptual interpretation to proceed to assess their consistency, internal logic, and construct validity, which will be the subject of a later dissemination article. During the axial coding process, it was possible to notice that there is a set of properties within each category that allow a more precise and complete explanation. These properties adhere to each dimension forming ranges of consciousness that are organized as follows:

Within development, the agency capacity is limited by the embryonic knowledge of sustainability and its application may or may not be present in the work or professional practice.

At disposition, the agent consolidates its sustainable knowledge, but there are external elements that limit its practical application in the work or professional practice.

In competences, the reflexivity impulses the agent to question the actions in favor of the environment with a sustainable vision.

In unification, the Sustainable Social Awareness is present in the agent's actions, product of reflexivity and the agency capacity, that inquires the agent's behavior and leads into sustainable actions.

Final regards

The Sustainable Social Awareness is a theoretical contribution that substantively contributes to strengthening organizational sociological theories in terms of Environmental Management Culture. This theoretical construct works to explain the way in which industrial workers are becoming aware of their role within organizations as transformation or environmental preservation agents. Its individual, social and organizational implications in terms of Sustainability emerge to make room for a new construct that can also become quantitatively operational to assess the environmental management exercised by individuals within organizations.

The present document displays how the Sustainable Social Awareness is demonstrated directly or indirectly in the daily work of worker. It then becomes an input to assess not only the knowledge in environmental matters, but also the awareness necessary to exercise agency capacity through reflection on environmental issues that require showing an implication towards the labor and professional choices that have a place in industrial organizations.

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ISSN-On line: 2414-8830

Article **ECORFAN Journal-Republic of Nicaragua**
December 2021, Vol.7 No.13 21-27

Environmental impact of disposing of mouth covers, masks or respirators what alternatives do we have?

Impacto ambiental del desecho de cubrebocas, mascarillas o respiradores ¿Qué alternativas tenemos?

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DOI: 10.35429/EJRN.2021.13.7.21.27 Received July 20, 2021; Accepted December 30, 2021

Abstract

The objective of this article is to study the different options we have to combat the environmental impact generated by the use and disposal of face masks, masks or respirators due to the pandemic that we have been suffering for more than a year (COVID-19). The growing demand for this article of personal protection has also brought with it a growing carbon footprint that we are generating towards the environment, because most of the facial masks that are used are not degradable and must be discarded after a single use. To achieve environmental sustainability, we must work and investigate other options for masks, masks or respirators that can be reused or that are biodegradable, in order to minimize the negative impact on our environment. The masks that are analyzed in this article for the raw material with which they are made are N95 and fabric masks, especially cotton ones.

Impact, Environmental, Masks

Resumen

El objetivo del presente artículo es estudiar las diferentes opciones que tenemos para combatir el impacto ambiental que está generando el uso y desecho de los cubrebocas, mascarillas o respiradores a causa de la pandemia que estamos padeciendo desde ya hace más de un año (COVID-19). La creciente demanda de este artículo de protección personal ha traído consigo también una creciente en la huella de carbono que estamos generando hacia el medio ambiente, debido a que la mayoría de las mascarillas faciales que se utilizan no son degradables y deben desecharse después de un solo uso. Para lograr la sostenibilidad ambiental debemos trabajar e investigar en otras opciones de mascarillas, cubrebocas o respiradores que puedan reutilizarse o que sean biodegradables, con el fin de minimizar el impacto negativo hacia nuestro medio ambiente. Las mascarillas que se analizan en el presente artículo por la materia prima con la que están constituidas son la N95 y las mascarillas de tela, en especial las de algodón.

Impacto, Ambiental, Mascarillas

Citation: HERNÁNDEZ-RODRÍGUEZ, María Guadalupe, ORTEGA-CHÁVEZ, Laura Antonia, GALLEGOS-OROZCO, Carmen Angelina and CARO-ESCUDERO, Iveth Selene. Environmental impact of disposing of mouth covers, masks or respirators what alternatives do we have?. ECORFAN Journal-Republic of Nicaragua. 2021. 7-13:21-27.

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Introduction

Faced with the COVID-19 outbreak, the modern population found for the first time the need to use face masks, masks or respirators for any type of activity outside the home. However, these have been used for hundreds of years, dating back to the Middle Ages.

