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Presentation of Content

In the first chapter we present, *Space migrants*, by BORTONI-ANZURES, Liborio & HERRERA-RIVAS, Hiram, with ascription in Universidad Politécnica de Victoria, as following article we present, *Earth Terraforming*, by BORTONI-ANZURES, Liborio & ORTIZ-MOCTEZUMA, Manuel Benjamín, with ascription in the Universidad Politécnica de Victoria, as following article we present, *Situation of agricultural policy in the sector of agave mezcalero in Mexico, theory and reality*, by VÁZQUEZ-ELORZA, Ariel, SANCHEZ-OSORIO, Ever, HERNÁNDEZ-LÓPEZ José de Jesús, CASTAÑEDA-BERNAL Xóchitl Yolanda, with ascription Centro de Investigación y Asistencia en Tecnología y Diseño del Estado de Jalisco A.C., as following article we present, *Preliminary study of wind speed characterization to install a 400 W wind turbine*, by FAJARDO-PULIDO, Gustavo Adolfo, SANDOVAL-VILLEGAS, Juan Carlos and FUSTER-LOPEZ, Gerardo, with ascription in Universidad Tecnológica de Cancún.

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Space migrants

Migrantes espaciales

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Abstract

Man has dreamed of stars since their origins, they have inspired hundreds of great thinkers, artists and religious to understand why they are there, to understand how the celestial map changed night after night, imagining that we could reach them and find new and fantastic worlds, as well as unthinkable flora and fauna. Progressively, as science and technology advance, we can feel that those dreams are closer and closer to being realized. Today we are mainly focused on conquering Mars and although still distant, this idea starts to sound feasible. Using probes and terrestrial drones, we have been able to see the planet, decisive and transcendental steps, but they are the beginnings of a great sequence of necessary objectives before a human being can call the red planet "home". This article addresses the main challenges and obstacles that we would have to overcome in order to start an exodus to Mars, such as development of space vehicles, habitats, and environmental suits, generation of oxygen, water, food and energy, as well as essential genetic modifications.

Space, Planets, Man Kind

Resumen

El hombre ha soñado con las estrellas desde sus orígenes, han inspirado a cientos de grandes pensadores, artistas y religiosos para comprender porque están ahí, entender como el mapa celeste cambiaba noche tras noche, imaginando si algún día podrían ser alcanzadas y encontrar nuevos y fantásticos mundos, así como flora y fauna impensables. Progresivamente, conforme la ciencia y tecnología avanzan, se siente que esos sueños están cada vez más cercanos a realizarse. Hoy la humanidad se ha enfocado en conquistar Marte y aunque aún distante, esta idea empieza a sonar factible. Empleando sondas y drones terrestres ya ha sido posible asomarse al planeta, pasos decisivos y trascendentales, pero son los inicios de una gran secuencia de objetivos necesarios antes de que un ser humano pueda llamar "casa" al planeta rojo. En este artículo se abordan los principales retos y obstáculos que se tendrían que salvar para poder iniciar un éxodo a Marte, tales como desarrollo de vehículos espaciales, hábitats, trajes ambientales, generación de oxígeno, agua, alimentación y energía, así como modificaciones genéticas indispensables.

Espacio, Planetas, Humanidad

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Introduction

Audacious adventures accompanied by incomprehensible technology, magic, fantastic beings, unimaginable landscapes and great riches are the ingredients to conform to science fiction, a literary genre that has inspired man for generations. Although the term science fiction was coined in 1929 by Hugo Gernsback, editor of one of the first magazines of the genre and that defined science fiction as "fantastic narratives interspersed with scientific facts and prophetic visions".

However, the Syrian writer Luciano de Samósata (125-192) was one of the great satirical writers of antiquity, in his work "True stories" narrates how he himself and his companions who leave to navigate the Western Ocean; soon the ship leaves the sea and, sailing through the air, until it reaches the moon; (figure 1) after a long stay between, the selenitas, the ship returns again to the sea, continuing its adventures.

The list of works related to the journey to space is endless, and at the same time, progressively an intrinsic relationship between technology, knowledge and fiction, have come to solve some of the problems posed by the fact of leaving this world, and at the same time some new challenges have been discovered, but it is still far from being able to conquer another planet, much has been advanced since that humble beginning in which the first earthlings managed to travel out of the atmosphere in 1947, even if they were only a group of flies of the fruit.

There is already an orbital camping house, located 400 km high, in which since 2000 it has been inhabited by crews that in some cases have managed to stay up to a continuous year, it is only necessary to build a vehicle that achieves approaching the speed of light, discover how to reverse cryogenics, and it would not be too bad to also get artificial gravity, teleportation, food replicators, holographic salons, and universal translators.

How to deal with neighboring species, will we get to mix? Will they end up with us or us with them ?, It is difficult to have tolerance between individuals of our own societies, probably the coexistence with aliens is something more rough.



Figure 1 "True stories" on the way to the Moon. Luciano from Samósata

Honey moon on the moon

After achieving a round trip to the moon in 1969, it was speculated that once it was possible for vacationers to spend a weekend on the moon, with this in mind the space vehicles were designed so that one day they could operate as a commercial airline, the first of which was the "Challenger Ferry" that made its first flight in April 1983 (figure 2).

This dream was not realized by a series of accidents that cost the cancellation of the budgets of this project, and on the other hand, it turned out that the Moon was a more dangerous destination than had been considered, it is continually haunted by meteorites and intense waves of solar radiation, same reason why it was ruled out to locate a space shuttle from the moon, because of the high cost of survival and maintenance (for each day that an astronaut stays on the Moon it would cost something around 22 million dollars).



Figure 2 First launch of the shuttle Challenger in 1983

Very recently with the incursion of the Entrepreneur Elon Musk in the space race, some of these plans have been dusted off and it seems that they have returned to the work tables, at least they seem to be in consideration. For now it is scheduled that by 2023 with his company SpaceX take a Japanese tourist to go around the Moon.

Objective: Mars

Why go to Marte?

Going to Mars could be considered as a step more as the objective that the earthlings become a race capable of traveling through the galaxy and founding colonies in various worlds where our civilization can survive and perpetuate.

But there are definitely intermediate goals that do not stop being interesting. Robert Zubrin is an aerospace engineer who argues the need to go to the red planet in a conference he gave in 2018.:

"Mars was initially warm and contained liquid water on its surface for more than 100,000 years, which is five times the time it took Earth to emerge after it had it. So if the theory that life is a natural development of certain chemical components is correct, that is, if you have liquid water and certain elements long enough, life should have also appeared on Mars even though it then went extinct. And if we could go to Mars and find fossils there it would be proven that the development of life is a phenomenon that occurs throughout the Universe.

Or if we go to Mars and there is proof of the existence of water, but no fossil, it could indicate that the development of life is not a natural process that occurs with great probability, but rather a process that requires a random component and we could be alone in the Universe.

Also, if we go to Mars and drill its surface we could find liquid water that could contain life at this very moment, and if we could examine its biological composition we would determine if life on Mars is the same as that which exists on Earth because all terrestrial life has the same biochemical composition: we all share amino acids, we have DNA, RNA, etc.

Is this life? Or can life be very different from this?, Are we life, or are we an example of multiple possibilities of life? "

Each agency or country pursues its own goals, some are satisfied to cover their communication needs of meteorological monitoring, while others seriously consider escaping the Earth to settle even beyond our solar system.

Participants

The National Administration of Aeronautics and Space (NASA) founded in July 1958 has made all the developments and research related to space by the United States, monopolizes the entire budget (about 20 billion dollars per year) and flow of information, it is worth mentioning that Astronaut calls the person trained to travel to space.

The Russian Federal Space Agency, known as ROSCOSMOS, founded in February 1992 in the Soviet counterpart specializing in taking Cosmonauts into space, grabbed the beginning of the race to space, Russia and the USA were stepping on each other's feet, for some time was delayed the Soviet Union but managed to put into orbit the first space station (MIR in 1986) are now allies in the project of the international space station (first module launched in 1998), however Russia has plans to orbit its own space station.

China, India, Spain, Italy, France, Canada, Japan, Belgium, Holland, Denmark, Norway, Germany, Great Britain, Sweden, Switzerland, Brazil, the Arab Emirates and Mexico have their own space agencies, some who are interested in be part of the conquerors of space and others with somewhat more modest purposes, focused on communications and meteorology.

And privately BLUE ORIGIN by Jeff Bezos, SPACEX by Elon Musk, Russian mogul Yuri Milner and his project BREAKTHROUGH STARSHOT, Paul Allen with STRATOLAUNCH, VIRGIN GALACTIC by Richard Branson, and the company BOEING who by the way announcement in 2017 that would reach Mars before SpaceX.

The sum of the efforts, sharing achievements and knowledge could provide results in a shorter term, maximize efficiency and gradually reduce operating costs. In addition to the technological and economic contributions to society.

About the Trip

The vehicle

One of the first elements to consider in order to make a trip to another planet is the development of the means of transport, with enough load capacity, which is fast and primarily has the capacity to make the trip back and forth.

With the current technology it requires 500 tons of solid fuel to propel us up to Mach 23 for 480 seconds, and this is necessary only to escape the Earth's atmosphere.

This fuel is composed of propellant oxidant, ammonium perchlorate, which makes up 69.93% of the mixture. The fuel is pulverized aluminum (16%), with iron oxidizer powder (0.07) as a catalyst. The substance that holds the mixture together is polybutadiene acrylic acid acrylonitrile (12.04%). In addition, the mixture contains a preservative glue agent (1.96%). Each Kilogram that tries to take out of the atmosphere requires an investment of 25 million pesos.

But we still do not have a propulsion system, not only that it was sustainable simply that it could work in space or in other atmospheres, if we consider being able to make a return trip.

On the other hand, the development of new technologies in engines has some collateral damage as important levels of air pollution and a large generation of solid waste on land and in space.

Recorded since 1957, more than 5400 rockets have been launched into space (without counting failed launches), which added to damaged or out-of-use satellites result in approximately two million pieces orbiting the atmosphere at speeds of up to 28,000 km / h (called Debris) that are an increasing risk for the following vehicles that try to go out into space.

Currently it is considered that they add more than 800 tons.

Travel time

For some time, all missions must be suicidal, at least until there is a propulsion system that can be re-used from Mars to return, but surely this obstacle will be saved at some point, leading to a second problem:

Since the orbits of the earth and Mars, are not coplanar and also differ in duration, and mainly, that our entire solar system is moving through the galaxy, it is definite that we can not make the trip at any time.

Every three years the Earth and Mars become as close as possible to their trajectories, with a distance of around 55 million kilometers, 180 days of uninterrupted travel considering current technology.

With that travel time, it is not possible to consider an immediate return, the crew should remain on mission for three years, waiting for the orbits to approach again, and later, another 180 days on the return trip.

In short, a mission with return to earth would last about 4 years.

Loading capacity

How many people would man the ships? What combination of skills will be necessary? In the journey to the unknown, a pilot, a navigator, an engineer in maintenance, a doctor (with all specialties), a psychologist are surely required, a nutritionist, archaeologist, expert in linguistics, some experts in tactics and weapons, some pawns for rough work.

In addition to the accumulated weight of each traveler and some of their belongings, they require space for operation, sleeping, eating and cleaning.

The human being requires to breathe a mixture of air composed of nitrogen (78%) and oxygen (20.9%), with the presence of 0.95% of other inert gases and 0.03% of carbon dioxide. At a rate of 8000 liters per day.

Although in developed countries, the daily consumption of water is up to 480 liters, the World Health Organization estimates that 100 liters of drinking water per day are indispensable for the individual biological and health processes.

While a trained astronaut with liquid recovery and recovery systems can survive with 12 liters per day.

Regarding food, the current system consists of bags of dehydrated food and vacuum, these must be hydrated and heated to be consumed, it is important to emphasize that a well-balanced diet with the right amount of minerals, proteins, carbohydrates is of vital importance and calories.

It will now be necessary to consider the fuel, materials and infrastructures used on Mars, measuring equipment, analysis and laboratory, compounds and materials of the mission, tools, vehicles, solar panels, communication equipment, exploration robots and many more things.

Risks during the trip

And if something fails? How many spare parts and emergency cargo will be relevant? It should be considered that a rescue trip is completely ruled out. Practically, nothing can fail.

Radiation is the main problem faced by space travelers, generated by solar storms and cosmic rays, although the effects of radiation or its prolonged exposure have not been studied, all experts agree that it accelerates the appearance of radiation. all kinds of cancers.

Protejerse of such radiation implies the generation of powerful magnetic fields around the ship or habitat on Mars, emulating the protection on Earth, which is complicated, expensive, and in our case, heavy.

Biologically, weightlessness has an effect on the organism; first, many astronauts get to experience the Space Adaptation Syndrome, in which balance is lost because the auditory system is disoriented, causing dizziness and vomiting.

Later, in more prolonged periods, muscle mass is lost, due to the null effort required in space, which can lead to severe atrophy (which hinders movement when arriving at a place that has gravity).

We also have to face the problem of biological risks, how we would fight a pathogen that we could find, the viruses and terrestrial bacteria have evolved with humanity, but if we enter an extraterrestrial one, we are not sure of the effects that our antibiotics can have on the.

Likewise, what effects could we trigger if some kind of illness accompanies us on the trip and we infect a different ecosystem, it is a great responsibility.

Finally, what a technological difference we could find, how we would conduct ourselves when facing a hostile race or if at least we could communicate with them.

Conclusion

The idea of wandering through the confines of the universe, discovering new worlds, cultures and species, in a concept that has been closely linked with humanity since its inception, is how the planet has been populated, leaving our lands for the promise of something better, this story has been repeated in the Vicki, Phoenicians, Greeks, Europe to conquer the new world.

Many obstacles must be overcome and many technologies developed so that one day a person can already consider himself a citizen of Mars (or in any other world), however, there is no doubt that much progress has been made and like some previous dreams, this also someday it will be possible.

