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Journal of Research and Development

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The works must be unpublished and refer to topics of industrial development, project model, computer application, research production, systems development, research networks, application design, programming and development proposals and other topics related to Humanities and Behavioral Sciences.

Presentation of the Content

In the first article we present, *Extensionism in Mexico and its impact on changes in agricultural production yields*, by LANDÍN-ALCÁNTAR, Herlinda, VÁZQUEZ-MIRAMONTES, Nicolás, PALOMINO-NÚÑEZ, Sergio Joel and MENA-CASTAÑEDA, Juan Pablo, with adscription in Universidad de Guadalajara, as following article we present, *Proposal of infrastructure in Baluartes Circuit Avenue, between the San Juan Baluarte and the Santa Rosa Baluarte as a promoter of tourism development and social welfare in Campeche, Mexico*, by BARRERA-LAO, Francisco, CRUZ-Y-CRUZ, Andrea, PALEMÓN-ARCOS, Leonardo, QUIJANO-GARCÍA, Román and MEDINA-BLUM, Fernando, as following article we present, *Management of digital documents with encrypted signature, through the use of centralized PKI, and distributed using blockchain for a secure exchange*, by ANTOLINO-HERNÁNDEZ, Anastacio, FERREIRA-MEDINA, Heberto, TORRES-MILLAREZ, Cristhian and OLIVARES-ROJAS, Juan Carlos, with adscription in Instituto Tecnológico de Morelia, as following article we present, *Magentite particles change electrical properties of a porcine heart tissue*, by SOLIS-ROJAS, Michelle, MORENO GONZÁLEZ-TERAN, Gustavo, GÓMEZ-SOLIS, Christian, GALINDO-GONZÁLEZ, Rosario and BALLEZA-ORDAZ, José Marco with adscription in Universidad Politécnica del Bicentenario and the Universidad de Guanajuato.

Content

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Extensionism in Mexico and its impact on changes in agricultural production yields

El extensionismo en México y su impacto en los cambios de rendimientos de producción agropecuaria

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Abstract

Extensionism in Mexico emerged as a system of assistance and education to improve production efficiency in the agricultural sector. Initially small groups were instructed in low-income regions to mainly traditional crops such as corn and beans and in minor proportion to livestock species. Subsequently, extension programs were structured to promote productive techniques and methods that improved the efficiency and income of producers. In addition, institutions are involved with the participation of field professionals oriented to the transfer of technology without considering a specific model of evaluation of the dissemination program, product of the involvement of several institutions such as Secretary of Agriculture, Bank, The Agricultural Insurance and others. From the above, it can be deduced that the program had high expectations however; the expected results were not given due to lack of institutional coordination.

Production, Extension, Economic and social welfare, Marginalized areas

Resumen

El extensionismo en México surge como un sistema de asistencia y educación para mejorar la eficiencia productiva en el sector agropecuario, inicialmente se instruía a pequeños grupos en las regiones de bajo ingreso y principalmente a los cultivos tradicionales como es el maíz y el frijol y en menor proporción a especies ganaderas. Posteriormente se estructura programas de extensionismo que promovía técnicas y métodos productivos para mejorar la eficiencia y el ingreso de los productores. Además, se involucran las instituciones con la participación de profesionales del campo orientado a la trasferencia de tecnología sin considerar un modelo específico de evaluación del programa de divulgación producto de la involucración de varias instituciones como era Secretaria de Agricultura, Banco, La Aseguradora Agrícola y otras. De lo anterior se deduce que el programa tenía altas expectativas, sin embargo, no se dieron los resultados esperados por falta de coordinación institucional.

Producción, Extensionismo, Bienestar económico y social, Zonas marginadas

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Introduction

The objective of this study is to show if the programs established by the government had any impact on agricultural production, in a specific case: Extensionism. This program was implemented by the government in order to reach the main marginalized areas, with the opportunity to increase production yields to those producers with scarce resources and therefore little or no technology from their plots. According to IICA / sf, agricultural extension is defined as "the instruction and technical and practical guidance that is available to all farmers, with the aim of helping them to obtain better and greater harvests and as a consequence, to raise their standard of life ", with the special characteristic that in Mexico who gave the support of extension was the government through the corresponding institutions, while other countries was through the educational institutions.

This diagram shows how the investigations that were carried out were carried out in the first instance by the government (research centers), and later were made known by demonstration plots made by the extensionists (Rendon 2013) together with the producers, talks with a flipchart , as well as the delivery of brochures to these.

On many occasions, there was no adequate coordination because while the producer received technology he did not have the resources to apply it and had no way of expressing his dissatisfaction (Jansen and Ekanayake 2007) only focusing on his production. Subsequently, in order to offer better technical assistance to agricultural production, Inter-institutional work teams were created, such as the Federal Electricity Commission, the Secretary of Agriculture and Hydraulic Resources, the Agrarian Reform and the Rural Credit Bank, since it had been observed that technology was available to disclose but there was no financing for the application of this technology, and even fertilizer credit was started for their plots, and in many cases the use of credit was limited due to the lack of defined tenure. the earth what was a limitation for the use of technology. (Rodríguez 2007).

"In 1973, the Public Investment Program for Rural Development was created (PIDER), which ended its activities in 1983. Its orientation was to resolve social and productive lags in specific regions through the coordinated investment of various sectors and levels of government. which had been characterized by achieving duplication of resources and efforts.

The objective of PIDER was to achieve an integral rural development that allowed the rational use of natural resources and the roots of the population in their places of origin ", depended on the Presidency of the Republic together with the support of international organizations such as the World Bank and the Inter-American Development Bank and there should be an increase in both agricultural and livestock production, which should generate more employment and social infrastructure.

It can be said that the greatest achievement was the establishment of effective forms of coordination between the states and the federal government, which was carried out through its regional delegations COPRADES (Committees promoting socio-economic development).

These organizations depended on the Presidency of the Republic and had the support of international organizations such as the World Bank and the Inter-American Development Bank, it is worth mentioning that personnel (Agronomists, Veterinary Doctors, Agricultural Technicians and Social Workers) were hired to develop the work of Agricultural Extensionism.

It is worth mentioning that to meet the needs in Mexico, mainly in the most vulnerable places, some programs were developed during the seventies, such as the PIDER, the General Coordination of the National Plan for Depressed Areas and Marginalized Groups (COPLAMAR) and the Food System. Mexican (SAM), which were the main programs for the fight against poverty.

However, they did not reach the required importance due to the fact that the target population to which they were destined were not the priority groups in the governmental agenda of the time. (Palacios 2007).

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In 1976 a decentralization of resources to the different states of the country was presented, and by 1980 the main objective of the PIDER was for the population to improve their health, nutrition, education and housing, however, the most significant was an improvement in planning regional level and its coordination, as well as the process of decentralization of public administration. In this period, technical assistance and application of subsidies was implemented, although it was not enough to combat poverty.

The purpose of COPLAMAR was to carry out actions that would help marginalized rural areas to organize themselves and obtain material elements so that there would be a more equitable participation of the national wealth. According to Cordera and Lomelí 2005, the objectives of COPLAMAR were: "a) to adequately take advantage of the productive potential of the marginalized groups and the areas where they were settled that would ensure a more abundant supply of goods such as food and services; b) promote the establishment of work sources and their diversification of zones through the channeling of public and private resources and the training of population centers; c) achieve a fair remuneration for the work and the products generated by self-consumption groups; d) promote respect for the groups' forms of organization.

Through this program, information was obtained regarding the basic needs of housing, nutrition, health and education, it can be said that the first measurement of poverty was made. Starting in 1980, in the face of an agricultural crisis, the MBRS program was established as a strategy for self-sufficiency in the production of basic grains. The main objectives were to increase the application of credits, the use of improved seeds, and the use of fertilizers. machinery and equipment, pest and disease control, and technical assistance.

Background

In the particular case of Mexico, extensionism arose with the purpose of helping subsistence peasant families whose welfare was clearly public, in Mexico the extension program began in a few regions of the country given that there was no infrastructure or personnel to cover the rest of the country, it can be said that they were isolated programs (Freire 1973).

In the 1960s extension and dissemination programs emerged as a system of assistance and education to improve production efficiency in corn and bean producers, where they were trained in their plots or in their homes. From the 70s' economic policies to the agricultural sector are structured as a service or a system that promotes techniques and production methods to improve the efficiency and income of producers. Surge and development is developed based on the use of large volumes of complementary inputs for production such as fertilizers, herbicides, insecticides and economic resources (Aguilar 2005).

By the year 1980, the Institutions of the productive sector that participated in extension work were already considered as a professional intervention in the transfer of technology; it was tried to replace the model of increase in the use of inputs by high economic efficiency. The most important time of extension programs in the country, which predominated by state policies. It is worth mentioning that the Postgraduate College participated in specific extension programs with a whole development model in which it based its strategy on field research, dissemination, evaluation, producer organization, credit, Institutional participation and participation in temporary districts, this was mainly in the Mixteca Alta regions in Oaxaca, Chiautla de Tapia Region in the state of Puebla, arid zones in San Luis Potosí and in the case of the Humid Tropics the College trained technical teams; in the programs of temporary areas in the States of Durango, Chihuahua, Michoacán, Chiapas and Oaxaca (central valleys). (Vázquez 1984). In the 1990s, the dissemination programs were an exchange of information and transfer of skills; Its essence was to facilitate interaction and dynamic generation in a system that includes educational training and agricultural research. In Mexico the research component is separated from the productive and the demonstrative.

Evaluation system

During the bibliographic review of the state programs and their policy, none of the development plans found any way to measure the impacts or integral rural development as it should have been for the measurement of results such as performance and economic impact.

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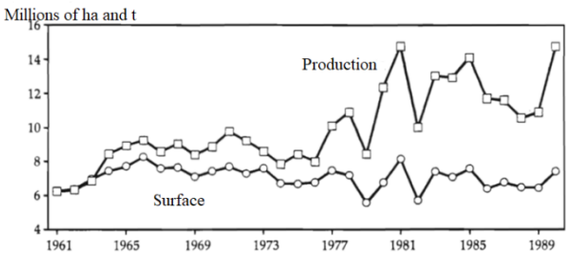
In the income, only the increase in yields per unit area was observed as well as the productivity in the particular case of corn, and statistics show that the area decreased but production increased.

Area and annual corn production, Mexico 1961-1990

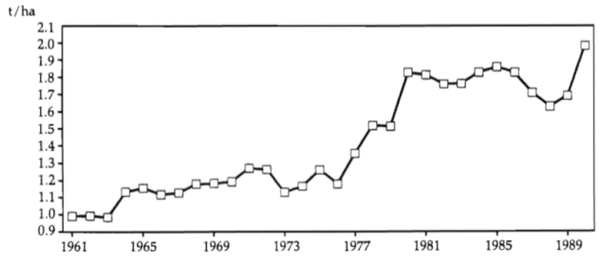


Graph 1
Source: Data obtained from FAO through SARH. 1961-1990

Table one and two are analyzed where the surface and yields are found, in which the following is indicated: the production of maize in Mexico increased with a rate of 2.1% in annual average between 1961 and 1990. This growth was due to a increase in yields that rose 2.3% annually in the same period, while the area harvested decreased at an annual rate of 0.2%. When these trends are analyzed in different subperiods; It is evident that the increase in harvested area reached its peak in the mid 60's and then declined continuously, particularly in the 70's, with a slower decline in the 80's.

In 1981, an exceptionally good year in terms of rainfall and the incentives given by economic policies to the sector, the harvested area expanded considerably from seven to eight million hectares in the previous year. Also in 1990, Mexico registered a significant increase in the area sown with corn. On the other hand, maize yields rose 2.3% per year between 1961 and 1970 and an impressive 3.9% per year between 1971 and 1980, as the use of fertilizers in seasonal maize spread. However, maize yields remain stagnant in 1981 and 1989. Average annual yields of corn, Mexico 1961-1990

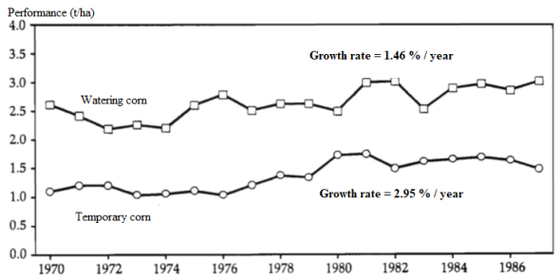
Average annual yields of corn, Mexico 1961-1990



Graph 2
Sourse: Data obtained from FAO through SARH. 1961-1990

Figure 2 shows the average annual yields of corn, Mexico, 1961-1990. They start with an average yield of approximately one tonne to 1.1 ton / ha in 1975, and it is from this date that production is doubled to almost two tons per hectare due to the use of technology disseminated by extension agents.

Average yields / ha of temporary corn and irrigation, Mexico 1970-1987



Graphic 3
Source: Data obtained from FAO through SARH. 1970-1987

The production of irrigated and temporary maize (figure 3), was reduced to 89% in the years from 1970 to 1972, to 77%. In the period from 1985 to 1987 the surface area of seasonal maize decreased by 77%, increasing yields to 2.95% per year. In the case of irrigated maize, yields grew 1.46% per year. The difference in productivity between seasonal maize and irrigation has not been enough to induce producers to increase or even maintain the area irrigated with corn.

Materials and methods

The methodology used was a descriptive method, because documents were reviewed to know the origins and background of the program and its implementation of the agricultural extension of the Extensionism program in Mexico, as well as the institutions that participated in its operation.

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It was necessary to develop a survey with producers over 50 who have had experience related to technical assistance to their agricultural activities in the state of Jalisco through students of the Agronomist career of the University Center of Biological and Agricultural Sciences (CUCBA) from the University of Guadalajara, where heads of families were producers and could answer the issue of Extensionism.

The sample was of 23 people selected at random in different Municipalities of the State, in order to make a comparison of the social policy and the yields at the National level, in addition, the data was worked with the National Institute of Geography and Information Statistics (INEGI), where We compared data from the area of rainfed and irrigated land, corn and beans, machinery and equipment, as well as livestock and its existence from the period from the years 1970 to 1990, in order to perform a quantitative evaluation that allows us to evaluate results in general. In addition, growth rates were calculated in order to analyze results and impacts on performance.

