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Presentation of the Content

In the first article we present, *Fractal transformations of recursive walks in the Julia fern*, by RAMOS-ESCAMILLA, María, with affiliation in the RINOE-Mexico, as following article we present, *Study of the independent recovery amount as a system for determining the minimum salary*, by GÁMEZ-MARTÍNEZ, Juan Xavier, PÁRAMO-RODRÍGUEZ, Raúl, GUERRERO-GARCÍA, Breana Vianney and OSEGUEDA-SILVA, América Rosalía, with ascription in the Universidad Politécnica de Juventino Rosas, as the third article we present, *Analysis of the relationship between the definition of the business vision and the impact of effective communication to the staff, as part of the leadership of the microentrepreneurs of Santa Cruz de Juventino Rosas, Guanajuato*, by CANO-RAMÍREZ, Eliseo, VALDEZ-GONZÁLEZ, María Isabel and GONZÁLEZ-ESCOTO, Claudia, with secondment in the Universidad Politécnica de Juventino Rosas, as the last article we present, *Device for collecting and monitoring temperature and humidity with cloud storage for agricultural purposes*, by MORALES-ROLDÁN, Edgar Rubén, FLORES-CISNEROS, Idalia Rubí and PIEDRA-CASTAÑEDA, María del Socorro, with ascription in the Universidad Tecnológica de Poanas.

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Fractal transformations of recursive walks in the Julia fern**Transformaciones fractales de caminatas recursivas en el helecho de julia**

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Abstract

One of the most studied fractals corresponds to the Julia Set and one of its elements can be obtained with the following recursive formula in the complex plane: $Z_{i+1} = Z_i - 1$, the result depends on the chosen starting complex number. We can define the Julia set of a complex variable polynomial as the boundary of the set of points that escape to infinity when iterating this polynomial. This means that the orbit of an element of the Julia set does not escape infinity.

Fractal, Recursive walks, Julia set**Resumen**

Uno de los fractales más estudiados corresponde al Conjunto de Julia y uno de sus elementos se puede obtener con la siguiente fórmula recursiva en el plano complejo: $Z_{i+1} = Z_i - 1$, el resultado depende del número complejo de partida escogido. Podemos definir el conjunto de Julia de un polinomio de variable compleja como la frontera del conjunto de puntos que escapan al infinito al iterar dicho polinomio. Esto significa que la órbita de un elemento del conjunto de Julia no escapa al infinito.

Fractal, Caminatas recursivas, Conjunto de Julia

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Introduction

The dynamic dialogue between form and content embodied in the spirit of fractal geometry, which precisely bridges the quantitative and qualitative aspects of objects in nature. As previously mentioned, the appearance of fractals as such coincides with the publication of Les objets fractals: Forme, hasard et dimension, in 1975 and republished in 1977, in which Mandelbrot gives a series of definitions of fractals:

That it has a form, either highly irregular, or highly interrupted or fragmented, and remains so at whatever scale it occurs.

That it contains distinctive elements whose scales are very varied and cover a very wide range.

They had dealt with some of these assemblages, but had not built any theory about them, and had not, therefore, needed a specific term to designate them. Once the author has shown that nature abounds with objects whose best representations are fractal sets, it is necessary to have an appropriate word that is not shared with any other meaning: A fractal is, by definition, a set whose Hausdorff-Besicovitch dimension is strictly greater than its topological dimension. Sets with non-integer D are fractals. Mandelbrot coined the term fractal to encompass the various mathematical "monsters" that progressively increased in number, accompanied by those "monsters" that were discovered in nature. The word fractal derives from the Latin adjective fractus, meaning fragmented, broken or irregular, which corresponds exactly to the graphic characteristics of fractal objects and their respective dimensions.

Nevertheless, some fundamental characteristics can be extracted which, if one or all of them are fulfilled, one could speak of a fractal set. Thus, a fractal set would be:

A set that is sufficiently irregular because it cannot be described with the usual geometric language, both locally and globally:

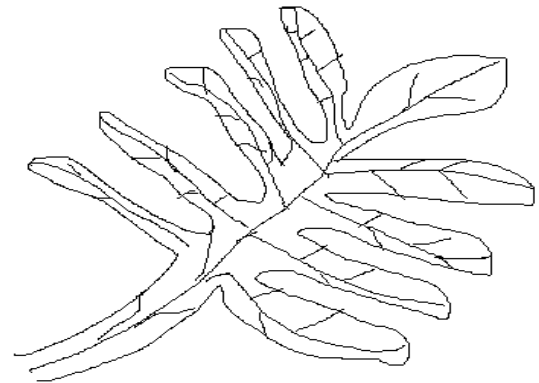
$$D_x^{((0))}=D_y^{((0))}=k^{((0))}$$

$$D_x^{((n))}=(y/z)^n k^{((0))},n=0,1,2$$

A set that exhibits some form of self-similarity, which may be approximate or statistical:

$$(D_x^n)/(D_x^{(n+1)})=\delta_x=1/2, \quad n=0,1,2$$

Usually: $(Dy^{((n))})/(D_x^{((n))}) = (L_y^{2n})/(L_x^{2n})$, there are also some additional characteristics of fractal structures in the following Julia's Fern:



The length between each leaf of its perimeter is infinite.

$$\left(\frac{\partial}{\partial t} + \vec{u}_i \cdot \vec{\nabla}\right) P_i + y_i P_i \vec{\nabla} \cdot \vec{u}_i = 0$$

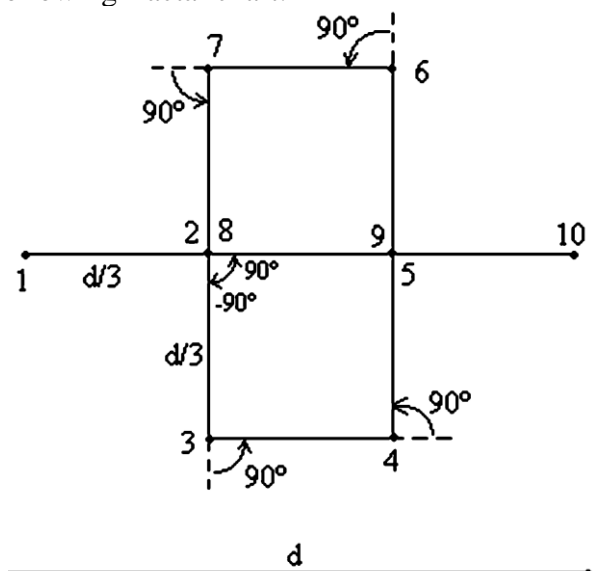
We will see how a curve of infinite length (perimeter) encloses a finite area and its construction is as follows:

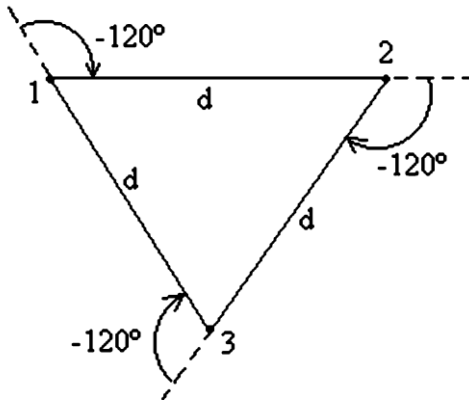
You take a segment, divide it into three equal parts.

$$\vec{\nabla}\psi - \Omega_{ci} \vec{U}_e x \hat{z} - \frac{1}{N_e} \vec{\nabla} P_e = 0$$

$$\frac{\partial P_e}{\partial T} + \vec{U}_e \cdot \vec{\nabla} P_e + y_e P_e \vec{\nabla} \cdot \vec{U}_e = \frac{\partial \psi}{\partial \tau} + A \psi \frac{\partial \psi}{\partial \xi} + B \frac{\partial^3 \psi}{\partial \xi^3} = 0$$