The face masks today have become an article of daily use from the governmental impositions worldwide, as their use within closed public spaces, such as shopping centers, restaurants, hospitals and other spaces becomes an indispensable requirement. . This in order to control the growing pandemic in a way that protects the possible carriers and receptors of the virus, reducing the number of positive cases due to contact or little social distancing.

What we know as face masks, as mentioned above, can have different names: face masks, masks or respirators, however, its conceptualization is the same.

According to the information guide of the Donostia University Hospital (the second largest hospital complex in Spain), face masks are personal protective equipment, and this protection provided to the user is mainly against powders, biological and cytostatic agents and other dangerous drugs. found in the air and can enter the body through the respiratory tract.

Its manufacture consists of a filtering material that traps pollutants but allows adequate breathing for the user, sometimes this quality of breathing can be supported by exhalation valves integrated into the mask itself. The rest of the mask consists of straps that are attached to the wearer's head or ears to keep them in place.

Within this same guide two types of existing face masks are specified. In the first instance, there is the surgical one, whose main function is to protect third parties by filtering the particles that the user can emit to the outside with speech or breathing, although it also protects the user from splashing biological fluids.

The second type of face masks treated are those of high efficiency FPP, these have the main function of protecting the user, since they oversee filtering the air and the particles and / or aerosols that it may contain harmful to the user if the inhale; Depending on its design, it can be: conical, horizontal and vertical. There are 3 ratings of this type of mask according to their effectiveness in combating the toxicity of contaminants concentrated in the environment: FPP1 (78% effective filtration), FPP2 (92% effective filtration) and finally FPP3 (98% effective filtration).

The types of face masks mentioned above are the most used today, but also the most polluting since they are for only one use, that is why it is intended to compare this type of protection articles with those made of fabric, to determine their environmental impact and see the advantages of using one type or another.

General objective

The main objective of the article is to study the options available and present a proposal to improve the environmental problem that face masks have become since the emergence of the COVID-19 pandemic. This proposal focuses on the management of environmentally friendly materials that reduce the damage caused to the planet, as well as a correct treatment when disposing of said face masks.

Theoretical framework

As already mentioned, the rise of the face mask brings with it a new set of problems: Demand has exploded, and medical supply chains are constantly struggling to get the necessary face masks into the hands of medical workers. In addition to this, we are facing increasing contamination, which is why it is necessary to dispose of this sanitary waste in a safe way, to guarantee community health and the integrity of the environment.

The following figures or images were taken in one day, in just one block from the city of Chihuahua, Mexico, which shows the seriousness that the use of this type of mask implies and of not having them correctly once they have been used.

ISSN-On line: 2414-8830

Figure 1 Surgical mask
Source: Own elaboration

Figure 2 N95 mask
Source: Own elaboration

Figure 3 Surgical mask
Source: Own elaboration

Figure 4 Face mask
Source: Own elaboration

Figure 5 N95 mask
Source: Own elaboration

Right now, we need millions, if not billions of more face masks than usual. It's time to ask the question: What is the environmental footprint of all that?

That is why it is necessary to compare the carbon footprint left by these types of masks and compare it with the carbon footprint left by a cloth face masks which is more environmentally friendly. How much CO2 does the current need for additional face masks cost us?

Figure 6 fabric mask Vs N95
Source: Own elaboration

ISSN-On line: 2414-8830

Of course, both masks serve different functions. And we are absolutely not medical experts. That is why we only look at the issue from an environmental perspective.

Face masks: seemingly simple products

Face masks are simple products. They don't require many different production steps or complicated material setups.

But this example illustrates very well how the consumption of hundreds of thousands or even millions of products causes significant environmental damage, even if the footprint of the individual product might be comparatively low.

N95 face mask: what is it made of?

This mask filters out particles and is therefore considered safe for medical workers.

N95 face masks are made of non-woven propylene (PP). They are transformed through a process called melt blown. In addition, they are attached via rubber bands, have a small aluminum strip and a small filtering accessory.

- 1 piece von Face Mask N95
  - 0.5 g von Aluminium Strip
    - 0.5 g of Aluminium
    - 0.5 g of Production Aluminium
  - 2 g of Filter
    - 2 g of Polypropylene
    - 2 g of Production PP
  - 9 g of Mask
    - 9 g of Polypropylene
    - 9 g of Produccion PP
  - 0.5 g of Rubber Strap
    - 0.5 g of Rubber

Table 1 Components of the N95 face shield
Source: Ecochain

The table above shows that an N95 mask is made up of a 0.5 g strip of aluminum, the filter of 2 g of polypropylene, the mask of 9 g of polypropylene and the straps of 5 g of rubber or plastic.