This was done on the agricultural surface in the cultivation of corn and beans, in machinery equipment and in livestock species. It is worth mentioning that in the literature review it generated a model of technical assistance that would allow to evaluate the extension and in some cases if the evaluation was given in yields obtained by cycles, in other cases changes were found without follow-ups to develop a more solid quantitative evaluation. to the conclusions. In the bibliographic review it was found that the postgraduate school, generated a model of agricultural development at the regional level and was carried out in some places like the state of Oaxaca specifically in the Mixteca Alta de Oax. (Tlaxiaco), whose model is described below:

Its orientation was the economic and social improvement of the rural population, which promotes agricultural development, trying to attack the problems of the regional economy; food shortages and low incomes received by an important part of the rural population. Bearing in mind the problems of the national economy and that in some parts is intensified with greater intensity as is the case that was referred to in Tlaxiaco.

A part of the food production comes from small plots in temporary zones, where the family work force is an important resource for production. The Puebla Plan model promotes development and as a starting point is the technical dissemination to temporary regions where productive potential existed, but with technology support it was sought to increase production and improve their conditions in their agrosystems as dictated by the research, based on a strategy with a technical team and institutional coordination, as well as regional producers. The developed strategy: Research, dissemination, agricultural credit, agricultural insurance, agricultural inputs, the benefit / cost ratio (evaluation), market, producer organization and promoting small agricultural infrastructure works.

According to a bibliography review, INEGI statistics from the period 1970 to 1990, and reports of professional experience in the field, it was first reviewed that it was Extensionism and its application of these programs in Mexico, in these documents the antecedents of the concept which was in Europe and the same North American model to improve technology in the agricultural sector, in the particular case of Mexico, it is rethought and added for marginal areas that had not had the use of technology in the PIDER regions, it was continued with the Extensionism with the other programs after the PIDER. With these projects the credit and some works like the irrigation and edification in some communities are added

Results

According to data from table 1, it is from the 60's, the construction of hydraulic infrastructure for the use of the hydrological basins in the country continues at a faster pace, causing an increase in the irrigation surface, raising the productivity of various crops; since in the 60's the surface of temporary was of 90% and the one of irrigation, arrived approximately at 10%. It is from the 70's that it diminishes a total surface of temporary to 84% and to irrigation increases to 16%. In the 1980s, the storm decreased to 74.3 and the risk rose to 25.7, that is, possibly the impact on production increases in this period was due to the use of agricultural inputs, extension and credit, including the irrigation surface almost rose by 10%.

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According to the SIAP, from the summary 80 '-2017, the hydraulic infrastructure in the construction of dams and irrigation canals has not grown, according to the latest data it states that only 28.14% of the total area cultivated under this system is irrigated. For the 1990s, rainfed lands decreased to 72.5% and irrigated land to 1.8%. in this period of analysis there was an impact of about 16.1% of the increase in irrigation in that period, that is, it is considered that the infrastructure greatly influenced the growth of agricultural production.

Harvested surface of Temporary and irrigation				
Year	Total area	Temporary surface	Percentage of participation in agriculture of rainfed	Percentage of participation in irrigation agriculture
70	15'128,700	1'271,298	84	16
80	17'824,243	13'238,896	74.3	25.7
90	17'974,637	13'031,194	72.5	27.5

Table 1 1950-1990. INEGI. Historical statistics of Mexico 1999
From INEGI. Mexico in the twentieth century and panaora. statistical ma Economic Transformation

In table number two corn and beans were included, since they are basic crops and that are planted in subsistence regions in most cases, finding the following results. In the case of beans, the yields per hectare went from 530 kg / ha to 615, that is, this represented 16% for this period of increase and, in terms of area, its growth rate increased by 20%, that is, the area increased more than the yield per hectare, which was caused by price control. In the case of corn, the area increased by 27% and in the case of yields per hectare, it increased by 67%, that is, corn was more productive than beans, as a result of economic support and agricultural inputs as well as extension . Making a comparison in terms of the period from 70 'to 90', with relation to 90'al 2017 of the basic crops corn and beans

Basic crops						
Area planted with corn and beans of the 70-90 period						
Year	Bean Area	Surface growth rate	Yield per hectare	Corn Area	Growth rate	Yield per hectare
70	1'746,947		530	6´766,000		1,194
80	1'551,352	-11.19	603	7'339,000	8.46	1,829
90	2'090,000	34.72	615	8'639,000	17.71	1,994
2000	2’120692	2.94	590	8’444,793	-2.24	2.460
2010	2’068705	-2.45	710	7’860,705	-6.91	3.260
2017	1’755339	-15.1	690	7’761,216	-1.26	3.720

Table 2 Area planted with beans and corn planted in Mexico in the period 70 - 90’
From INEGI. Mexico in the twentieth century and statistical panorama. Economic Transformation.

Results of the growth rate of beans and maize from the 70'-90 'and from 90' to 2017.

Year	**Bean Area**	**Surface growth rate**	**Yield per hectare**	**Growth rate per hectare**
70	1'746,947		530	
80	1'551,352	-11.19	603	13.77
90	2'090,000	34.72	615	1.99
2000	2’120692	2.94	590	-4.06
2010	2’068705	-2.45	710	20.33
2017	1’755339	-15.1	690	-2.81
		X= .71		X= .62

Table 3 Making a comparative analysis in the case of beans, it is observed that the surface from year 70 to 2017 did not have a great variation. Being in the 90 " that had a growth rate of 34.72% and in other years there were minor and even negative values, for example from the 70's to 90 ', the surface grew by 2.3% and from 90' to 2017 only 2.03% and the total growth in the 47 years on average that covers this period of analysis 70-2017 annual growth rate was .71%. Regarding yield productivity per hectare, its annual growth was of .62%, the most significant year being 2010, which reached 20.33%, that is, productivity increased but area did not equal.

It should be noted that productivity is practically the same for productivity per hectare from 70 to 90 as well as 90 to 2017, despite bean prices that have increased substantially.

Year	**Corn Area**	**Growth rate**	**Yield per hectare**	**Growth rate per hectare**
70	6´766,000		1,194	
80	7'339,000	8.46	1,829	52.93
90	8'639,000	17.71	1,994	9.02
2000	8’444,793	-2.24	2.46	23.37
2010	7’860,705	-6.91	3.26	36.58
2017	7’761,216	-1.26	3.72	10.71
		x= .33		X= 2.82

Table 4 In the case of corn compared to beans, in terms of the productivity performance of tons per hectare and the average of the total years, it was 2.82% in general average, being better the period from 90 to 2017, since it was 2.61 which is greater than the period from 70 to 90 which was 1.54%, although the average area only grew by .33%, that is, its productivity was more efficient despite the fact that they lost a lot of corn planting area or not It grew in the same proportion. If you had to make a comparison of the previous periods in terms of programs and policies of welfare to the agricultural sector, they are practically the same as for the first period the technology was known and for the 80s to the present there are better means communication, technology, communication channels, however, the prices paid to producers are much lower in relation to the sale of their products that are marketed in urban areas.

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In table three, it has been observed for the case of tractors that their growth rate in the period 70-80', grew by 67.5%, and from the period of 80-90' it increased by 47.3%, that is to say almost fivefold tractors in Mexico for this period, which is possibly one of the factors to increase production and productivity per unit area, since the use of this equipment made better fallow, tracking and furrowing as well as the use of fertilization in planting take better advantage of soil moisture as well as the use of agrochemicals with the use of the tractor.

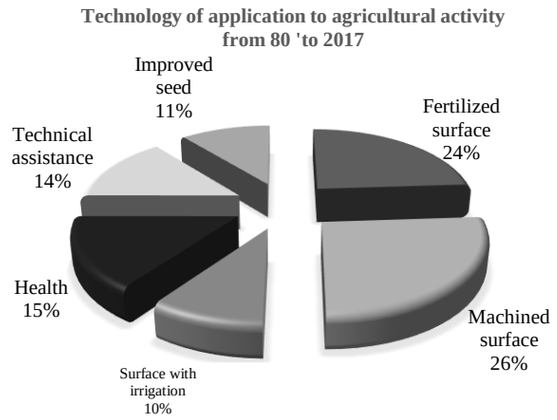
In the case of transportation for inputs and agricultural products for the period from 70 to 80'creció 39% subsequently 80 to 90'se increased 252.6%. that is why it is feasible that these two teams have been a factor of greater growth in agriculture in the country since nowadays they are essential to facilitate the technological changes and the transportation of their products to the markets, which possibly generated more production, but no greater gain, given that agricultural products to date have no added value that generate an excellent profit for producers

Machinery and equipment (technology)				
Year	Number of Tractors	Growth rate	Number of Trucks	Growth rate
70	54,537		40,411	
80	91,354	67.5	56,204	39.08
90	317,312	47.34	198,206	252.65

Table 5 Inventory of machinery and equipment from period 70 - 90
From INEGI. Mexico in the twentieth century and statistical panaorama. Economic Transformation

Table 4 includes a livestock inventory of the three main livestock activities in Mexico: cattle, pigs and poultry. There are other species that were not included because they are not representative at a National level, only at a Regional level. In the case of bovines, its growth rate for the period 70-80 'increased by 29% and from 80-90 it grew by 4.68%, after this period, in some regions of the country this species increased significantly in the case of milk production, mainly in the region of the high lagoon of Jalisco and Queretaro. In the case of the porcine species, its growth rate for the period of 70 - 80'se increased its inventory by 58% and for the next period from 80 to 90'crecimiento in smaller magnitude that was only 11.8%.

Regarding poultry was the one that had a growth rate of greater magnitude, since for the periods of 70 to 80'se increased by 95.2% and in the period from 80 to 90'se raised 206.5%, ie , in this period a growth of intensive consumption of chicken begins due to its characteristics of being a product more fierce than red meats, more economical and faster to reproduce.



Graphic 1
Own elaboration from the statistics of the period from 1980 to 2017 of the SIAP. The SIAP, in one of its pages developed a summary regarding the technology of the period and the data that are counted here, the graph was developed on the basic technology of agricultural production and the significant data, it is considered that the fertilized surface , health and technical assistance, represents a little more than 53% considering that a package covers all the previous ones, which indicates that 50% of achieving complete coverage of basic technology is being achieved.

Cattle raising						
Year	Cattle	Growth rate	Pigs	Growth rate	Poultry	Growth rate
70	17'668,265		5'988,348		57'667,636	
80	22'798,003	29	9'461,952	58	112'611,888	95.27
90	23'865,899	4.6	10'581,242	11.8	232'560,043	106.51
2000	25’080,011*	5.08	13’444,849	27.06	464’441,152*	99
2010	30’267,511	20.68	15’448,859	14.9	506’255,626	9
2017	31’771,738	4.96	18’157,305	17.5	556’128,022	9.8

*Estimated

Table 6 Livestock inventory of the most significant species (cattle, pigs and poultry) of the period 70 - 90'
From INEGI. Mexico in the twentieth century and statistical panaorama. Economic Transformation.SIAP 2017

In table 6, the species included here are the most significant percentage for their consumption, of these approximately 90% of the meat consumed. In the period from 70 to 90 their Growth Rate on average was 17% and for the period from 90 to 2017 their average was about 10%.

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In the case of cattle tending to grow permanently, agriculture that had negative growth rates was not equal and only in the 1980s had a 29% Growth Rate and had another significant period in 2010 with an increase in 20.68% and this species on average had a growth of .80% in total of the 47 years and it is in the period from 90 to 2017 that the consumption of this species grew to 1.13% against the 38% that grew from the 70's at 90 '. As for the swine population this species, had two significant periods of growth in terms of its inventory ie; it grew by 58% and the other important period was in the year 2000 it was 27.06% and in the rest of the years it was 11.8 to 17.5%, for the case of the first period, its average growth was 3.39% and for the period from 90 to 2017 was 2.20% and its average growth rate was 2.84%, that is, its population grew 3.5 times more than the cattle population, possibly because it was more economical and its backyard production.

In the case of poultry, this species in the 80's, 90's and 2000 grew on average 100% and from 2010 to 2017 its average growth was 9.4%, that is, until the 80's, in Mexico consumed 9 to 10 kg of per capita annual consumption and today consumption is 30 kg per capita. Possibly because of the price of the product, because it is healthier and easier to cook, it also has an average growth of 7.22% of the school years.

The most common products and livestock that were handled in those periods are observed in the previous tables, but it would be important to include other horticultural and fruit products that also require a greater amount of equipment and machinery for their production and that have more objective and allow to make a more objective analysis of extensionism in Mexico and separate them by products to see if the programs that were generated in that period were profitable, as well as their investment and specifically develop an evaluation on the use and management of agricultural credit since a significant amount of this credit he went completely lost.In the period of 1970, a large number of service providers were hired in extension and this went to areas where the impact could be greater to other regions where technology, machinery and irrigation were already used so that these comparisons could yield results in investment, production and growth.

In addition to including a single statistical source of information such as INEGI, who has a better record to develop information. Reviewing the different extension programs, an assessment system and comparison parameters were not included, which in some way influences the results that did grow but could not be compared and possibly because the research focused on fertilization and utilization. of some agricultural products to combat pests, likewise other research variables were missing such as soil pH, improved seeds, agricultural practices, moisture conservation system among others.

Discussion

With the purpose of making an analysis of the results obtained from dissemination or extensionism in Mexico, it is possible that strong impacts on production will not be found, for which reason it was necessary to apply questionnaires to 23 rural producers from different communities of Jalisco, some are small landowners and other ejidatarios, the assistance was in mass or group form through the demonstration plots, the disclosure was provided by the state through different programs or institutions. Regarding the current technical assistance, it is offered in a particular way by the companies and in specific cases the producer pays for the technical advice, and there is little governmental participation in the agricultural activity. The most outstanding results will be listed in terms of the qualitative part:

– Of the total survey of 23 producers, 35 percent were small landowners and 65% ejidatarios.

– In the case of the question: if your product has an added value? The answer was that only 39% had it and 61% of its product is sold directly without any process, it is worth mentioning that the value-added activity was not previously developed.

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– In terms of disclosure, only nine percent say they have technical assistance from the government and 93 percent are private companies or commercial houses that are providing technical assistance, and some even say that they propose other crops than traditional ones such as red fruits or some other product (such as vegetables) as long as you have water, and are for export, highly profitable when formerly they were basic or traditional crops.

– As for agricultural credit for their crops, 61 percent said they had or had credit, and 39 percent said they did not have this economic resource. Those that were generally granted were for agricultural inputs.

– One of the questions that was asked is: If I had the conditions to leave or remain in the agricultural activity ?, the answer of the producers was: This question in period of 70 to 90, 60 percent would like to stay because there were some supports , and the other 40% looked for other expectations; Currently 57 percent of respondents would like to abandon agricultural activity, and 43 percent would continue because they do not know how to do anything else and would expect more government support or encouragement to improve their economic conditions.