References

- BBC Mundo. (2014, 25 noviembre). Los peligros invisibles de viajar al espacio. Recuperado 30 abril, 2019, de https://www.bbc.com/mundo/noticias/2014/11/141125_peligros_viajar_espacio_lp
- Del Alamo, F. (2018, 13 julio). ¿Por qué debemos ir a Marte? Recuperado 28 abril, 2019, de <https://www.nuevatribuna.es/articulo/ciencia/po-r-que-debemos-ir-a-marte/20180707102212153733.html>

García Llama, E. (2015, 16 octubre). ¿Por qué es difícil ir a Marte? Recuperado 30 abril, 2019, de <https://www.elmundo.es/blogs/elmundo/apunte/snasa/2015/10/16/por-que-es-dificil-ir-a-marte-i.html>

Isasi Arce, R. (2017, 11 abril). Así se vive en la Estación Espacial Internacional | The Objective | Periodismo ethos. Recuperado 28 abril, 2019, de <https://theobjective.com/further/asi-se-vive-en-la-estacion-espacial-internacional/>

Marín, D. (2016a, 21 septiembre). ¿Cuánto le cuesta a la NASA mandar a sus astronautas en las Soyuz rusas? Recuperado 28 abril, 2019, de <https://danielmarin.naukas.com/2016/09/21/cuanto-le-cuesta-a-la-nasa-mandar-sus-astronautas-en-las-soyuz-rusas/>

Marín, E. (2016b, 14 octubre). Colonizar la Luna es mucho más peligroso de lo que creíamos por los bombardeos constantes de meteoritos. Recuperado 28 abril, 2019, de <https://es.gizmodo.com/colonizar-la-luna-es-mucho-mas-peligroso-de-lo-que-imag-1787773465>

Notimex. (2015, 25 noviembre). La alimentación de los astronautas en el espacio. Recuperado 30 abril, 2019, de <https://www.eluniversal.com.mx/articulo/ciencia-a-y-salud/ciencia/2015/11/25/la-alimentacion-de-los-astronautas-en-el-espacio>

Pérez Ventura, J. (2018, 11 septiembre). La conquista del espacio en manos privadas: SpaceX, Jeff Bezos y Virgin | VENTURA. Recuperado 30 abril, 2019, de <https://vaventura.com/divulgacion/ciencia/la-conquista-del-espacio-en-manos-privadas/>

Redacción AN. (2017, 11 marzo). Los 5 peligros de viajar al espacio, según.... Recuperado 30 abril, 2019, de <https://aristeguinoicias.com/1103/kiosko/los-5-peligros-de-viajar-al-espacio-segun-science/>

Earth Terraforming

Terraformar la Tierra

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Abstract

The concept of terraformation is applied in general to establish a course of action in which hypothetically, it is possible to modify the natural conditions of a planet or moon to make it habitable for the human race, create an atmosphere with breathable air, potable water, fertile soils, climatic stability at a comfortable temperature; this process could take hundreds or thousands of years, as well as an important investment of resources and technology, however in the course of the time that we have inhabited this planet has deteriorated in many of its characteristics, to the point that it could be close the day in which the Earth is no longer apt to sustain the life of the human race. This article shows some of the challenges we should face so that the planet can recover its original benefits, as well as adapt our technology to be able to inhabit regions that we consider hostile today. Surely it would require a minor effort to completely transform a distant planet.

Ecology, health, Future

Resumen

El concepto de terraformación es aplicado en lo general para establecer un curso de acción en el que de manera hipotética, fuera posible modificar las condiciones naturales de un planeta o luna para hacerlo habitable para la raza humana, crear una atmósfera con aire respirable, agua potable, suelos fértiles, estabilidad climática a una temperatura cómoda; este proceso podría tomar cientos o miles de años, así como una importante inversión de recursos y tecnología, sin embargo en el transcurso del tiempo que hemos habitado este planeta se ha deteriorado en muchas de sus características, al punto de que podría estar cercano el día en que la Tierra ya no sea apta para sostener la vida de la raza humana. En este artículo se muestran algunos de los retos que deberíamos confrontar para que el planeta pueda recuperar sus bondades originales, así como adaptar nuestra tecnología para poder habitar regiones que hoy consideramos hostiles. Seguramente requeriría un esfuerzo mucho menor que transformar por completo un planeta lejano.

Ecología, Salud, Futuro

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Introduction

It is estimated that our planet is about 15 billion years old, and it took some of those millions of years to be fit to support life, the oldest fossils that have been identified date back 3,500 million years, a large number of different species have arisen, evolved and disappeared in this time, the conditions of the planet are in permanent change, as a result of their cooling and loss in speed of rotation among other factors, as well as factors in their environment, solar radiation, meteors or other phenomena celestial.

The challenge to survive is adaptation. The first being related to our evolutionary history, the first primate on the planet appears 70 million years ago (the Purgatory) from which we progressed to become, 50 thousand years ago, the current Homo Sapiens Sapiens, dominant species, the first inhabitant of our world that is able to modify its environment to adapt it to its whims.

Victims of our own success in modifying the habitat, we proliferate irrationally in densely populated regions, with increasing complications to satisfy the requirements for living of its inhabitants. In figure 1, you can see a couple of photos of the planet provided by NASA, one 1978 (left) and another 2012 (right), in them you can clearly see the loss of vegetation, the melting of the north pole, to give rise to a growing desert.

The erosion of resources, the accumulation of pollutants, waste resulting from our activities and the extermination of other species, has reached a point where moving to another world would be a good solution, even if we keep on the same unsustainable way of living.

Finding a planet compatible with our current lifestyle, has not been possible so far. In addition to the efforts, resources and time it would take to carry out the exodus and terraforming, not to mention that we would probably continue with our same practices.

Although we have damaged our house a lot, the planet Earth is much closer to being habitable than someone else could be, if we apply our current knowledge and develop sustainable technology, instead of investing in research to be able to flee, we can modify our actions to diminish the deterioration or even more, contribute to the Earth regaining its balance, and not because we must "save the planet" but so that we can live in it for longer.

Current panorama

Figures 1 and 2 can be compared photographs of the planet Earth seen from space, provided by NASA, in which 34 years away (1978 - 2012), the conditions of the region that is appreciated have changed considerably.

It seems evident the reduction of the polar cap (probably due to thaw) and the growth of the desert areas, which in turn could imply a change in the climatic conditions of the planet, affecting the flora and fauna.

Solid waste

The amount of solid waste is one of the greatest sources of pollution resulting from our current lifestyle, each person discards an average of 1 kilogram of garbage per day, although the economic level of each country is closely related to the waste of each inhabitant, up to 4.5 kg in the more developed countries, in Mexico, for example, each citizen throws to the dump about 1.7 kg, while other less fortunate countries, a figure less than 300 grams.

What implies that every day more than 2 billion tons of solid waste are generated, according to some analysis, it is considered that 95% of the total of the things that we buy, reaches the dump in less than 6 months.



Figure 1 Planet Earth in 1978 (superior) and **Figure 2** Earth in 2012 (bottom)

Source: NASA

Research carried out by the United Nations in 2017, in the framework of the World Environment Day, indicated that an average of 10 million tons of this garbage is going to hit the sea, according to Antonio Guterres, Secretary General of the UN. Such amount of waste causes the intoxication of marine species that have been brought to extinction and some return to us at our own tables in the form of micro-plastics within the bodies of fish and shellfish that we consume.

Much of the non-biodegradable garbage thrown into the sea is washed away by marine currents, which has caused them to gather in masses to form large islands in different oceans, some of these garbage islands can reach up to 3 times the territory of Spain.

Garbage occupies large areas that become toxic, infertile, and damage the flora and fauna, which corresponds to modify our customs to consume less, sustainably, reuse and finally recycle in a more efficient way.

Drinking water

Although 71% of the surface of the Earth is covered with water, only 0.02% is potable, and while the World Health Organization considers that human beings require 100 liters a day to live, between their consumption for drink and clean, in several countries we exceed that figure by far, to consume more than 450 liters per person per day (including residual gray and black water) [Valdemar].

In addition, our goods also consume water, to be able to be manufactured industry, due to the necessary processes to manufacture many items and its components require this liquid, in the case of a denim trousers 7 thousand liters of water were required, while to build a car, 400,000 liters are needed. Additional to the treatment given to residual waste.

However, the agricultural sector is the largest consumer of water on the planet, using approximately 70% of the fresh water, plus the effects on water bodies by leaks or spills of pesticides, fertilizers, fungicides, herbicides and fertilizers used to maintain their performance.

Water is considered the "universal solvent", given its molecular structure, water has great capacity to establish hydrogen bonds with other molecules.

Because of this, it can dilute a large number of substances, water can be contaminated with inorganic substances, such as detergents and metals, natural or synthetic organic, all kinds of industrial waste, as well as biological waste, such as bacteria and pathogenic viruses.

Finally, a body of water can also be contaminated by acoustic or thermodynamic effects, affecting the ecological balance of the system, and consequently the biodiversity.

Situation of agricultural policy in the sector of agave mezcalero in Mexico, theory and reality

Situación de la política agrícola en el sector agave mezcalero en México, teoría y realidad

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Abstract

This research aims to examine the characteristics of the sector mezcalero in Mexico. The analysis was qualitative, of observation about the organization and quantitative of the information in the territories. The activity responds to the importance of generating income, strengthening the wealth of cultural, ancestral traditions and experiences of indigenous people. The agricultural policy undertaken by the Mexican state in the value chain should include coordinated actions among the three areas of government to boost productivity.

Agave, Mezcal, Agricultural policy, Production, organization

Resumen

Esta investigación tiene como objetivo examinar las características del sector mezcalero en México. El análisis que se presenta es bajo una metodología mixta, por una parte, se presenta una parte cualitativa por medio de la observación sobre la organización, así como un apartado cuantitativo de la información de los territorios. La actividad responde a la importancia sobre la generación de ingresos, fortalecimiento de la riqueza de tradiciones culturales, ancestrales y experiencias de pueblos indígenas. La política agrícola que emprenda el Estado mexicano en la cadena de valor debe incluir acciones coordinadas entre los tres ámbitos de gobierno para potenciar la productividad.

Agave, Mezcal, Política agrícola, Producción, Organización

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Introduction

The production in Mexico of distillates of mezcalero agaves is mainly located in rural communities formed mostly by indigenous and peasants who face socio-economic problems linked to marginalization and social inequality, as evidenced by relating the elaborated municipal Social Lag¹ (RZ) by the National Population Council (CONAPO, 2015), the Indicators generated by the National Council for the Evaluation of Social Development Policy (CONEVAL, 2015) and information on the mezcalera production of the Agrifood and Fisheries Information Service, and the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SIAP-SAGARPA, 2015).

There are 963 municipalities that have the Denomination of Origin (DO), and 44 more that are in the process of Denomination. From the first, in the country, it is evidenced that 128 municipalities have a very high RZ, 349 high RZ, 274 medium RZ, 211 low RZ, 41 very low RZ and, 4 do not have information. Namely, the majority of dwellings dedicated to the production of agave mezcalero in Mexico and located in rural locations are characterized by maintaining levels of poverty, lack of access to services, low levels of competitiveness and, on exploitation of wild agaves given the high demand for agave pineapples according to the characteristics and market structure of the by-products.

In the particular case of the mezcalero sector, it currently stands out with the existence of 493,750.88 square kilometers (km²) of territory in the country that has the Denomination of Origin (hereinafter DO), composed of 963 municipalities distributed in the following entities: Oaxaca (570) representing 56.6% of the national total; Guerrero (81, 8%) Durango (39, 3.9%), San Luis Potosí (58, 5.8%), Zacatecas (58, 5.8%), Guanajuato (2, 0.2%), Tamaulipas (11, 1.1%), Michoacán (29, 2.9%), Puebla (115, 11.4%).

In addition, there are three entities in the process of DO that are Aguascalientes (6, 0.6%), State of Mexico (15, 1.5%) and Morelos (23, 2.3%). It is important to note that the municipalities in the states of Aguascalientes, State of Mexico and Morelos joined the DO in August 2018.

The value chain^{2,3} refers to those actors involved in the agave and mezcal sector, including from suppliers to the final consumer. On the other hand, the productive chain is limited to the primary sector and agents that seek the transformation and commercialization of mezcal.

¹ The Social Delay Index “is a weighted measure that summarizes four indicators of social deprivation” that include “access to health services, housing quality, basic housing services and household assets” CONEVAL (2015). Baseline indicators are: 1. Percentage of population aged 15 years or more illiterate. 2. Percentage of population aged 6 to 14 who do not attend school. 3. Percentage of population aged 15 years and over with incomplete basic education. 4. Percentage of population without right to health services. 5. Percentage of dwellings with dirt floor. 6. Percentage of homes that do not have a toilet or toilet. 7. Percentage of homes that do not have piped water from the public network. 8. Percentage of homes that do not have drainage. 9. Percentage of homes that do not have electricity. 10. Percentage of homes that do not have a washing machine. 11. Percentage of homes that do not have a refrigerator.

² The productive chain is different from the value chain. According to Porter (1986), the generic value chain incorporates support activities such as the firm's infrastructure, human resources management, technology development and procurement; as well as internal logistics, operations, external logistics, marketing, sales and services (Porter, 1986, p. 38). On the other hand, the Red America establishes that “The concept of Productive Chain is linked to the spontaneous relationship between actors involved in economic relations and provision of goods and services from primary production to the arrival to the consumer” (Redameerica, 2018).

³ According to Van Der Hieden (2004) cited by FAO (2011), the production chain is made up of “interrelated actors and a succession of production, transformation and marketing operations of a product in a given environment [...], in addition, there is very little trust and even information is not shared among the actors” (FAO, 2011, p.9). On the other hand, Holmlund and Fulton (1999, cited by FAO, 2011); They point out that “Value chains are demand-oriented productive chains, which involve differentiated and specialized products, coordination relationships and clearly defined rules of the game for their management, higher income in the markets, close interdependence between actors” (FAO, 2011, p.9). Unlike the productive chain, in the value chain the actors share collaboration, risks with strong relationships of trust.

In this context, there is undoubtedly a need to have more productive Economic Units (PEU) more productive mixers and with higher incomes, yields, but, above all, with a greater insertion on their social valorization; coupled with a reduction in transaction costs. Undoubtedly, this reality is linked to relevant factors to consider in the design of public policies, such as: sustainable use of biodiversity, strengthening of idiosyncrasy, and traditional and traditional cultural factors existing between the rural and indigenous population.

The strategic indicators of the rural and fisheries sector in Mexico (2012), obtained by FAO (2012 a; 2012 b), show the existence of 5,424,430 rural economic units (EBUs) established in urban locations, but especially in rural areas. Among the federal entities that stand out can be mentioned Oaxaca with 661,333 UER, Guerrero (514,581) and Chiapas (500,727). 47.67% of the EBUs are located in the strata classified with low assets and with a high marginality; 56.64% of the units have primary education, 13.29% with secondary, 4% with high school, 1.02% with a technical career, 13.82% have a university and only 0.18% have a postgraduate degree. In the case of the production of agave mezcalero the representation is greater in the states of Oaxaca and Guerrero in the Southeast South of the country.

The makers of the design and implementation of public policies should consider multifactorial aspects of the social problems facing the sector, in addition to those related to productive improvement, public management and institutionality that benefits or harms the national agave mezcal sector. To contextualize the productive importance of the sector, some important characteristics are listed below.

1.1. Agave Mezcal Value Chain problem tree

Among the main problems in the value chain is the lack of a vision of entrepreneurship to boost business in the Productive Units that inhabit the marginalized areas. However, it is important to keep in mind that cultural, regional factors and the relationship between producers play a preponderant role in localities and states with DO.

The problem tree is related to regions where there is a strong presence of ethnic groups (Zapotec, Chichimecas, Mixtecas, Nahuatl, among others) that affect the development of productive activities where they do not necessarily incorporate the element of profitability as the main incentive for mezcal production, but is linked to the status that symbolizes in the community belong to the production chain or be master mezcalero.