The total footprint of such a mask is 0.05 kg CO_2 equivalent, that is, around 50 grams.

Cotton or cloth face mask

Of course, a homemade or purchased cotton mask does not have the same protective properties as an N95 mask, however it still protects the people around you, and much more is available.

How does the mask made of cotton fabric compare to the N95 mask?

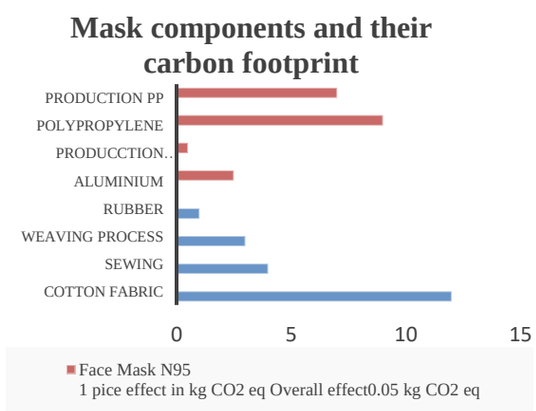
- 1 piece of Self-made Cloth Facemask
  - 12 g of Cloth
    - 12 g of Cotton fabric
    - 12 g of Weaving process
  - 0.5 g of Rubber Strap
    - 0.5 g of Rubber
  - 0.01 kWh of Sewing

Table 2 Components of the cotton mask
Source. Ecochain

Table 2 shows the components of a cloth or cotton mask in general form. 12 gr of woven and processed cotton fabric, 0.5 gr of rubber strap and 0.01Kwh of sewing.

The result: 0.06 kg of CO_2 equivalent per mask. The CO2 footprint of the cotton face mask is 20% higher than the footprint of the N95 protective mask.

As we can see, the carbon footprint of a fabric mask is higher than that of an N95 mask. The answer is in cotton: cotton fabric, although very small, has a relatively high CO_2 footprint throughout its production cycle. Therefore, it even outperforms "artificial" polypropylene material.



Graphic 1 Comparison of manufacturing components and carbon footprint between cloth and N95 masks
Source: Ecochain

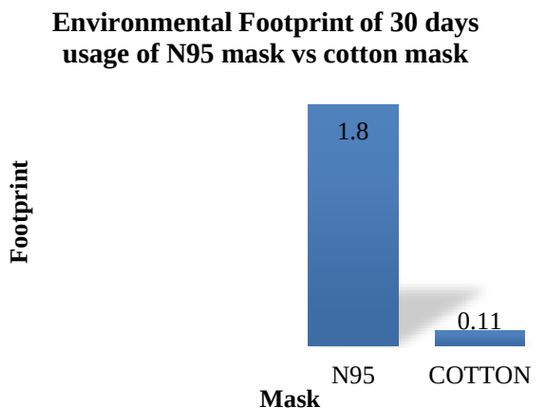
However, these results are misleading, as they do not cover the life cycle of both types of masks.

N95 face masks are used only once, and although some people choose to use them multiple times, maximum protection can only be guaranteed with a single use.

In this case, the N95 mask turns into plastic waste on a daily basis. A medical worker would have to wear one mask per workday.

The cotton or fabric mask, on the other hand, can be used many times, of course it does not provide the same protection as an N95 mask, however, if we are not health workers, this type of mask will provide us with the necessary protection In addition, this type of mask can be washed frequently.

This is where we can observe the true carbon footprint left by both types of masks, since, for example, after 30 days of using one type of mask and another, it shows us a very different image from the one presented in graph 2 , although the following table does not contemplate the footprint left by constantly washing the cloth mask.



Graphic 2 Environmental footprint of 30 days of use of N95 masks Vs cloth masks
Source: Ecochain

As we can see, the environmental footprint of a single mask is comparatively low. But the problem in this crisis is not the individual mask, it is the large number of masks needed.

For example, in another study we conducted, we considered the population in the main cities of the state of Chihuahua:

Cd. Juárez	1,500,000
Chihuahua	926,000
Cuauhtémoc	180,000
Delicias	152,000
Total	2,758,000

If it is estimated that on average each inhabitant generates 4 used respirators per month, we would obtain 1,103,200 pieces per month in just those cities, translating this into 55.16 tons of CO_2.