– In the agricultural activity, 39 percent have irrigated crops or milk production and 61 percent are seasonal crops, mainly corn, previously were basic crops such as beans and corn.

– It is worth mentioning that in the state of Jalisco there is currently a significant amount of hectares of protected crops and irrigation such as red fruits, red pepper and tomato among others, as well as avocado and lemon orchards which have technical assistance and credits from the initiative. private, being the information difficult to obtain, in terms of volume of production and area, as well as export. That is to say, the state ceased to be operative since the 1990s to provide the dissemination and extension of the technologies that are now applied. This has caused that the prices of many products are elevated in great proportion, product of the costs of the technology for its production.

– It is important to point out that the state granted technical assistance to the producers, there were important impacts on production, mainly on livestock activity, and to a lesser extent on agricultural activity. It will be necessary for the State to generate the technologies and disseminate them through technical assistance programs, since, in the agricultural activity, there are still conditions of extreme poverty in this sector since it is difficult for producers to pay for technical assistance and technology. It was detected that not all the regions evaluated the technical assistance programs, or this was very general since there are no records. In the case of the Postgraduate College if there was an evaluation system, but only for some regions, mainly in the states of Puebla and Oaxaca.

Conclusions

It is important that the government works with regional technology packages based on agrosystems, and technology dissemination programs at the regional level and where the increase in production and the technical and economic evaluation of the impact on production increases is significant. to your profitability.

The use of technology, requires financing to apply this technology so it is advisable to offer credits at preferential rates and agricultural insurance to prevent natural disasters.

It is necessary to promote other agricultural products that allow to add value to the products, in order to give a longer shelf life to the processed products, this also generates an agroindustrialization and the generation of jobs. In addition, to realize new forms and types of organizations among the producers to define well the areas of production, process and commercialization.

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The extension must cover not only the technical disclosure, but also the most direct marketing channels to the final consumer, avoiding sudden changes in the final prices of the product.

The following observation is made for the two periods analyzed, in the case of the period from 70 'to 90', the disclosure model was through the extension model generated by the government and specifically for regions of extreme poverty, where the fundamental idea was to increase the production of their crops, small infrastructure works and demonstration plots; and it was found in terms of productivity that in this period was better than the period 90 'to 2017, since its yield per unit area was better in the first period and is feasible due to the impact of inputs, agricultural practices and the use of insecticides.

It is from the 80's that another dissemination model is generated, which are the "Temporary Districts", where the country is divided with the objective of increasing production and productivity, both agricultural and livestock, and based on the data obtained, the growth in the two periods have grown less than 1% in the agricultural part, and it is in the livestock sector where the yields are more significant than possibly due to per capita income, fixed employment and consumption habits.

According to the compilation of SIAP and SAGARPA 2011, it is estimated that there are currently 22,000 hectares of protected crops that produce around 3.5 million tons of various products per cycle. With an annual growth of 1,270 hectares per year, which are incorporated into this type of agriculture and four states concentrate the largest area of greenhouse crops which are: Sinaloa, Baja California, State of Mexico and Jalisco, with 65% of National production, and of these 70% corresponds to red tomatoes and other crops such as red pepper, cucumber, eggplant and chili. 60% of production is exported. The surface of protected crops that are around 22,000 hectares has replaced temporary agriculture in some areas, mainly in the aforementioned states.

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Proposal of infrastructure in Baluartes Circuit Avenue, between the San Juan Baluarte and the Santa Rosa Baluarte as a promoter of tourism development and social welfare in Campeche, Mexico

Propuesta de infraestructura en la Avenida Circuito Baluartes, entre el Baluarte San Juan y el Baluarte Santa Rosa como promotora del desarrollo turístico y bienestar social en Campeche, México

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Abstract

The Regulating Plan of Campeche in 1952, constituted one of the first formal projects of rules and regulations for the city, whose principals were based on sustainability and modern urbanism. Through the same, three fundamental points were developed: a) zoning of the areas according to their use, b) regeneration of housing areas and c) structuring of a road communication system. Over time, the historic center of the city and in particular the Circuito Baluartes avenue, have presented a series of constant changes in its road infrastructure due to the increased vehicular and demographic flow of the population that affects the tourist influx in the city that It has the denomination of Cultural Patrimony of the Humanity granted by the UNESCO. Based on the above, the reorganization of the circulation is proposed, through the relocation of pedestrian crossings, the diagnosis of signage and pavement, as well as the construction of a public parking lot that helps to decongest local traffic and allows tourism to access greater ease to the bulwark. To formulate the diagnosis and the subsequent proposal of parking in the road environment, a methodology was developed that considered a detailed inspection of the area under study in a visual manner, accompanied by photographs of existing problems to support the approach, obtaining a more analytical description. In this way, different proposals of the area under study were obtained and analyzed, which allowed choosing the most viable option that would be adapted to the current needs of the area without affecting the existing landscape architecture and adhering to the norms and laws in force..

Urbanization, Planning, Social project, Cultural Heritage

Resumen

El Plan Regulador de Campeche en 1952, constituyó uno de los primeros proyectos formales de reglas y ordenamientos para la ciudad, cuyos principios se basaban en la sustentabilidad y urbanismo moderno. Mediante el mismo, se desarrollaron tres puntos fundamentales: a) zonificación de las áreas según su uso, b) regeneración de zonas habitacionales y c) estructuración de un sistema vial de comunicación. A través del tiempo, el centro histórico de la ciudad y en particular la avenida Circuito Baluartes, han presentado una serie de cambios constantes en su infraestructura vial debido al incremento del flujo vehicular y demográfico de la población que afecta la afluencia turística en la ciudad que cuenta con la denominación de Patrimonio Cultural de la Humanidad otorgado por la UNESCO. Con base a lo anterior se propone el reordenamiento de la circulación, mediante la reubicación de pasos peatonales, el diagnóstico de la señalización y del pavimento, además de la construcción de un estacionamiento público que coadyuve a descongestionar el tránsito local y permita al turismo acceder con mayor facilidad al baluarte. Para formular el diagnóstico y la posterior propuesta del estacionamiento en el entorno vial, se desarrolló una metodología que consideró una inspección detallada del área en estudio de manera visual, acompañado de fotografías de los problemas existentes para sustentar el planteamiento, obteniendo una descripción más analítica. De esta manera, se obtuvieron y analizaron diferentes opciones para el área en estudio, que permitieron elegir la más viable y que se adecuara a las necesidades actuales de la zona sin afectar la arquitectura del paisaje existente y apegada a las normas y leyes vigentes.

Urbanización, Planeación, Proyecto social, Patrimonio cultural

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Introduction

San Francisco de Campeche is a city located on the shores of the Gulf of Mexico, being famous for being one of the few walled cities of America that still preserve its fortified historical heritage that surrounds the Historic Center, it is formed by a hexagon with eight bastions originally united by wall canvases.

In its natural evolution, the city has modernized, an example of this is that during the state governorship from 1943 to 1949, public policies were generated that had the objective of expanding the city geographically, by filling land reclaimed from the sea, where a new, different city would be developed, with modern buildings according to the architectural image of the city.

The sixth government report of the period mentioned above, mentioned that "the new Campeche, so controversial, is there, with its buildings, facing the sea, which encourages new projections and open doors for progress" (El Expreso de Campeche, 20 July 2014), with this, came the transformation of the municipality of Campeche, building new roads and paving roads, which significantly improved communication between different areas of the city.

When the construction of road infrastructure was carried out, it began to implement systems and lines of electric power, telephone and telegraph, potable water and sewerage.

The proposals of the Regulatory Plan were based on a mixture of trends of development and growth of the city, (Novedades de Campeche, 2006), which in turn were divided into three:

- Circulation Areas. They formed a network that communicated the city with the new residential areas, due to this and its dimensions the road implementation of the "Herrey System" of continuous circulation was proposed, which gave life to the Baluartes Circuit, surrounding the city center, which resolved the connection between the historical center and its adjacent areas, allowing to delimit and isolate the center of the rest of the city.
- Work areas. It includes the areas of growth both on the mainland and on land reclaimed from the sea, these areas of work are divided into zones, which are: commercial, farm and industrial; all the zones would be communicated by means of the railroad and highway, which helped to classify the roads and therefore the first roadway was constructed to divert the heavy traffic of the city.

Areas to inhabit. This type consisted of each household having basic services.

With the above, it was possible to implement the "New Campeche", which would be the social and economic future for the state of Campeche opening the way to sustainability (Castellanos and Novelo, 2002).

In 2003, Circuito Baluartes avenue presented another appearance, which gave it a touch of modernity, with a fairly wide central ridge, reduced sidewalks and returns on the avenue that could cause sporadic vehicular traffic accidents, however, with the reconstruction of a part of the wall and the construction of the Mega drainage in the whole stretch, included from the Baluarte de Santa Rosa to the Baluarte de San Juan, in 2014 the complementary works of this artery began. A new line was formed where the central ridge disappeared to give life to a new road next to the wall that would become a green area and where the Shooting Range was housed, it should be noted that it was on the side of the Baluarte de San Juan; the installation of street lighting, signage, pedestrian crossings, wider sidewalks and ridges were modernized, as well as the change and creation of some roads, having as objective the mobility of both vehicle traffic and pedestrians throughout the Baluartes Circuit where for a while, urban transport no longer circulated.

From 2003 to 2017 this section of the circuit has not presented any modification, as it was delivered the work, in 2014, except that public transport returned to resume its routes along this avenue and is currently implemented the change of colors in the fringes of the sidewalk, which comprises from the Campeche Arena, where drivers can no longer park, which exacerbated the few parking spaces that exist in the first square of the city.

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Historical background

The city of San Francisco de Campeche is located in the south of the Gulf of Mexico, for many years it was attacked and plundered by invaders since it was rich in different varieties of products (Trujillo, 2009), in addition to being strategically located, which it was recognized as the main port of the peninsula for more than three centuries (Piña, 1987).

Because of the continuous attacks of the pirates, the governor Francisco de Bazán, recommended in 1658, the coastal wall of Campeche to the King of Spain. Peraza, (2000) mentions that Francisco Bazán makes the first uprising of the town, noting the most important buildings and fortifications, including the neighborhoods of San Francisco, Santa Ana and San Román, locating the Plaza Mayor in the center of the complex. In 1662, the Governor Campero made a call to the King of Spain to remind him of the need to improve and strengthen the fortifications. However, it is not until a year later, in 1663, when the Governor Juan Francisco de Esquivel poses a method to distribute the buildings in an organized way and thus be able to save space to regulate the growth of the town, with the sole purpose of unifying it in a smaller space (Figure 1), (Peraza, 2000, p.103)

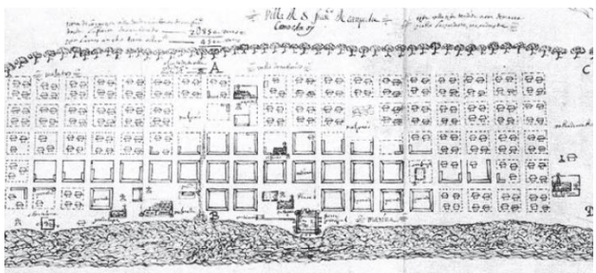

Figure 1 Plan of Campeche ordered by the governor Francisco de Esquivel in 1663, made in the second evolutionary period.
Source: Morales, F. (2004). Campeche, fortified historic center World Heritage of Mexico

In 1680, Don Antonio de Layseca y Alvarado, governor of the province, sent the proposal to wall the town of Martín de la Torre (Figure 2). His proposal was to build a wall with eight medium bastions, separated by the distance of a musket shot between each one, adapting in this way to the human resources that were counted for the defense. The proposal was accepted by the Crown, but due to lack of money and the death of the captain, the work was not carried out.

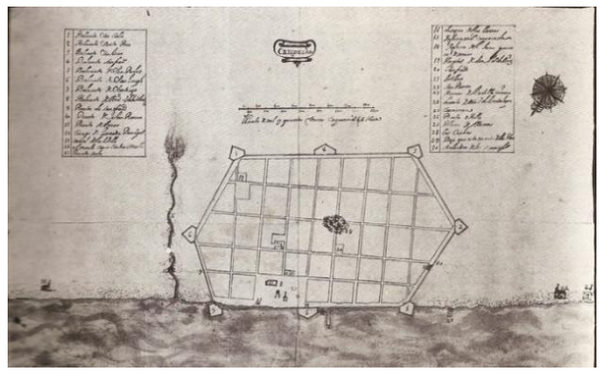

Figure 2 Final project for the walling of the village, by Jaime Franck in 1680
Source: Antochiw (2007). The first fortifications of the Villa and Port of San Francisco de Campeche

The Villa, he told himself, would be safe to wall it; it would avoid infinity of expenses and anxieties to the province; it would benefit the whole country, because this port was an important refuge for the boats in need of repair and for being there the best shipyard in America; would have a positive effect on the increase in the collection of real rights, since it would protect trade that would return to its past of splendor.

Layseca's proposal on Martin de la Torre's plan was approved by the Board of War of the Council of the Indies, after listening to the considerations of the Marquis de la Granja and Enrique Enríquez advisers, that the work was completed in two years projected by the engineer.

However, the works were carried out with great slowness (...) (Álvarez, 2015, pp. 51-52), it was decided to wall in January 1686 the Villa, with a defensive system comprised of an irregular polygon of eight sides, with a bastion in each vertex and four doors that communicated with the outside, for then, the project of the walls was in charge of sergeant major Pedro Osorio de Cervantes. (Pacheco, 2008, page 38), In the year 1704, the last Baluarte, the Baluarte de Santiago, was finished, the polygon being completely closed (Secretariat of Culture of the State of Campeche, 2017).

The walled city has the following bastions:

- **Baluarte de San Carlos.** It is the first bulwark of the fortification system, it is located on 8th Street, next to the current Chamber of Deputies in the Historic Center.

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- **Baluarte de Santa Rosa.** Built at the end of the 18th century, it was the first of the 8 bastions to be completed for protection against pirate attacks.

  It is located on the Baluartes Circuit at 14th Street in the Historic Center and owes its name to the dedication of the first sanctified American: Rosa de Lima, whose cult was widespread among the Creoles of the Colony during the seventeenth century.

- **Baluarte de San Juan**. Built in the year of 1698 as the defensive system of the Puerta de Tierra, it is located on the Baluartes Circuit on 65th Street, the Historical Center.

- **Baluarte de San Francisco**. Built at the end of the seventeenth century, between the years 1686 and 1690, this Baluarte guarded the Puerta de Tierra on its left side and joins said Puerta, it is located in the Baluartes Circuit on 57th Street, in the Historic Center.