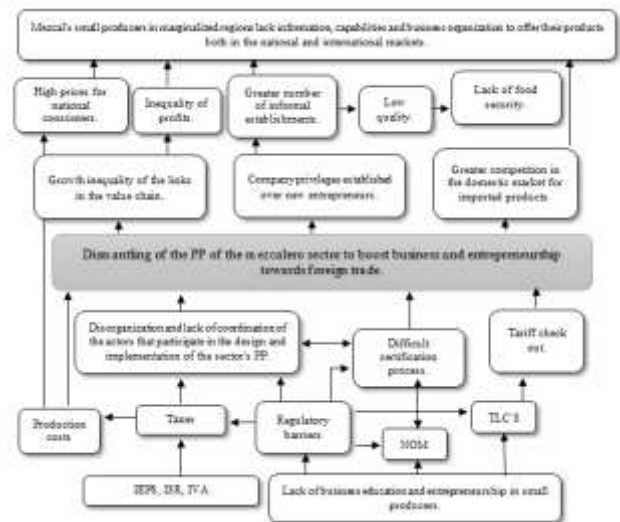


Figure 1 Agave Mezcal Value Chain problem tree
Source: Alvarado, Vázquez, Contreras y Carmona (2017)

In the field work carried out in rural producing areas, there has been a disarticulation between the institutions to create synergies and increase local productions, such as: financing accessible for planting, production, increase in certifications for small mezcal producing units in the localities with DO, conversion programs for wild agave exploited areas, access to commercialization channels among small producers to increase their profit margins, reuse of wastes and compounds obtained for the manufacture of natural products, cosmetics, inulins, coal, paper, eco blocks, flavored distillates, among others.

In spite of the great territorial extension that the DO has in the country with planting and production potential, only 16.30% of the municipalities made plantings in 2016; that is, 158 municipalities of 963, according to data from SIAP-SAGARPA, (2016). This reality demonstrates a weak link (lack of coordination) between productive actors and public policy strategies in the federal entities to encourage the sustainable use of agaves as a measure to meet local and international demand.

This leads to obtaining some negative effects such as the increase in raw material, a situation that has occurred in recent years, having as one of its main consequences, high prices for mezcal production.

As a result of the lack of productive planning in the sector, at a national level, small producers have suffered more from the high prices resulting from the cost of harvested agave pineapple, this has encouraged producers and private institutions located in “Without Denomination of Origin” (SDO) municipalities to plant agaves; in 2016, seven municipalities that carried out this primary production activity were registered.

The agave mezcalero sector is no stranger to the reality described by the indicators obtained by FAO (2012 a, 2012 b). This problem is increased in the absence of efficient and effective government programs to potentiate agribusiness, sustainable use of agaves, training and specialization in production, the management of financial budgets to increase profitability, the use of agricultural waste to obtain products with added value, among others.

The Economic Commission for Latin America (ECLAC, 2017), Inter-American Institute for Cooperation on Agriculture (IICA) and the Food and Agriculture Organization of the United Nations (FAO) noted that Mexico, as well as other Latin American countries and the Caribbean (LAC) needs to accelerate the step to achieve the Sustainable Development Goals (SDGs) proposed in the 2030 Agenda, mainly on three main fronts: policies aimed at improving crop productivity; policies to reduce inequality within agrifood chains, facilitating an equitable distribution of benefits among all actors; and policies aimed at developing systems based on agriculture with greater resilience and less impact on natural resources and climate (CEPAL, FAO, IICA, 2017, pp. 204-205).

After the commercial and economic opening of Mexico in the 1990s, the domestic agricultural market generated structural changes both in the supply and in the demand for products and services with the world.

The mezcal production chain is no exception and it has been observed that in recent years the international demand has increased, generating an increase in consumption of wild agaves. In contrast, the need to increase competitiveness and strengthen the Value Chain is evident; namely, the Annual Average Growth Rate (TCMA) of the volume of the national primary production of agave mezcalero between 2010-2016 was negative with a 10.2% reduction annually.

This reality of the mezcalera activity intensifies the unsustainable use in the sector whose consequences can be transferred towards social and economic problems in the municipalities, mainly, in those that have the denomination of origin (DO). For the development of this work it was necessary to analyze qualitative, quantitative variables and experiences of field work carried out within the framework of the Agave Mezcal Project PN-1406-2015 CONACyT-CIATEJ.

General considerations on public policy in agave and mezcal

In Mexico, agricultural, environment and rurality policies are sectorized in the Ministry of Agriculture and Rural Development (SADER), Ministry of Environment and Natural Resources (SEMARNAT), Secretariat of Rural Development (SEDESOL); In addition, the Ministry of Finance and Public Credit (SHCP) that controls the economic policy (financial, fiscal and expenditure).

There are also decentralized, decentralized and parastatal institutions that participate directly and indirectly in activities that seek to boost the agricultural sector from different fronts, including: the National Council of Science and Technology (CONACyT), with its Public Centers of Research (CPI's), in the line of work on environment, health and food; Chapingo Autonomous University (UACH); Antonio Narro Autonomous Agrarian University (UAAAN); National Forest Research Institute; Agricultural and Livestock (INIFAP) and Regional Centers, Graduate College (COLPOS); PRODUCE Foundations; National Autonomous University of Mexico (UNAM), among others.

After investigating the reports on the sector, it can be observed that unfortunately there is no accessible global repository in the country that shows all the evidence and results obtained towards the productive chain between the different institutions. The generation of information, knowledge, cultural practices, innovation are scattered. On the other hand, there are research studies (such as other documents such as theses, theses, etc.) available to society through electronic means in various universities, research centers, universities and public and private institutes in the country in a disjointed manner. In the absence of inter-institutional coordination guidelines in the federal and state public administration for the agave and mezcal sector, a comprehensive system that offers transparency on the materialization of public resources allocated to the chain in terms of plant propagation, packages, is lacking Technological production, profitability, updated information on the number of producers in the localities, certifications and transaction costs in the value chain in agave and mezcal, among other actions.

Continuing with the context on the legal precepts of the Mexican state for development in the primary sector, it is pointed out that through the executive branch the guidelines of agricultural policy are established on the components that will be operationalized in the different areas of government (which are commonly carried out from top to bottom or top down) within the framework of administrative, political and economic centralism. Article V of the Federal Planning Law establishes that these must be built on “The basis for participation and consultation of society, including indigenous peoples and communities, through their representatives and authorities, in the preparation of the Plan and programs referred to in this Law ”; (Federal Planning Law) whose result is the National Development Plan (PND) that represents the articulating axis of the public policies of the sexennium. On the other hand, the Federal Public Administration Law (LCF) establishes in Article 35 section I that the SADER corresponds to “Formulate, conduct and evaluate the general policy of rural development, in order to raise the standard of living of families living in the field, in coordination with the competent agencies ”(LCF, p. 25).

In addition, the PND (2019-2024) points out in the Economy component Boosting economic recovery, the internal market and employment; as well as food self-sufficiency and rescue of the PND field (pp. 51-55).

In recent years, the study of public policies has represented an important tool for government actors in the executive and legislative power to generate efforts to solve national problems, mainly in the social and economic fields. Anderson (2006) defines the Policy as "a relatively stable and intentional course of action followed by an actor or group of actors when dealing with a problem or situation of interest" (p. 6). For its part, Tamayo (1997), describes that public policies "are the set of objectives, decisions and actions carried out by a government to solve the problems that citizens and the government themselves consider a priority at a given time" (p. 281). It is important to point out that the great public policy scholars have developed methodologies with the purpose of adapting and replicating in other countries such as Mexico, however, these actions are generally carried out in the government spheres through federal programs; in contrast, its applicability at a local and regional level with agricultural municipalities that remain with high levels of poverty and marginality is still distant.

On the other hand, there are several factors that have influenced the increase in the price of the Mezcal spirit drink, among them stand out: the accelerated increase in national and international consumption, reduction in the supply of wild agaves as a result of a lack of planning for increase the area planted in the main fields of production, changes in the climate that have affected the appearance of new diseases and attack of insects in the plantations.⁴

According to the field work carried out, it is evident that small producers lack adequate information, knowledge and infrastructure to reach higher levels of negotiation and compete with certified producers, achieving high prices, processes and products to export.

⁴ Until now, Agave mezcalero does not have the federal strategic product range in the Agromercados Social y Sustentables (AMSYS) Program whose purpose would be to offer producers incentives to market; certify; train and technical assistance, among other benefits given to the country's strategic products.

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In addition, it is essential that society and consumers, mainly value the culture, traditions and intangible aspects offered by an artisanal and ancestral product. In this way, the process and design of public policies should be aimed at solving productive, socio-economic and business problems, always with respect to the environment and the place of the plant and drink within the culture of small producers. Inequality and diversity among localities producing agave mezcalero force agrifood public policies to treat unequals in the social development of the vulnerable population involved in the value chain. That is, existing heterogeneous problems cannot be treated the same.

Undoubtedly, Oaxaca is the state in the country that is an example in the production of agave mezcalero. Therefore, it is relevant to know what are the actions undertaken so far. According to the Master Plan of the Maguey Mezcal Product System in the state of Oaxaca (PRSPMMO, 2014, p. 10), it considers that the chain is made up of the following link levels: a) agave collector, firewood collector; b) grower producer, B) producer of maguey, c) packer, d) marketer, e) at other levels are carriers, input supplier, COMERCAM, service providers, federal, state government, research institutions, Committees Product Systems and other actors such as the National Institute of Industrial Property (IMPI), Federal Consumer Office (PROFECO), among others.

In fieldwork, the existence of various marketing channels has been confirmed with the presence of imperfect markets where the large mezcal producing companies, located mainly in Santiago Matatlán, commonly known as the “Mezcal World Capital”, dominate due to the large volumes that produce and commercialize, in addition to the presence of large marketers or brands that come to buy mezcal in bulk. In contrast, there are also groups of small producers with weak formal linkages with the national market, insufficient information on prices, market, potential niches, marketing, certification processes to export, lack of technological packages to increase production, collection centers, transport to distribute mezcal, manuals of good process practices, among others. This reality hinders the development and growth of their economic productive units.

Small producers seek to get closer to the final consumer and reduce intermediary to increase profit margins in marketing. The above is generated by the lack of marketing mechanisms, economic incentives, asymmetry of information on prices in by-products, among others. As an organizational measure to counteract this situation in recent years, advances have been developed, such as the constitution of the Association of Master Teachers (AMM) whose purpose is to increase their access and information capabilities for the sale of their products at prices more competitive; as well as helping each other to generate collaboration networks and mass sales as much as possible (Personal communication).

The AMM is characterized in that it is directed mainly by a group of women from the regions of Villa Sola de Vega, San Baltazar Chichicapam and Miahuatlán de Porfirio Díaz, in Oaxaca. When small producers join, they increase their negotiation skills, mainly because they go to national and international fairs to promote their products considering the differentiation that exists in each of them. Given this scenario, it will be very important to generate public policies that incorporate social and solidarity economy, cooperatives, collaborative work, clusters, fair trade, mainly. However, there is also the theory of rational choice “that incorporates the application of notions of economics (and to some extent, from mathematics) to the analysis of the way in which the selfless behavior of individuals can influence the process of policies” (Hill 2005, p. 51).

1.1.1 Value chain structure

Although the PRSPMMO (2014) establishes a descriptive platform for the value chain of mezcal agave, it is important to note that in the country it is diversified and structured depending on the federative entity where the analysis is carried out; In general, it is very heterogeneous.

The value chain is in a development process due to its heterogeneity and the diversity of actors involved, according to the state under study, since each operates in very particular ways.

In this case, it can be established that the link in order of political - administrative hierarchy corresponds to the executive branch with the federal, state and municipal government that include institutions related to the operation of policies and programs aimed at strengthening the primary sector. The main links in the value chain that have been identified in the value chain can be distinguished in Figure 2.

From an external scope, although directly related to the local and federal power relations, the agriculture and innovation commissions of the legislative branch where the budgets are designed and programmed to be exercised in the strategic sectors. Here the guidelines and legislative rules to operate the actions and resources in the case of the executive branch are established. Undoubtedly, the Product Systems of Maguey Mezcal in the states of the Republic seek to represent producer organizations in general. However, there are various types of alliances between them, which interact individually or in groups as appropriate.

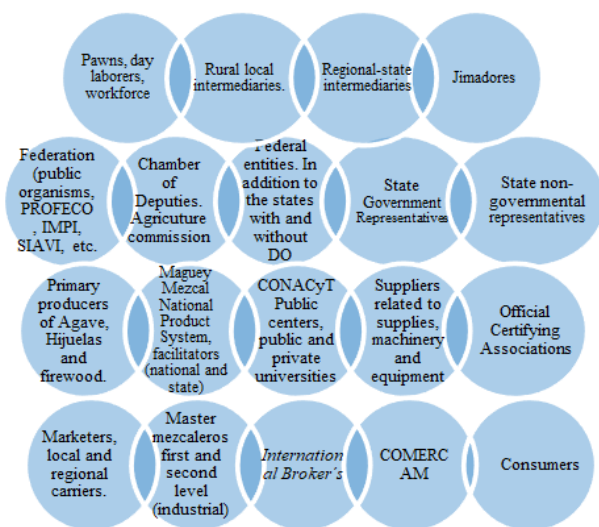


Figure 2 Links of the mezcal agave value chain
Source: Own elaboration based on field work

In the primary sector, it is the wood producers, nurseries that offer important and necessary raw materials in the primary and industrial processes. Most of them are part of the same families that live in the producing localities. The problem that small producers incorporate is also related to the lack of knowledge about tax requirements, export permits, certifications before COMERCAM and even lack registered trademarks before IMPI.

For these reasons they are forced to sell their production in bulk without having knowledge of the final destination of the consumption of their product, nor the price at which it ends up selling. Due to lack of financial resources, they do not have the conditions to place their product on a shelf in convenience stores.

In the case of national and international marketers, there is a hoarding of the production of small mezcal producers in marginalized regions, this reality is frequent, to subsequently place the product in private state stockpiles and be sold in cities or areas Metropolitan consumption. In this context, public policies should be aimed at clearing unwanted or convenient practices that are developed, and instead improve flows by reducing intermediaries and increasing marketing margins for the primary sector.

According to the COMERCAM report (2017), in Mexico there were a total of 2.0 million liters (mill / l) for the export market and 1.8 million / l for the national market. Of this total, approximately 2.4 million 750 ml bottles were packaged in the country. Considering the taxes generated in the sector, 626.5 million pesos in taxes would have been obtained in the whole sale of mezcal. It should be noted that the state of Oaxaca contributed 65.1% in 2016, that is, if there were a distribution of taxes to the producing areas, it would have to exercise an amount of 408 million pesos which would enhance the deficiencies that exist in the sector through the implementation of effective, efficient and economic PP. In reality, a focused policy that contains this amount of resources has not been identified to guide them to the most unprotected areas.

With the coordination of the Center for Research and Assistance in Technology and Design of the State of Jalisco, a Mexican thematic Network was established on the integral sustainable use and biotechnology of agaves –AGARED– with the purpose of promoting research, linking and research teams of diverse disciplines (biotechnology, process innovation, food, sociology, administration, economics) and propose solutions to the sector.

To date, academics from various institutions in the country, public and private, as well as producers and entrepreneurs are integrating, trying to define axes of action for prospective purposes to participate in the solution of several of the problems stated in the tree described above. Likewise, the Center for Research and Assistance in Technology and Design of the State of Jalisco A.C. (CIATEJ) has maintained in the last 15 years research studies providing a large number of new forms and processes for the integral use of agave.

In short, Mexico has consolidated in recent years to increase exports in the main strategic agrifood products, including: avocado, coffee and cocoa, mainly (ECLAC, FAO, IICA, 2017, p. 6). However, much remains to be done in the productive chains, in particular, in the drinking of mezcal because those who participate are mostly small producers who live in high marginalization areas whose PP have failed to curb the marginalization, poverty and disarticulation of actions for the welfare of families.