If we make the same estimate of 4 respirators per month, but for the entire population of Mexico, which consists of 128.97 million people, that will translate into 6,448.8 tons of CO_2 per month.

To put this in perspective, 6,448.8 tons of CO_2 equates to roughly 2,806,994,118 medium-sized steaks (and steaks are a real climate killer for the issue of cow excrement). Driving 100 km with an 8-liter car produces approximately 20 kg of CO2 equivalent, which means that we could comfortably drive 42,500,000 kilometers. That's going around the world 1060 times ...

That is why we must start thinking about making changes that can have significant effects on the environment.

Of course, this is all very theoretical. But it shows how small changes to a product can make a big difference on a large scale. Because the number of masks needed in this pandemic is nothing compared to the number of single-use products that we produce and consume every day.

Imagine that a simple material change in the masks could reduce your impact by 20%. With 12 billion masks required, this would save 144,000 tons of CO_2 emissions.

Methodology

An exhaustive bibliographic research is carried out to collect reliable information for analysis, from which conclusions and improvement proposals for the problem presented will be obtained.

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As in all bibliographic research, we will rely on the use of secondary data as the source of our information. These will be obtained by different documents previously prepared and processed, which if they had the capacity to be based on practical realities to obtain their exposed results.

For each of the bibliographic sources used in this research project, we will ensure that the ways in which the data have been obtained and exposed are reliable, so that there are no inconsistencies or contradictions within them. They will also be a good number of different sources to analyze different points of view on the same topic.

Obtaining bibliographic sources will be online from search engines specialized in scientific articles and certified for a higher level of reliability. As well as articles from renowned magazines and portals also of a scientific nature.

This research methodology will help to find solutions to the problems raised within the research. This being possible by relating all the existing data from different sources, so that it is possible to have a broader and more systematic perspective on the environmental issues of face masks elaborated in multiple sources.

As a final result of the research, the final project will be composed based on the most important and relevant secondary data collected with which the work team is available, which will give rise to our conclusions, and the most important part, the improvement proposal according to our considerations.

Conclusions

In conclusion, it is extremely important to promote the use of reusable face masks, which we can wash daily, which is supported by the World Health Organization (WHO), and this in turn recommends that we leave it exclusively for medical personnel, people over 60 years of age and people with special medical conditions wearing medical grade or single-use masks.

Masks for non-medical use or made of materials such as fabric are highly recommended for other people who do not fall into these categories.

ISSN-On line: 2414-8830

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ISSN-On line: 2414-8830

Article **ECORFAN Journal-Republic of Nicaragua**
December 2021, Vol.7 No.13 28-32

The productivity in the beekeeping sector of Comalcalco, Tabasco, for the design of an improvement proposal

La productividad en el sector apícola del municipio Comalcalco, Tabasco, para el diseño de una propuesta de mejora

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DOI: 10.35429/EJRN.2021.13.7.28.32 Received July 25, 2021; Accepted December 30, 2021

Abstract

The objective of this research was to analyze the productivity of the beekeeping sector of the municipality of Comalcalco, Tabasco for the design of an improvement proposal, which was approached by studying the behavior of the context variables (environmental, cultural, economic, political, social and technological) and its influence on the dependent variable, (productivity). For this, a design of the Likert scale tool was carried out, which is composed of sections that include the context variables, through this tool the results were analyzed, then SWOT matrices (Strengths, Weaknesses, Opportunities, Threats) were generated. for each context variable, from which the following improvement proposals were obtained according to each variable respectively; characterize natural flowering, foster a business culture, create income control, manage political support, disseminate the benefits of bees to eradicate fear from society, and manage genetic improvement programs.

Productivity, Beekeeping, Variable

Resumen

El objetivo de la presente investigación fue analizar la productividad del sector apícola del municipio de Comalcalco, Tabasco para el diseño de una propuesta de mejora, lo cual se abordó mediante el estudio del comportamiento de las variables del contexto (ambiental, cultural, económica, política, social y tecnológica) y su influencia sobre la variable dependiente, (la productividad). Para ello se realizó un diseño de la herramienta escala de Likert, el cual se compone por secciones que incluyen las variables del contexto, a través de esta herramienta se analizaron los resultados, posteriormente se generaron matrices FODA (Fortalezas, Oportunidades, Debilidades, Amenazas) para cada variable del contexto, de lo cual se obtuvieron las siguientes propuestas de mejora de acuerdo a cada variable respectivamente; caracterizar la floración natural, fomentar una cultura empresarial, creación de un control de ingresos, gestion de apoyos políticos, difusion de las bondades de las abejas para erradicar el temor de la sociedad y gestión de programas de mejoramiento genético.