- **Baluarte de San Pedro**. It was the sixth Baluarte to be built at the end of the 17th century, it is located on Avenida Circuito Baluartes on Avenida Gobernadores.

- **Baluarte de Santiago**. It was demolished and partially rebuilt, its reconstruction took place in the 50s of the twentieth century, was similar to that of San Carlos, nowadays it has the function of being a botanical garden that receives the name of Xmuch -haltún, it is located on Avenida Circuito Baluartes on Calle 8 of the Historic Center.

- **Baluarte de Nuestra Señora de la Soledad**. It was built in the year of 1690, connected with the Puerta de Mar and the Baluarte de Santiago, located in the Historic Center, between 8th Street and 57th Street.

- **Baluarte de San José**. It is the eighth bulwark and received this name in honor of the husband of the virgin and father terrain of Christ, the demolition of it was made in the first decades of the twentieth century.

  Currently the space is occupied by Justo Sierra Méndez primary school. Was one of the two dismantled bastions, for the apparent progress of the city of San Francisco de Campeche. It was at an approximate distance of 277 meters from the Baluarte de San Pedro.

The Baluarte de Santa Rosa has as a special feature access through a courtyard at street level. It is around 227 meters. of the bastion of San Carlos, occupying an area of 1,157.45 square meters with 31.54 meters. in its fronts and 15.35 meters. on its flanks. In 1766 it had 11 iron cannons of different calibers. As quarters had the body of the guard, another more built in the eighteenth century under the ramp and two vaults for gunpowder and ammunition that surrounded the courtyard with its cistern. By 1690, there were the bastions of San Carlos, San Juan, San Francisco, San Pedro, San Jose, La Soledad, Santiago and Santa Rosa. Shortly thereafter, in 1704, the eight bastions with their respective were seven curtains had already completed three to four feet high (Figure 3). However, there were not any steps, parapets, or sentry boxes in the bastions. (Peraza, 2000, pp. 103-104)

Figure 3 Sketch of the walled area of Campeche towards the year 1705
Source: Recovered from https://unmundoporrecorrer.wordpress.com/2014/04/11/campeche-y-uxmal-research-of-an-pasado

When the importance of the walled city ceased to exist, as piracy on the high seas declined with the passage of time, at the beginning and during the 20th century (Figure 4), the demolition tasks of some of the walls' canvases began. and of some bastions for various purposes, all in favor of "modernity" then in force.

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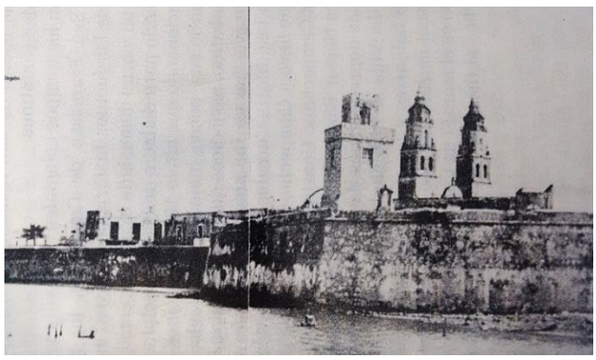

Figure 4 View of San Francisco de Campeche, the sea reached the edge of the belt of walls that separated it from the sea
Source: Piña, R. (1987). Campeche during the colonial period

The San Francisco, ran with the fortune of only being divided into two sectors to make way for the tram that at that time was used as a means of transport and was not destroyed in its entirety, as those of Santiago and San José el Bajo. For the years 1910 and 1915 Mr. Salvador Dondé, owner of the tram, asked the City Council, the demolition of the canvases of walls that comprise the Bastion of Santa Rosa to the Bastion of San Juan (Viadal, 2008).

The surroundings of the historic center are formed by a fortified system that acquired the shape of an irregular hexagon with eight bastions, joined by canvases of walls of 6 meters high by 2.50 meters wide, various monuments housed in roundabouts, streets with a length of 7.00 meters wide, sidewalks of 2.00 meters wide, underground electrical and telephone installations, this not to affect the urban landscape of the historic center, as well as the traditional dwellings with Spanish colonial architecture that are part of the first picture of the city, which they make the perfect set to catalog it as a historical heritage (Gutiérrez y Rivero, 2015). Only in this municipality is 1.81 km², decreed as an area of historical monuments, on November 24, 1986, later in December 1999 it was declared a World Heritage Site by the United Nations Educational Organization, Science and Culture, UNESCO (López, 2004).

Macro and micro location

Circuito Baluartes Avenue is located southwest of Mexico, in the State of Campeche (Figure 5); It is located in the southwest of the Yucatan Peninsula, southeast of the Mexican Republic.

It limits to the north with the state of Yucatan, to the south with the state of Tabasco and the Republic of Guatemala, to the east with the state of Quintana Roo and Belize, and to the west with the Bay of Campeche in the Gulf of Mexico. It has a total area of 56,858.84 km^2 (INEGI, 2016), which is equivalent to approximately 2.9% of the national territory. Politically the state of Campeche is currently divided into thirteen municipalities: Calkiní, Calakmul, Campeche, Candelaria, Dzitbalché, Escárcega, Hecelchakán, Tenabo, Hopelchén, Champoton, Carmen, Palizada and Seybaplaya.

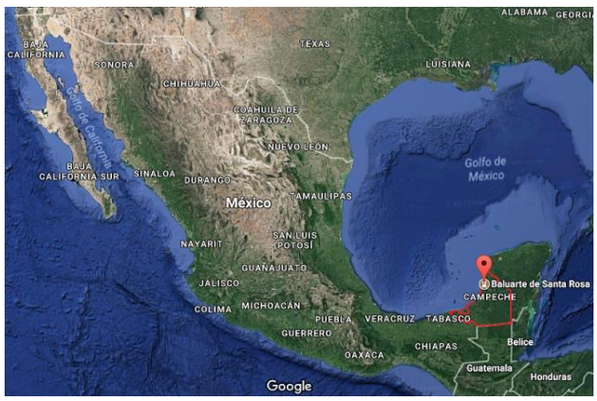

Figure 5 Macro location of the Santa Rosa Bastion
Source: Google Maps (2017). Satelital image

Within the State, Circuito Baluartes avenue is located in the municipality that bears the name Campeche and that in maya means: Place of snakes and ticks; comes from the Maya Kim = snake, Pech = tick. This is one of the thirteen municipalities of the State of Campeche; its municipal head is called Campeche and San Francisco de Campeche, it is the capital of the same state. It has a total area of 3,410.6 km^2, equivalent to 6% of the total territory of the state of Campeche.

This limits to the North with the municipality of Tenabo; to the East and Southwest with Hopelchén; to the south with Seybaplaya and Champoton and to the west with the Gulf of Mexico. (Gio, 1996, p.15) (Figure 6).

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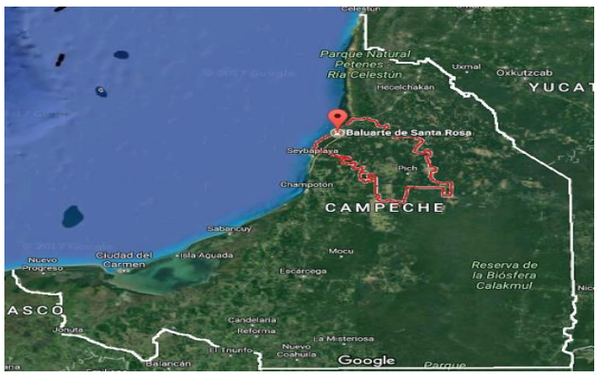

Figure 6 Micro location of the Santa Rosa Bastion
Source: Google Maps (2017). Satelital image

With a population of 220,389 inhabitants according to the 2010 Population and Housing Census (INEGI, 2010), it is the most populated city in the state.

Geographically San Francisco de Campeche is located between parallels 19º51'00 "of north latitude and between meridians 90º31'59" of west longitude. It is located to the Northwest to 387 kms of the City of Villahermosa; 177 km southwest of Mérida and southeast 1,127 km from Mexico City. The city has a maximum altitude of 100 meters. above sea level.

The study area includes the Baluartes Circuit Av., Starting from the Baluarte de Santa Rosa and ending at the Baluarte de San Juan with the junction to Av. Adolfo López Mateos and 67th Street in the city center. The streets surrounding this artery are: Talamantes street in the neighborhood of San Román, the street Pedro Moreno del Barrio mentioned above, the street 14 or Moctezuma, as well as the street 67 both belonging to the Colonia Centro. The stretch has a total extension of 10,302.37 ml, with a total width of 45.00 ml, (Figure 7).

Figure 7 Current status of Baluartes Circuit Av., Baluarte de San Juan section - Baluarte de Santa Rosa, as of 09/20/2017
Source: Google Earth (2017)

Description of the problem

The Historic Centers are living settlements, spaces with the opportunity to grow, the development of these, totally changes the way of life of the individuals that inhabit the place and of those who travel daily through its streets, that is, the elements that make up the image urban, such as: streets, sidewalks, parks, houses, green areas, etc.

Currently, the Historic Center faces the problem of road congestion, both in its streets and its main avenues and an urban transport system that has not been modernized according to population growth.

Such is the case of av. Circuit Baluartes, in the stretch Baluarte de San Juan - Baluarte de Santa Rosa and vice versa, located in the city of San Francisco de Campeche, where pathologies that have been increasing over time, affecting motorists and pedestrians that daily are forced to transit through this area, coupled with this problem, is the difficult access to the Bastion of Santa Rosa and which affects domestic and foreign tourism as they cannot enter the walled area easily, this is due to the influx of existing vehicles and the lack of safety measures that help the pedestrian and motorists to interact without being affected, that is to say that there is a system of comfort between both.

Over time, the urban sprawl of the city has been increasing, leading to the construction of new avenues, streets and parking spaces, such as the streets 67 and Talamantes that are in the vicinity of the Baluarte. The increase of the population and the vehicular park brings as a consequence problem of: traffic congestion, pollution, lack of parking, inoperative road systems, the construction of new roads, among others, that can be perceived at present. The current deterioration in the infrastructure of urban pavements presents four important aspects, such as: the loss of service capacity, the economic effects of deferring maintenance, operating costs derived from the current state and the action of heavy vehicles (Ferro, 2008).

Problems derived from roads are more evident in the so-called heritage cities because they were never foreseen for automobiles (Ferro, 2008), which is aggravated by the growth of the population.

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The aforementioned leads to plan a road reordering of the area that is adapted to current needs, since the current road infrastructure does not fulfill the necessary functions: pedestrian crossings are poorly located so they are inoperative for pedestrians, the returns that are around the Baluarte de Santa Rosa cause problems of road congestion, pollution, lack of parking, roads and inoperative road systems; Among the main affectations are: narrow streets in the first square of the city, road signs are inadequate and insufficient, poorly located pedestrian passages, central ridges of different types not uniform to the urban image of the site, ignorance of poisonous vegetation planted, inefficient lighting, insufficient placement of ramps for the disabled, among others coupled with this, is the current deterioration that the pavement infrastructure presents, having loss of the service capacity with which it must comply, for which there must be an urban mobility that facilitates the daily life of all passers-by. the problem is derived from the lack of promotion by the competent authority since there is no whereabouts or parking in which they can descend and access the Baluarte, coupled with this we can mention the difficult access to the site, because it is not counted with an adequate road system where it does not endanger the integrity of the people who visit it.

In the last decades, different adaptations were made in the Baluarte de Santa Rosa - Baluarte de San Juan section, where, for example, the closure of 14th Street before Moctezuma intersected the Av. Circuito Baluartes, it was a parking place and served to descend and access the Baluarte de Santa Rosa with great security, however, this altered the traffic in the area to stop being useful space, so they decided to close the road space.

Justification

The roads in heritage cities are similar to those of any contemporary city: problems of traffic congestion, pollution, lack of parking, roads and inoperative road systems, among other things; from which the fact that the appearance of the automobile transformed the cities is confirmed. The problems arising from the road, are exacerbated or become more evident in the so-called heritage cities because they were never foreseen for automobiles. (Ferro, 2008).

The west sector of the municipality of Campeche presents human settlements regulated by the supply and demand of urban growth, also concentrates commercial, educational, bureaucratic activity and the most important urban equipment.

Here is the Walled Enclosure, recognized today by UNESCO as a Cultural Heritage of Humanity. (IET, 2016). Narrow streets in the first square of the city, existing roads with inadequate signage and that adapt to the type of road; pedestrian steps poorly located with problems to cross by the pedestrian; central ridge of different types, (which affect the uniformity and urban image of the site) and part of the existing vegetation are a danger to the general population since some are poisonous which can cause health problems.

Regarding lighting is a vital factor, since an area of historical monuments must have quality lighting allowing a better image at night, in the case of the walled wall it is deteriorated; the placement of ramps for the disabled is an important issue and even more so in a tourist area such as the center of the city, these are essential for the person who needs to ascend or descend from the sidewalk, and those near the Bastions do not have a ramp that allows adequate mobility.

In recent years in the city of Campeche the different strategies aimed at the rescue and conservation of the Historical Heritage have been noted and have resulted in the visit of a large number of tourists from different countries and who want to know the cultural and architectural wealth of state.

The need to carry out this project arises over time and to the demand of society since the areas surrounding the Santa Rosa Bastion have undergone significant changes, and require modernization and maintenance of its infrastructure and urban equipment, for which, it is intended to thoroughly analyze its road infrastructure, in order to have a detailed diagnosis and in the future implement actions to meet current needs, without losing the original touch of the urban image.

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This project aims to offer a tool to government institutions and interest groups (schools, chambers, private initiative), which require executing a physical intervention with a proposal that allows them to establish dissemination strategies to the spaces that the State has to visit, adhering to the corresponding norms and laws.

Theoretical framework

In recent years, the Historic Center of the city of Campeche has undergone various changes in its urban image, especially in the section of the Baluarte de Santa Rosa to the Baluarte de San Juan; currently the roads of the av. Circuit Baluartes have paved asphalt (flexible pavement), except for the interior of the Historic Center, which uses hydraulic concrete (rigid pavement); also in different points of the study area, it can be observed that there are different models of central ridging, which affects the uniformity of the urban landscape of the site; the road signs that exist in the section are: preventive, restrictive, and tourist and service which impart information, necessary, to users who transit through the area.

Over the years, the demographic increase of the population and the arrival of tourists have been increasing, causing the placement of pedestrian crossings, allowing crossing safely the street and where the pedestrian has the right of way.