The central part is replaced by two parts of equal length making an angle of $\pi/4$ radians ($60-90-120^\circ$), to be iterated as shown in the following fractal chart:





$$\beta_{IF} = \int_{n\alpha_i}^{Ca} + \int_{n\alpha_{ii}}^{CM} + \int_{n\alpha_{iii}}^{C\beta} \therefore \left[\frac{(Ca+CM+C\beta)^{3/4}}{\left(\left[\frac{n}{\alpha_i}\right] + \left[\frac{n}{\alpha_{ii}}\right] + \left[\frac{n}{\alpha_{iii}}\right]\right)^{1/2}} \right]^2 +$$

$$\frac{\alpha Ca + \alpha CM + \alpha C\beta}{\begin{matrix} \lambda_0 & \lambda_1 \\ \alpha_i & \alpha_{ii} \\ \lambda_1 & \lambda_0 \\ \alpha_{ii} & \alpha_i \\ \lambda_0 & \lambda_1 \\ \alpha_i & \alpha_{ii} \end{matrix}}$$

Step 1: Perform the substitution for every element by their algebraic expression formula, in theory it does not matter what value is given to these probabilities, but in practice it is necessary to assign a probability according to the area covered by each transformation in order to optimise the speed of representation:

$$IRMM = \int_{n\alpha_i}^{C_a} + \int_{n\alpha_{ii}}^{C_M} + \int_{n\alpha_{iii}}^{C_B} \left[\frac{(Ca+CM+C\beta)^{3/4}}{\left(\left[\frac{n}{\alpha_i}\right] + \left[\frac{n}{\alpha_{ii}}\right] + \left[\frac{n}{\alpha_{iii}}\right]\right)^{1/2}} \right]^2 +$$

$$\left[\frac{\alpha C_a + \alpha C_M + \alpha C_B}{\begin{matrix} \frac{n}{\alpha_i} + \frac{\lambda_0}{\alpha_{ii}} + \frac{\lambda_1}{\alpha_{iii}} \\ \frac{\lambda_1}{\alpha_{ii}} + \frac{\lambda_0}{\alpha_i} + \frac{\lambda_1}{\alpha_{iii}} \\ \frac{\lambda_0}{\alpha_i} + \frac{\lambda_1}{\alpha_{ii}} + \frac{\lambda_0}{\alpha_{iii}} \end{matrix}} \right] \left[\frac{\left(\frac{dM_2 + dM_4}{d\lambda_i - d\lambda_{ii}} - \int_{M_1} \frac{dM_1}{d\lambda_i} \right)^{3/4} + \alpha}{\left[\frac{d\pi^{1/2} + dTC^2}{1+1/2} + d\lambda_{ii} \right]^2 \left(\left[\frac{d\pi^{1/2}}{dTC^2} \right]^1 + \left[\frac{d\lambda_i}{d\lambda_{ii}} \right] \right) \left[\frac{d\pi^{1/2} + d\lambda_{ii}}{dTC^2 + d\lambda_i} \right]^{3/4 - 1/2}} \right]^2 +$$

$$\left[\int_{[TC]^2}^{(\pi)^{1/2}} + 1 \frac{d\pi^{1/2}}{d\lambda_i} + \frac{d(TC)^2}{d\lambda_{ii}} + \alpha \right] \left[\frac{\left(\frac{(Ca+CM+C\beta)^{3/4}}{\left(\left[\frac{n}{\alpha_i}\right] + \left[\frac{n}{\alpha_{ii}}\right] + \left[\frac{n}{\alpha_{iii}}\right]\right)^{1/2}} \right)^2}{\begin{matrix} \frac{n}{\alpha_i} + \frac{\lambda_0}{\alpha_{ii}} + \frac{\lambda_1}{\alpha_{iii}} \\ \frac{\lambda_1}{\alpha_{ii}} + \frac{\lambda_0}{\alpha_i} + \frac{\lambda_1}{\alpha_{iii}} \\ \frac{\lambda_0}{\alpha_i} + \frac{\lambda_1}{\alpha_{ii}} + \frac{\lambda_0}{\alpha_{iii}} \end{matrix}} \right]^2$$

Step 2: Replace every variable with their value in the formula and with the levels of confidence required of the fractal model, there are many natural shapes that are so irregular and fragmented that, compared to Euclid's geometry (ordinary geometry), nature not only has a higher degree of complexity but the complexity is at a completely different level, since the number of length scales of the various natural shapes is, for practical purposes, infinite. Undoubtedly, one of the most remarkable aspects of fractal geometry is that it offers an alternative model to other geometries. It seeks a regularity in the relationships between an object and its parts at different scales.

$$ERE = \int_{(7)(1)_i}^{0.99} + \int_{(7)(1)_{ii}}^{0.66} + \int_{(7)(1)_{iii}}^{0.33} \left[\frac{(0.99+0.66+0.33)^{3/4}}{\left(\left[\frac{n}{\alpha_i}\right] + \left[\frac{n}{\alpha_{ii}}\right] + \left[\frac{n}{\alpha_{iii}}\right]\right)^{1/2}} \right]^2 +$$

$$\left[\frac{\left(\frac{d(60.39)^2 - 1 + d(80.52)^2 - 1}{d(20.13)^4 - 3 + d(40.26)^4 - 3} - \int_{60.39} \frac{d(80.52)}{d(12.97)} + 1 \right)}{\left[\frac{d(4.63)^{1/2} + d(97.19)^2}{1+1/2} + d(12.97) \right]^2 \left[\frac{d(4.63)^{1/2}}{d(97.19)^2} \right]^1 + \left[\frac{d(12.97)}{d(97.19)^2} \right]^1 \left[\frac{d(4.63)^{1/2} + d(12.97)}{d(97.19)^2 + d(12.97)} \right]^{3/4 - 1/2}} \right]^2 +$$

$$\left[\int_{(97.19)^2}^{(4.63)^{1/2}} + 1 \frac{d(4.63)^{1/2}}{d(12.97)} + \frac{d(97.19)^2}{d(12.97)} + 1 \right] \left[\frac{\left(\frac{(0.99+0.66+0.33)^{3/4}}{\left(\left[\frac{n}{\alpha_i}\right] + \left[\frac{n}{\alpha_{ii}}\right] + \left[\frac{n}{\alpha_{iii}}\right]\right)^{1/2}} \right)^2}{\left(\frac{(0.99+0.66+0.33)^{3/4}}{\left(\left[\frac{n}{\alpha_i}\right] + \left[\frac{n}{\alpha_{ii}}\right] + \left[\frac{n}{\alpha_{iii}}\right]\right)^{1/2}} \right)^2} \right]^2$$

From step 3 is solved every mathematical operation, until have a final result:

Step 3

$$ERE = \int_{\left(\frac{1}{7}\right)(\frac{1}{7})}^{(0.99)\left(\frac{1}{7}\right)} + \int_{\left(\frac{1}{7}\right)(\frac{1}{7})}^{(0.66)\left(\frac{1}{7}\right)} + \int_{\left(\frac{1}{7}\right)(\frac{1}{7})}^{(0.33)\left(\frac{1}{7}\right)} \left[\frac{(0.99+0.66+0.33)^{3/4}}{(7+7+7)^{1/2}} \right]^2 +$$

$$\left[\frac{\left(\frac{d(60.39)^2 - 1 + d(80.52)^2 - 1}{d(20.13)^4 - 3 + d(40.26)^4 - 3} - \int_{60.39} \frac{d(80.52)}{d(12.97)} + 1 \right)}{\left[\frac{d(4.63)^{1/2} + d(97.19)^2}{1/2} + 1 \right]^2 \left[(4.63)^{1/2} - (97.19)^2 + 1 \right] \left[(4.63)^2 - (97.19)^{1/2} + 1 \right]^{1/4}} \right]^2 +$$

$$\left[\int_{(97.19)^2}^{(4.63)^{1/2}} + (1)(4.63)^2 + (97.19)^{1/2} + 1 \right] \left[\frac{\left(\frac{(0.99+0.66+0.33)^{3/4}}{(7+7+7)^{1/2}} \right)^2}{\frac{1.98}{32.94} \frac{20.97}{9}} \right]$$

The repetition of the topological patterns of these fractals (at different scales) leads to their being called self-similar. They contain parts that are scaled-down versions of the whole object. In the case where random variations can be applied to the reduced scale subparts, the fractal is said to be statistically self-similar.