Conclusions

Public policies in the sector must be aimed at increasing the productivity of the chain in agave and mezcal, in addition, the solutions, programs and strategies need to be transversal in order to face the challenges of social development through actions that improve the quality of life of rural families. Although there are isolated efforts to address the problem from the productive and research fronts, in practice there is evidence of the lack of an operational sector program or plan that involves states with DO and the participation of actors in the Value Chain. In the last two years, important efforts have been made by national forums and tables in the Chamber of Deputies in order to generate a diagnosis of the sector, but above all to build inter-institutional, legislative and linking strategies to enhance the development of the producing regions of coordinated and joint way. However, despite the participation of public instruments of agricultural policy at different levels of government for the production, organization and planning of the sector, there is a lack of coordination and lack of mainstreaming of public policies aimed at solving social, cultural, environmental and economic problems. in the value chain.

This reality requires that in the future multifactorial diagnoses be made, analyze and propose alternatives to comprehensive public policies with the purpose of increasing profitability, productivity, and social improvement of the sector.

As a result of the high increases in mezcal agave, it is currently the small producers who are most interested in increasing the plantation of agaves that can be used in distillation to obtain mezcal in the main producing states with both DO and SDO, although also visualizing the use for others byproducts.

However, they mostly lack the financial resources to do so. Around this reality, there has been a diversification of the producers according to the type of ancestral, artisanal and industrial drinks, packaging machines, exports, consumers and, in general, associated to the Mexican Council for the Quality Regulation of Mezcal (COMERCAM). The main motivation is to improve conditions on the use of the plant, although the most benefited have been the industrial sector and large producers with greater investment and marketing capabilities for the product.

At the local - regional level, it is difficult for municipal governments to transfer the resources necessary to create infrastructure, technology and collaborative networks for access, use, processing and management in the use of information for the design of public policies in the mezcalero sector. It should be noted that there are important (isolated) efforts from research, science and technology for the development of technological projects that seek to respond to socio-productive solutions and improve mezcal production processes in order to generate new opportunities for exploitation. sustainable.

In addition, there is a reduced capacity in the negotiations that small producers have with the sale of their product to marketers due to low volumes of mezcal production and access to convenience stores. Some of the main findings obtained in the field, is that small producers of agave mezcal make clear the lack of knowledge about the existence of public programs aimed at the Value Chain.

They also highlight that the presence of corruption, impunity and violence that prevails in the country are not foreign to the sector, since the living conditions where they live generate many needs and therefore also said problem (information obtained from personal communication).

Given the lack of coordination of targeted public policies, it is proposed that agricultural policy actions establish objective guidelines and empirical information to guide public policies with a multidisciplinary and interdisciplinary approach, coupled with the great diversity and heterogeneity of the sector. Although there are great advances in internalizing the concepts and methodologies of federal programs with the support of national (public management, academy) and international institutions, in reality there is a disarticulation between government actors and the needs presented by small producers that slow down the promotion of business and entrepreneurship towards foreign trade in the mezcalero sector.

References

Alvarado A., Vázquez A., Contreras, D. Carmona. *Análisis de las políticas públicas del sector mezcalero, para potenciar los negocios y empresarialidad hacia el comercio exterior*. Tesis. UTSG-CIATEJ, Guadalajara, México. 2017.

Anderson, J. E. 2006. *Public policymaking*. Sixth Ed. Cengage Learning.

Comisión Económica para América Latina y el Caribe (CEPAL), Organización de las Naciones Unidas para la Agricultura y la Alimentación (FAO), Instituto Interamericano de Cooperación para la Agricultura (IICA). 2017. *Perspectivas de la agricultura y del desarrollo rural en las Américas: una mirada hacia América Latina y el Caribe*. San José, C.R.: IICA. URL: https://repositorio.cepal.org/bitstream/handle/11362/42281/1/PerspAgricultura2017-2018_es.pdf. [fecha de acceso: 29 de abril de 2018].

Consejo Mexicano Regulador de la Calidad del Mezcal (COMERCAM). 2017. Informe Anual. Oaxaca, México.

Consejo Nacional de Evaluación de la Política de Desarrollo Social (CONEVAL). 2015. Índice de Rezago Social. (Accesado el 10 de mayo de 2019). URL: https://www.coneval.org.mx/Medicion/IRS/Paginas/Indice_Rezago_Social_2015.aspx.

Consejo Nacional de Población (CONAPO). 2015. Índice de Marginación Municipal 2015. (Accesado el 23/01/2019). URL: <http://www.conapo.gob.mx/>.

Heyden, D., Camacho, P., Marlin, C., & Salazar, M. (2004). Guía metodológica para el análisis de cadenas productivas. Rualter para CICDA, SNV e Intercooperation.

Holmlund, M., & Fulton, M. (1999). Networking for Success: Strategic Alliances in the New Agriculture Centre for the Study of Co-operatives. *University of Saskatchewan, and Agriculture Institute of Management in Saskatchewan, Inc.*

Holmlund, M., & Fulton, M. E. (1999). *Networking for success: Strategic alliances in the new agriculture* (No. 31769). University of Saskatchewan, Centre for the Study of Co-operatives.

Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO). 2012a. Diagnóstico del sector rural y pesquero de México 2012. (Accesado el 10 de junio de 2017) URL: <http://www.sagarpa.gob.mx/programas2/evaluacionesExternas/Lists/Otros%20Estudios/Attachments/47/1%20Diagn%C3%B3stico%20del%20sector%20rural%20y%20pesquero.pdf>.

Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO). 2012b. Compendio de indicadores estratégicos del sector rural y pesquero. (Accesado el 10 de junio de 2017). URL: http://fao-evaluacion.org.mx/cuestionario_final/graficas_compendio/apps/pdf/compendio_indicadores.pdf.

Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO). 2011. GCP/ELS/008/SPA. “Apoyo a la rehabilitación productiva y el manejo sostenible de microcuencas en municipios de Ahuachapán a consecuencia de la tormenta Stan y la erupción del volcán Ilamatepec”. (Accesado el 03 de noviembre de 2018). URL: <http://www.fao.org/climatechange/30322-0f6b6122dbb0e982c1b301f177a745160.pdf>.

Plan Nacional de Desarrollo (PND). 2019-2024. Presidencia de la República. México. (Accesado el 27 de mayo de 2019). URL: <https://lopezobrador.org.mx/wp-content/uploads/2019/05/PLAN-NACIONAL-DE-DESARROLLO-2019-2024.pdf>.

Plan Rector del Sistema Producto Maguey Mezcal en el estado de Oaxaca (PRSPMMO). 2014. Servicio de Información Agroalimentaria y Pesquera-SIAP de la Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación-SAGARPA.

Plan Rector Sistema Producto Estatal Maguey Mezcal, Guerrero (PRSPMMG). 2012. Servicio de Información Agroalimentaria y Pesquera-SIAP de la Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación-SAGARPA.

Porter, M. E. (1985). *Competitive advantage: creating and sustaining superior performance*. 1985. *New York: FreePress*.

Red de América. (Accesado el 03 de noviembre de 2018). URL: <http://www.redeamerica.org/Noticia-detalle/ArtMID/2470/ArticleID/1064/Las-Cadenas-Productivas-concepto-elementos-y-barreras>.

Sistema Agroalimentario y Pesquero de la Secretaría de Agricultura y Desarrollo Rural de la Secretaría de Agricultura y Desarrollo Rural (SIAP-SADER). 2018. (Accesado el 1 de mayo de 2019). URL: <http://www.siap.gob.mx/agricultura-produccion-anual/>.

Tamayo Sáez, M. 1997. El análisis de las políticas públicas. *La nueva administración pública*, Capítulo 11, pp. 281-312.

Van Der Hieden, D. y Camacho, P. (2004). *Guía Metodológica para el análisis de cadenas productivas*. RURALTER, SNV, CICDA e Intercooperation.

Air

Also referenced as an atmosphere, it is a mass of gases that surrounds our planet, in ideal conditions for us, composed of nitrogen (78%) and oxygen (20.9%), with the presence of 0.95% of other inert gases and 0.03% of carbon dioxide, this mixture is not uniform, it depends on the height above sea level, temperature, humidity and some other factors, mainly pollution.

We consider air pollution to any substance, introduced into the atmosphere that has a detrimental effect on living beings and the environment. Some pollutants are the result of organic chemistry, such as CO₂ and methane. But according to WHO figures of deaths in 2016, 4.2 million deaths were directly due to air pollution. Nowadays it is considered that the air in many urban areas is already too toxic, affecting more than 3000 million individuals, again, a determining factor in this process of contamination is the industry, but not least the abuse of fossil fuels, overpopulation, etc. The main pollutants are:

Particles (PM)

PMs are a common representative indicator of air pollution. They affect more people than any other pollutant. The main components of PM are sulphates, nitrates, ammonia, sodium chloride, soot, mineral powders and water. They consist of a complex mixture of solid and liquid particles of organic and inorganic substances suspended in the air. While particles with a diameter of 10 micrometers or less can penetrate and lodge deep within the lungs, there are other particles even more harmful to health, which are those with a diameter of 2.5 micrometers or less. These can cross the pulmonary barrier and enter directly into the bloodstream. Chronic exposure to particles contributes to the risk of developing cardiovascular and respiratory diseases, as well as lung cancer.

Ozone (O₃)

Ozone at ground level is one of the main components of smog. This is formed by the photochemical reaction of pollutants such as nitrogen oxides (NO_x) and volatile organic compounds (VOC) both waste emitted by vehicles, solvents and industry.

The highest levels of ozone are recorded during periods of sunny weather. It can cause respiratory problems, asthma, and reduce lung function

Nitrogen dioxide (NO₂)

The main source is nitrate aerosols, which are also an important part of PM_{2.5} and combustion processes in heating, power generation and engines. It causes symptoms of bronchitis in asthmatic children, and decreased development of lung function.

Sulfur dioxide (SO₂)

It is a colorless gas with a pungent odor that is generated by the combustion of fossils (coal and oil). It can affect the respiratory system and pulmonary functions, and causes eye irritation. The inflammation of the respiratory system causes cough, mucous secretion and aggravation of asthma and chronic bronchitis; It also increases the propensity of people to contract respiratory system infections. In combination with water, SO₂ is converted to sulfuric acid, which is the main component of acid rain that causes deforestation.

Feeding

Around 795 million people in the world do not have enough food to lead a healthy and active life. Every year the FSIN (Food Security Information Network) involves several world organizations with the objective of diagnosing the humanitarian crisis in nutrition issues, in 2018 it is reported that the number of people with high health risk levels due to malnutrition has reached 124 million in 51 countries (11 million more than the previous year).

Extreme poverty, deficient agricultural exploitation, wars, climate change and economic conflicts are some of the main factors that can double the mortality rates of any region due to extreme malnutrition.

Temperature

A common, but at the same time difficult to measure, form is the warming of the environment resulting from the use of heat sources, which individually may seem insignificant, but in their totality, they raise the global temperature.

Among these are the radiant heat of the large concrete plates in the urban spots, the heat produced by motors, boilers, kitchens and even the smoker, of course the industrial processes, aircraft and projectile engines, etc.

Biological risks

In its daily activity, the human being is exposed to contact with a great diversity of other living beings and chemical elements, whether they belong to a region or activity or as a result of weather phenomena, we can be attacked by amebas, bacteria or viruses, and in In case of an extraordinary increase in the number of cases of an infectious disease, this may be considered an epidemic. Likewise, if the epidemic covers several nations or the majority of individuals in a region, it becomes classified as a pandemic.

Although we have advanced in the development of medicines and vaccines to counteract various diseases, they also adapt, evolve, or mutate, and new diseases arise. According to the International Federation of Red Cross and Red Crescent Societies, the current diseases with the greatest risk to humanity are: Cholera, Dengue, Ebola, Malaria, Measles, Meningitis, Yellow fever, HIV / AIDS and Tuberculosis.

By a wide margin, chickenpox is the disease that most affected humanity, not only because more than 300,000 million people have died from it, but the majority who suffered it are left with skin marks for life, for the references found, it is considered that it has been present since 12000 BC. Figure 3 shows a list of the five diseases that have decimated humanity the most throughout history.

Finally it is worth mentioning that not all evolutionary changes always favor us, as a rule we consider as evolution the survival of the strongest (or the fittest), however this rule we stopped fulfilling it some time ago, because now we have many amenities and resources to extend the life of a person that natural selection seems to have designated it not to be achieved, so survival could depend on social or economic factors, resulting in an impoverishment of our genetic material.

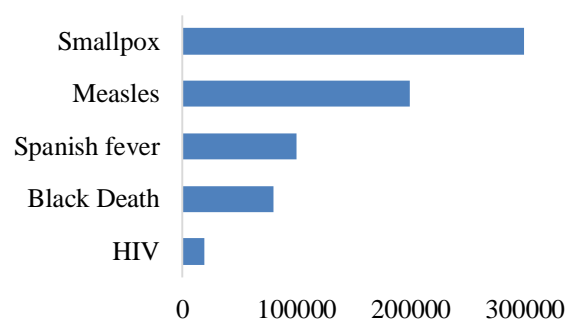


Figure 3 Main deadly diseases throughout history

Face the facts

Despite all this evidence, there are voices that still deny these effects, even some of the countries that pollute the most close their eyes and refuse to accept this reality, probably in an effort to avoid taking responsibility. In addition to that taking remedial measures would affect the income of some groups in power.

Most of us settle for commenting our concerns in social networks, which is the same as doing nothing, we have not really taken conscience of our environment, probably hoping that by government decree the contamination is eliminated, but without wanting to see us personally involved or affected.

Some steps have already been taken, we have technologies that have been maturing in the sense of efficiency and profitability. Recycling, water and air purification, biofuels, alternative energies and many more.

Conclusion

We can only speculate about whether there is still time to correct the course and alter our lifestyles for one with more common sense, conscious and sustained, that although it is difficult for the world to recover, at least slow down the rate at which we are destroying it.

Diversify our fuels, use sustainable energy sources, modify our culture of consumption and waste, stop thinking about individual interests and become citizens of the world, stop coveting so much wealth, for the common good, things that in theory may sound easy, but they involve a great challenge, simply, the day will come when we no longer have the opportunity to react.

Going into space to colonize other planets sounds like a great adventure, but how many hundreds of years are needed and how many could have enough purchasing power to save themselves. The destiny of humanity is on afford in view of the present horizon this Earth, our house.