Productividad, Apícola, Variable

Citation: PAYRÓ-GARCÍA, Génesis, MOREJON-SANCHEZ, Juana María, PAYRÓ–DE LA CRUZ, Emeterio and MONTEJO-ZAMUDIO, Manuela de Jesús. The productivity in the beekeeping sector of Comalcalco, Tabasco, for the design of an improvement proposal. ECORFAN Journal-Republic of Nicaragua. 2021. 7-13:28-32.

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Introduction

In recent years, companies have largely focused their attention on the productivity indicators they possess, since productivity is the means by which the company's performance can be identified, that is, if the resources with what Whether human, material, equipment, technological, energy or financial resources, to mention just a few, they are used effectively and efficiently. Productivity in Latin America is a very broad topic to deal with because in this part of the world since past decades it has remained with a lack of increase in its productivity levels, growth has been extremely slow and minimal, despite the Different changes of government that have occurred over time have not reflected relevant changes, this is a great sign that neither the necessary actions nor the interest are carried out to generate a positive change in this regard. In the study of productivity it is mentioned that beekeeping can be considered as a business opportunity, as long as profitability is guaranteed, looking for alternatives that allow increasing income through increased productivity and defining better market strategies, at their own expense. Once it is explained that one way to increase productivity is by promoting favorable changes in production levels, which is why it is important to identify the variables of the context that have had a positive impact, such as economic and cultural, which would allow the design of strengthening programs to improve this indicator (Contreras & Magaña, 2017).

Mexico is the fourth producer and third exporter of honey in the world, according to SIAP-SAGARPA (2021), in 2018 36,068,281 tons were exported, in 2019 26,914,892 were exported and in 2020 23 were exported. 768,840 tons, which shows a downward trend in the last 3 years; however, it continues to be one of the livestock products that generate the most foreign exchange for our country. At the national level there are 2, 157, 866 beehives, of which 388, 433 are located in the state of Yucatán, 268, 907 in Campeche, 171, 822 in Chiapas, 141, 998 in Veracruz, with 11, 760 in Tabasco being one of the states with the lowest number of hives and as well as honey production, despite its great floristic potential.

Production is affected by a large number of factors, such as floral availability, environment, technical capacity, genetic quality of the bees and not least is the level of organization of the beekeepers. Guzmán-Novoa et al., (2002), demonstrated that both the capacity for honey production and the defensive behavior of bees are highly influenced by the genotype, concluding that the defensiveness of Africanized bees is a highly heritable characteristic; however, there is little research aimed at understanding the genetic bases of this behavior and its correlation with productivity.

Currently there are controversies regarding whether or not hybrid (Africanized) bees are more efficient in honey production compared to European bees, however, Uribe-Rubio et al, (2003), affirm that this controversy is caused by that few comparative studies have been carried out and the lack of representativeness in the experiments carried out.

It is essential to consider that highly defensive behavior is the most undesirable character of Africanized bees, however, there are equipment, techniques and safety measures to work with bees safely, however, production costs and production costs are significantly increased. the number of hives that a beekeeper can attend per working day decreases (Guzmán-Novoa et al., 1994). It is worth mentioning that bees, in addition to all the products they generate, also through their sting provide health benefits to people, and many times it is used as an alternative medicine to combat different diseases, it must be recognized that beekeeping is a noble activity, which leaves a great imprint of learning of perseverance, perseverance and many other benefits in the people who exercise it, and provides economic, environmental and social benefits.

The Inter-American Development Bank (IDB), an institution that has different financing programs in charge of benefiting countries that wish to increase their economic development, either through donations or through loans; the donations that are made can be to both private and public entities, both participate and can benefit, however this institution mentions that América Lantina presents a slow chronic growth that has persecuted it for years, this due to the productive resources with which account are used without proper planning.