Step 4

$$ERE = \int_{0.00027}^{0.0066} \left[\frac{1.66}{4.58} \right]^2 +$$

$$\left[\frac{1.98}{(32.94)(20.97)(9)} \right] \left[\frac{\left(\frac{(60.39)+(80.52)}{(20.13)+(40.26)} - \int_{(60.39)(107.36)} + 1 \right)}{\left[\frac{(101.82)^2}{1/2} + 1 \right]^2 \left[(2.15) - (9445.89) + 1 \right] \left[(21.43) - (9.85) + 1 \right]^{1/4}} \right]^2 +$$

$$\left[\int_{(48.59)^{9.26}} + (1)(21.43) + (9.85) + 1 \right] \left[\frac{1.66^2}{4.58} \right]$$

$$ERE = \int_{0.00027}^{0.0066} [0.36]^2 +$$

$$\left[\frac{1.98}{6216.76} \right] \left[\frac{2.33 - \left(\frac{(20.13)(80.52)}{(60.39)(107.36)} + 1 \right)}{\left[\frac{10367.31}{1/2} + 1 \right]^2 \left[-9442.74 \right] \left[12.58 \right]^{1/4}} \right]^2 +$$

$$\left[\int_{(48.59)^{9.26}} + (1)(21.43) + (9.85) + 1 \right] \left[\frac{[0.36]^2}{1.98} \right]$$

$$ERE = \int_{0.00027}^{0.0066} (0.12) +$$

$$(0.00031) \left[\frac{2.33 - \left(\frac{1.620.86}{6483.47} + 1 \right)}{(429965936.78)[-9442.74] \cdot (1.88)} \right]^2 +$$

$$\int_{(48.59)^{9.26}} + (1)(21.43) + (9.85) + 1 \left[\frac{(0.12)}{(0.00031)} \right]$$

$$ERE = \frac{(0.0066)(0.12)}{(0.00027)(0.00031)} \cdot \left[\frac{2.33 - (1.24)}{-7632906313755.56} \right] + \frac{(9.26)(21.43)(0.12)}{(48.59)(9.85)(-0.00031)}$$

$$ERE = \frac{7.92 \times 10^{-4}}{8.37 \times 10^{-8}} \cdot \left[\frac{1.09}{-7.63 \times 10^{12}} \right] + \frac{23.81}{(48.59)(9.85)(-0.00031)}$$

$$ERE = \frac{7.92 \times 10^{-4}}{8.37 \times 10^{-8}} \cdot (-1.42 \times 10^{13}) + \frac{23.81}{-0.14}$$

By transferring and copying the generator to the appropriate scale, the different steps or iterations in the generator process can be generated:

Step 5

$$ERE = 9462.36 (1.42 \times 10^{13}) + (-170.07)$$

$$ERE = 1.35 \times 10^{-9} + (-170.07) = (-170.07) = |170.07|$$

ERE Step 6: Transforming absolute value and obtained the logarithmic number.

$$ERE = \text{Log}170.07 = 2.23$$

Step 7: Apply the indexing process = (2.23)(100)(100)=2.23%

In $Z_0 = 1.05 + 0.3i$ produces a finite orbit in the complex plane for 2.2% acceptance in its fractal coordinate, precisely, fractal geometry has an internal irregularity with a certain ordering, and describes the boundary between the ordered and chaotic motion of the trajectories of a system. The contribution of fractals to the understanding of the world results in a kind of natural philosophy, an integrated view of the world, an organising element.

$$\lambda(x_0) = \lim_{n \rightarrow \infty} \frac{1}{n} \log \left| \frac{df^n(x_0)}{dx_0} \right|$$

Conclusions

As we observed the concept of fractal can be approached from several points of view, however it is commonly accepted that a fractal is a geometric object composed of elements, also geometric, of variable size and orientation, but of similar aspect, with the particularity that its dimension must be dependent on the scale or resolution in its topological calculation.

After presenting Hausdorff's definition of dimension, we could ask ourselves if it does not correspond to a mere mathematical instrument, but this is the way we have defined the theory of numerical fractals and we have developed an assumption about the theory of the real number based on the positional number systems, different from Dedekind's of the cuts in the field of rational numbers and Cantor's of the completeness of the metric space of rational numbers.

That is to say, in the decimal numbering system, the integers are those which are written with a finite number of digits to the left of the decimal point (without any decimal point), including zero, while rational numbers are those which result from adding to any integer (including zero), a number less than one with a finite number of decimal places (to the right of the decimal point), or an infinite number of decimal places with period (group of digits that repeats indefinitely), the remaining numbers are the irrational ones, our theoretical basis is that the numerical fractals have the power of the continuum and their dimension is less than one (which is that of the real numbers).

Numerical fractals are not closed sets for addition, subtraction, multiplication or division, because the sum, difference or product of two numbers of the same numerical fractal may not belong to the same one and the one is equal to the number formed by zero followed by a comma and infinitely many equal digits for this broken geometry.

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Study of the independent recovery amount as a system for determining the minimum salary

Estudio del monto independiente de recuperación como sistema de determinación del salario mínimo

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Abstract

The objective of this article is to propose an idea that serves as support to build within our country, a system that allows to have an income, that even if it is the least, can cover the fundamental needs of an average family, for this, As a comparison, historical data on the evolution of minimum wages, the change since the imposition due to the government's setting and its evolution since the implementation of the MIR (independent amount of recovery). Will also be used, we will also equate the reasoning with which the amount of the MIR is established, and the methodology used in other countries with minimum wages that allow for better living conditions, a relationship between both methodologies will be established for its determination, in order to create a hypothesis of the operation of this system. With this information it is considered to have a support that allows theorizing in a new method for the provision of a new system on the subject of minimum wages.

Relation, System, Variation

Resumen

El objetivo de este artículo, es proponer una idea, que sirva de apoyo para erigir dentro de nuestro país, un sistema que permita tener un ingreso, que, aunque sea el menor, pueda cubrir con las necesidades fundamentales de una familia promedio, para esto, se utilizará a modo de cotejo, datos históricos de las variaciones de los salarios mínimos, el cambio desde la imposición por la fijación del gobierno y su evolución desde la implantación del MIR (monto independiente de recuperación). También equipararemos el razonamiento con el que se establece el importe del MIR, y la metodología usada en otros países con salarios mínimos que permiten tener mejores condiciones de vida, se establecerá una relación entre ambos métodos de trabajo para su determinación, para poder crear una hipótesis del funcionamiento de este sistema. Con esta información se considera tener un sostén que permite teorizar en un nuevo método para la disposición de un nuevo sistema en el tema de las remuneraciones mínimas.

Relación, Sistema, Variación

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Introduction

The minimum wage is defined by the Federal Labour Law in its article 90, stating that it is the lowest amount that a worker should receive in cash for services rendered in one (working) day. This should be sufficient to satisfy the normal material, social and cultural needs of a head of household, and to provide for the compulsory education of the children.

Based on the above, we can determine that it is the minimum or minimum remuneration of money to a co-worker for all the work done. Now, who is in charge of its surveillance, establishment and care (in Mexico), is the CONASIMI (National Commission of Minimum Wages).

It should be noted that, as of 2017, this wage in our country is established by two elements, which is by fixation and by the MIR.