The green areas have also evolved in recent years, have been planted different types of trees and ornamental plants, such as bougainvillea, royal palm, areca palm among others, further extending the vegetation. Torres, Ramírez and Garzón (2014) assure that it is one of the aspects least treated in the landscape studies of the city and its implications in the construction of the urban heritage image, especially its historical centers, is the pavement:

Public roads are important, as they allow access to significant places; so, they are a variable that conditions a prominent part of the public space, which helps to set the functions and the urban image of a city. The pavement influences the urban image of the historic cities, since they are part of its heritage value and are capable of renewing the cultural image of the city.

According to Curiel (2008) the road and transport reorganization consists in the extension of sidewalks, a non-polluting transport system (trams and bicycles) within a Historic Center, multimodal stops in the periphery of the Center, regulation of concessions, routes and schedules of the operation of the pedicabs, strict application and revision of the Traffic Regulations referring to loading and unloading.

As well as prohibition of parking on the streets, adaptation of sidewalks to facilitate the transit of people with special needs:

Having an adequate road reordering in World Heritage areas is of vital importance, since pedestrians and people with different disabilities can travel without so much risk in these areas.

The road reordering is combined with the type of building that is around, improving the urban image, but without losing its original context. Cerezo (2012) affirms:

An important element and starting point for the realization of the project, is the type of order to be adopted for transit: the road network, with all the aspects related to it, sidewalks, parking lots, etc., in conjunction with the buildings. In order to achieve an adequate order of the road network it is necessary to be informed of the hierarchy of the roads, and the capacity of the same. (p.18).

The rehabilitation process must seek a balance between conserving heritage without musealizing (sic) the city, inducing its abandonment, and providing its resident population with opportunities to improve their conditions and quality of life and contribute to their development. (p.321). Serna (2016) affirms:

The rehabilitation of historic centers today is important, since part of the history of a city is preserved, intervening in the pathologies found, improving their conditions and adapting to the current urban landscape which is developing historic centers (Petzet and Ziesemer, 2004).

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Methodology

Due to the high demand in recent years for better roads, as a consequence of the growing vehicle fleet in the city, the historic center is of vital importance as the main thoroughfare for both citizens and tourists.

Regarding the study of the roads surrounding the Santa Rosa bastion, a diagnosis was made mainly in the area identified as the Baluartes Circuit, since this Monument is located on this road.

As well as the influx of the streets 14, 12, 16 and Av. Adolfo López Mateos (Figure 8).

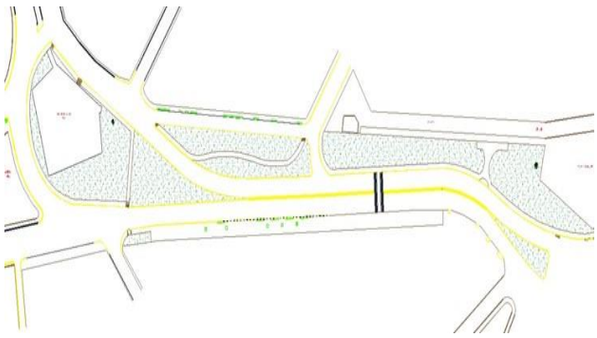

Figure 8 *Current study section of the area*
Source: Own elaboration (2018)

This project considers the road diagnosis of the Baluartes Circuit, and for this the following studies were carried out:

1. Geometric survey Secretariat of Communications and Transportation (SCT). (2016). Highway Geometric Project Manual.
2. Vehicle gauging
3. Survey of road infrastructure
4. Speed study.

1 Hypotheses raised

Central hypothesis

With a road reordering that adapts to traffic, visits would increase significantly and safely without altering the current traffic of vehicles.

Secondary hypotheses

1. Roads operating at a Service Level between A and B, characterized by a free and fluid circulation with stability at high speed, 10 years ago, now operate at levels between C and D or E that varies in range of a stable circulation, unstable and forced respectively, in hours of maximum demand (EIT, 2016).
2. The deterioration that can currently be felt in the infrastructure of urban pavements, presents four important aspects, such as: the loss of service capacity of the pavements, the economic effects of deferring maintenance, operating costs derived from the state of the pavements, and the action of heavy vehicles (Ferro, 2008).
3. The great road problems in the heritage cities, is due to the fact that they did not foresee the natural growth of the population, which resulted in the saturation of the spaces of community benefit, exceeding the levels of vehicular operability in a sustainable and sustainable way..

Results

1 Geometric survey

The Geometric Survey refers to the horizontal geometry of the roadways that make up the area in which the Santa Rosa Bastion is located. For this, satellite photography was used, as well as the manual survey of the area under study. With this, a scale map was finally developed that serves as the basis for the subsequent studies that will lead to improvement proposals (Figure 9).

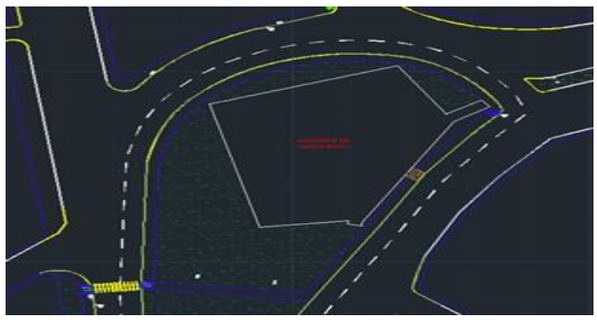

Figure 9 Current geometry of the parking area that intends to intervene
Source: Own elaboration (2018)

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2 Vehicle gauges

Vehicle gauges allow accounting and classifying the vehicles that transit the roads. To do this, the methodology established by the Ministry of Communications and Transportation (SCT, 2016) was used through the manual for the realization of vehicle gauging, formulated by the Mexican Institute of Transportation. For the study, a manual capacity was developed, which consists of the accounting and visual classification by the personnel trained for this purpose.

For the elaboration of the vehicular gauges, it was decided to place three gauging stations Balán, (2015):

1. Av. Adolfo López Mateos with Circuito Baluartes.

2. Calle 10-B junction with Circuito Baluartes.

3. Av. Circuito Baluartes in front of the Santa Rosa Bastion.

To carry out the study, the vehicle classification that will be applied in the counts as shown in Table 1 was previously defined:

Vehicle type	Description
A	Automobiles, Van, PickUp, Vans
B	Minibuses, School bus, Staff, Foreign
C1	2 and 3 axle cargo trucks, Turn over
C2	Tractor trucks (tractor with one or two trailers)
D	Motorcycles, bicycles and tricycles

Table 1 Vehicle Classification for the Capacity
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

Due to the increase in road infrastructure, it was also necessary to analyze the flow in the roundabouts that surround the first square, since it is necessary to know how busy they are at different times of the day (Transportation Research Board, Highway Capacity Manual, 2000). The present work is based on a quantitative and qualitative investigation of the vehicle fleet that circled the roundabout "Adolfo López Mateos" taking place on November 30, 2018, from 9:00 am to 10:00:00 am; 11:00 am-12:00pm; and from 6:00 pm to 7:00 pm (Table 2 and Figure 10).

Vehicle type	Type A	Type B	Type C1	Type C2	Type D
TOTAL	4582	389	51	5	721

Table 2 Data obtained in Station 4.
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

Figure 10 Current photograph of the proposed parking area
Source: Own elaboration (2018)

Stations 1, 2, 3, and 4 were established to carry out this methodology, which were in strategic places and with ample visibility, which allowed a correct observation of the area, always taking into account the necessary safety equipment.

The quick counting of vehicles was done in blocks of 5 in 5, with 4 vertical lines and a diagonal, this facilitated the final count. Next, the satellite image of the location of the stations is shown, (Figure 11):

Figure 11 Location of the stations on the Adolfo López Mateos roundabout, whose coordinates were: station 1 (19.840116, -90.537880); station 2 (19.840044, -90.538202); station 3 (19,839626, -90,538,204); station 4 (19.839821, -90.537735). Google
Source: Google Earth

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The vehicle with the highest frequency in the gauging results in the four stations was type "A" with a total flow of 3,367, secondly type "D" with a vehicular flow of 702 and third type "B" With a total flow of 413 see (Table 3 and Figure 12), it is observed that there is very little frequency of vehicles type C1 and C2 given that it is an area where it is difficult for the heavy vehicle to drive through the road and would represent a problem of circulation for the other units.

Vehicle Types	A	B	C1	C2	D
Station 1	112	139	5	0	273
Station 2	175	47	3	1	27
Station 3	1119	93	9	1	234
Station 4	961	134	16	0	168
Sums per column	**3367**	**413**	**33**	**2**	**702**

Table 3 Results of the type of vehicle according to traffic on the road
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

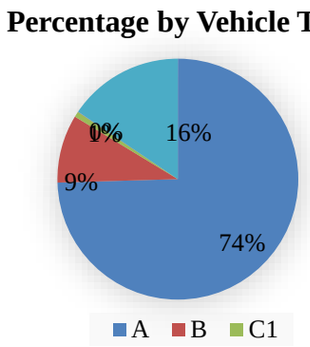

Figure 12 Graph of percentage representation of each segment of the vehicle classification (A, B, C1, C2, D)
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

In the results shown in Table 3, it is observed that the vehicles with the highest frequency are those of type A, D and B, this indicates that the vehicle with the greatest presence in the vehicle flow is the particular compact type, followed by those that they are not necessarily vehicles but they have a recurring presence in the road such as motorcycles and bicycles; finally, type B vehicles (public transport) such as buses and cargo trucks that also transit the area, (Figure 13).

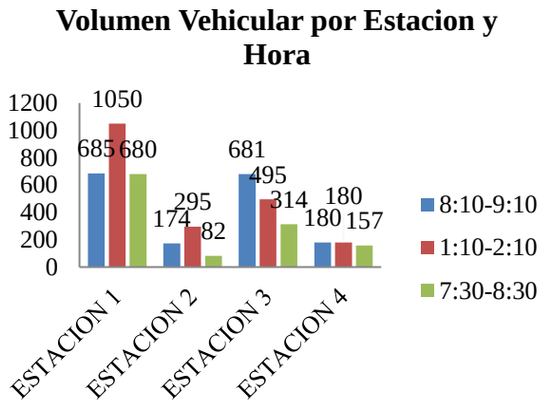

Figure 13 Vehicle volume
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

According to the results obtained; it can be determined that, of the three observation periods, from 12:00 pm to 1:00 pm. there is the greatest vehicular flow in all three directions, with cars and trucks being the vehicles with the most traffic (Table 4).

Hour	Aforo 1	Aforo 2	Aforo 3
8:00 a 9:00	865	326	631
12:00 a 13:00	1088	359	740
18:00 a 19:00	889	288	562

Table 4 Result of vehicular flow by stations
Source: Vehicle Gauging Study Faculty of Engineering of the Autonomous University of Campeche (2018)

With these results it is possible to establish the need to build a public parking lot in the surrounding area of the Circuito Baluartes avenue, a few meters from the Santa Rosa Bastion, (Figure 14).

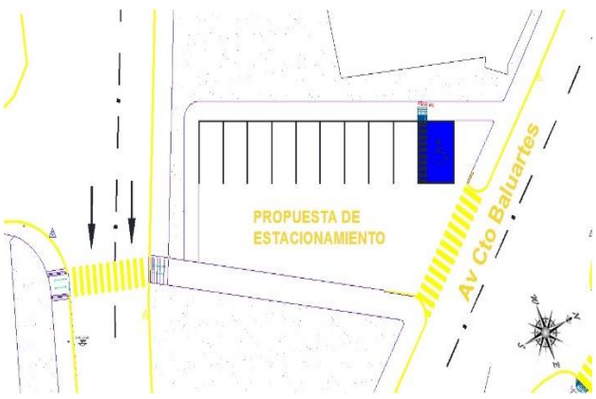

Figure 14 Public parking proposal for the Santa Rosa monument area
Source: Own elaboration (2018)

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The parking consists of 9 drawers for vehicle type (A), since these represent 70% to 80% of vehicles that pass through the Baluartes Circuit area, and a drawer for the disabled, by current regulations.

Conclusions

1. Pedestrian safety is minimal, since there are no well-marked signs that indicate to the driver the decrease in speed or the pedestrian crossing.

2. Mobility for people with disabilities is very limited or almost nil, because there are no adequate ramps, especially for the change of sidewalks.

3. To improve the parking service for tourists or local public, a study is required to create a space that allows to accommodate a truck with tourist ticket, in order to increase visits to the Santa Rosa Bastion....

4. The geometry is not available for the displacement of a truck with tourist passage that can enter 67th Street, because the speed with which it circulates is 30 km / hr. and we have a 70% percentage of light vehicles (type "A")

5. The hour of maximum vehicular flow has a schedule of 13 a.m. to 4 p.m.

6. Both drivers and pedestrians show little road culture.

7. To replace the existing signaling and comply with NOM-SCT-2016, a more detailed study is required.

8. Carry out a study of pedestrian capacity, in order to make the appropriate adjustments for mobility, empowering people with disabilities (example: adequate ramps, widths of bench, etc.).

9. In order to improve the urban image of the place, a thorough study of the placement of the street furniture is required, in order to rid the sidewalks, improve the lighting and the use of the surrounding green areas.

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Annexes

Proposal for parking.

Panoramic view No. 1.

Figure 16 Proposal for parking
Source: Own (2018)

Panoramic view No. 2

Figure 17 Proposal for parking
Source: Own (2018)

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BARRERA-LAO, Francisco, CRUZ-Y-CRUZ, Andrea, PALEMÓN-ARCOS, Leonardo, QUIJANO-GARCÍA, Román and MEDINA-BLUM, Fernando. Proposal of infrastructure in Baluartes Circuit Avenue, between the San Juan Baluarte and the Santa Rosa Baluarte as a promoter of tourism development and social welfare in Campeche, Mexico. Journal of Research and Development. 2019.