ISSN-On line: 2414-8830

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Currently, the amount of financing approved for Mexico is $825.80M, leveraging six productive sectors, which are financial markets, science and technology, education, energy, social investments, environment and natural disasters. Likewise, according to IDB (2021), the low level of productivity is the primary cause why a large number of the countries belonging to Latin America fail to achieve a higher level of growth, since they lag behind in comparison. of the countries belonging to East Asia and in the same way to the countries that are advanced, if a country increases its productivity all its inhabitants will be benefited since they entail great monetary and service gains.

Kind of investigation

Due to the resources that are currently available, the municipality of Comalcalco was selected, since there is previous knowledge regarding producers and location of apiaries for the start-up, all the information collected was taken as a basis for the generation of a improvement proposal that contributes to increasing productivity and therefore the regional development of this sector. The investigation on the beekeeping sector is documentary, because information was obtained from different secondary sources, in turn, a field investigation was carried out obtaining information directly from the producers. At another time it is descriptive because each one of the study variables is described. At another moment the research is considered correlational, because it determines how each of the independent variables (social, cultural, environmental, political, technological, economic) influences the research variable (productivity of the beekeeping sector).

Methodology to be developed

The methodology used for the present investigation is based on the identification of the problem as a starting point, subsequently the variables of the context to be analyzed were identified and the Likert scale tool was designed to collect the information. directly with the beekeepers of the municipality, through meetings and interviews with the beekeepers as well as visits to the apiaries, which were georeferenced, for the elaboration of a map in order to know the territorial distribution of the production properties in the municipality of Comalcalco (Figure 1).

It is worth mentioning that the tool includes each of the variables, as well as items [environmental (items = 15), economic (items = 21), political (items = 7), social (items = 9) and technological (items = 26)], which are closely related to the dependent variable (productivity), it is important to mention that the tool was applied personally to beekeepers and a detailed explanation of the meaning of each of the items that make up the tool was provided to them, in order to In this way to ensure the veracity of the information provided, once the tool was applied, the interpretation and analysis of the results was carried out, consequently a SWOT matrix was made for each of the variables, within which the strengths, opportunities, weaknesses, threats, which will make it possible to develop comprehensively and efficiently improvement strategies that will bring positive aspects in terms of productivity to the sector.

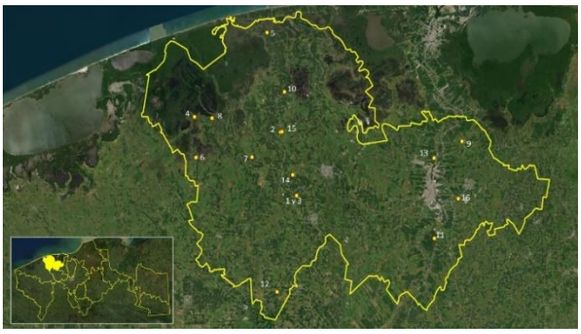

Figure 1 Territorial distribution of the apiaries of the surveyed beekeepers, (ID): 1. José Alfredo Aguilar Sánchez, 2. Alejandro Jiménez Hernández, 3. Bella Ruth Hernández Hernández, 4. David Calderón Alvarado, 5. Rene Alejandro Alejandro, 6. Manolo Castillo Arévalo, 7. Teresa Alejandro Carrillo, 8. Sebastián Córdova Arévalos, 9. Julio Cesar Diaz Méndez, 10. José Luis Sánchez Izquierdo, 11. Heriberto Alejandro Romero, 12. Luis Mario Córdova Madrigal, 13. Virginia Falconi Alejandro, 14. Cristóbal Izquierdo Alcocer, 15. Sebastián Rodríguez Córdova, 16. Mario Pérez Córdova. Sources: Apiaries georeferenced by the author. Made with QGIS software. Scale 1: 200,000. ESRI Satellite

Results

According to the results obtained through the Likert scale, six SWOT martices were elaborated, one for each context variable, as shown in Figures 2 to 7, respectively:

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SWOT	
ENVIRONMENTAL VARIABLE	
THREATS Effects by floods Climate change	STRENGTHS Identification of the time of greatest flowering in the year, which are the months of January, February and March.
WEAKNESSES Mobilization of hives due to flooding	OPPORTUNITIES Characteristics of the flowering that surrounds the apiaries is optimal