FIXATION (by inflation)

The percentage of fixation for the increase of the minimum wage, is calculated by conducting a study, estimating the inflation of the immediate following year. According to this figure, the minimum wage is increased by one or two percentage points.

MIR (Independent Recovery Amount)

This is an amount of money that is added to the current (minimum) wage so that each year it grows and regains purchasing power. In addition, the MIR is established by tripartite agreement: government, employers and workers:

- On the government side there is a commission within CONASIMI.
- On the labour side, there are workers' representatives in the national commission for minimum wages and the confederation of Mexican workers (CTM).
- And finally, there is a part of the employers' sector, i.e. companies and employers.

The extra and almost exponential growth that the minimum wage has had in our country has been largely due to the MIR, which, as mentioned above, was established so that all sectors (government, companies and workers) involved obtain profitable benefits.

Methodology

The procedure used was applied statistically, covering minimum wages from 1934 to 2023, given that, with this data, it was possible to make a conversion to our current monetary value that, at the time, was in force in the country.

In addition, the INPC was considered in order to determine inflation year by year, and to have a better evaluation parameter between the income received (by the minimum wage) and the purchasing power with it. This stipulates the following: it does not matter if you earn a lot if your purchasing power is low. In other words, having more cash does not ensure that you have more goods, and this is reflected in a decrease in the number of items in the basic basket of goods. Therefore, the table below shows the changes in the minimum wage (over the years).

Year	Average Price Index (July 2018 = 100)	Real minimum wage	Percentage
1934	0.00130462	97.69	
1935	0.00129604	98.34	99.34%
1936	0.00138244	103.33	106.67%
1937	0.00164165	87.01	118.75%
1938	0.00172805	95.32	105.26%
1939	0.00172805	95.32	100.00%
1940	0.00172805	98.9	100.00%
1941	0.00185766	92	107.50%
1942	0.00203046	85.57	109.30%
1943	0.00250568	69.34	123.40%
1944	0.0031105	71.77	124.14%
1945	0.00336971	66.24	108.33%
1946	0.00388812	71.98	115.38%
1947	0.00410413	68.19	105.56%
1948	0.00432014	79.24	105.26%
1949	0.00457934	74.75	106.00%
1950	0.00522736	73.45	114.15%
1951	0.0064802	59.25	123.97%
1952	0.00673941	77.27	104.00%
1953	0.00660981	78.79	98.08%
1954	0.00712822	98.38	107.84%
1955	0.00816506	85.88	114.55%
1956	0.00859707	93.76	105.29%
1957	0.00911549	88.42	106.03%
1958	0.0094179	98.84	103.32%
1959	0.0094179	98.84	100.00%
1960	0.00993631	106.68	105.50%
1961	0.00993631	106.68	100.00%
1962	0.01006592	125.48	101.30%

1963	0.01028192	122.84	102.15%
1964	0.01080034	164.72	105.04%
1965	0.01088674	163.41	100.80%
1966	0.01110275	188.24	101.98%
1967	0.01118915	186.79	100.78%
1968	0.01140516	211.75	101.93%
1969	0.01179397	204.77	103.41%
1970	0.01238407	225.53	105.00%
1971	0.01238407	225.53	100.00%
1972	0.01306136	254.41	105.47%
1973	0.01370707	285.98	104.94%
1974	0.01536315	359.56	112.08%
1975	0.01901713	290.48	123.78%
1976	0.02185915	378.51	114.94%
1977	0.02531829	360.21	115.82%
1978	0.03267684	316.71	129.06%
1979	0.03838133	312.08	117.46%
1980	0.057317	245.46	149.34%
1981	0.073328	249.63	127.93%
1982	0.116528	273.14	158.91%
1983	0.235242	195.12	201.88%
1984	0.389205	184.74	165.45%
1985	0.613964	180.41	157.75%
1986	1.14341	196.23	186.23%
1987	2.65073	221.34	231.83%
1988	5.67686	127.76	214.16%
1989	6.81268	121.92	120.01%
1990	8.62837	125.01	126.65%
1991	10.5838	114.17	122.66%
1992	12.2251	98.85	115.51%
1993	13.4172	97.34	109.75%
1994	14.3518	97.34	106.97%
1995	19.3749	95.12	135.00%
1996	26.0356	93.33	134.38%
1997	31.4056	77.37	120.63%
1998	36.408	87.65	115.93%
1999	42.4465	75.18	116.59%
2000	46.4754	75.57	109.49%
2001	49.4348	76	106.37%
2002	51.9217	76.54	105.03%
2003	54.2826	76.51	104.55%
2004	56.8276	76.18	104.69%
2005	59.0939	76.56	103.99%
2006	61.2387	76.83	103.63%
2007	63.6679	76.77	103.97%
2008	66.9309	75.96	105.13%
2009	70.4765	75.47	105.30%
2010	73.406	78.28	104.16%
2011	75.9072	78.81	103.41%
2012	79.0281	78.87	104.11%
2013	82.0362	78.94	103.81%
2014	85.333	78.86	104.02%
2015	87.6546	79.97	102.72%
2016	90.1279	81.04	102.82%
2017	95.573	92.45	106.04%
2018	100.255	88.14	104.90%
2019	103.476	99.23	103.21%

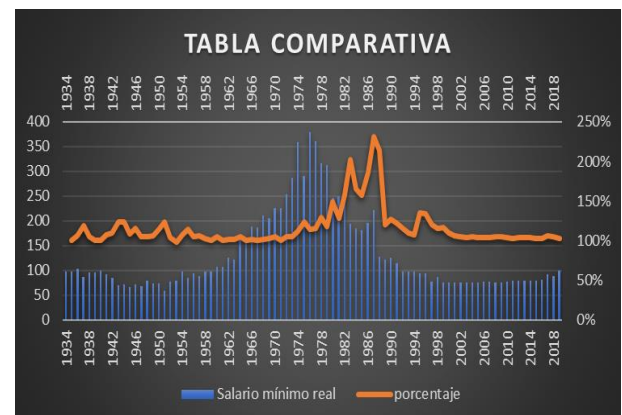
Table 1 Salary per year

Results

With the research carried out in which historical data were taken from 1934 (the year in which the minimum wage was established as such in Mexico), until the direct intervention of the government, the results show an upward trend based on the minimum wage (as shown in graph 1: "comparative table"). However, in the decade of the 40's there is a decrease and, from the 50's to the 70's, the highest point is reached, to then fall in an accelerated manner.

On the other hand, it is observed that inflation in Mexico from 1934 to the 70's (graph 1), remained stable with small rises and falls; since at the beginning of the 70's, there is a notorious rise in this item, a period in which the minimum wage reached its maximum peak.

With a new analysis carried out from 2016 to March 2023, it can be deduced that the growth of the minimum wage has been on a sustainable upward trend (graph 2), while inflation follows a stationary standard.



Graphic 1



Graphic 2

Likewise, to show the change in the minimum wage when the Independent Recovery Amount is added, a calculation was made, considering the NCPI.

It is worth noting that the highest percentages of inflation obtained in this comparative period were in times of the full COVID-19 pandemic, highlighting moderate inflation and, even so, an increase (in the minimum wage).

Year	minimum wage	INPC	PERCENTAGE
2016	\$ 73.04	92.03904	
2017	\$ 80.04	98.27288	106.77%
2018	\$ 88.36	103.02	104.83%
2019	\$ 102.68	105.934	102.83%
2020	\$ 123.22	109.271	103.15%
2021	\$ 141.70	117.308	107.36%
2022	\$ 172.87	126.478	107.82%
2023	\$ 207.44	128.389	101.51%

Table 2 Minimum wage comparison incorporating the MIR

Conclusion

In view of the above, we believe that a standardisation of our minimum wage system can be carried out in order to manage it in a more appropriate way. That is to say, more by understanding than by arbitrariness. Taking the MIR as the main and essential part for change.