References

- Campillo, S. (2014, 10 octubre). Las 10 pandemias más letales en la historia de la humanidad. Recuperado 21 abril, 2019, de <https://hipertextual.com/2014/10/pandemias>
- Composición y propiedades del aire. (2014, 18 mayo). Recuperado 20 abril, 2019, de <https://quimicayalgomas.com/quimica-general/composicion-y-propiedades-del-aire/>
- Del Real, J. (2018, 20 febrero). ¿Cuánta basura generas al año? Recuperado 20 abril, 2019, de <https://www.expoknews.com/cuanta-basura-generas-al-ano/>
- IFRC. (s.f.). Peligros biológicos: epidemias - IFRC. Recuperado 21 abril, 2019, de <https://www.ifrc.org/es/introduccion/disaster-management/sobre-desastres/definicion--de-peligro/tipologia-del-peligro/>
- Fondo para la Comunicación y la Educación Ambienta. (s.f.). Contaminación del agua. Recuperado 20 abril, 2019, de <https://agua.org.mx/contaminacion-del-agua/>
- Food Security Information Network. (2018). Global Report Food Crisis 2018. Recuperado de <https://www.wfp.org/content/global-report-food-crisis-2018.pdf>
- Ionkova, K. (2018, 31 agosto). What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Recuperado 20 abril, 2019, de <https://openknowledge.worldbank.org/handle/10986/30317>
- NatGeo. (2010, 5 septiembre). La contaminación del aire. Recuperado 20 abril, 2019, de <https://www.nationalgeographic.es/medio-ambiente/la-contaminacion-del-aire>
- Organización Mundial de la Salud. (2018, 2 mayo). Calidad del aire y salud. Recuperado 20 abril, 2019, de [https://www.who.int/es/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/es/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health)
- Sostenibilidad.com. (s.f.). Islas de basura en los océanos. Recuperado 20 abril, 2019, de <https://www.sostenibilidad.com/agua/islas-de-basura/>
- The World Bank. (2019, 1 abril). Solid Waste Management. Recuperado 20 abril, 2019, de <http://www.worldbank.org/en/topic/urbandevelopment/brief/solid-waste-management>
- Valdemar, J. (2017, 3 agosto). México, el quinto país que más consume agua. Recuperado 20 abril, 2019, de <https://www.elfinanciero.com.mx/economia/mexico-el-quinto-pais-que-mas-consume-agua>

Situation of agricultural policy in the sector of agave mezcalero in Mexico, theory and reality**Situación de la política agrícola en el sector agave mezcalero en México, teoría y realidad**

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Abstract

This research aims to examine the characteristics of the sector mezcalero in Mexico. The analysis was qualitative, of observation about the organization and quantitative of the information in the territories. The activity responds to the importance of generating income, strengthening the wealth of cultural, ancestral traditions and experiences of indigenous people. The agricultural policy undertaken by the Mexican state in the value chain should include coordinated actions among the three areas of government to boost productivity.

Agave, Mezcal, Agricultural policy, Production, organization

Resumen

Esta investigación tiene como objetivo examinar las características del sector mezcalero en México. El análisis que se presenta es bajo una metodología mixta, por una parte, se presenta una parte cualitativa por medio de la observación sobre la organización, así como un apartado cuantitativo de la información de los territorios. La actividad responde a la importancia sobre la generación de ingresos, fortalecimiento de la riqueza de tradiciones culturales, ancestrales y experiencias de pueblos indígenas. La política agrícola que emprenda el Estado mexicano en la cadena de valor debe incluir acciones coordinadas entre los tres ámbitos de gobierno para potenciar la productividad.

Agave, Mezcal, Política agrícola, Producción, Organización

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Introduction

The production in Mexico of distillates of mezcalero agaves is mainly located in rural communities formed mostly by indigenous and peasants who face socio-economic problems linked to marginalization and social inequality, as evidenced by relating the elaborated municipal Social Lag¹ (RZ) by the National Population Council (CONAPO, 2015), the Indicators generated by the National Council for the Evaluation of Social Development Policy (CONEVAL, 2015) and information on the mezcalera production of the Agrifood and Fisheries Information Service, and the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SIAP-SAGARPA, 2015).

There are 963 municipalities that have the Denomination of Origin (DO), and 44 more that are in the process of Denomination. From the first, in the country, it is evidenced that 128 municipalities have a very high RZ, 349 high RZ, 274 medium RZ, 211 low RZ, 41 very low RZ and, 4 do not have information. Namely, the majority of dwellings dedicated to the production of agave mezcalero in Mexico and located in rural locations are characterized by maintaining levels of poverty, lack of access to services, low levels of competitiveness and, on exploitation of wild agaves given the high demand for agave pineapples according to the characteristics and market structure of the by-products.

In the particular case of the mezcalero sector, it currently stands out with the existence of 493,750.88 square kilometers (km²) of territory in the country that has the Denomination of Origin (hereinafter DO), composed of 963 municipalities distributed in the following entities: Oaxaca (570) representing 56.6% of the national total; Guerrero (81, 8%) Durango (39, 3.9%), San Luis Potosí (58, 5.8%), Zacatecas (58, 5.8%), Guanajuato (2, 0.2%), Tamaulipas (11, 1.1%), Michoacán (29, 2.9%), Puebla (115, 11.4%).

In addition, there are three entities in the process of DO that are Aguascalientes (6, 0.6%), State of Mexico (15, 1.5%) and Morelos (23, 2.3%). It is important to note that the municipalities in the states of Aguascalientes, State of Mexico and Morelos joined the DO in August 2018.

The value chain^{2,3} refers to those actors involved in the agave and mezcal sector, including from suppliers to the final consumer. On the other hand, the productive chain is limited to the primary sector and agents that seek the transformation and commercialization of mezcal.

¹ The Social Delay Index “is a weighted measure that summarizes four indicators of social deprivation” that include “access to health services, housing quality, basic housing services and household assets” CONEVAL (2015). Baseline indicators are: 1. Percentage of population aged 15 years or more illiterate. 2. Percentage of population aged 6 to 14 who do not attend school. 3. Percentage of population aged 15 years and over with incomplete basic education. 4. Percentage of population without right to health services. 5. Percentage of dwellings with dirt floor. 6. Percentage of homes that do not have a toilet or toilet. 7. Percentage of homes that do not have piped water from the public network. 8. Percentage of homes that do not have drainage. 9. Percentage of homes that do not have electricity. 10. Percentage of homes that do not have a washing machine. 11. Percentage of homes that do not have a refrigerator.

² The productive chain is different from the value chain. According to Porter (1986), the generic value chain incorporates support activities such as the firm's infrastructure, human resources management, technology development and procurement; as well as internal logistics, operations, external logistics, marketing, sales and services (Porter, 1986, p. 38). On the other hand, the Red America establishes that “The concept of Productive Chain is linked to the spontaneous relationship between actors involved in economic relations and provision of goods and services from primary production to the arrival to the consumer” (Redameerica, 2018).

³ According to Van Der Hieden (2004) cited by FAO (2011), the production chain is made up of “interrelated actors and a succession of production, transformation and marketing operations of a product in a given environment [...], in addition, there is very little trust and even information is not shared among the actors” (FAO, 2011, p.9). On the other hand, Holmlund and Fulton (1999, cited by FAO, 2011); They point out that “Value chains are demand-oriented productive chains, which involve differentiated and specialized products, coordination relationships and clearly defined rules of the game for their management, higher income in the markets, close interdependence between actors” (FAO, 2011, p.9). Unlike the productive chain, in the value chain the actors share collaboration, risks with strong relationships of trust.

In this context, there is undoubtedly a need to have more productive Economic Units (PEU) more productive mixers and with higher incomes, yields, but, above all, with a greater insertion on their social valorization; coupled with a reduction in transaction costs. Undoubtedly, this reality is linked to relevant factors to consider in the design of public policies, such as: sustainable use of biodiversity, strengthening of idiosyncrasy, and traditional and traditional cultural factors existing between the rural and indigenous population.

The strategic indicators of the rural and fisheries sector in Mexico (2012), obtained by FAO (2012 a; 2012 b), show the existence of 5,424,430 rural economic units (EBUs) established in urban locations, but especially in rural areas. Among the federal entities that stand out can be mentioned Oaxaca with 661,333 UER, Guerrero (514,581) and Chiapas (500,727). 47.67% of the EBUs are located in the strata classified with low assets and with a high marginality; 56.64% of the units have primary education, 13.29% with secondary, 4% with high school, 1.02% with a technical career, 13.82% have a university and only 0.18% have a postgraduate degree. In the case of the production of agave mezcalero the representation is greater in the states of Oaxaca and Guerrero in the Southeast South of the country.

The makers of the design and implementation of public policies should consider multifactorial aspects of the social problems facing the sector, in addition to those related to productive improvement, public management and institutionality that benefits or harms the national agave mezcal sector. To contextualize the productive importance of the sector, some important characteristics are listed below.

1.1. Agave Mezcal Value Chain problem tree

Among the main problems in the value chain is the lack of a vision of entrepreneurship to boost business in the Productive Units that inhabit the marginalized areas. However, it is important to keep in mind that cultural, regional factors and the relationship between producers play a preponderant role in localities and states with DO.

The problem tree is related to regions where there is a strong presence of ethnic groups (Zapotec, Chichimecas, Mixtecas, Nahuatl, among others) that affect the development of productive activities where they do not necessarily incorporate the element of profitability as the main incentive for mezcal production, but is linked to the status that symbolizes in the community belong to the production chain or be master mezcalero.

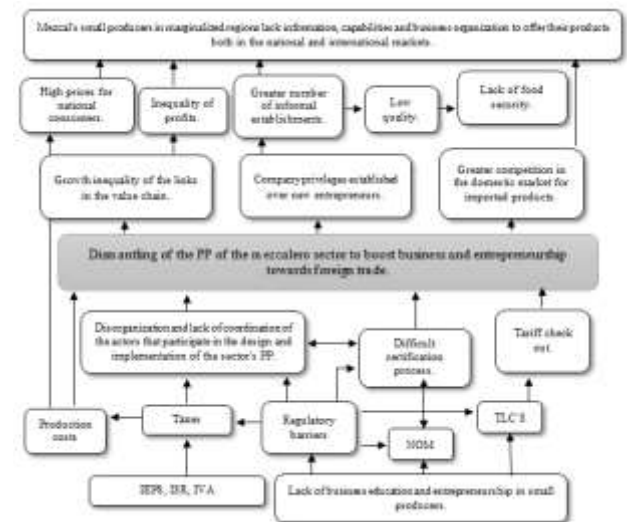


Figure 1 Agave Mezcal Value Chain problem tree
 Source: Alvarado, Vázquez, Contreras y Carmona (2017)

In the field work carried out in rural producing areas, there has been a disarticulation between the institutions to create synergies and increase local productions, such as: financing accessible for planting, production, increase in certifications for small mezcal producing units in the localities with DO, conversion programs for wild agave exploited areas, access to commercialization channels among small producers to increase their profit margins, reuse of wastes and compounds obtained for the manufacture of natural products, cosmetics, inulins, coal, paper, eco blocks, flavored distillates, among others.

In spite of the great territorial extension that the DO has in the country with planting and production potential, only 16.30% of the municipalities made plantings in 2016; that is, 158 municipalities of 963, according to data from SIAP-SAGARPA, (2016). This reality demonstrates a weak link (lack of coordination) between productive actors and public policy strategies in the federal entities to encourage the sustainable use of agaves as a measure to meet local and international demand.

This leads to obtaining some negative effects such as the increase in raw material, a situation that has occurred in recent years, having as one of its main consequences, high prices for mezcal production.

As a result of the lack of productive planning in the sector, at a national level, small producers have suffered more from the high prices resulting from the cost of harvested agave pineapple, this has encouraged producers and private institutions located in “Without Denomination of Origin” (SDO) municipalities to plant agaves; in 2016, seven municipalities that carried out this primary production activity were registered.

The agave mezcalero sector is no stranger to the reality described by the indicators obtained by FAO (2012 a, 2012 b). This problem is increased in the absence of efficient and effective government programs to potentiate agribusiness, sustainable use of agaves, training and specialization in production, the management of financial budgets to increase profitability, the use of agricultural waste to obtain products with added value, among others.

The Economic Commission for Latin America (ECLAC, 2017), Inter-American Institute for Cooperation on Agriculture (IICA) and the Food and Agriculture Organization of the United Nations (FAO) noted that Mexico, as well as other Latin American countries and the Caribbean (LAC) needs to accelerate the step to achieve the Sustainable Development Goals (SDGs) proposed in the 2030 Agenda, mainly on three main fronts: policies aimed at improving crop productivity; policies to reduce inequality within agrifood chains, facilitating an equitable distribution of benefits among all actors; and policies aimed at developing systems based on agriculture with greater resilience and less impact on natural resources and climate (CEPAL, FAO, IICA, 2017, pp. 204-205).

After the commercial and economic opening of Mexico in the 1990s, the domestic agricultural market generated structural changes both in the supply and in the demand for products and services with the world.

The mezcal production chain is no exception and it has been observed that in recent years the international demand has increased, generating an increase in consumption of wild agaves. In contrast, the need to increase competitiveness and strengthen the Value Chain is evident; namely, the Annual Average Growth Rate (TCMA) of the volume of the national primary production of agave mezcalero between 2010-2016 was negative with a 10.2% reduction annually.

This reality of the mezcalera activity intensifies the unsustainable use in the sector whose consequences can be transferred towards social and economic problems in the municipalities, mainly, in those that have the denomination of origin (DO). For the development of this work it was necessary to analyze qualitative, quantitative variables and experiences of field work carried out within the framework of the Agave Mezcal Project PN-1406-2015 CONACyT-CIATEJ.

General considerations on public policy in agave and mezcal

In Mexico, agricultural, environment and rurality policies are sectorized in the Ministry of Agriculture and Rural Development (SADER), Ministry of Environment and Natural Resources (SEMARNAT), Secretariat of Rural Development (SEDESOL); In addition, the Ministry of Finance and Public Credit (SHCP) that controls the economic policy (financial, fiscal and expenditure).

There are also decentralized, decentralized and parastatal institutions that participate directly and indirectly in activities that seek to boost the agricultural sector from different fronts, including: the National Council of Science and Technology (CONACyT), with its Public Centers of Research (CPI's), in the line of work on environment, health and food; Chapingo Autonomous University (UACH); Antonio Narro Autonomous Agrarian University (UAAAN); National Forest Research Institute; Agricultural and Livestock (INIFAP) and Regional Centers, Graduate College (COLPOS); PRODUCE Foundations; National Autonomous University of Mexico (UNAM), among others.

After investigating the reports on the sector, it can be observed that unfortunately there is no accessible global repository in the country that shows all the evidence and results obtained towards the productive chain between the different institutions. The generation of information, knowledge, cultural practices, innovation are scattered. On the other hand, there are research studies (such as other documents such as theses, theses, etc.) available to society through electronic means in various universities, research centers, universities and public and private institutes in the country in a disjointed manner. In the absence of inter-institutional coordination guidelines in the federal and state public administration for the agave and mezcal sector, a comprehensive system that offers transparency on the materialization of public resources allocated to the chain in terms of plant propagation, packages, is lacking Technological production, profitability, updated information on the number of producers in the localities, certifications and transaction costs in the value chain in agave and mezcal, among other actions.

Continuing with the context on the legal precepts of the Mexican state for development in the primary sector, it is pointed out that through the executive branch the guidelines of agricultural policy are established on the components that will be operationalized in the different areas of government (which are commonly carried out from top to bottom or top down) within the framework of administrative, political and economic centralism. Article V of the Federal Planning Law establishes that these must be built on “The basis for participation and consultation of society, including indigenous peoples and communities, through their representatives and authorities, in the preparation of the Plan and programs referred to in this Law ”; (Federal Planning Law) whose result is the National Development Plan (PND) that represents the articulating axis of the public policies of the sexennium. On the other hand, the Federal Public Administration Law (LCF) establishes in Article 35 section I that the SADER corresponds to “Formulate, conduct and evaluate the general policy of rural development, in order to raise the standard of living of families living in the field, in coordination with the competent agencies ”(LCF, p. 25).