Panoramic view No. 3

Figure 18 Proposal for parking
Source: Own (2018)

Panoramic view No. 4

Figure 19 Proposal for parking
Source: Own (2018)

Panoramic view No. 5

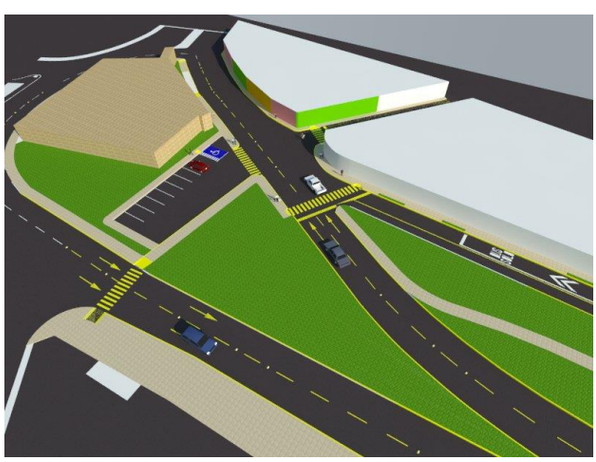

Figure 20 Proposal for parking
Source: Own (2018)

Panoramic view No. 6

Figure 21 Proposal for parking
Source: Own (2018)

Panoramic view No. 7

Figure 22 Proposal for parking
Source: Own (2018)

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Management of digital documents with encrypted signature, through the use of centralized PKI, and distributed using blockchain for a secure exchange

Gestión de documentos digitales con firma encriptada, mediante el uso de PKI centralizado, y distribuido utilizando blockchain para un intercambio seguro

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Abstract

The project explores the use of digital documents as a response to the problems presented by physical documents, since they are at risk of partial or total loss. The solution is the digitalization that plays a very important role in society and the contemporary world. This helps sustainability and the preservation of natural resources. The security of the archives is a necessity that requires as solution to use the technology of public key infrastructure (PKI) to generate a digital document, besides registering the public and private keys of the personnel that has the legal power to sign them. These documents are stored on an official server and distributed among the registered hosts of the network. This certificate will help to detect changes in an unauthorized way, when comparing the document with the original. In this phase of distributed verification, the Blockchain technology will be used. Then the proposal is to build a tool to generate digital documents, in addition to managing public keys, transaction logs and records. The use of Blockchain will allow to establish and configure a Peer to Peer (P2P) network for a secure exchange.

Public Key, Blockchain, Digital document

Resumen

En este proyecto se explora el uso de documentos digitales como respuesta a los problemas que presentan los documentos físicos ya que éstos corren el riesgo de pérdida parcial o total. La solución es la digitalización que juega un papel muy importante en la sociedad y el mundo contemporáneo. Esto debido a que ayuda a la sustentabilidad y a la preservación de los recursos naturales. La seguridad de los archivos es una necesidad que requiere como solución utilizar la tecnología de infraestructura de llave pública (PKI, por sus siglas en inglés) para generar un documento digital, además de registrar las llaves públicas y privadas del personal que tiene el poder legal de firmarlos. Estos documentos se almacenan en un servidor oficial, y se distribuirán entre los hosts registrados de la red. Este certificado ayudará a detectar cambios de forma no autorizada, al compararse el documento con el original. En esta fase de verificación distribuida se utilizará la tecnología de Blockchain. Se propone entonces la construcción de una herramienta que permita generar documentos digitales, además de administrar las llaves públicas, bitácoras de transacciones y registros. El uso de Blockchain permitirá establecer y configurar una red Peer to Peer (P2P) para un intercambio seguro.

Llave pública, Blockchain, Documento digital

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† Researcher contributing first Author.

Introduction

Currently, a large majority of people and companies, usually carry all the documentation in paper records (figure 1). However, this situation involves a lot of time for the attention, maintenance, search and presentation of said documents.

Figure 1 Physical records on paper, stored in a metal drawer
Source: Self made

To solve this problem, the documents collated in PDF files (Portable Document Format) will be kept (Adobe, 2016), through a system that will automatically manage these digitized documents, figure 2.

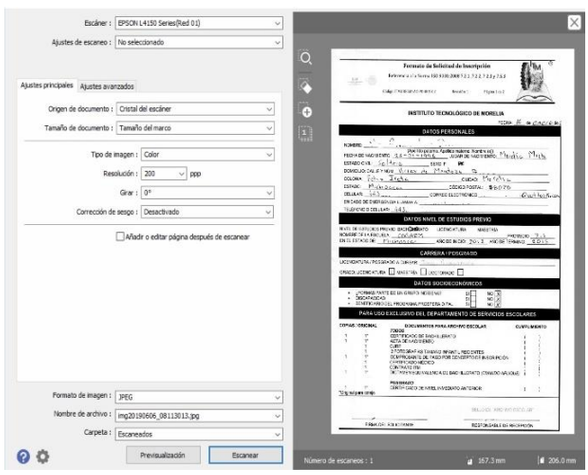

Figure 2 Example of a digitized document, to transform to PDF format
Source: Self made

This format is widely used on the Internet and was released as an open standard in 2008 by the creative company, Adobe Inc. This standard is published in ISO 32000 (2016). This standard is used, since a PDF file can contain text flow (encoded and / or compressed in several ways), images, fonts and various interactive elements, among others.

The management of these PDF files is done through their metadata, see figure 3, which can be stored in an information dictionary or viewed as a metadata flow, (Acrobat, 2016) (Adobe Metadatos, 2018).

Figure 3 Example of a PDF file, with data and metadata
Source: Self made

The problem to be solved is to identify the authenticity of a file in PDF format. To solve it, the system contemplates access to the metadata of the digitized files, for the validation of these, by means of the management of a digital signature (Digital Signature, 2018) (Digital Signature CR, 2018), which will serve to know if a file was altered by people outside the system.

The objectives of the implemented system are to guarantee the creation, modification and elimination of digital files, using digital signatures with the Hash encryption algorithms (Genveta Dev, 2018), see figure 4, SHA256 and RSA, respectively. Users and administrators must be provided with authenticity, reliability and integrity records.

The purpose of the mechanism proposed in this article is to take the appropriate measures to create and capture the digital files that meet the activity evidence requirements, see figure 5.

This is achieved by implementing watermarks per file for each user and system administrator.

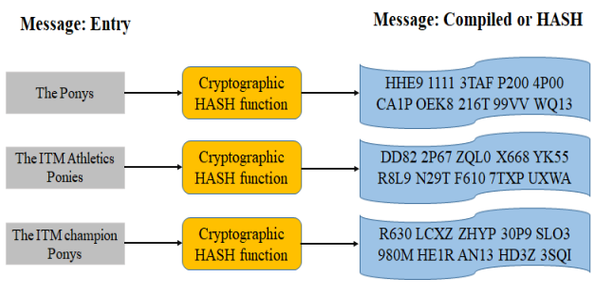

Figure 4 Example of operation of the Hash algorithm
Source: Self made

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Background

The concept of digital signature began its history in 1976, with the creators of computer cryptography Diffie-Hellman. Basically, the digital signature consists of a set of data associated with a message, which ensures the identity of the signer. In that year they presented their message authentication algorithm, which allows the protection of information. This algorithm uses symmetric keys for session encryption, so it is currently vulnerable. Subsequently, in 1978, the RSA algorithm emerged, which is the safest at present, since it uses the protocol known as asymmetric cryptography (Stallings W., 2005).

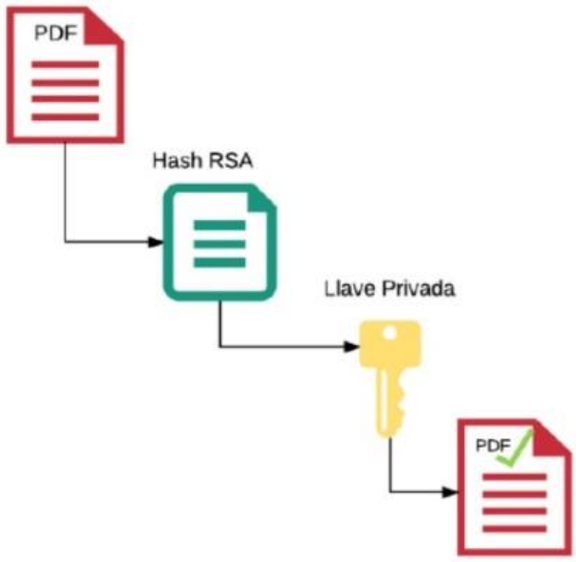

Figure 5 Structure of encrypted PDF files
Source: Self made

The RSA algorithm (from the authors: Rivest, Shamir, Adleman) uses two types of keys: public key and private key, unlike symmetric cryptography that only uses private keys. In the algorithms of symmetric encryption, we have the characteristic that the same key is used to encrypt and decrypt a message, the content of the message being vulnerable with the simple fact of sharing the same private key to protect the information.

Using asymmetric cryptography to protect a message sent between computers converts the same asymmetric cryptography into a digital signature. Instead of digitally signing the complete message, a summary or hash function of the message to be sent will be obtained, represented by a string of bits.

This hash will be encrypted and will serve to authenticate the identity of the sender and receiver of the message. When the message arrives at its destination, a different key will be used to decrypt the message, known as the public key. The summary of the document will be recalculated and as a consequence, if the values of the deciphered summary and the calculated summary are identical, the signature will be authentic and the message will be validated as complete.

Throughout time and technology, three types of digital signatures were developed, which are:

- Basic Signature: Includes a method of identifying the signer (authenticity). It her is the most vulnerable type.

- Advanced Signature: In addition to identifying the signer allows to guarantee the integrity of the document, preventing changes or alterations subsequent to the time of signing. PKI techniques are used.

- Recognized signature: It is the advanced signature executed with a DSCF (secure signature creation device) and covered by a recognized certificate (certificate that is granted after the face-to-face verification of the signer's identity).

Sometimes, this firm is called Qualified (Qualified) of the European Directive on Electronic Signature (UPV, 2017). The first legal antecedent of the digital signature was Directive 1999/93 / CE, of December 13, 1999, of the European Parliament and of the Council. There, a community framework for electronic signature was established.

To validate digital signatures are symmetric and asymmetric cryptography. As it was mentioned, nowadays, symmetric encryption is considered insecure, therefore, a digital signature has been implemented using an asymmetric encryption algorithm.

Cryptography

In computer science, it is the method of coding data, according to a specific algorithm and secret key so that only authorized users can re-establish their original form.

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It offers secure tools to ensure the authenticity, integrity and confidentiality of digital information (Herranz J., 2010).

Until 1976, the cryptography used was symmetric, when Whitfield Diffie and Martin Hellman introduced the concept of Public Key Cryptography and with the publication of the RSA algorithm in 1977 by Ron Rivest, Adi Shamir and Len Adleman, the most used cryptography was consolidated. Based on the public key, Herranz J. (2010).

Symmetric cryptography

Symmetric key encryption means that two or more users have a single secret key; this key will be the one that will encrypt and decrypt the information transmitted through the insecure channel.

This process is exemplified in Figure 6, where the secret key must have the two users (Emitter-Receiver), and with this key, the Issuer user will encrypt the information, send it through the insecure channel, and then the user Receiver will decipher that information with the SAME key that the issuer user has used.

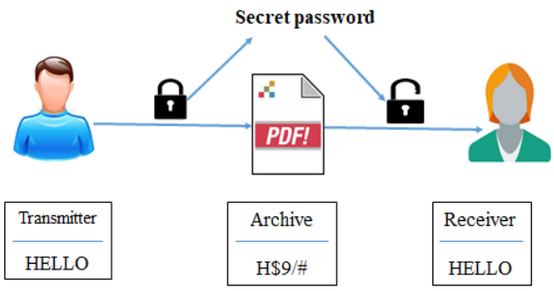

Figure 6 Symmetric encryption scheme
Source: Self made

With the asymmetric private key, the messages are encrypted and decrypted with the public key. In this way, the messages can be encrypted by the Issuer and transmitted to the Recipient, knowing the public key, that only he will be able to understand the message Ortega, J., López M. & García E. (2006). This procedure is described in figure 7.

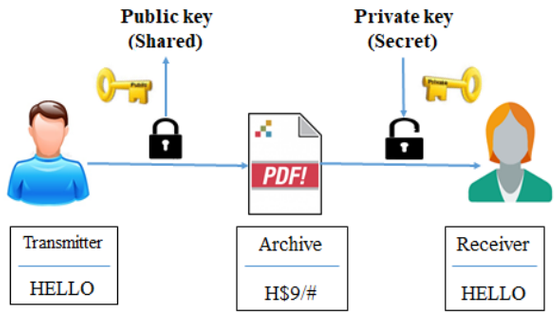

Figure 7 Scheme of asymmetric encryption
Source: Self made

The asymmetric encryption system has the purpose of signing PDF documents, certifying that the issuer is who he claims to be, this by signing with the private key and verifying, the receiving identity, with the public key.

Hash function

The hash functions are an encryption algorithm that, from an input either text, password or summary of a file, creates an alphanumeric output with a fixed 40-bit length. To regenerate the data in the chain, it is necessary to enter the same data again, which is why it is mostly used for passwords in databases. In figure 8, this procedure is exemplified.

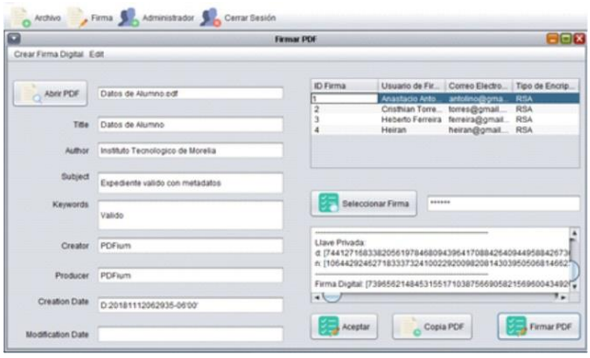

Figure 8 Application of the hash function to a digital document
Source: Self made

Asymmetric cryptography

Also known as public key cryptography, or public key encryption and private key. It is named like this, because in this cryptography each key consists of two keys: a public key, which can be shared or known by everyone; and another private, held by a single person, which is protected and saved by the user.

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Asymmetric algorithms are based on mathematical functions that are easy to solve in one direction, but very complicated to do in the opposite direction, unless the key is known. The public and private key are generated simultaneously and are linked to each other. This relationship must be very complex so that it is very difficult to obtain one from the other (De Luz, S., 2010).

Validation of documents using QR. The QR code (Quick Response code), emerged in 1994 as an evolution of the bar code, since it stores more information through a two-dimensional point matrix (crhoy.com, 2018), see figure 9, (TEC-IT, 2018).

Figure 9 Example of QR generated by the system
Source: (TEC-IT, 2018)

This special code is read by mobile devices or specific QR readers, which, when verifying the code, generate a text string, where the information stored is most commonly, a link to a website address or website or information that describes some particular topic.

In the project, the QR is used to obtain an address to a page in the Technological Institute system, with which a query is made and the document consulted is obtained according to an ID or folio. Which can be compared with the printed document or on file and compare its validity.

Figure 10 describes the methodology in a graphical way, the process in the generation of certified PDF documents. The process consists in scanning personal documents of the students, or generating a PDF document, such as a study kardex or a certificate of qualifications.