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Analysis of the relationship between the definition of the business vision and the impact of effective communication to the staff, as part of the leadership of the microentrepreneurs of Santa Cruz de Juventino Rosas, Guanajuato

Análisis de la relación entre la definición de la visión empresarial y el impacto de la comunicación efectiva al personal, como parte del liderazgo de los microempresarios de Santa Cruz de Juventino Rosas, Guanajuato

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Abstract

Communication is one of the main competencies that leaders must develop and apply, since with these they can influence the performance of employees, which generates orientation, motivation and persuasion to carry out the activities that allow the achievement of business goals. In the review of the literature, it becomes clear that it is important to identify how the vision is connected with managerial communication and the managerial exercise itself. The purpose of this research work is to carry out an analysis of the relationship between the definition of the business vision and the impact of communication to the staff, as part of the leadership of the micro-entrepreneurs of Santa Cruz de Juventino Rosas, Guanajuato. The quantitative method was applied, through a probabilistic sample, a sample of 510 microentrepreneurs was obtained for study. It is concluded that entrepreneurs with managerial skills and who define the business vision, have leadership skills by assertively communicating the business vision to their employees, which allows them to meet business objectives.

Resumen

La comunicación es una de las principales competencias que deben desarrollar y aplicar los líderes, ya que con ésta pueden influir en el desempeño de los empleados, lo que genera orientación, motivación y persuasión para llevar a cabo las actividades que permiten el logro de las metas empresariales. En la revisión de la literatura queda manifiesto que es importante identificar cómo se conecta la visión con la comunicación directiva y el propio ejercicio gerencial. El presente trabajo de investigación tiene como finalidad llevar a cabo un análisis sobre la relación que existe entre la definición de la visión empresarial y el impacto de la comunicación al personal, como parte del liderazgo de los microempresarios de Santa Cruz de Juventino Rosas, Guanajuato. Se aplicó el método cuantitativo, mediante un muestro probabilístico se obtuvo una muestra de 510 microempresarios para su estudio. Se concluye que los empresarios con habilidades directivas y que definen claramente la visión empresarial, cuentan con las competencias de liderazgo al comunicar asertivamente a sus empleados la visión del negocio, lo que permite cumplir los objetivos empresariales.

Communication, leadership, vision

Comunicación, Liderazgo, Visión

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Introduction

Micro and small enterprises are important for the Mexican economy, not only because they contribute 52% of GDP and 72% of employment, but also because they are enterprises that can be strengthened by developing leadership skills and effective communication of their business vision with employees, as part of the functions of those who lead such organisations, which can guide business decisions and therefore their success.

Leadership includes orchestrating major changes in an effective manner that respond to the challenges faced by MSMEs. Running a business requires organising the enterprise, staffing it with skilled personnel and directing activities. Leadership, however, involves inspiring people to achieve the business vision. Leaders keep staff focused on moving the organisation towards the achievement of objectives, motivating them to overcome the obstacles along the way, for which communication in the organisation is decisive. This is one of the main competences that leaders must develop and apply, as it influences staff performance, generating orientation, motivation and persuasion to carry out the activities in the company. In this way, Mazzola (2012) argues that communication management in organisations continues to demonstrate in most cases, vestiges of communication rationality with a linear and vertical aspect and with an emphasis on results rather than on communication processes. Poor communication can be a problem for any company, regardless of size. Gisbert and García (2014) state that miscommunication can originate in different areas, from the company director who does not express the company's vision to sales staff who do not listen to their customers. As a result of miscommunication, the organisation can lose morale, focus, performance and customers.

The purpose of this research work is to carry out an analysis of the relationship between the definition of the entrepreneurial vision and the impact of communication to staff, as part of the leadership of micro-entrepreneurs in Santa Cruz de Juventino Rosas, Guanajuato, which was carried out through a statistical investigation of data, considering a sample of 510 micro and small enterprises, applying the quantitative, cross-sectional and exploratory research method.

The following hypotheses were defined; H0: there is no relationship between the definition of the entrepreneurial vision with the impact of communication to staff as part of the leadership of micro-entrepreneurs in Santa Cruz de Juventino Rosas, Guanajuato. H1: There is a relationship between the definition of the vision and the impact of communication to staff as part of the leadership of microentrepreneurs in Santa Cruz de Juventino Rosas, Guanajuato. The result is that entrepreneurs with managerial skills and who clearly define the business vision, have leadership competencies when communicating assertively to their employees the vision of the business, which allows them to meet the business objectives.

Literature review

Globally, micro, small and medium-sized enterprises (MSMEs) are recognised as having a very important socio-economic relevance. According to INEGI (2019), in almost all countries, more than 90% of enterprises are micro, small or medium-sized. Globally, these businesses represent 90% of all enterprises, generate between 60% and 70% of employment and are responsible for 50% of the Gross Domestic Product worldwide, according to the International Council for Small Business.

In Mexico, of the 4.9 million establishments in the private and parastatal sector registered in the 2019 Economic Census, 99.8% belong to the group of micro, small and medium-sized establishments, generating employment for 27 million people, according to the results of the second edition of the ECOVID-IE and the Study on Business Demographics (INEGI, 2020).

According to the latest Economic Census, of the universe of economic units in Mexico: a) 95.2% are microenterprises, b) generate 45.6% of employment, and c) contribute 15% of the added value of the economy. In Guanajuato there are 220 thousand economic units or businesses, of which 98.5%, i.e. approximately 216,700 are micro, small and medium-sized enterprises, according to data from INEGI (2020).

Sánchez (2017) in his article mentions that MSMEs in Guanajuato generate 50% of the Gross Domestic Product and up to 70% of the total number of jobs in the state.

If every management process is oriented towards the future by a vision and if every management process is developed through communication, then vision and communication are determinants of management and of the future of the leader's action. Therefore, the mastery of vision and communication will be necessary for the best exercise of efficient management.

Although the concept of management refers us to the organisational dimension, when we explore how the manager forms his vision, how he communicates it, and how it integrates the organisation leaning towards the future, it is necessary to move into a review that interprets vision and communication at both the organisational and the personal level.

Leading the group, dealing with change, managing conflict, motivating, all involve the deployment of interpersonal behaviours that are based on communication and, therefore, on people's ability to communicate. On the other hand, from an organisational perspective, experience shows that many of the problems that arise in day-to-day business are the direct consequence of communication failures. Poor communication leads to confusion and misunderstanding. This can lead any management plan, or any good initiative by an employee, to failure. Mazzola (2012) refers that it is not strange that the messages and strategies that are developed in internal communication are often ineffective, as they are constructed and designed from the logic of broadcasting, safeguarding the interests of the organisation's top management, providing only prescriptions and recommendations that are perceived as alien to the rest of the team. García, Prieto and García (2016) mention that the success in the application of the strategy will depend on the way in which managers assimilate and handle the information, in the research carried out by the authors, the result obtained in the aspect of communication was that managers have opportunities for improvement.

Communication is the process by which people influence each other. This process is delicate and complex, determined by a multitude of variables and studied by a multitude of disciplines. Ramírez and Fusté (2007) propose that the objective is to offer some approaches that may be useful for acquiring a greater awareness of the impact of communication in the exercise of leadership.

Communication is perceived as a management tool and not as a building force of business action.

Microsoft's Workplace Trend Index indicates that 65% of workers at the operator level in Mexico believe that they do not receive information from business leaders, and 65% globally. In Mexico, 24% feel that their voice is not taken into account in the organisation (Hernández, 2022).

Regarding the strategic dimension of communication, Contreras and Garibay (2020) mention that it is essential to add value to companies, since it is through communication that the organisation manages to position itself in the market by planning actions aligned with the organisation's objectives established in the mission, vision and values (Contreras & Garibay, 2020).