In addition, the PND (2019-2024) points out in the Economy component Boosting economic recovery, the internal market and employment; as well as food self-sufficiency and rescue of the PND field (pp. 51-55).

In recent years, the study of public policies has represented an important tool for government actors in the executive and legislative power to generate efforts to solve national problems, mainly in the social and economic fields. Anderson (2006) defines the Policy as "a relatively stable and intentional course of action followed by an actor or group of actors when dealing with a problem or situation of interest" (p. 6). For its part, Tamayo (1997), describes that public policies "are the set of objectives, decisions and actions carried out by a government to solve the problems that citizens and the government themselves consider a priority at a given time" (p. 281). It is important to point out that the great public policy scholars have developed methodologies with the purpose of adapting and replicating in other countries such as Mexico, however, these actions are generally carried out in the government spheres through federal programs; in contrast, its applicability at a local and regional level with agricultural municipalities that remain with high levels of poverty and marginality is still distant.

On the other hand, there are several factors that have influenced the increase in the price of the Mezcal spirit drink, among them stand out: the accelerated increase in national and international consumption, reduction in the supply of wild agaves as a result of a lack of planning for increase the area planted in the main fields of production, changes in the climate that have affected the appearance of new diseases and attack of insects in the plantations.⁴

According to the field work carried out, it is evident that small producers lack adequate information, knowledge and infrastructure to reach higher levels of negotiation and compete with certified producers, achieving high prices, processes and products to export.

⁴ Until now, Agave mezcalero does not have the federal strategic product range in the Agromercados Social y Sustentables (AMSYS) Program whose purpose would be to offer producers incentives to market; certify; train and technical assistance, among other benefits given to the country's strategic products.

VÁZQUEZ-ELORZA, Ariel, SANCHEZ-OSORIO, Ever, HERNÁNDEZ-LÓPEZ José de Jesús, CASTAÑEDA-BERNAL Xóchitl Yolanda. Situation of agricultural policy in the sector of agave mezcalero in Mexico, theory and reality. ECORFAN Journal-Republic of Paraguay. 2019.

In addition, it is essential that society and consumers, mainly value the culture, traditions and intangible aspects offered by an artisanal and ancestral product. In this way, the process and design of public policies should be aimed at solving productive, socio-economic and business problems, always with respect to the environment and the place of the plant and drink within the culture of small producers. Inequality and diversity among localities producing agave mezcalero force agrifood public policies to treat unequals in the social development of the vulnerable population involved in the value chain. That is, existing heterogeneous problems cannot be treated the same.

Undoubtedly, Oaxaca is the state in the country that is an example in the production of agave mezcalero. Therefore, it is relevant to know what are the actions undertaken so far. According to the Master Plan of the Maguey Mezcal Product System in the state of Oaxaca (PRSPMMO, 2014, p. 10), it considers that the chain is made up of the following link levels: a) agave collector, firewood collector; b) grower producer, B) producer of maguey, c) packer, d) marketer, e) at other levels are carriers, input supplier, COMERCAM, service providers, federal, state government, research institutions, Committees Product Systems and other actors such as the National Institute of Industrial Property (IMPI), Federal Consumer Office (PROFECO), among others.

In fieldwork, the existence of various marketing channels has been confirmed with the presence of imperfect markets where the large mezcal producing companies, located mainly in Santiago Matatlán, commonly known as the “Mezcal World Capital”, dominate due to the large volumes that produce and commercialize, in addition to the presence of large marketers or brands that come to buy mezcal in bulk. In contrast, there are also groups of small producers with weak formal linkages with the national market, insufficient information on prices, market, potential niches, marketing, certification processes to export, lack of technological packages to increase production, collection centers, transport to distribute mezcal, manuals of good process practices, among others. This reality hinders the development and growth of their economic productive units.

Small producers seek to get closer to the final consumer and reduce intermediary to increase profit margins in marketing. The above is generated by the lack of marketing mechanisms, economic incentives, asymmetry of information on prices in by-products, among others. As an organizational measure to counteract this situation in recent years, advances have been developed, such as the constitution of the Association of Master Teachers (AMM) whose purpose is to increase their access and information capabilities for the sale of their products at prices more competitive; as well as helping each other to generate collaboration networks and mass sales as much as possible (Personal communication).

The AMM is characterized in that it is directed mainly by a group of women from the regions of Villa Sola de Vega, San Baltazar Chichicapam and Miahuatlán de Porfirio Díaz, in Oaxaca. When small producers join, they increase their negotiation skills, mainly because they go to national and international fairs to promote their products considering the differentiation that exists in each of them. Given this scenario, it will be very important to generate public policies that incorporate social and solidarity economy, cooperatives, collaborative work, clusters, fair trade, mainly. However, there is also the theory of rational choice “that incorporates the application of notions of economics (and to some extent, from mathematics) to the analysis of the way in which the selfless behavior of individuals can influence the process of policies” (Hill 2005, p. 51).

1.1.1 Value chain structure

Although the PRSPMMO (2014) establishes a descriptive platform for the value chain of mezcal agave, it is important to note that in the country it is diversified and structured depending on the federative entity where the analysis is carried out; In general, it is very heterogeneous.

The value chain is in a development process due to its heterogeneity and the diversity of actors involved, according to the state under study, since each operates in very particular ways.

In this case, it can be established that the link in order of political - administrative hierarchy corresponds to the executive branch with the federal, state and municipal government that include institutions related to the operation of policies and programs aimed at strengthening the primary sector. The main links in the value chain that have been identified in the value chain can be distinguished in Figure 2.

From an external scope, although directly related to the local and federal power relations, the agriculture and innovation commissions of the legislative branch where the budgets are designed and programmed to be exercised in the strategic sectors. Here the guidelines and legislative rules to operate the actions and resources in the case of the executive branch are established. Undoubtedly, the Product Systems of Maguey Mezcal in the states of the Republic seek to represent producer organizations in general. However, there are various types of alliances between them, which interact individually or in groups as appropriate.

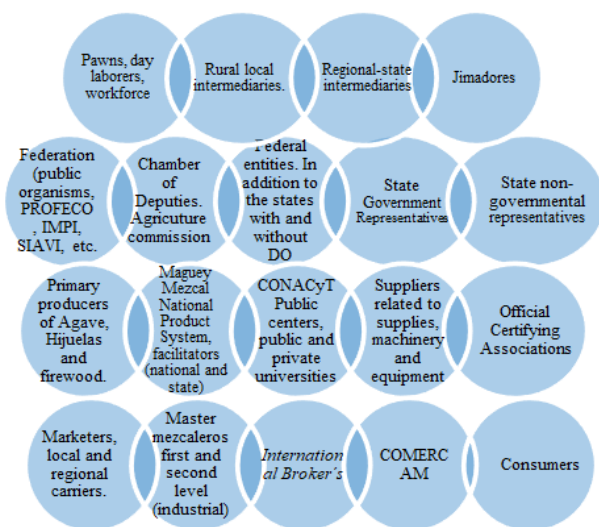


Figure 2 Links of the mezcal agave value chain
Source: Own elaboration based on field work

In the primary sector, it is the wood producers, nurseries that offer important and necessary raw materials in the primary and industrial processes. Most of them are part of the same families that live in the producing localities. The problem that small producers incorporate is also related to the lack of knowledge about tax requirements, export permits, certifications before COMERCAM and even lack registered trademarks before IMPI.

For these reasons they are forced to sell their production in bulk without having knowledge of the final destination of the consumption of their product, nor the price at which it ends up selling. Due to lack of financial resources, they do not have the conditions to place their product on a shelf in convenience stores.

In the case of national and international marketers, there is a hoarding of the production of small mezcal producers in marginalized regions, this reality is frequent, to subsequently place the product in private state stockpiles and be sold in cities or areas Metropolitan consumption. In this context, public policies should be aimed at clearing unwanted or convenient practices that are developed, and instead improve flows by reducing intermediaries and increasing marketing margins for the primary sector.

According to the COMERCAM report (2017), in Mexico there were a total of 2.0 million liters (mill / l) for the export market and 1.8 million / l for the national market. Of this total, approximately 2.4 million 750 ml bottles were packaged in the country. Considering the taxes generated in the sector, 626.5 million pesos in taxes would have been obtained in the whole sale of mezcal. It should be noted that the state of Oaxaca contributed 65.1% in 2016, that is, if there were a distribution of taxes to the producing areas, it would have to exercise an amount of 408 million pesos which would enhance the deficiencies that exist in the sector through the implementation of effective, efficient and economic PP. In reality, a focused policy that contains this amount of resources has not been identified to guide them to the most unprotected areas.

With the coordination of the Center for Research and Assistance in Technology and Design of the State of Jalisco, a Mexican thematic Network was established on the integral sustainable use and biotechnology of agaves –AGARED– with the purpose of promoting research, linking and research teams of diverse disciplines (biotechnology, process innovation, food, sociology, administration, economics) and propose solutions to the sector.

To date, academics from various institutions in the country, public and private, as well as producers and entrepreneurs are integrating, trying to define axes of action for prospective purposes to participate in the solution of several of the problems stated in the tree described above. Likewise, the Center for Research and Assistance in Technology and Design of the State of Jalisco A.C. (CIATEJ) has maintained in the last 15 years research studies providing a large number of new forms and processes for the integral use of agave.

In short, Mexico has consolidated in recent years to increase exports in the main strategic agrifood products, including: avocado, coffee and cocoa, mainly (ECLAC, FAO, IICA, 2017, p. 6). However, much remains to be done in the productive chains, in particular, in the drinking of mezcal because those who participate are mostly small producers who live in high marginalization areas whose PP have failed to curb the marginalization, poverty and disarticulation of actions for the welfare of families.

Conclusions

Public policies in the sector must be aimed at increasing the productivity of the chain in agave and mezcal, in addition, the solutions, programs and strategies need to be transversal in order to face the challenges of social development through actions that improve the quality of life of rural families. Although there are isolated efforts to address the problem from the productive and research fronts, in practice there is evidence of the lack of an operational sector program or plan that involves states with DO and the participation of actors in the Value Chain. In the last two years, important efforts have been made by national forums and tables in the Chamber of Deputies in order to generate a diagnosis of the sector, but above all to build inter-institutional, legislative and linking strategies to enhance the development of the producing regions of coordinated and joint way. However, despite the participation of public instruments of agricultural policy at different levels of government for the production, organization and planning of the sector, there is a lack of coordination and lack of mainstreaming of public policies aimed at solving social, cultural, environmental and economic problems. in the value chain.

This reality requires that in the future multifactorial diagnoses be made, analyze and propose alternatives to comprehensive public policies with the purpose of increasing profitability, productivity, and social improvement of the sector.

As a result of the high increases in mezcal agave, it is currently the small producers who are most interested in increasing the plantation of agaves that can be used in distillation to obtain mezcal in the main producing states with both DO and SDO, although also visualizing the use for others byproducts.

However, they mostly lack the financial resources to do so. Around this reality, there has been a diversification of the producers according to the type of ancestral, artisanal and industrial drinks, packaging machines, exports, consumers and, in general, associated to the Mexican Council for the Quality Regulation of Mezcal (COMERCAM). The main motivation is to improve conditions on the use of the plant, although the most benefited have been the industrial sector and large producers with greater investment and marketing capabilities for the product.

At the local - regional level, it is difficult for municipal governments to transfer the resources necessary to create infrastructure, technology and collaborative networks for access, use, processing and management in the use of information for the design of public policies in the mezcalero sector. It should be noted that there are important (isolated) efforts from research, science and technology for the development of technological projects that seek to respond to socio-productive solutions and improve mezcal production processes in order to generate new opportunities for exploitation. sustainable.

In addition, there is a reduced capacity in the negotiations that small producers have with the sale of their product to marketers due to low volumes of mezcal production and access to convenience stores. Some of the main findings obtained in the field, is that small producers of agave mezcal make clear the lack of knowledge about the existence of public programs aimed at the Value Chain.

They also highlight that the presence of corruption, impunity and violence that prevails in the country are not foreign to the sector, since the living conditions where they live generate many needs and therefore also said problem (information obtained from personal communication).

Given the lack of coordination of targeted public policies, it is proposed that agricultural policy actions establish objective guidelines and empirical information to guide public policies with a multidisciplinary and interdisciplinary approach, coupled with the great diversity and heterogeneity of the sector. Although there are great advances in internalizing the concepts and methodologies of federal programs with the support of national (public management, academy) and international institutions, in reality there is a disarticulation between government actors and the needs presented by small producers that slow down the promotion of business and entrepreneurship towards foreign trade in the mezcalero sector.

References

Alvarado A., Vázquez A., Contreras, D. Carmona. *Análisis de las políticas públicas del sector mezcalero, para potenciar los negocios y empresarialidad hacia el comercio exterior*. Tesis. UTSG-CIATEJ, Guadalajara, México. 2017.

Anderson, J. E. 2006. *Public policymaking*. Sixth Ed. Cengage Learning.

Comisión Económica para América Latina y el Caribe (CEPAL), Organización de las Naciones Unidas para la Agricultura y la Alimentación (FAO), Instituto Interamericano de Cooperación para la Agricultura (IICA). 2017. *Perspectivas de la agricultura y del desarrollo rural en las Américas: una mirada hacia América Latina y el Caribe*. San José, C.R.: IICA. URL: https://repositorio.cepal.org/bitstream/handle/11362/42281/1/PerspAgricultura2017-2018_es.pdf. [fecha de acceso: 29 de abril de 2018].

Consejo Mexicano Regulador de la Calidad del Mezcal (COMERCAM). 2017. Informe Anual. Oaxaca, México.

Consejo Nacional de Evaluación de la Política de Desarrollo Social (CONEVAL). 2015. Índice de Rezago Social. (Accesado el 10 de mayo de 2019). URL: https://www.coneval.org.mx/Medicion/IRS/Paginas/Indice_Rezago_Social_2015.aspx.

Consejo Nacional de Población (CONAPO). 2015. Índice de Marginación Municipal 2015. (Accesado el 23/01/2019). URL: <http://www.conapo.gob.mx/>.

Heyden, D., Camacho, P., Marlin, C., & Salazar, M. (2004). Guía metodológica para el análisis de cadenas productivas. Rualter para CICDA, SNV e Intercooperation.

Holmlund, M., & Fulton, M. (1999). Networking for Success: Strategic Alliances in the New Agriculture Centre for the Study of Co-operatives. *University of Saskatchewan, and Agriculture Institute of Management in Saskatchewan, Inc.*

Holmlund, M., & Fulton, M. E. (1999). *Networking for success: Strategic alliances in the new agriculture* (No. 31769). University of Saskatchewan, Centre for the Study of Co-operatives.

Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO). 2012a. Diagnóstico del sector rural y pesquero de México 2012. (Accesado el 10 de junio de 2017) URL: <http://www.sagarpa.gob.mx/programas2/evaluacionesExternas/Lists/Otros%20Estudios/Attachments/47/1%20Diagn%C3%B3stico%20del%20sector%20rural%20y%20pesquero.pdf>.

Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO). 2012b. Compendio de indicadores estratégicos del sector rural y pesquero. (Accesado el 10 de junio de 2017). URL: http://fao-evaluacion.org.mx/cuestionario_final/graficas_compendio/apps/pdf/compendio_indicadores.pdf.

Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO). 2011. GCP/ELS/008/SPA. “Apoyo a la rehabilitación productiva y el manejo sostenible de microcuencas en municipios de Ahuachapán a consecuencia de la tormenta Stan y la erupción del volcán Ilamatepec”. (Accesado el 03 de noviembre de 2018). URL: <http://www.fao.org/climatechange/30322-0f6b6122dbb0e982c1b301f177a745160.pdf>.

Plan Nacional de Desarrollo (PND). 2019-2024. Presidencia de la República. México. (Accesado el 27 de mayo de 2019). URL: <https://lopezobrador.org.mx/wp-content/uploads/2019/05/PLAN-NACIONAL-DE-DESARROLLO-2019-2024.pdf>.

Plan Rector del Sistema Producto Maguey Mezcal en el estado de Oaxaca (PRSPMMO). 2014. Servicio de Información Agroalimentaria y Pesquera-SIAP de la Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación-SAGARPA.

Plan Rector Sistema Producto Estatal Maguey Mezcal, Guerrero (PRSPMMG). 2012. Servicio de Información Agroalimentaria y Pesquera-SIAP de la Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación-SAGARPA.

Porter, M. E. (1985). *Competitive advantage: creating and sustaining superior performance*. 1985. *New York: FreePress*.

Red de América. (Accesado el 03 de noviembre de 2018). URL: <http://www.redeamerica.org/Noticia-detalle/ArtMID/2470/ArticleID/1064/Las-Cadenas-Productivas-concepto-elementos-y-barreras>.

Sistema Agroalimentario y Pesquero de la Secretaría de Agricultura y Desarrollo Rural de la Secretaría de Agricultura y Desarrollo Rural (SIAP-SADER). 2018. (Accesado el 1 de mayo de 2019). URL: <http://www.siap.gob.mx/agricultura-produccion-anual/>.

Tamayo Sáez, M. 1997. El análisis de las políticas públicas. *La nueva administración pública*, Capítulo 11, pp. 281-312.

Van Der Hieden, D. y Camacho, P. (2004). *Guía Metodológica para el análisis de cadenas productivas*. RURALTER, SNV, CICDA e Intercooperation.

Preliminary study of wind speed characterization to install a 400 W wind turbine

Estudio preliminar de caracterización de la velocidad del viento para instalar un aerogenerador de 400 W

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Abstract

The characterization of wind speed in Cancun, Q. Roo Mexico, had as objectives: 1. To estimate the efficiency and energy produced by a 400W wind turbine at a height of 10 m; 2. To carry out the wind speed characterization. The methodology used was the Weibull distribution. In order to calculate the distribution of the wind speed, with the Wind Rose software we analyzed the energy in different directions and the calculation of potential wind energy based on Rayleigh's analysis. The results showed: that the power generated from the wind speed calculated in (PV) 2.8 m/s was 1.48 W, its capacity factor at 0.004 which does not reach the permissible range of 0.25 to 0.40; the energy produced annually was 14.02 kW/year, it is required to raise the wind turbine to 13.4 m, to reach 12 m/s speed and to be efficient to install a 400 W wind turbine. The paper identifies the preliminary activities and illustrates the method of calculation of wind characterization and energy produced to define the installation conditions of the wind turbine. It also contributes to the scientific advance by estimating the characterization of the wind in Cancun Quintana Roo, Mexico, for future wind turbine installations.

Efficiency, Generated power, Wind speed

Resumen

La caracterización de velocidad del viento en Cancún, Q. Roo México, tuvo como objetivos; 1. Estimar la eficiencia y energía producida por un aerogenerador de 400W a una altura de 10m, 2. Hacer la caracterización de velocidad del viento. La metodología utilizada, fue la distribución de Weibull, para conocer la distribución de velocidad del viento, con el software Rosa de viento se conoce la energía en diferentes direcciones y el cálculo de energía potencial del viento basada en el análisis de Rayleigh. Los resultados arrojaron: que la potencia generada a partir de la velocidad del viento calculada en (PV) 2.8 m/s, fue 1.48 W, su factor de capacidad en 0.004 que no alcanza el rango permisible de 0.25 a 0.40, la energía producida anualmente fue de 14.02 kW/año, se requiere elevar el aerogenerador a 13.4m, para alcanzar 12 m/s de velocidad y sea eficiente instalar un aerogenerador de 400 W. Se contribuye identificando las actividades preliminares e ilustrando el método de cálculo de caracterización del viento y energía producida, para definir las condiciones de instalación del aerogenerador. La aportación al avance científico es estimando la caracterización del viento en Cancún Quintana Roo México, en futuras instalaciones de aerogeneradores.

Eficiencia, Potencia generada, Velocidad del viento

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Introduction

One source of renewable energy generation is through wind turbines, which, driven by wind energy, spin their blades and produce via induction and magnetic field, an electromotive force or potential difference (V). In order to install a wind turbine, we must analyze certain environmental characteristics, such as: wind speed and direction, humidity, among others. However, it is important to estimate the wind characterization, i.e., identify its speed, constant speed intervals, direction and energy that it can produce for a particular wind turbine; therefore the questions we must answer are: What is the wind speed and direction? What is the potential energy of the wind speed? How many hours a day a wind turbine produces electricity? Is it efficient to install a 400W wind turbine in the city of Cancun?

However, with the wind speed characterization, the aforementioned questions can be estimated and answered.

To establish the wind profile in the city of Cancun, Q. Roo Mexico, we obtained the wind speed data of the Capitanía de Puerto, Cancun, Q. Roo Mexico, in 2018, at a height of 10 m. These data were obtained with the Wind Rose and the techniques of Weibull and Rayleigh, to know the direction, distribution and potential energy of the wind speed respectively.

We present how the wind speed characterization was measured, the relationships to calculate the average wind speed, its distribution through Weibull, the wind energy density E_D in kW/m^2 , the intensity of annual energy E_I in kWh/m^2 , the wind speed frequency V_E in m/s , the maximum energy speed for the wind $V_{F_{\max}}$ in m/s and the energy in KW that a 400 W wind turbine will produce, installed at a height of 10 m.

Wind power

To carry out wind power generation projects, wind characterization must be done. It is necessary to know its speed and the direction that prevails at different times. Ecological aspects are also considered for implementation (Mathew, 2006).

(Fatma Gül Akgül, 2016) also mentions two important factors to obtain wind energy efficiently and economically, the first factor is to select the location where the wind system will be installed and the second is to identify the characteristics of the wind speed using the Weibull statistical distribution to model the data, together with the mean square root error and the correlation coefficient R^2 to identify the distribution that best fits the wind speed data and conclude that the inverse Weibull distribution is an alternative for better knowledge and extensive use of the Weibull distribution.

In reference to the calculation of wind energy, wind energy density (E_D) is the energy available by the rotor unit's regime and time. This energy density is a function of wind speed and distribution. We can obtain the total energy available in the spectrum (E_S) by multiplying the wind energy density by the time factor.

Wind direction is an important variable in an energy conversion system. If the greatest amount of wind energy is received from one direction, it is important to know if there is any obstruction on that side for the wind flow. In this sense, most anemometers have a vane (propeller that is used to identify the wind direction).

On the other hand, the wind speed information and its direction can be presented in the Wind Rose application which indicates the distribution of the wind in different direction. The page is divided into 8, 12 or 16 equal sectors that represent different directions.

The information presented by the Wind Rose software is:

1. The average time of the direction in which the wind is received.
2. The product of this percentage and the average wind speed in this direction.
3. The product of the percentage of time and the wind speed cube.

With this information, the energy that exists in different directions can be identified.

For the estimation of wind energy potential, it is recommended to analyze and interpret data from a weather station near the site where a wind generator is intended to be installed.

The Wind Rose software shows the distribution of frequencies, speed and energy in different directions. In this way, a preliminary estimate can be made and a profile of the site's potential to generate electricity can be presented.

The average wind speed is given by:

$$V_m = \left(\frac{1}{n} \sum_{i=1}^n V_i \right)^{1/3} \quad (1)$$

Where, V is the wind speed and n is the number of data measurements.

The standard deviation indicates the variability and individual deviation of the speeds.

$$\sigma_V = \sqrt{\frac{\sum_{i=1}^n (V_i - V_m)^2}{n}} \quad (2)$$

Thus, the lower values of the standard deviation indicate a uniformity of the data set.

If the wind speed values are presented as a frequency distribution, the average and standard deviation are given by:

$$V_m = \left(\frac{\sum_{i=1}^n f_i V_i^3}{\sum_{i=1}^n f_i} \right)^{1/3} \quad (3)$$

$$\sigma_V = \sqrt{\frac{\sum_{i=1}^n f_i (V_i - V_m)^2}{\sum_{i=1}^n f_i}} \quad (4)$$

Using the accumulated frequencies and histograms, a pattern of wind speed curves can be defined, so that the Weibull and Rayleigh distributions are used to describe the wind variation more accurately.

The distribution function can be used to calculate the time at which the wind speed interval is.

$$P(V_1 < V < V_2) = e^{-(V_1/c)^k} - e^{-(V_2/c)^k} \quad (5)$$

The turbine generates energy per h number of hours =

$$\left(e^{-(V_1/c)^k} - e^{-(V_2/c)^k} \right) \times 24hrs \quad (6)$$

For the wind regime analysis of the Weibull distribution, the parameter of factor k must be estimated as a parameter to determine wind uniformity, and c as the scale factor.

By the standard deviation method, the factor k is expressed as:

$$k = \left(\frac{\sigma_V}{V_m} \right)^{-1.090} \quad (7)$$

$$c = \frac{V_m k^{2.6674}}{0.184 + 0.816 k^{2.73855}} \quad (8)$$

(R. Ian Harris, 2014) demonstrates that the Weibull distribution is effective for the marginal distribution of the CDF P (V) wind speed and shows the Wind Rose waveforms. On the other hand, (J.V. Seguro, 2000) asserts that when wind speed data is available in a frequency distribution, the medium maximum likelihood method is the one recommended due to its accuracy and superiority in relation to the graphic method.

It is also important to calculate the wind energy density E_D in kW/m^2 , the annual energy intensity E_I in kWh/m^2 , the wind speed frequency V_E in m/s and the maximum energy speed for the wind $V_{F_{\text{max}}}$ regime in m/s .

On the other hand, the dependence of wind regimes implies that energy production is variable, so more energy is not always produced in the consumption peaks. That is why the use of wind energy should be considered as a complementary energy, and cannot be regarded as the energy base of a community, region or country. The prediction of the production of a wind turbine installation is very difficult, which creates problems and uncertainties in energy planning.

A wind turbine obtains its input power by converting the wind force into a torque (turning force), acting on the rotor blades; the amount of energy transferred to the rotor by the wind depends on the density of the air, the sweeping area of the rotor and the wind speed. Turbulence decreases the possibility of using wind energy effectively in a turbine, also causing greater breakage and deterioration in the wind turbine; wind turbine towers are usually built high enough to avoid wind turbulence near ground level (Danish wind industry Association, 2003).

With equation 9, it is observed that the speed required for a wind system to be efficient is a function of the ratio of the initial height and the required height.

$$V_2 = V_1 \left(\frac{h_2}{h_1}\right)^\alpha \tag{9}$$

The value of α is set in a range of 0.20 to 0.40.

The effect of a building on wind flow affects wind speed and direction, according to figure 1, (Hemani, 2012).

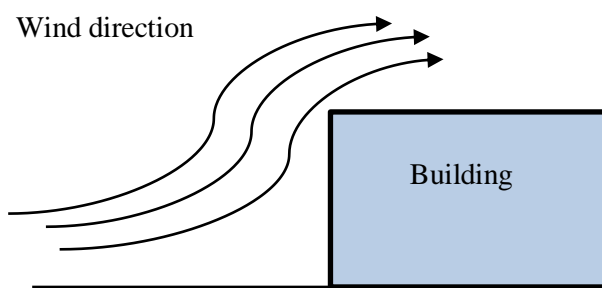


Figure 1 Turbulence generated by obstruction
Source: Ahmad Hemani

Power extracted from wind

According to Betz’s law, a wind turbine slows down the wind up to 2/3 of its initial speed by passing through the rotor; this means that it is not possible to take advantage of all the kinetic energy of the wind. For a given value of wind speed, an aerodynamic rotor can only extract 59% of the available wind power (López, 2013).

The power of this air flow through the rotor is the flow of kinetic energy per unit of time, which is partially extracted by the blades varying linearly with the density of the air and by the wind speed cube (López, 2013).

Methodology

The analysis of wind distribution and speed in the city of Cancun; Latitude: 21.0833, Longitude: -86.85 can be done through a Weibull statistical distribution which models the wind speed distribution and therefore determines the average wind time and speed to estimate the electrical power and efficiency of a wind turbine.

With the wind speed data, the wind speed distribution, standard deviation, monthly frequency distribution, the Weibull distribution and the density probability are obtained, which indicates the fraction of time or the speed probability of wind and cumulative distribution function. The number of hours that the turbine generates energy is estimated through the minimum and maximum cutting speed, with a scale factor of $c=3.5$ and a form factor of $k=2.88$.

The potential energy estimate based on the Rayleigh analysis allows us to know the monthly wind energy and speed.

Results

Wind data analysis

The wind speed data which were used as first approach were obtained from the weather station of the Capitanía de puerto, in Puerto Juarez, Cancun Quintana Roo, Mexico, of the year 2018, categorized by day.

The data was analyzed and interpreted with the WRPLOT software for the wind rose, the WERA for the monthly analysis of the wind data and the Easy Fit software for statistical analysis.

The statistical data of the wind speed sample is shown in table 1, with an average wind speed of 2.799 m/s and a standard deviation of 1.0674.

Statistics	Value	Percentile	Value
Sample Number	365	Min	0.17
Range	5.66	5%	0.916
Mean	2.79	10%	1.356
Variance	1.13	25% (Q1)	2.105
Standard deviation	1.06	50% (Median)	2.81
Coefficient of variation	0.38	75% (Q3)	3.555
Standard error	0.05	90%	4.158
Asymmetry	-0.04	95%	4.519
Kurtosis	-0.24	Max	5.83

Table 1 Statistics of wind speed data
Source: Prepared by the authors

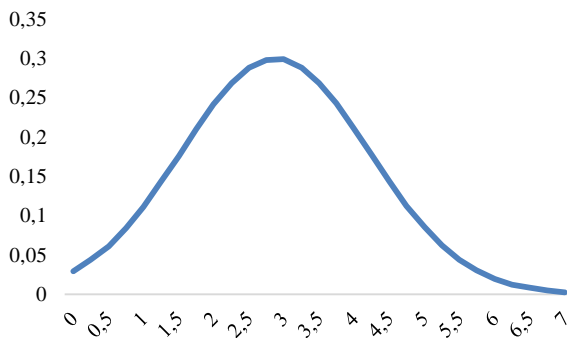
As shown in Table 2, with the Wera software and Rayleigh analysis we calculated the wind energy density E_D in kW/m^2 , the annual energy intensity E_I in kWh/m^2 , the wind speed frequency V_E in m/s and the maximum frequency speed for the V_{Fmax} wind regime in m/s.