Once the PDF document is obtained, it is necessary to introduce control and information data to said file. The data are, for example, control number, creation date, system user ID, career, generation, etc. That they are practically internal control data, but if the document is intended to be delivered to the graduate or sent to another institution, it is certified digitally.

This digital certification consists of the following: a Hash code is added to the document, which is encrypted with the private key of the user responsible for issuing the official document.

After this digital signature, the QR code is added to the document for online validation.

The certified document is finally stored in the system database, see figure 10.

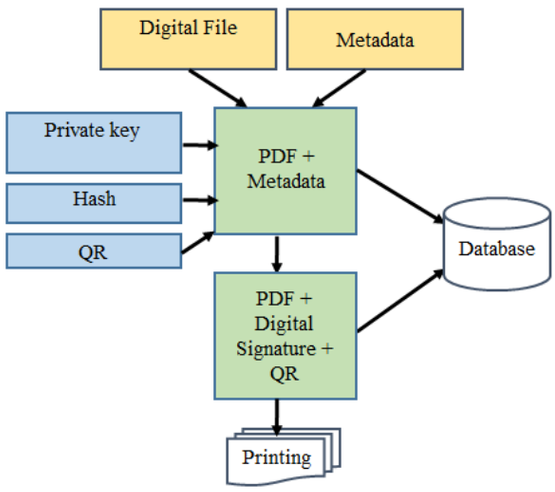

Figure 10 Methodology to generate secure signatures in documents
Source: Self made

Blockchain

We currently live in the fourth Industrial Revolution characterized by the use of ICTs in virtually all processes of human life.

Within ICTs, the most outstanding technologies are the following: artificial intelligence (AI), data analytics (AD), augmented reality (RA), Internet of Things (IoT), cloud computing (Cloud), printing in 3D and finally highlighting cyber security (CS).

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When talking about block chains, more than 90% of the time is associated with what BitCoin is: An encrypted electronic currency (cryptocurrency) from point to point and open source. There has been an increasing use of this technology to support cybersecurity.

Among its frequent uses include, in addition to the virtual currency, the handling of secure payments, authentication in IoT devices, smart contracts, electronic voting, validation of products as documents among many others. Some benefits are:

- Saving of time since transactions can be done in less time guaranteeing trust.
- Elimination of costs in the absence of intermediaries.
- Reduction of risks by avoiding cybercrimes such as manipulation and information fraud.
- Increased confidence in having a shared and traceable process.

Blockchain represents a historical database (DB) where you have all the information of the operations that have been carried out on a block of data from its origin to its current state. Queries of these operations can be made, although it is not fully optimized.

The DB grows rapidly over time as transactions are made. Figure 11 shows how a transaction is processed in a chain of blocks using the Hyperledger Fabric software that offers the facility to build nodes that exchange block chains consistently and safely (Androulaki E., 2018).

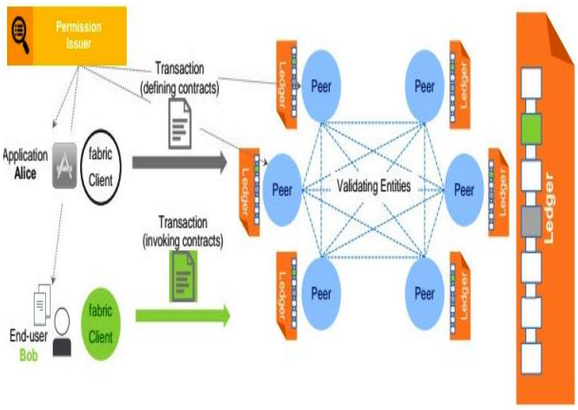

Figure 11 Hyperledger Fabric model
Source: (Androulaki E., 2018).

As shown in Figure 11, the Hyperledger factory is an authorized system in which all peer nodes are known (as opposed to the anonymous world of Bitcoin), block chains with a unique identity are managed. It is a system of permits where there are different roles for users and those that validate information (validators). Users invoke and implement their transactions (with the code that will be embedded in the block), which are then validated to create a new version of the block chain, that is, a single database (ledger in English). The key cryptographic element is an improved version of Byzantine fault tolerance practice (PBFT) known as a sieve.

Methodology

A PDF document is described through its metadata, and there may be multiple metadata flows from a single document. The structure of the files, when they are received with their respective metadata, go through the following process. The RSA encryption algorithm is applied, consequently it generates a private key that only the administrator of the digital signature will have. This key is used to encrypt the file and a public key will be used to decipher, thereby ensuring the integrity and authenticity of the document. Figure 12 shows a diagram of the mentioned procedure, to sign a document.

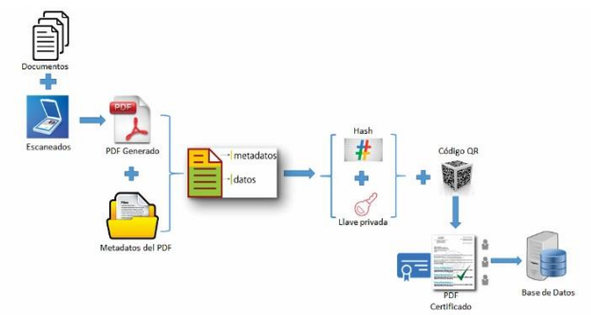

Figure 12 Scheme of the process of certifying documents
Source: Self made

To control the documents issued in PDF format, a program was implemented in the programming language Java SE (Standard Edition), using the free code library iText (2018), which was created to manipulate PDF, RTF, and HTML in Java. This software will read a document, get a summary of it, as well as the public and private key pair, which will be stored in a database within the institute.

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For the implementation of the digital signature, the Java SE programming language and the storage of the data in the MySQL manager were used. To be able to access the digital signature software, a login must be implemented, for which the data of the users that will be able to sign the documents digitally, as well as the resulting signatures, are stored.

For the storage of the users, the users table was designed, as shown in Table 1 and for the storage of the digital signatures, the table of signatures was designed, indicated in Table 2.

Key	Name	Type	Long Bytes	Description
PK	IdUsua	int	4	Id user for login
Nom	Name	varchar	50	User name
Usu	User	varchar	40	Profile
Clv	Clave	varchar	40	Password
TU	TpoUsua	int	4	Type of user, administrator, capturist, verifier
Act	Activo	int	4	Enabled to use application

Table 1 User information
Source: Self made

Key	Name	Type	Bytes	Description
PK	IdFirma	int	4	Digital signature ID
FK	UsuFinal	int	4	Id user who signed the document
NDo	NomDoc	varchar	50	Name of the document that was signed, metadata
HDo	HashDoc	varchar	128	Hash obtained encryption
PuK	ClvePub	varchar	50	Public key of the document
PbK	ClvePri	varchar	50	Document private key

Tabla 2 Información de las llaves digitales
Source: Self made

Implementation of blockchain

In general, blockchain mechanisms have been used mainly for the management of secure digital currencies (cryptocurrencies). In recent years, many applications have appeared, to ensure security in various areas of knowledge such as medicine, electronic voting systems, supply chain, among others.

That is why the idea of implementing a blockchain to guarantee security in transactions between servers that will exchange signed digital documents is born.

The problem to be addressed is to avoid malicious users, misconfigured devices, anomalies in documents, among many other external factors that affect transactions. Particularly, with this technology you can solve the problem of data manipulation (known as tampering).

On the other hand, within the project, a solution method is used, such as ElasticSearch, which is a distributed document-oriented search and analysis engine capable of solving a growing number of requests. Provides a full-text, distributed and multi-tenant search engine with a RESTful Web interface and JSON document standard.

This tool allows you to store, search and analyze large volumes of data quickly and almost in real time. It is used as the underlying engine / technology that drives applications that have complex search characteristics and requirements.

It is built on a search server based on Lucene (developed in Java) and using the Apache server, Angular framework. Some features offered by this search subsystem are (see figure 13):

- Access in real time: It allows us to access the documents that are being modified in real time.
- Scalability: Thanks to its design it allows us to scale horizontally and scale our servers (nodes) according to our needs.
- High availability: ElasticSearch clusters are able to detect which nodes are failing and reorganize to make data always accessible.
- Multi-Tenant: It allows us to operate on different indices at the same time and thus enhance our searches.
- It does not use schemes: It allows to work without a fixed structure of database.

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- Document oriented: Elasticsearch entities are stored as structured JSON files, where all the fields are indexed and we can include all the indexes in the same query.

- API: ElasticSearch provides RESTful APIs in JSON along with APIs for different languages.

- Text-based searches: ElasticSearch is based on Lucene, which increases text search capabilities, supporting gps and autocomplete.

- Conflict management: Prevents loss of data by simultaneously editing records.

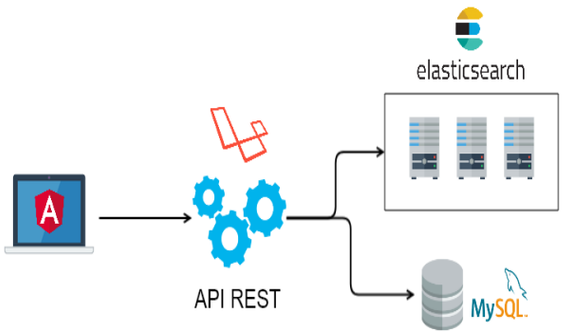

Figure 13 Tools used to search files with Slasticsearch
Source: (Espinoza-Avalos, Et. Al., 2017)

Returning to the use of block chains, it can be said that to implement the blockchain implementation, the following phases were used:

1. Network environment configuration. It is used to create the blockchain network.

2. Compilation software to build the chaincode. For the compilation system Hyperledger Fabric with Gradle is used (it is a compilation automation system that combines simple syntax to specify compilation components), along with the best features of Apache ANT and Apache Maven to create a powerful compilation system that is Easy to use.

3. Use of an http client: to invoke transactions in the chaincode. An http client software, which allows your chaincode to communicate with the REST interface of hyperchain's blockchain fabric. Your browser can issue an HTTP: GET, but to interact with the factory you need to be able to publish POST messages. This means that you need an HTTP client.

4. Start the network blocks.

5. Build the Java or C ++ client program that stores each transaction securely in a DB handler.

Results

The implementation of the Blockchain was done with three Hyperledger Fabric nodes, which in this case were three virtual machines using Docker, the general architecture of the developed solution is shown in figure 14.

Each docker container (virtual machine) refers to an organization. In our example, three educational organizations are being managed. Each organization has its client application developed in Java that is in charge of providing the scanned files in PDF, and the metadata as input.

In order for the organizations to communicate with each other, they are in charge of at least one entity that manages the communication with the other nodes of the blockchain network; in the Hyperledger architecture, this node is called peer. Therefore, the first step was to build the peers of the blockchain network; for this, it was necessary to configure the crypto-config.yaml file with the specifications of the topology of the network. Through this tool we can generate the certificates and keys for the organizations and the components within them (users and peers). In this case, for the three organizations, a single peer was created per organization and a single client per peer.

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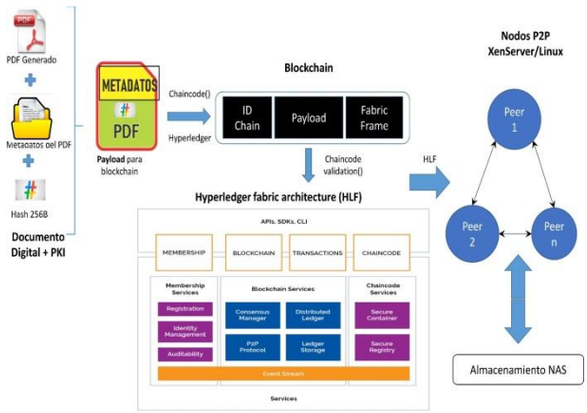

Figure 14 Blockchain model for digital file exchange, P2P
Source: Based on Bangbit.in (2018)

The second step was to define the coordinating node of the blockchain (it must be remembered that, although blockchain is a centralized mechanism, Hyperledger enters the category of private blockchain with permissions, which provides even more security). This coordinating node is defined in Hyperledger as the orderer, which is the main node in charge of the coordination of the organizations, see figure 13. The order was implemented within the organization of the Technological Institute of Morelia as another separate Docker container.

Then the channels and the MSP (Membership Service Providers) were configured. For this, it is necessary to configure the configtx.yam file as well as the consensus used by the orderer. In our case the kafka algorithm was used, which is tolerant to Byzantine failures.

Within this file in the Profiles section, communication channels are configured, in this case it was defined that all organizations can communicate with all of them, but this can be customizable.

For the creation of certificates you can use the fabricOps.sh script, which has an online command wizard that will guide us in the process for generating certificates. For the correct generation of certificates it is necessary to modify the function generateChannelArtifacts () with the appropriate routes of our project.

In our case we chose to use certificates and digital signatures already used in the PKI infrastructure, so we must modify the Hyperledger configuration files of each peer, to indicate the signatures and certificates to be used.

After generating the certificates it is necessary to modify the configuration of the Docker files that will generate the images of the peers, the certificates and the network ordering system. So that the blockchain network is consistent. This process has to be done in each new peer that connects to the network and in the order that will control it.

Then you have to create the channels, you have to make the peers join the channel, define the chaincode, instantiate it and be able to interact with it.

To execute the blockchain network, use the fabricOps.sh script with the start option. To create the channel, the peer channel create command is executed, indicating the files and variables of previously configured environments. For our case only one channel was created since all the peers of the organizations can communicate with each other.

The entry of each peer to the channel is done with the peer channel join -b command with the name of the created channel.

To install the intelligent contract you must execute the command peer chaincode install -n mycontract -v 1.0 -p route of the chaincode.

To instantiate the contract you must execute the command peer chaincode instatiate indicating in the variable Args, the initialization variables of our chaincode. At any time you can ask for some variable of our blockchain through the command peer chaincode query -C and indicating the contract and variables to consult.

To execute the intelligent contract, the peer chaincode invoke command must be used, indicating the contract route and its arguments (transactions).

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The implementation of the intelligent contract consists of two variables: series and folio. Three series A, B and C are configured, representing if they are grades, Kardex records and certificates. The other variable is a folio number that goes from 0 to 999. The chaincode validates the series and increases the number of folios.

When executing the chaincode and launching transactions the system behaves in a good way since there is no high load. The consensus is achieved quickly thanks to the kafka algorithm. The environment was programmed to make the consensus of nodes every minute, so you have to wait for this time to confirm transactions.

The size of the packages does not represent a big change, it has an average of 3.0 Mb per PDF with its metadata already included, so the ID size of the block and its Hashes do not consume more than 3.1 Mb.