The same happens with the issue of vision, which seems to escape into the intangible or the imaginary, and because it is not measurable, it seems to have no value for many. For now, we can understand the vision as a set of personal or group ideas that one wishes to communicate in part, but, paradoxically, also in part to conceal. The formulation of the vision may be based on ideas that speak of thoughts that are not very precise, of images or private sensations that are closer to intuition than to logic. It may be related to desires, illusions, imaginations, superstitions; beliefs, cultural values or preconceptions. It can even constitute a focal point of view on something and, at the same time, a frame of reference made up of networks of specific visions that explain or direct our position on various facts. They can also be perceived as a fleeting or persistent way of seeing things. They take the form of a point view or a global view, being very precise or blurred, easy or complex, highly formalised or really over-understood.

According to ENAPROCE (2018), 95.4% of SMEs do not participate in global value chains mainly due to lack of information (34.8%), which may influence the lack of entrepreneurial vision to orient themselves for decision making and venture into new markets, innovate processes and achieve the necessary growth to perpetuate the business.

According to the Eugenio Garza Lagüera Entrepreneurship Institute, one of the five reasons why Mexican companies close is due to poor planning, which includes lack of planning, lack of management experience and lack of business vision, which represents 44% of these organisations. Another important factor that influences the closure of these organisations is the lack of clarity in the business objectives, why and what they work for, as well as the required and expected returns.

In the management field, communication and vision are often referred to as unclear issues. Vision and communication are seen as rhetorical contrivances of management, especially in management styles where a technicist spirit prevails. Their impact and value in management is even known, but they are associated more with a set of personal qualities than with developed learning capabilities.

Today, having a vision for the future and communicating it to others are essential components of great leadership. "If there is no vision, there is no business," says entrepreneur Mark Leslie. Joe Nevin, director of leadership information systems, describes leaders as "painters of the vision and architects of the journey". Entrepreneurs are not alone in this belief; academic research shows that a clear vision and the communication of that vision leads to greater growth in companies (Bateman & Snell, 2009).

A vision is a picture of a possible and desirable future of the organisation. It expresses the leader's ambitions for the organisation. A leader may create a vision that describes aspirations for high performance, the nature of corporate or business strategy, or even the kind of workplace worth creating. The best visions are both ideal and unique. If a vision conveys an ideal, it communicates a standard of excellence and a clear choice of positive values. If the vision is also unique, it communicates and inspires pride in being different from other organisations. The choice of language is important; the words should imply a combination of realism and optimism, an orientation towards action and resolve and confidence that this vision will be achieved.

Vision is an essential characteristic when it comes to the subject of leadership. It is important for a leader to have a vision as it will allow him to visualise a desired scenario of where he wants to lead his company and thus be able to translate this scenario into real results that will achieve success. Therefore, this vision is a clear image that requires the leader to be optimistic and confident in everything he or she sets out to do. This vision is also an image towards the people who collaborate with a leader and the leader must help them, motivate them and guide them to give their maximum effort.

Leaders must know what they want and the rest of the staff must understand what it is all about. The leader must be able to articulate the vision, clearly and often. Others in the organisation must understand the vision and be able to state it clearly to themselves. But the business vision has no meaning until the leader and his or her subordinates take action to turn the vision into a reality. This is what vision communication is all about: making it clear where we are going. Barboza (2018) publishes that organisations are demanding a new generation of managers, who have the ability to respect processes, inspire a vision that can be shared, encourage followers, as well as give appropriate guidance in situations of non-conformity.

The vision must incorporate new ideas in its strategies and new challenges that challenge people so that it can resolve these challenges in the best possible way, because when you have a good vision that manages to excite, then it can be fulfilled almost effortlessly.

For González, Manrique and González (2010), one of the most important factors that support the successful implementation of the managerial vision is the degree of commitment of the director or owner, which must be translated into an attitude that is capable of inspiring it in his employees. The implementation of the vision by the manager is the first aspect that should distinguish the leader of the organisation.

Methodology

This research work has a cross-sectional design, with a quantitative approach and is of an exploratory, descriptive and correlational type, whose objective is to determine the relationship that exists between the definition of the business vision and the impact of communication to personnel, as part of the leadership of the micro-entrepreneurs of Santa Cruz de Juventino Rosas, Guanajuato, which was carried out through a simple random probabilistic sampling of the municipality's small and medium-sized enterprises, considering that they have between 2 and 50 workers. A 95% confidence level was established, with a 5% error and an estimated probability of $p=0.5$. A total of 510 surveys were applied.

The following hypotheses were defined; H0: there is no relationship between the definition of the vision and the impact of communication to the personnel as part of the leadership of the microentrepreneurs of Santa Cruz de Juventino Rosas, Guanajuato. Juventino Rosas, Guanajuato.

H1: There is a relationship between the definition of the vision and the impact of communication to staff as part of the leadership of microentrepreneurs in Santa Cruz de Juventino Rosas, Guanajuato.

Considering the information provided by the entrepreneurs of the different business lines, whose constructs were system processes and from this the variable leadership was used: I have a clear vision and I share it with the staff, I try to fulfil it and the other construct in terms of managerial skills: when I communicated a vision it reached both the heart and the mind of the people.

The data analysed were obtained from the results of the research conducted by Relayn (Peña, Posada and Aguilar, 2022). Statistical calculations were performed in Minitab version 21.2. The reliability of the research allows the use of the method of intercorrelation of items applying the value of Cronbach's Alpha, the measure of reliability allows estimating the internal consistency of the items analysed, this considers that the items in Likert-type scale of the same construct and that they are highly correlated (Welch and Conner, 1989).

Results

To establish the results, the research objective was considered, which refers to an analysis of the relationship between the definition of the entrepreneurial vision and the impact of communication to staff as part of the leadership of microentrepreneurs in Santa Cruz de Juventino Rosas, Guanajuato, for which the following hypotheses were established H0: there is no relationship between the definition of the entrepreneurial vision and the impact of communication to staff as part of the leadership of microentrepreneurs. H1: there is a relationship between the definition of the vision and the impact of communication to staff as part of the microentrepreneurs' leadership. A data collection instrument consisting of a questionnaire with several constructs was used for this purpose. The first part of the validation of the application of this instrument consisted of carrying out a reliability test, which resulted in a Cronbach's Alpha indicator of 0.8609, higher than the 0.8 recommended by Nunnally and Bernstein (1994), using a covariance matrix with two different constructs; System Processes and Management Skills, specifically in Management and Leadership respectively.

Cronbach's alpha	N elements
0.8609	510

Table 1 Cronbach's alpha score. Source: Own elaboration.

The data collection instrument consists of a survey rated with a Likert scale. For values of this type, a statistical indicator for non-parametric data is recommended (Levine, Krehbiel & Berenson, 2014). In this case, Pearson's r was calculated for the total data, which gave a value of 0.4589, and Spearman's Rho, with a value of 0.4705, both values that are found to be higher than the alpha statistic of 0.05 used in the research, using the method called cross-tabulation.

Variable	Media	Std. dev.
26a.	4.216	0.938
26b.	4.292	0.842
26c.	3.703	1.091
26d.	3.911	1.007
26e.	3.911	1.019
26f.	3.934	1.172
44a.	4.277	0.836
44b.	4.292	0.787
44 .	4.256	0.813
44d.	4.317	0.791
44e.	4.055	0.942

Table 2 Descriptive Statistics of the Instrument
Source: Own elaboration

CANO-RAMÍREZ, Eliseo, VALDEZ-GONZÁLEZ, María Isabel and GONZÁLEZ-ESCOTO, Claudia. Analysis of the relationship between the definition of the business vision and the impact of effective communication to the staff, as part of the leadership of the microentrepreneurs of Santa Cruz de Juventino Rosas, Guanajuato. Journal-Financial Economy. 2023

For non-parametric tests, the larger Spearman's Rho and Pearson's r compared to the alpha statistic, the greater the chance of rejecting the null hypothesis. In this case, the large difference between these values supports rejecting H0 and accepting H1.

r of Pearson	Rho of Spearman
0.4589	0.4705

Table 3 Results of cross-tabulation

Source: Own elaboration

Using Minitab 21.2 statistical software, a Kruskal Wallis test was performed, which resulted in an H value of 128.14, and a p variable so small that the same software presents it as a value of 0.000, approaching zero. The theory indicates that, in the Kruskal Wallis test, the smaller the statistic compared to the alpha variable, the greater the possibility of rejecting H0. The result is that entrepreneurs with managerial skills and who clearly define the business vision have leadership competencies in assertively communicating the business vision to their employees, which allows them to meet the business objectives.