Month	E_D (Kw/m ²)	E_f (Kw/m ² /mes)	$V_{F\text{ máx}}$ (m/s)	$V_{E\text{ máx}}$ (m/s)
January	0.02	168.53	2.03	4.05
February	0.07	577.81	3.06	6.11
March	0.05	460.12	2.83	5.66
April	0.04	318.4	2.5	5.01
May	0.02	200.19	2.15	4.29
June	0.04	383.2	2.66	5.33
July	0.01	128.43	1.85	3.7
August	0.02	216.23	2.2	4.4
September	0.02	138.65	1.9	3.8
October	0.03	248.24	2.31	4.61
November	0.01	99.39	1.7	3.4
December	0.03	228.19	2.24	4.48

Table 2 Potential wind energy based on Rayleigh’s analysis

Source: Prepared by the authors

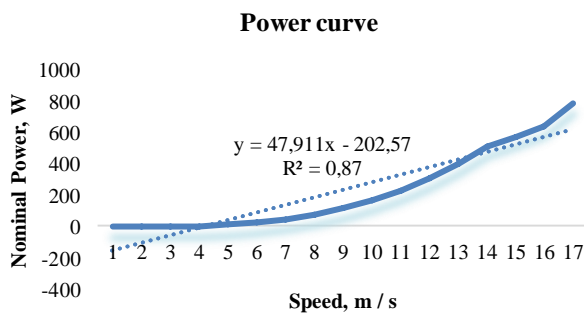
The probability density and the cumulative distribution function of the Weibull wind regime is shown in Graph 1, the peak of the curve shows that the most frequent wind speed is 2.8 m/s.



Graph 1 Weibull density probability function

Source: Prepared by the authors

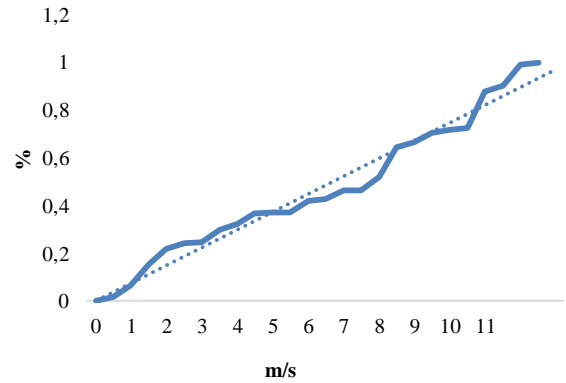
In Figure 2, with an average wind speed of 2.79 m/s during the day and the wind distribution, the turbine will start generating electricity at 2.5 m/s and the generation is interrupted at 15 m/s, the maximum power reached is 1.48 kW which will be produced at 2.79 m/s.



Graph 2 Nominal power curve

Source: Prepared by the authors

Graph 3 shows the Weibull wind speed probability, which indicates the probability percentages, in the Y axis, and their correlation with the wind speed.



Graph 3 Weibull density probability function

Source: Prepared by the authors

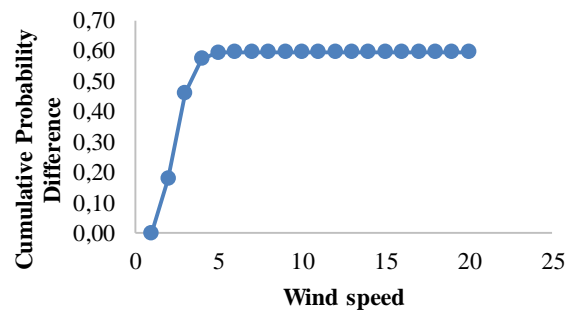
A wind turbine with a cutting speed of 3 m/s to 15 m/s can be installed with a scale factor of $c=3.5$ and a form factor of $k=2.88$; we calculated that the number of hours that the turbine generates energy is 14.4 hours.

The turbine generates energy per h Number of hours

$$= \left(e^{-(V_1/c)^k} - e^{-(V_2/c)^k} \right) \times 24hrs$$

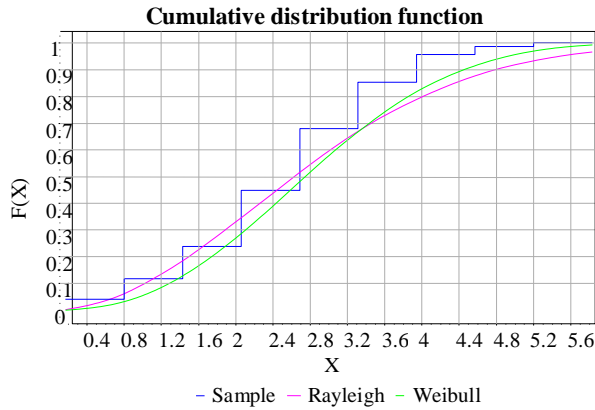
$$\left(e^{-(2.5/3.15)^{2.88}} - e^{-(15/3.15)^{2.88}} \right) \times 24hrs = 0.60 * 24 = 14.4 hrs.$$

Graph 4 shows the probability of wind speed in a range of 2.5 to 15 m/s, which is calculated by the difference in cumulative probabilities (Eq. 5), and it can be seen that from 5 m/s it stabilizes at a probability value of 0.6.



Graph 4 Probability that the wind does not exceed the cutting speed 15 m/s

Source: Own elaboration of data simulation

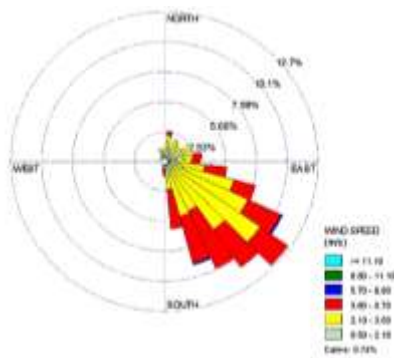


Graph 5 Comparison of the cumulative distribution by the Weibull and Rayleigh method
 Source: Own elaboration of data simulation

The results of the Weibull and Rayleigh distributions can be seen in graph 5, which are very similar; in the end, the Weibull cumulative distribution is closer to the speed data.

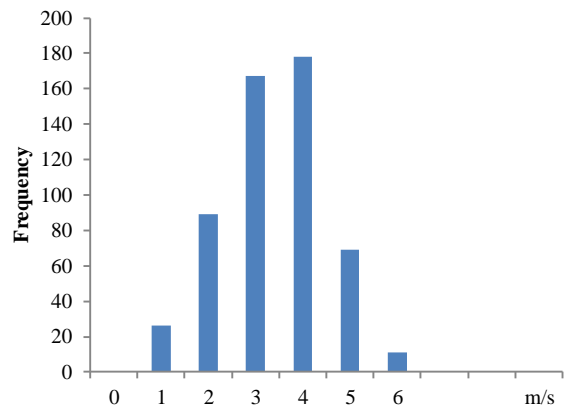
Wind distribution and speed with the wind rose

Figure 6 shows the wind rose, where we can observe that the wind tendency is to the southeast direction and the percentage indicates the probability of occurrence at different wind speeds.



Graph 6 Cancun wind rose
 Source: Own elaboration of data simulation

The wind speed density distribution in graph 7 show that the wind speed frequency intervals, the maximum frequency (36), is in the range of 2.8 m/s.



Graph 7 Cancun wind frequency distribution
 Source: Own elaboration of data simulation

The wind speed distribution establishes direction intervals and wind speed ranges, as shown in table 3.

Wind speed Distribution

Wind Direction	0.50 - 2.10	2.10 - 3.60	3.60 - 5.70	5.70 - 8.80	8.80 - 11.10	>= 11.10	Total
355.00 - 5.00	0	5	0	0	0	0	5
5.00 - 15.00	4	3	2	0	0	0	9
15.00 - 25.00	4	1	0	0	0	0	5
25.00 - 35.00	2	6	0	0	0	0	8
35.00 - 45.00	4	1	0	0	0	0	5
45.00 - 55.00	4	2	0	0	0	0	6
55.00 - 65.00	4	2	0	0	0	0	6
65.00 - 75.00	5	4	0	0	0	0	9
75.00 - 85.00	4	6	3	0	0	0	13
85.00 - 95.00	4	6	4	0	0	0	14
95.00 - 105.00	4	13	7	0	0	0	24
105.00 - 115.00	7	21	7	0	0	0	35
115.00 - 125.00	5	29	11	1	0	0	46
125.00 - 135.00	1	32	13	0	0	0	46
135.00 - 145.00	3	19	15	0	0	0	37
145.00 - 155.00	4	13	11	0	0	0	28
155.00 - 165.00	5	11	6	0	0	0	22
165.00 - 175.00	3	5	7	0	0	0	15
175.00 - 185.00	3	0	3	0	0	0	6
185.00 - 195.00	4	0	1	0	0	0	5
195.00 - 205.00	2	0	0	0	0	0	2
205.00 - 215.00	0	0	0	0	0	0	0
215.00 - 225.00	0	0	0	0	0	0	0
225.00 - 235.00	0	0	0	0	0	0	0
235.00 - 245.00	0	1	0	0	0	0	1
245.00 - 255.00	0	0	0	0	0	0	0
255.00 - 265.00	1	1	0	0	0	0	2
265.00 - 275.00	0	0	0	0	0	0	0
275.00 - 285.00	0	0	0	0	0	0	0
285.00 - 295.00	0	0	0	0	0	0	0
295.00 - 305.00	0	0	0	0	0	0	0
305.00 - 315.00	0	0	0	0	0	0	0
315.00 - 325.00	1	1	0	0	0	0	2
325.00 - 335.00	0	0	0	0	0	0	0
335.00 - 345.00	2	3	0	0	0	0	5
345.00 - 355.00	2	2	0	0	0	0	4
Sub-Total:	82	187	90	1	0	0	360
		Total:	365	Wind	Speed	2.80	m/s

Table 3 Wind speed distribution
 Source: Prepared by the authors

Average Wind Speed: 2.80 m/s, Table 3 shows the frequency distribution of the wind speed and its direction, for a one year period.

Energy produced annually

To evaluate the field performance of a wind turbine, the capacity factor (RC_F) in wind energy conversion systems is used, that the ratio of the power produced at the average speed of the place (P_{Vm}) and the nominal power of the wind turbine.

$$RC_F = \frac{P_{Vm}}{P_R} = \frac{1.48W}{400W} = 0.004 \quad (10)$$

The capacity factor range for a turbine to be efficient is set from 0.25 to 0.4.

The energy produced annually is calculated approximately by multiplying the capacity factor by the nominal power and the period of time.

$$400 \times 0.004 \times 8760 \text{ hours} = 14.02 \text{ kW/year}$$

Calculation of power as a function of wind speed

By setting the generator capacity of 400W, identifying a starting cut-in speed of 2.5 m/s and cut-out wind speed of 12 m/s, we calculate the wind speed power P_V (W). In table 4 it can be observed that to obtain 400W, an average wind of 12 m/s is required.

n	3	
Rated Power: p	400 W	
Cut - in wind speed: V_I	2.5 m/s	
rated wind speed: V_R	12	
	V	P_V (W)
Cut - in wind speed	2.5	0.00
	2.8	1.48
	3	2.66
	4	11.30
	5	25.55
	6	46.81
	7	76.47
	8	115.95
	9	166.64
	10	229.94
	11	307.26
Rated wind speed	12	400.00
	13	509.56
	13.5	571.08
	14	637.33
Cut-out-wind speed	15	784.73

Table 4 Calculation of power as a function of wind speed
Source: Own elaboration of data simulation

We can see that to have a capacity factor (RC_F) of 0.4, an average wind speed between 8 and 12 m/s must be obtained.

Acknowledgments

Wind speed data was provided by Capitanía de Puerto, Puerto Juárez, Cancun, Q. Roo, Mexico

Conclusions

With the wind speed data captured at a height of 10m by the port captaincy, the average speed calculated by the wind rose method and descriptive statistics, we obtained the value of 2.8 m/s. By applying the wind rose methodology, it is obtained that the wind tendency is to the southeast direction and the percentage indicates the probability of occurrence at different speeds.

With equations 7 and 8, the scale factor and form factor are calculated, at $c=3.5$, $k=2.88$ respectively. The estimation of potential energy based on Rayleigh's analysis allowed us to know the wind energy density E_D in kW/m^2 , the annual energy intensity E_I in kWh/m^2 , the wind speed frequency V_E in m/s and the maximum energy speed for the V_{Fmax} wind regime in m/s. See table 2.

In table 4, we calculated that the power generated from the wind speed (P_V) at 2.8 m/s, yielded a value of 1.48W and its capacity factor at 0.004, which does not reach the permissible range of 0.25 to 0.40. The calculation of its annual produced energy was 14.02 kW/year; therefore, a speed of 12 m/s is required to reach 400W of nominal power according to the manufacturer.

Findings

Because an average speed of 2.8 m/s is obtained at a height of 10m, it is necessary to raise the wind turbine to a height of: 13.4m with an α factor of 0.20, to reach an average speed of 12 m/s and to install an efficient 400W wind turbine.

References

Danish wind industry Association. (25 de Junio de 2003). *Manual de referencia sobre la energía eólica*. (Danish wind industry Association) Retrieved on April 05, 2019, from www.windpower.org/es/tour/wres/enerwind.htm

Fatma Gül Akgül, B. S. (2016). Energy Conversion and Management. *An alternative distribution to Weibull for modeling the wind speed data: Inverse Weibull distribution*, 234-240.

Hemani, A. (2012). *Wind Turbine Tecnology*. USA: Cengage Learning.

J.V. Seguro, T. W. (2000). Modern estimation of the parameters of the Weibull wind speed distribution for wind energy analysis. *journal of wind engineering and insdutrial aerodynamics*, 75-84.

López, M. V. (2013). *Ingenieria de la energía eólica*. Barcelona: Marcombo.

Mathew, S. (2006). *Wind energy fundamentals, rosources analysis and economics*. Springer.

R. Ian Harris, N. J. (2014). The parent wind speed distribution: Why Weibull? *Jorunal of wind Engineering and Industrial Aerodynamics*, 72-87.

R. Patel, M. (2006). *Wind and solar power systems(Design, Analysis and operation)*. Boca Raton, FL: CRC Press.

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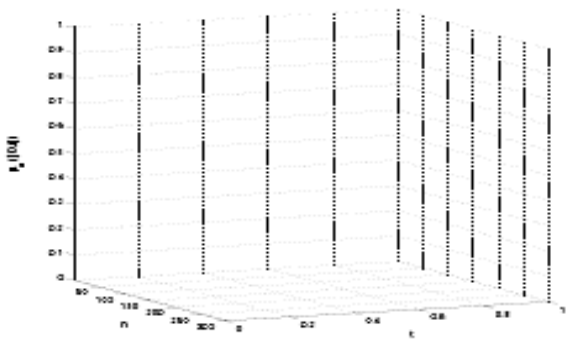
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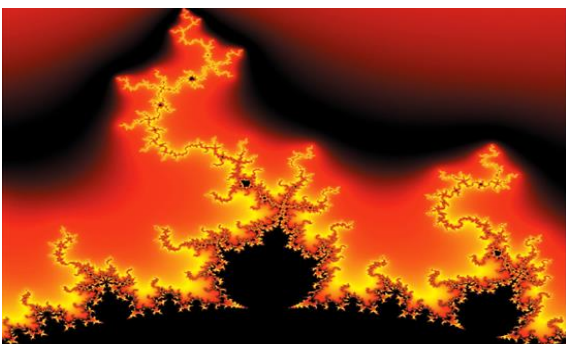


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