Tests were conducted to measure the performance of the system with a period of 30 days under normal operating conditions in the middle of the semester (intermediate load period in school services) obtaining the following statistics from table 3:

Variable	Result
Number of Total Documents	2189
Total number of report cards	999
Total number of transcripts	757
Total number of records	433
Number of Modified Documents	288
Total number of blocks	1833
Number of transactions	2457
Average transactions per block	1.34
Final size of the chain blocks	66.58 Mb

Table 3 Variables counted during 30 days
Source: Self made

In a matter of safety tests the following were carried out:

1. It was validated that the smart contract will validate the folios and that they will not assign the same folios to different documents.
2. It was validated that, when the number of pages was finished, documents could no longer be stored in the ledger (Case of Qualification Records).
3. Confidentiality tests were conducted seeing that, without the proper keys and certificates, it is impossible to sign transactions in the blockchain without authorization.
4. Integrity tests were performed when trying to modify a metadata of an intermediate block, it could be noted that Hyperledger detects the change and reconstructs the chain of blocks with the replicas of other peers.
5. Finally, availability tests were performed with the Slowirs tool simulating Distributed Denial of Service (DDoS) attacks. For this, the firewalls of each peer and the orderer were temporarily disabled.

It was found that with at least one active peer the ledger can be replicated to the other dropped nodes. It was also observed that the ordering is vital and that if it falls, the transaction mechanisms are interrupted. Therefore, it is advisable to have more orders that help to balance loads, although for blockchain networks that are so small, it is not recommended for the operational load of infrastructure and performance for the blockchain network.

Conclusions

From the results obtained, when designing and implementing a system for the validation of digital documents in PDF format, it has been observed that this software can be used reliably to protect the integrity of the data, and thus, give more credibility and confidence to users and institutions.

Verification methods for the generation of digital signature using the RSA algorithm and QR code have been effective in terms of generation time and reliability that can be provided to a digital document.

The generation of the digital signature is relatively fast, the only drawback is the processing capacity of the peer node, since the larger the PDF document, the longer the digital signature is generated.

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The files generated with metadata have an average size of 3.0 Mb with key hashes of 256 bytes included, this information is used as blockchain payload, each block measures approximately 3.1 Mb, this is shared with the Hyperledger peers. It is observed the need to implement storage servers of large volumes of data to maintain the information of the blocks.

As a general conclusion, nowadays, it is important to have a system that can guarantee the integrity of the data and the application proposed in this article, it fulfills the established expectations, and it can even be used in the draft model of governance for implement the blockchain network Mexico (Michel G., 2018).

Finally, it is concluded that the use of paper in government institutions and companies can be significantly reduced, by using secure digital documents. Contributing to government projects oriented towards the ecology and sustainability of the environment.

Acknowledgments

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Magentite particles change electrical properties of a porcine heart tissue

Las partículas de magnetita cambian las propiedades eléctricas de un tejido cardíaco porcino

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Abstract

Objectives. Electrical impedance spectroscopy (EIS) is a harmless non-invasive technique that allows to measure and monitor different physiological parameters. One of the problems with establishing new procedures based on EIS is difficulty to distinguish between tissue types. For that reason, our research group have decided to assess a possibility to use nanomagnetite as a contrast medium in EIS procedures. In this work we present characterization the electrical properties of a porcine heart tissue by EIS using a magnetite particles suspension as contrast medium. Methodology. SP-150 from BioLogic Science Instruments was used as EIS equipment. Porcine heart tissue was used as biological tissue. Nanomagnetite particles were synthetized by coprecipitation and combustion methods and named NM1 and NM2, respectively. EIS device was connected at each ventricle through four hypodermic needles (38mm). Left and right ventricle was injected with NM1 and NM2 particles, respectively. Impedance measurements were acquired for each ventricle before and after the injection. Contribution. Both samples of magnetite nanoparticles were able to change electrical properties of heart tissue. Studies in vivo must be performed in order to confirm the conclusion.

Biological tissue, Electrical impedance, Nanomagnetite

Resumen

Objetivos. La espectroscopia de impedancia eléctrica (EIS) es una técnica no dañina y no invasiva que permite medir y monitorizar diferentes parámetros fisiológicos. Uno de los problemas para establecer nuevos procedimientos basados en EIS es dificultad en distinguir entre los tipos de tejido. Por esa razón, nuestro grupo de investigación ha decidido evaluar la posibilidad de usar nanomagnetita como medio de contraste en los procedimientos de EIS. En este trabajo presentamos la caracterización de las propiedades eléctricas de un tejido cardíaco porcino mediante EIS utilizando una suspensión de partículas de magnetita como medio de contraste. Metodología. SP-150 de BioLogic Science Instruments se usó como equipo EIS. Se utilizó tejido cardíaco porcino como tejido biológico. Las partículas de nanomagnetita se sintetizaron mediante métodos de coprecipitación y combustión y se denominaron NM1 y NM2, respectivamente. El dispositivo EIS se conectó en cada ventrículo a través de cuatro agujas hipodérmicas (38 mm). Los ventrículos izquierdo y derecho se inyectaron con partículas NM1 y NM2, respectivamente. Se adquirieron mediciones de impedancia para cada ventrículo antes y después de la inyección. Contribución. Ambas muestras de nanopartículas de magnetita pudieron cambiar las propiedades eléctricas del tejido del corazón. Se deben realizar estudios in vivo para confirmar la conclusión.

Tejido biológico, Impedancis eléctrica, Nanomagnetita

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Introduction

Nanoparticles composed by different metals have been extensively investigated to be used in different biomedical applications. The applications include biomedical imaging, drug delivery, colorimetric biosensing, etc. Then synthesised properly, metal nanoparticles exhibit low cytotoxicity and less susceptibility to oxidation. For instance, gold nanoparticles have received great attention as contrast in multiple imaging techniques due to its high atomic number and X-ray absorption coefficient. Similarly, nanometric form of magnetite have emerged recently as contrast medium in magnetic resonance imaging because of its supermagnetic and surface properties and biodegradability. In summary, metal nanoparticles are emerging as imaging agents for different techniques.

On the other hand, our research group work is developing new medical diagnostic procedures based on electrical impedance spectroscopy (EIS). EIS is a noninvasive technique that is used to obtain the characterization and electrical properties of biological and nonbiological materials in frequency domain through electrodes. Due to complex nature of impedance, two important parameters of EIS measurements can be highlighted: module and phase. Module can provide information about changes in the volume of tissue and phase reflects changes of cellular structure. The technique is non-invasive, harmless and relatively cheap. One of the problems with establishing new procedures based on EIS is difficulty in distinguishing between tissue types. For that reason, our research group have decided to assess a possibility to use nanomagnetite as a contrast medium in EIS procedures.

In this work we present characterization the electrical properties of a porcine heart tissue by EIS using a magnetite particles suspension as contrast medium.

Methodology

Materials. SP-150 from BioLogic Science Instruments was used as EIS equipment. Porcine heart tissue was purchased as fresh as possible at local market and used as biological tissue.

Nanomagnetite particles were synthetized by coprecipitation and combustion methods and named NM1 and NM2, respectively (Figure 1). Hypodermic needles (38mm) were implemented as electrodes.

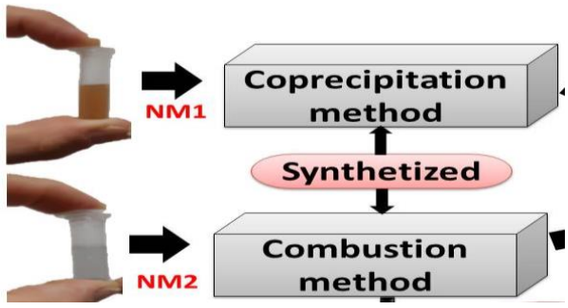

Figure 1 Magnetite nanoparticles and methods of synthesis

Methods. NM1 and NM2 were suspended in sterile physiological solution at concentration 1 mg/mL and injected to the biological tissue separately. EIS measurements were performed before and after the injection. Figure 2 depicts generally the methodology used in this study. All data was analysed by Bode graphics (impedance and phase) at 50kHz frequency.

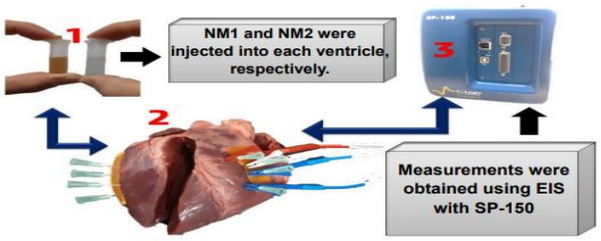

Figure 2 Measurement process in porcine tissue under the influence of magnetite nanoparticles

Results

Scanning electron microscopy have shown that particle of both samples NM1 and NM2 were well dispersed and have irregular shape. The size of obtained particles were less than 100 nm.

Raman spectra of NM1and NM2 are shown at figure 3. It can be observed, that both samples present similar peak pattern, so it can be concluded that their chemical composition is the same.

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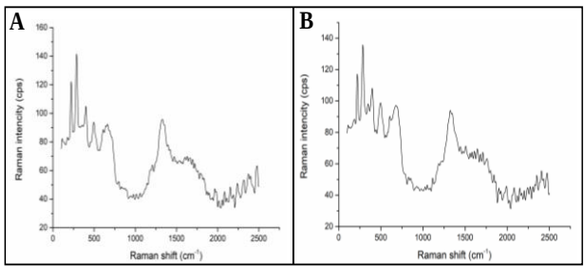

Figure 3 Raman spectroscopy for NM1 (A) and NM2 (B)

The mean value of impedance (phases) at basal biological stage of left and right ventricles were of 287.7 Ω (-53.12°), and 421.8 Ω (-65.3°), respectively. The mean value of impedance-module and phases in the left ventricle with NM1 and right ventricle with NM2 were of 156.36Ω (-60.24°) and 141.8Ω (-57.90°), respectively. The comparative graphs between phases and frequencies are shown in figures 4 and 5.

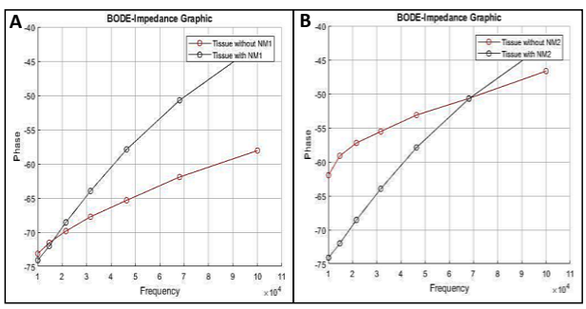

Figure 4 Phase graphs between basal state and under the influence of nanoparticles

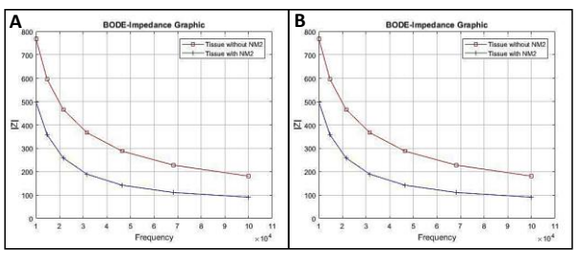

Figure 5 Module (|Z|) graphs between basal state and under the influence of nanoparticles

Conclusions

It can be concluded that both samples of magnetite nanoparticles were able to change electrical properties of heart tissue. Studies in vivo must be performed in order to confirm the conclusion.

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Resumen (En Español, 150-200 palabras)

Objetivos
Metodología
Contribución

Indicar 3 palabras clave en Times New Roman y Negritas No. 10 (En Español)

Resumen (En Inglés, 150-200 palabras)

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† Investigador contribuyendo como primer autor.

Introducción

Texto redactado en Times New Roman No.12, espacio sencillo.

Explicación del tema en general y explicar porque es importante.

¿Cuál es su valor agregado respecto de las demás técnicas?

Enfocar claramente cada una de sus características

Explicar con claridad el problema a solucionar y la hipótesis central.

Explicación de las secciones del Artículo

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Desarrollo de Artículos en Times New Roman No.12, espacio sencillo.

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En el *contenido del Artículo* todo gráfico, tabla y figura debe ser editable en formatos que permitan modificar tamaño, tipo y número de letra, a efectos de edición, estas deberán estar en alta calidad, no pixeladas y deben ser notables aun reduciendo la imagen a escala.

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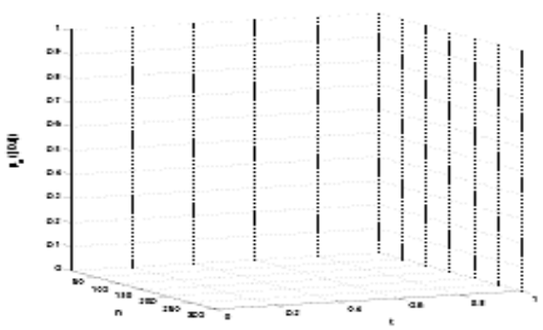

Gráfico 1 Titulo y *Fuente (en cursiva)*

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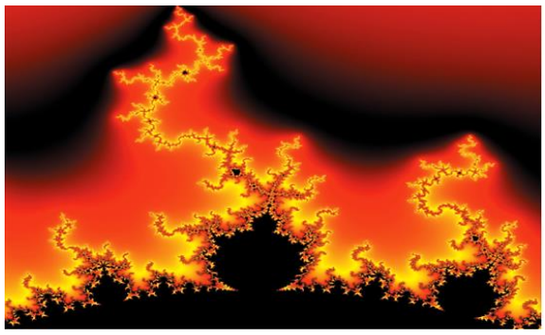

Figura 1 Titulo y *Fuente (en cursiva)*

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Tabla 1 Titulo y *Fuente (en cursiva)*

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$$Y_{ij} = \alpha + \sum_{h=1}^{r} \beta_h X_{hij} + u_j + e_{ij} \qquad (1)$$

Deberán ser editables y con numeración alineada en el extremo derecho.

Metodología a desarrollar

Dar el significado de las variables en redacción lineal y es importante la comparación de los criterios usados

Resultados

Los resultados deberán ser por sección del Artículo.

Anexos

Tablas y fuentes adecuadas.

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Conclusiones

Explicar con claridad los resultados obtenidos y las posibilidades de mejora.

Referencias

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Utilizar Alfabeto Romano, todas las referencias que ha utilizado deben estar en el Alfabeto romano, incluso si usted ha citado un Artículo, libro en cualquiera de los idiomas oficiales de la Organización de las Naciones Unidas (Inglés, Francés, Alemán, Chino, Ruso, Portugués, Italiano, Español, Árabe), debe escribir la referencia en escritura romana y no en cualquiera de los idiomas oficiales.

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4. *Resultados*
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