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Conclusions

In this study, an analysis was carried out on the relationship between the definition of the entrepreneurial vision and the impact of communication to personnel, as part of the leadership of microentrepreneurs, which is related to the null and alternative hypotheses previously defined. Taking into account Chen, Sharma, Zhan and Liu (2019) in their publication indicate that transformational leadership is a synchronized process where the leader inspires the followers to achieve a performance superior to the previously defined expectations, which benefits the organization and the employee.

González, Manríque and González (2010) in their research conclude that when talking about the managerial business vision, reference is made to the projection that the leader has in mind for the organization, and that to ensure success he/she must ensure that the message is extended to subordinates, for which it is important to apply a methodology that considers lifelong learning, according to the context, in addition to applying stimuli that enable the fulfillment of the vision.

It is intended to value vision and communication as fundamental issues of management and/or leadership and to be able to interpret them positively in strengthening the leader's performance.

Therefore, it is concluded from the research study in the context of Juventino Rosas, Guanajuato, that entrepreneurs with managerial skills and who clearly define the business vision, have the leadership competencies to communicate assertively to their employees the vision of the business, which allows meeting the business objectives.

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Device for collecting and monitoring temperature and humidity with cloud storage for agricultural purposes

Dispositivo de recogida y control de la temperatura y la humedad con almacenamiento en la nube para fines agrícolas

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Abstract

The integration of technology in different areas of research undoubtedly represents one of the best practices that human beings can do, areas that help the growth of sustainability such as the use of technology in agriculture, represent today an area of opportunity for technological development not only in urban but also in rural regions; the present research project aims to develop a device that helps in the collection and monitoring of agroclimatic variables such as temperature and humidity using real-time storage technology in the cloud, this will help protected agriculture to maintain and keep track of these variables to facilitate decision making in terms of saving resources and get better crops based on really relevant information, the research methodology is considered quantitative with an applied technology approach, what will be measured is the impact of the device used in the greenhouse of the technological university of Poanas as a first stage. The implementation of this technology in the rural area of Poanas in Durango, is undoubtedly a milestone in the employability of technology in improving the sustainability of local agricultural products.

Resumen

La integración de la tecnología en los diferentes ámbitos de la investigación sin duda representa una de las mejores prácticas que el ser humano puede hacer, áreas que ayuden al crecimiento de la sustentabilidad como lo es el uso de la tecnología en la agricultura, representan hoy en día un área de oportunidad para el desarrollo tecnológico en regiones no solo urbanas si no rurales; el presente proyecto de investigación tiene como objetivo desarrollar un dispositivo que auxilie en la recolección y monitoreo de variables agroclimáticas como lo es la temperatura y humedad haciendo uso de la tecnología de almacenamiento en tiempo real en la nube, esto ayudará a la agricultura protegida a mantener y llevar un control de dichas variables que faciliten la toma de decisiones en cuanto al ahorro de recursos y obtener mejores cosechas basadas en información realmente relevante, la metodología de investigación se considera cuantitativa con un enfoque de tecnología aplicada, lo que se medirá es el impacto de dicho dispositivo usado en el invernadero de la universidad tecnológica de Poanas como primera etapa. La implementación de esta tecnología en el área rural de Poanas en Durango, en sin duda un hito en la empleabilidad de tecnología en la mejora de la sustentabilidad de los productos agrícolas locales.

IoT, technology, Protected agriculture

IoT, Tecnología, Agricultura protegida

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Introduction

Introducing Information and Communication Technologies (ICT) in agriculture allows making it more efficient, reducing costs and introducing certainty in decisions. Similarly, using ICT based on the use of digital platforms, Big Data, Analytics, IoT, contributes to the rational use of resources, increased productivity and improved profitability. (Rambauth, 2022, pp 34).

The implementation of information and communication technologies (ICT) has become an excellent tool that allows companies to generate added value to operational activities, seeking to offer business advantages to achieve consolidation in a global market. Similarly, it can be seen how companies have opted for innovation, which is a set of tools that allow the correct application of knowledge management (Jiménez and Rodríguez, 2019, pp 85).

Due to globalization, companies in general have more demands in terms of competitiveness, seeking to generate products and services that are of excellent quality for the final consumer. The present document consists of designing and implementing a device that can collect and monitor climatic data of humidity and temperature which will be stored in the cloud in real time, which will allow the user through a connection to the database to review the information obtained and make decisions leading to detailed solutions to a specific situation, allowing to generate added value to operational activities.

Nowadays, agriculture and technology must come together to work as a team, according to Chanchí, Ospina & Saba (2022) suggest that "one of the topics that has had great diffusion in the last decade thanks to the advantages of monitoring and automation of different processes in various application contexts is the Internet of Things (IoT)" (p 258), which will support the monitoring of climatological variables of interest in various crops for different users.

Technology represents an impact on human society, however, these impacts are not homogeneous, sectors and social classes differ and are affected in different aspects. The use of technology in society awakens the interest of scientific research applied to different sectors and on different aspects (Foladori, 2022).

Therefore, the following article seeks to collect some of the agroclimatic variables that allow users to make their agricultural processes more efficient, seeking sustainability and environmental protection.

The hypothesis to be tested is: H1: The use of a device that monitors humidity and temperature variables reinforces and facilitates decision-making aimed at sustainability.

H0: The use of a device that monitors humidity and temperature variables does not reinforce or facilitate decision-making aimed at sustainability.

The present research work contains the development methodology of the device, as well as the research approach used, the justification, objectives to be met, results, conclusions, recommendations and bibliographical references.

Development of the device

In the globalized world in which we find ourselves, it is of vital importance to share knowledge with the various business partners, according to Tovar, Solorzano, Badillo & Rodríguez (2019) suggests that "there is currently a strong growth in the automation of agricultural work due to the technological evolution and population expansion of the planet" (p. 88), hence the importance of sharing knowledge.

The necessary requirements for the implementation of the device are defined, which according to consists of a 20 x 4 LCD screen, with I²C module to display the data of: Temperature, Humidity, Date and Time, DS3231 which has I²C communication to obtain the date and time previously set, the DHT11 sensor which is digital and from it the humidity and temperature data are obtained; the nodemcu, which is a microcontroller that has integrated wifi and controls the aforementioned devices and sends the data to the cloud hosted in Firebase.

According to Arellano Díaz, (2022) "the LCD display has 20 columns and 4 rows, plus it has led lighting and contrast adjustment for correct data display" (p. 11), of humidity, temperature, date and time and it also has I²C module.

The DHT11 temperature and humidity sensor has an operating voltage of 3 to 5 volts and is digital, which makes it optimal for connection to the nodemcu microcontroller; it has a measuring range of 0 to 50°C and relative humidity from 20 to 90%.(Feresu, Z. ,2022)

According to Tarun Singh and Ritula Thakur (2019) "the DS3231 clock module is device that provides real time (date and time) that integrates a crystal with temperature compensation, so it ensures long-term accuracy"(p. 364), as long as the battery it uses is in optimal condition, which communicates with I²C protocol.