Figure 2 SWOT of the environmental variable
Source: Author's Perception, 2021

SWOT	
CULTURAL VARIABLE	
THREATS Drastic cultural changes	STRENGTHS Current culture and traditions help to carry out beekeeping activities
WEAKNESSES Lack of corporate culture	OPPORTUNITIES Opening receive training to identify and treat diseases

Figure 3 SWOT of the cultural variable
Source: Author's Perception, 2021

SWOT	
ECONOMIC VARIABLE	
THREATS Lack of financial support from the government and private organizations	STRENGTHS Starting your micro business with your own financial resources
WEAKNESSES No own vehicle to get to the apiaries	OPPORTUNITIES Promotion of income and expenditure control

Figure 4 SWOT of the economic variable
Source: Author's Perception, 2021

SWOT	
POLICY VARIABLE	
THREATS The requirements that the city council asks for to formalize its micro enterprises are many	STRENGTHS Members of the honey safety and traceability program
WEAKNESSES Lack of application of the manual of good practices	OPPORTUNITIES They have the support of the city council of the municipality

Figure 5 SWOT of the political variable
Source: Author's Perception, 2021

SWOT	
SOCIAL VARIABLE	
THREATS Beehives damaged because of people's fear	STRENGTHS Closeness to customers allows them to know their preferences
WEAKNESSES Lack of trust in their micro businesses	OPPORTUNITIES Customers' preference to buy in artisan shops

Figure 6 SWOT of the social variable
Source: Author's Perception, 2021

SWOT	
TECHNOLOGICAL VARIABLE	
THREATS They do not have a good internet signal	STRENGTHS It has materials and equipment to perform extraction, which reduces waste.
WEAKNESSES They do not have an extraction room	OPPORTUNITIES Website creation

Figure 7 SWOT of the technological variable
Source: Author's Perception, 2021

Conclusions

The conclusions are presented for each variable of the context: 1.- Environmental: Characterize the natural flowering and promote plantings of nectar pollinifera species, as well as implement strategies for the protection of hives in times of flooding. 2.- Cultural: Promote a business culture in beekeepers, which will help them to have a better vision of their production. 3.- Economic: Promotion of income control, as well as the selection of points of sale strategically, registration of brands and labels. 4.- Policy: Adopt good honey production practices, streamline registration procedures that allow government support to be managed. 5.- Social: Promote awareness programs of the benefits of bees for the environment that allow eradicating the fear that society feels towards bees. 6.- Technological: Promote genetic selection and improvement programs from bees adapted to local environmental conditions that favor the annual change of queen bees with surveillance of pests and diseases, as well as the acquisition of equipment for the extraction of honey in attachment to food safety standards. It is estimated that within a year favorable results will be achieved for each of the context variables, which can be evaluated at the end of the next harvest.

ISSN-On line: 2414-8830

Thanks

To the Municipal Development Directorate of the Comalcalco City Council, Tabasco, for the logistical support in carrying out the meetings and field visits for the interviews and application of the surveys.

To the United Beekeepers of Comalcalco for their kind collaboration.

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ISSN-On line: 2414-8830

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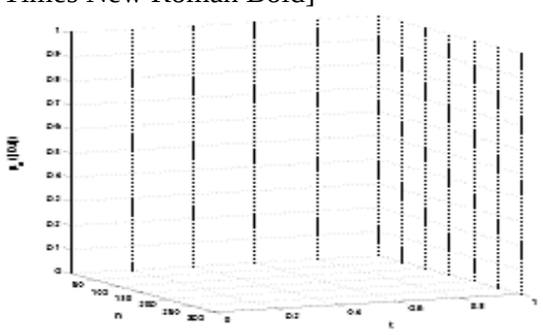

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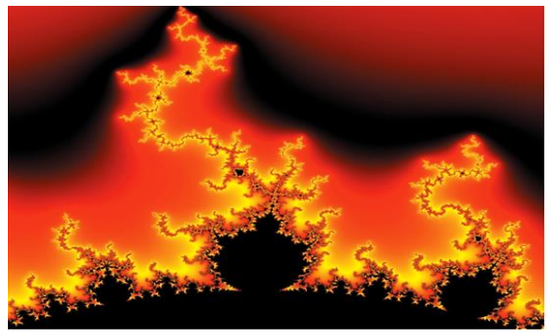

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ECORFAN Journal-Republic of Nicaragua

2414 8830
ISSN 2414 - 8830

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