According to Satria(2019) "the nodemcu ESP32 is a controller device of electronic circuits or hardware to perform particular functions according to the application program developed, it has wifi connection to be able to perform programs focused on internet of things (IoT)."(p. 134)

According to Jiménez-Naharro, R.. (2017) "the use of the I²C protocol helps to make the wiring less, being that, by the same pair of wires, several devices can be connected."(p. 2)

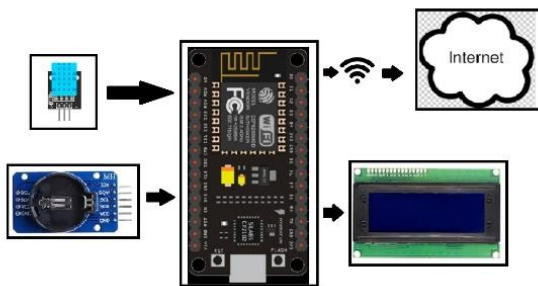


Figure 1 Block diagram. Source: Own elaboration

Figure 1 shows the block diagram used for the implementation of the device, showing the inputs and outputs of the elements that make it up.

The place of study will be the greenhouse of the Technological University of Poanas, which at the present date of this document has as

sowing tomato saladette XXL, has a size of 50 m x 40 m, in Figure 2 you can see the greenhouse.



Figure 2 Greenhouse at the Universidad Tecnológica de Poanas

Figure 3 shows the device in the greenhouse area and how the connections are made to access the monitored data in real time.



Figure 3 Prototype Implementation in Work Area

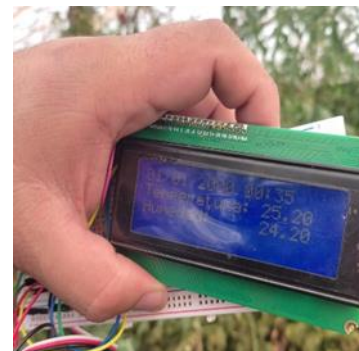


Figure 4 Temperature and Humidity Measurement

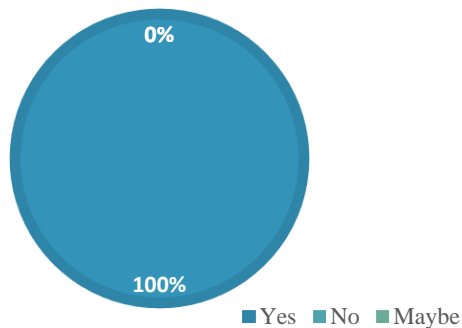
Figure 4 shows the measurement of temperature and humidity with the DHT11 sensor, with a measurement accuracy of +-2° C, the result is displayed on the LCD screen informing in real time the data captured at that precise moment of the measurement.

Results

The Smart agriculture using IOT has been experimentally proven to work satisfactorily by monitoring the values of humidity and temperatures successfully. Through the internet control the motor in the field. It also stores the sensor parameters in the timely manner. This will help the user to analyze the conditions of various parameters in the field anytime anywhere. Then control or maintain the parameters of field properly. Finally it concludes that automatic irrigation system is more efficient than scheduled irrigation process. (Jyostna, Aala, Srilatha, Vijay y Bharath, 2018, pp 3028)

The device was implemented in the greenhouse of the Technological University of Poanas, where they currently have an XXL saladette tomato planting, the sample selected for testing the alternative hypothesis that indicates H1: The use of a device that monitors humidity and temperature variables reinforces and facilitates decision making aimed at sustainability, was considered for convenience, considering the aspects of sustainable and protected agriculture in this case the greenhouse, the following results were reached.

Did the use of the device help improve crop management decision making?

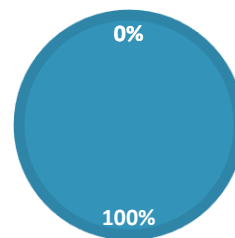


Graphic 1 Improved Decision Making

Graph 1 shows that the device greatly helped to improve decision making in terms of crop management, from controlling humidity, responsible use of water and plant health to proper soil use.

As a user, do you consider the use of the device efficient in your agricultural activities?

■ Yes ■ No ■ Maybe

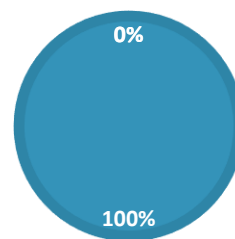


Graphic 2 Device Efficiency in Agricultural Activities

According to the opinion of the user participating in the research, as shown in Figure 2, the use of the device makes agricultural activities inside the greenhouse more efficient, since the values are stored in a database in real time in the cloud, which will allow consultation from anywhere without the need to go physically.

As a result of the device, have sustainable actions been taken in the management of the crop?

■ Yes ■ No ■ Maybe



Graphic 3 Sustainable Actions in Crop Management

According to Graph 3, the proper use of the device has generated benefits in terms of sustainable actions in crop management, such as the responsible use of water.

Does the use of the device help in the visualization of humidity and temperature records, which facilitates and reinforces decision making aimed at the responsible use of natural resources such as water?

■ Yes ■ No ■ Maybe



Graphic 4 Device Use in Data Visualization

Graph 4 shows that the visualization of the humidity and temperature records helps the user to make decisions on the responsible use of natural resources, having a good production of XXL saladette tomato in the protected cultivation area of the institution.

According to the data analyzed with the instrument implemented in the expert's opinion, it can be said that the alternative hypothesis is accepted indicating that the use of the device will reinforce and facilitate decision making aimed at sustainability activities starting with the responsible use of water.

Conclusions

Undoubtedly one of the challenges for Mexico and the world is to cover the food supply, according to Baldivia and Ruiz (2017) suggests that "between 1980 and 2015 the available land per capita decreased 31 percent, this means that in the future to increase production farmers should focus on improving crop yields" (p. 2079), therefore it is of utmost importance to acquire technological tools that support decision making for farmers.

The consequences of climate change, such as the increase in temperature, CO₂ and the variation of soil acidity, agriculture is one of the areas that has been affected. As a result, low productivity is seen, as well as a decrease in the quality of most crops. (Ossa Duque, 2017, pp 51).

The evolution of the field and the activities carried out allow us to affirm that the agricultural sector is an area of great opportunity for the implementation of IoT in the coming years. The implementation of IoT solutions allows to follow the modernization based on the demand that the agricultural sector presents. It is expected that in the following years the use of technology in this sector will allow a 70% increase in global food production, this for the year 2050 allows generating an encouraging impact since it is estimated a population of 9.5 billion inhabitants in the world. (Tovar Soto, et al., 2019). The implementation of the device has the following advantages: the temperature and humidity can be monitored in real time without being physically in the protected area, in addition to the fact that the device displays the aforementioned values.

In the future, we intend to implement the development of a mobile application that will allow monitoring of the data collected by the device from any location.

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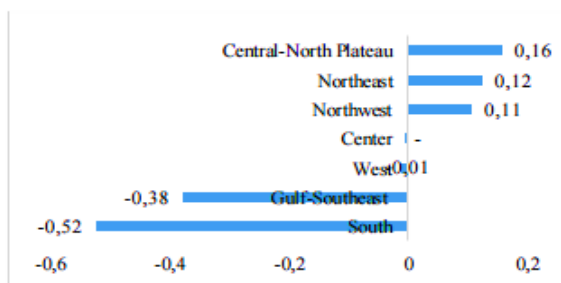
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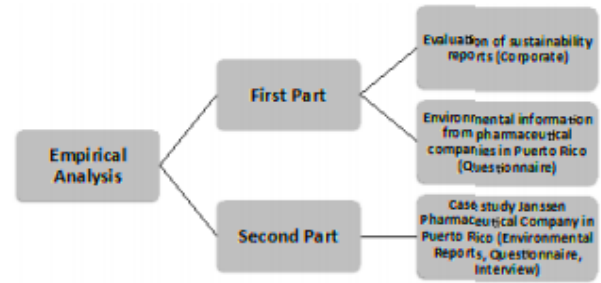


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